An investigation into the health outcomes of Canadian ethnic minorities following a 17 week community-based exercise programme

Sherldine Tomlinson

Thesis submitted to the faculty of health sciences at Staffordshire University in partial fulfilment of the requirement for the degree of

Professional Doctorate

In

Healthcare Science

Acknowledgement

First and foremost, I am deeply grateful for my family's support. My siblings, Corneal Tomlinson, Dr Lisa Tomlinson, and Karen Tomlinson, have been my pillars of strength throughout this journey, offering constant encouragement and keeping me grounded. My heartfelt gratitude goes to my mom, Gwendolyn Tomlinson, who has been my foundation and a boundless source of inspiration. Thank you all for everything you have done for me. I always carry your love and support with me. Thank you and acknowledge my cousins, Jennifer Robinson and Shanick Wright, for their support and encouraging words. Ah wi sey family!

I sincerely thank Professor Roozbeh Naemi, my principal supervisor, for his mentorship. Despite the challenges and moments of doubt, Professor Naemi has been a guiding light, and I aspire to carry forward his spirit of research and academia. Thank you for listening and encouragement. I would also like to express my gratitude to Dr Jacky Forsyth, my thesis co-supervisor, for her dedicated time and effort in reviewing my chapters. Her support and positivity have been instrumental in my thesis journey. Thank you to the thesis defence committee. Special thanks to Dr Trudy Gaillard for agreeing to sit on the thesis committee as the external examiner. I also want to express my special gratitude to Dr Gemma Hurst for agreeing to act as an internal examiner for my viva.

My research would not have been possible without the cooperation of the Fitness for Life clients. I extend my gratitude to Dr Saadia Akram-Pall, the Rexdale Women's Centre Director of Program, for allowing me to conduct my research at the Centre and to the diligent Fitness for Life staff for assisting with the fitness assessments and questionnaires. Thank you, fitness instructors and kinesiology students, for your assistance. To my friends Dr Agaezi Sonya, Desrine Hyatt, Marcia Wint, Dawn Veron and Marsha Hall, your support has been precious, and I am thankful for your presence in my life over the years.

This thesis is a culmination of the collective efforts and support of these individuals, Staffordshire University and the Rexdale Women's Centre. I am profoundly grateful for their contributions to my academic journey…cheers.

Table of Contents

Acknowledgement ii

Abstract vii

List of Tables x

List of Figures xi

Chapter 1: Introduction 1

1.1 Background 1

1.2 Purpose of the Study 8

1.3 Research Question 10

1.4 Hypothesis 11

1.5 Literature Review 11

1.6 Study 1: The effect of exercise response on cardiovascular health outcomes among ethnic groups participating in a community-based intervention 12

1.6.1 Study Objective 12

1.6.2 Study Methodology 12

1.7 Study 2: The differences in cardiovascular response to 10 exercise sessions between African Canadian and South Asian cardiac patients 15

1.7.1 Study Objectives 15

1.7.2 Study Methodology 15

1.8 Significance of the study and potential impact 17

Chapter 2: Literature Review 19

2.1 Physical Inactivity Epidemiology 19

2.2 Health Consequences of Physical Inactivity 21

2.3 Determinants of Physical Inactivity 24

2.4 Impact of COVID-19 and Physical Inactivity 27

2.5 Physical Inactivity in Different Ethnic Groups 29

2.6 Physical Activity Interventions 34

2.6.1 Faith Based Interventions 35

2.6.2 Transtheoretical Model 39

2.6.3 Social Ecological Model 41

.... 46

2.7 Benefits of Physical Activity 46

2.7.1 Cardiovascular Benefits 47

2.7.2 Strength Training Benefits 48

2.8 Exercise Physiology *49*
2.8.1 Cardiovascular Response to Exercise 49
2.8.2 Blood Pressure Response to Exercise 50
2.8.3 Heart Rate Response to Exercise 53
2.8.4 Exercise Response to Mean Arterial Pressure 54
2.8.5 Exercise Response to Rate Pressure Product 56
2.8.6 Exercise Response to Pulse Pressure 57

2.9 Summary of Literature Review *59*

Chapter 3: **61**

The effect of exercise response on health outcomes among ethnic groups participating in a community-based intervention **61**

Abstract *62*

3.1 Background *63*

3.2 Study Methodology *69*
3.2.1 Recruitment Process *69*
3.2.2 Inclusion and Exclusion Criteria 70
3.2.3 Intervention Design 70
3.2.4 Blood Pressure Assessment 71
3.2.5 Fitness Assessment 72
3.2.6 Group Exercise Sessions 72
3.2.7 Health Education Workshops 73

3.3 Statistical Analysis *74*

3.4 Study Results *75*
3.4.1 Physical Activity Questionnaire 76
3.4.2 PAR-Q 80
3.4.3 Differences in Pre and Post Conditions for Body Composition 81
3.4.4 Dunn's Post Hoc Pairwise Test Difference Across Ethnic Groups – Body Composition 82
3.4.5 Differences in Pre and Post Conditions for Cardiovascular Profiles 85
3.4.6 Dunn's Post Hoc Pairwise Test Across Ethnic Groups – Cardiovascular Profiles 86
3.4.7 Predicated Cardiovascular Profiles on Gender, Age, and BMI 89

3.5 Discussion *92*
3.5.1 The Physical Activity Questionnaire 92
3.5.2 *Physical Activity Readiness Questionnaire* 95
3.5.3 Body Composition Assessment *98*
3.5.4 Cardiovascular System Profiles 102
3.6 Study Limitations 108

3.7 Conclusion *109*

Chapter 4: Ethnic differences in the rate pressure product to dance aerobic exercise with African Canadian and South Asian cardiac patients **113**

Abstract **114**

4.1 Background ... *115*

4.2 Methods ... *120*
4.2.1 Inclusion and Exclusion Criteria ... 120
4.2.2 Baseline Assessment ... 121
4.2.3 Exercise Programme ... 122

4.3 Statistical analysis ... *123*

4.4 Results ... *124*
4.4.1 Difference Between the Pre and Post Conditions ... 125
4.4.2 Difference Between Pre and Post in African Canadian Population ... 125
4.4.3 Difference Between Pre and Post in South Asian Population ... 127
4.4.4 Difference Between Pre and Post in All Population ... 127
4.4.5 Difference Between the Two Groups ... 128
4.4.6 The Difference in Pre Exercise ... 128
4.4.7 The Difference in Post Exercise ... 129

4.5 Discussion ... *129*

4.6 Limitations ... *136*

4.7 Conclusion ... *137*

Chapter 5: Discussion ... 139

5.1 Summary of Outcomes ... *139*
5.1.1 *Study 1:* ... 139
5.1.2 Study 2: ... 143

5.2 Discussion of the outcomes of study 1 and 2 ... *144*
5.2.1 African Canadians Focused ... 153
5.2.2 Community-Based Fitness Programme ... 154
5.2.3 Limitations ... 155
5.2.4 Future Directions ... 156

Chapter 6: Conclusion ... 161

Reflective Analysis ... 173

Glossary ... 177

References ... 179

Appendix 1: Blood Pressure Profiles ... 214

Appendix 2: Body Composition Profile ... 216

Appendix 3: Strength Training Workout ... 217

Appendix 4: Consent Form & Information Sheet ... 218

Appendix 5: Physical Activity Readiness Questionnaire (PARQ) ... 221

Appendix 6: Physical Activity Questionnaire 222

Appendix 7: Infographic 225

Abstract

Introduction: Despite the many advantages of physical activity, research has shown that a significant portion of the population does not regularly engage in exercise. What is particularly concerning is that racialised groups tend to have lower rates of physical activity participation and, in some cases, higher rates of chronic health conditions. In response to this issue, community-level initiatives have been implemented across the United States (US) to encourage greater involvement in exercise among ethnic minorities and reduce their risks of chronic diseases. These community exercise programmes have adopted a variety of multifaceted strategies to engage minority populations effectively. To the academic knowledge, no health research has been conducted in Canada to explore the impacts of disparities on socially vulnerable populations utilising a multilevel approach and an intersectional lens concerning community-level exercise programmes. Given the limited research on this and the research gap, the Fitness for Life (FFL), a physical literacy programme designed to promote exercise and recreational sports participation among ethnic minorities, presented a unique opportunity to study these diverse groups. In this thesis, two studies were conducted.

The first study assessed the participants' health outcomes across the five ethnic groups (Black or African Canadians, South Asians, Middle Eastern, Asians, and Europeans) who engaged in the FFL exercise programme. **Objectives:** 1) to determine the overall effectiveness of FFL, 2) to compare the impact of the exercise programme on health outcomes, including the cardiovascular profiles (BP, HR, MAP, RPP, and PP) and body composition (body mass, BMI, percentage of body fat, and water percentage) among the five ethnic groups. 3) to analyse the two self-reported questionnaire responses of participants. In total, 365 participated in the FFL. The exercise programme was 17 weeks, including low to moderate impact aerobics and light strength training. The sessions operated 3 days a week. Two days were scheduled for aerobics exercise. The other was for strength training workouts. The strength training sessions consisted of 5 exercises targeting upper and lower body workouts. Each exercise session lasted 45 minutes long. Before the start of the programme, the study intake included participants completing two self-reported surveys: the Physical Activity Questionnaire and the Physical Activity Readiness Questionnaire (PAR-Q). The questionnaires were administered to determine participants' health status, such as their current health conditions and medications, to ensure their safety and to identify their medical needs by identifying symptoms and determining risk factors. **Results**: Significant improvements were observed in all cardiovascular profiles and body composition metrics from baseline to post-exercise ($p < 0.05$) with small effect sizes (0.2). The comparisons saw more significant differences between South Asians and African Canadians ($p < 0.05$). Regression analysis for pre-systolic blood pressure showed significant results ($R^2 = 7.00\%$, $F = 3,307$, $p < 0.005$). The questionnaires indicated variability across all ethnic groups. **Conclusion:** The findings from Study 1 indicated that the FFL exercise programme significantly impacted various cardiovascular and anthropometric parameters among the different ethnic groups studied. Following the exercise programme, there were differences in improvements in the cardiovascular profiles (e.g., lower BP) and reductions in body weight and BMI, suggesting the programme's effectiveness in promoting heart health and overall well-being. The self-reported questionnaire responses further highlighted the programme's positive impact on participants' health status. These findings contributed to and supported the understanding of the potential benefits of tailored exercise interventions within ethnically diverse communities. Further, the study highlighted the importance of promoting physical activity for improved health outcomes among ethnic groups.

The second study aimed to investigate the effect of 10 dance aerobic sessions exercise on the blood pressure indices in two specific subpopulations, African Canadians and South Asians, who were diagnosed with hypertension or high blood pressure (defined as 140/90 mm Hg) or other cardiovascular ailments. Moreover, the research is limited to inquiring into the effects of exercise on the RPP within racialised groups. As such, this gap is pressing because of the increased potential risks some of these populations might face from cardiovascular complications during physical exercise. These subgroups participated in 10 dance aerobic sessions on the RPP, a crucial cardiovascular indicator. **Objectives:** 1) to investigate changes in physiological responses, such as RPP, HR, and BP, on the 10 dance aerobic sessions and 2) to assess the degree of health improvements among the two groups. In total, 160 clients participated in this study (i.e., 80 African Canadians and 80 South Asians). **Results:** The study illustrated differences in SBP and HR ($p < 0.05$) between the two groups before and after the 10 dance aerobic sessions. However, the shifts in RPP ($p > 0.05$) did not yield much statistical significance. Improvements were also observed in MAP and PP, but PP was not significant ($p > 0.05$) measurements from the baseline to the completion of the 10 exercise sessions. **Conclusion:** The African Canadians and South Asians responded differently regarding the effect of the BP measurements on the 10 dance aerobics. For example, the South Asians saw slightly lowered BP by 11 mm Hg compared to 10 mm Hg in the African Canadian group. The findings suggested that the prescribed 10 dance

aerobic sessions led to changes and reduced BP, positively influencing cardiovascular health despite the RPP not reporting significant improvement. While further research is needed to fully understand the long-term effects and mechanisms underlying these changes, the findings provide valuable insights into the potential benefits of dance aerobic sessions as a non-pharmacological intervention for individuals with hypertension from diverse ethnic backgrounds. The study also highlights the importance of cultural diversity when designing exercise programmes for specific health conditions. Furthermore, each study in this thesis highlights the efficacy of adapting community-based exercise programmes to support ethnic groups' distinctive needs. Additionally, FFL contributed to reducing the health gap, specifically in physical movement. The initiative was crucial for participants to enjoy and benefit from participating in FFL.

List of Tables

3.1 Descriptive Characteristics 76
3.2 Physical Activity Questionnaire 76
3.3 Physical Activity Questionnaire – Health Conditions 78
3.4 PAR Q 80
3.5 Group pre, post and pre-post - Body Composition 81
3.8 Pairwise Comparison Pre and Post – Cardiovascular Profiles 87
3.9 Linear Regression Results for Predicting Pre-Systolic Blood Pressure (SBP) 90
3.10 Linear Regression Results for Predicting Pre-Diastolic Blood Pressure (DBP) 90
3.11 Linear Regression Results for Predicting Pre Heart Rate (HR) 90
3.12 Linear Regression Results for Predicting Pre Mean Arterial Pressure (MAP) 91
3.13 Linear Regression Results for Predicting Pre Pulse Pressure (PP) 91
3.14 1Linear Regression Results for Predicting Pre Rate Pressure Product (RPP) 91

List of Figures

2.1 Physical Activity Participation..22
2.2 The Social Ecological Model Levels.. 42
2.3 Intervention Targets Using the Ecological Model 46

Chapter 1: Introduction

1.1 Background

Physical activity is a universally acknowledged pillar of health, backed by robust evidence (Pinckard et al., 2019; Andrade, 2023; Abou-Elmagd, 2016; Fletcher et al., 2018). This leisure is a pleasant pastime and a formidable preventive activity. Physical activity efficacy extends to primary and secondary prevention of chronic health conditions. However, a disconcerting reality persists despite this knowledge. Many of the global population falls short of meeting recommended physical activity guidelines. Their sedentary lifestyles elevate the spectre of chronic diseases and premature mortality (as highlighted by the World Health Organization [WHO], 2020). Insufficient physical activity ranks as the fourth leading risk factor for global mortality, contributing to 6% of deaths worldwide. Beyond health consequences, there is an economic toll by 2030, and the anticipated burden could reach a staggering US$300 billion (according to the WHO, 2022).

More concerning is the convincing evidence highlighting that underserved populations, such as ethnic minorities and those with low socioeconomic status, are less likely to engage in physical activity at recommended levels (i.e., 150 minutes of moderate to vigorous physical (Hawes et al., 2019; Bantham et al., 2021). Notably, studies have shown that African American and Hispanic communities in US urban areas exhibit significantly lower participation rates than their White counterparts (Hawes et al., 2019; Bantham et al., 2021). Globally, surveillance on physical inactivity rates found the lowest level in Southeast Asia (17.6%) and sub-Saharan Africa (17.9%), while higher-income Western countries showed a higher rate of 42% (Bantham et al., 2021). These numbers pose a significant public health concern and demonstrate that physical activity is not just about movement but reflects a broader understanding of various influences (e.g., social and environmental) (Dipietro et al., 2020). Addressing these inactive lifestyle determinants affecting specific groups, we can uncover a rich tapestry of influences to implement inclusive health and physical activity promotion strategies. Prioritising communities' unique challenges, we can also begin to support fostering equitable access to resources and promote more active living.

As indicated, there remains a significant shortfall in achieving equity and inclusion in the physical movement arena despite the known health benefits of physical activity and the observed inactivity among racialised groups (Viola et al., 2021). The gap underlines a critical problem: the disconnection between our extensive knowledge base and its application in clinical, public health, and policy practices (Koorts et al., 2018). The disconnection often stems from failing to translate our understanding into practical, real-world scenarios (Harden et al., 2017). Adopting transdisciplinary research approaches encompassing diverse fields of study is imperative to bridge the gap. Engaging stakeholders at all levels, from policymakers to community leaders, is important in developing and executing successful strategies to motivate and assist people in becoming more physically active. As suggested by exercise experts, exploring the barriers and challenges to implementing existing strategies across different environments is crucial (Koorts et al., 2018). These experts point to the need for evaluation to recognise that each setting might need exclusive approaches to successfully translate interventions, such as adapting exercise routines to meet the specific needs of diverse communities. Understanding these impediments is fundamental for creating sustainable health promotion schemes for populations with less active lifestyles. As such, we need to focus more on what works effectively and on understanding what it takes to sustain, maintain, and expand the magnitude of these initiatives following their successful implementation. Discussions on bridging the gap between knowledge and action can begin through this process, supporting the formulation of more robust and inclusive health strategies that yield benefits for all segments of the populace, particularly emphasising those groups presently marginalised or underserved.

To address the critical need for increased physical activity in preventing and managing chronic conditions among ethnic populations, a multifaceted and targeted approach is important, as King et al. (2019) and others have advocated. This approach seeks to promote the long-term sustainability of healthy behaviours, mainly through strategies that reinforce consistent engagement in physical activity and other health-promoting practices. While promoting physical activity as a public health priority is not new, earlier research by Liu et al. (2012) highlighted adaptations for ethnic groups but failed to produce conclusive recommendations. This failure was because of limited evidence. Similarly, theoretical frameworks, such as those explored by King et al. (2019), have examined predictors of physical activity participation. However, the pressing challenge remains: How can we effectively and inclusively enhance fitness and exercise levels across diverse populations?

Specific theoretical models and frameworks used in the exercise literature have acknowledged the substantial influence of social and built environments on physical activity behaviours. These models emphasise the importance of considering the specific settings in which physical activity occurs. Physical activity, including exercise, commonly unfolds within distinct social contexts, such as family units, community spaces, and local neighbourhoods (Milat et al., 2017). The nature of these environments exerts a considerable impact on either facilitating or hindering physical activity, as highlighted by the research of McCulloch et al. (2005) and Salvo et al. (2018).

Creating community spaces conducive to physical exercise becomes paramount in augmenting physical activity engagement, especially within challenging demographics. This can necessitate investing in equitable urban park systems and implementing planning policies to boost the walkability and bike-friendliness of neighbourhoods, along with free access to recreational facilities, including parks and trails (Eldridge et al., 2019). These physical environment plans can help support culturally sensitive and accessible programmes for ethnic groups (Kepper et al., 2019; Giles-Corti & Donovan, 2002). Likewise, cultivating a culture centred around physical activity within family and community frameworks can significantly impact individual behavioural tendencies. King et al. (2018) and Buman et al. (2019) conducted research that effectively demonstrated the efficacy of such an approach in stimulating and sustaining physical activity across a range of diverse population groups. For example, organising community events such as hosting local sporting events, fun runs, or walkathons could encourage families to participate together (Flynn et al., 2017). Recognising the significance of these environmental and social determinants, public health initiatives can be tailored to increase physical fitness and exercise regularity, particularly within racially diverse populations who may encounter distinct barriers in their pursuit and perpetuation of physical activity (Mendoza-Vasconez, 2016; Buman et al., 2019).

Theoretical frameworks that support efforts to promote physical activity within ethnic populations while simultaneously addressing these groups' distinct challenges and needs represent strategic avenues for increasing participation in physical activity. For instance, the ecological model, as conceptualised by Bronfenbrenner (King & Gonzalez, 2018; Viola et al., 2021; Cleand et al., 2020), offers a comprehensive framework for understanding the multifaceted impact of the social environment on an individual's opportunities for physical activity. Applied across various disciplines, the model has significantly advanced our understanding of how health behaviours influence overall health outcomes. It presents a layered structure of influence, encompassing individual, interpersonal, organisational, community, and policy levels, each contributing uniquely to an individual's behaviour and choices (Viola et al., 2021; Cleand et al., 2020). At the individual level, the model considers personal factors like knowledge, attitudes, and skills that influence physical activity. This level emphasises the importance of tailored information and motivation to encourage individuals to exercise. The interpersonal tier focuses on social relationships and support systems like family, friends, and peers. These relationships can significantly influence an individual's decisions and behaviours regarding physical activity, featuring the need for social support mechanisms. The organisational influences include schools, workplaces, and religious institutions. These organisations can shape the physical activity behaviours of individuals through policies, resources, and cultural norms. Community factors, such as the availability of safe and accessible recreational spaces, community norms, and local health services, play a pivotal role in enabling or restricting physical activity.

Finally, the policy level involves local, provincial, and national policies that can profoundly influence physical activity through public health initiatives. An exemplary illustration of this approach is the recent initiative known as ParticParks, a pilot project collaboratively undertaken by ParticipACTION and the Public Health Agency of Canada. The primary objective of this initiative is to enhance the well-being of individuals residing in Canada who confront health disparities and are susceptible to the onset of chronic ailments. The overarching aim is to offer easily accessible outdoor physical activity opportunities to individuals from all walks of life, regardless of socioeconomic status, age, cultural background, racial identity, gender, physical abilities, sexual orientation, or geographical residence. The development of ParticiPARKS involves close collaboration with each local community site, with a special emphasis on soliciting input from community members belonging to equity-deserving groups. The ultimate designs are intended to create an outdoor park environment characterised by equity, inclusivity, and accessibility. Such parks are envisioned as dynamic community focal points that bolster community members' physical and mental well-being (ParticipACTION, n.d).

When devising strategies to address the complex determinants of physical activity, achieving exercise equity necessitates a comprehensive consideration of factors outlined within the ecological framework (Cleland et al., 2020). This model is instrumental in identifying multiple influences on behaviour, spanning individual, interpersonal, community, and policy levels. For example, Essiet et al. (2017) examined physical activity determinants among Nigerian first year university students, highlighting the importance of environmental and personal factors. Similarly, Bauman et al. (2012) extended the scope of analysis to include individual, interpersonal, and ecological aspects, as well as regional, national, and global policies, across diverse age groups and cultural contexts. Further validation of this model is provided by Fleury and Lee (2006), whose study on African American women underscores its applicability in understanding and sustaining physical activity engagement. Collectively, these findings highlight the ecological framework as a practical tool for mobilising populations, particularly racial and ethnic groups, by addressing health inequities and the structural disparities influencing health behaviours. In Canada, a significant gap exists concerning cardiovascular health outcomes of racialised groups related to exercise. Canadian health research, much like its international counterparts, shows a considerable lack of focus on minority populations. This results in underrepresenting these groups in health studies, leading to a knowledge gap about their health outcomes. As a result, the distinct health challenges faced by racialised communities are not adequately addressed, and interventions designed to improve their health outcomes are scarce or poorly implemented. The absence of inclusivity and targeted exercise research highlights the urgent need for more comprehensive studies to understand and address the cardiovascular health disparities challenged by minority populations in Canada (Reifenstein, 2018). It is also troubling, considering these groups are often reported to exhibit lower cardiovascular fitness levels and higher incidences of chronic conditions.

The Rexdale Women's Centre (RWC), located in a suburb of Toronto, Ontario, Canada, launched a community-level physical literacy initiative called Fitness for Life

(FFL), which primarily targeted immigrant and newcomer populations, including women, older adults, and seniors, in physical activities and light recreational sports. A central component of FFL involved instructing clients and staff on fundamental movement skills (FMS). These basic movements, typically acquired during childhood, lay the groundwork for various physical activities, including play, games, sports, dance, and exercise (Lander et al., 2017). Regularly practising FMS benefits FFL clients, as they can improve their fitness, strength and coordination, contributing to overall health while encouraging lifelong physical activity engagement. This is especially favourable for those clients who have not previously participated in exercise routines or find exercising challenging.

Moreover, given the limited research on exercise participation among racialised communities in Canada, FFL presented a unique opportunity to study these groups and their health outcomes. This research is vital considering the existing literature gaps regarding ethnic groups' health status. Guided by the social-ecological model, this thesis examines FFL and conducts two studies to deepen our understanding of how tailored exercise programmes, when implemented as multilevel initiatives in community settings, can effectively accommodate the specific needs of ethnic groups and support the reduction of their cardiovascular health risks.

1.2 Purpose of the Study

This thesis research evaluated the effectiveness and health outcomes of participants from 5 ethnic populations participating in the FFL exercise programme. Two studies were conducted with several objectives: 1) study 1 to evaluate the overall efficacy of the FFL 17-week exercise programme, 2) to observe changes in cardiovascular profiles (i.e. blood pressure (BP), heart rate (HR), mean arterial pressure (MAP), pulse rate (PP) and body composition (body mass, body mass index (BMI), fat percentage and water percentage) to the 17 week exercise regime across the five ethnic groups (African Canadians, South Asians, Middle Eastern, Europeans and Asians and 3) to identify the physiological responses to the exercise regimen (e.g., which groups increase or decrease BP following the end of exercise intervention). Study 2 objectives were 1) to investigate how physiological parameters (i.e., RPP, HR, and BP) may impact the African Canadians and South Asians' responses to 10 dance aerobic sessions and 2) to assess the degree of health improvements among the two groups. Participants' BP, HR, and other cardiovascular profiles were also measured in this study. Presented in appendix 7 is an infographic summary of each study.

As mentioned, the first study involved participants engaging in a 17 week exercise. The exercise prescription included low to moderate impact aerobics and light strength training workouts. The workouts were done 3 days a week, totalling 51 sessions lasting 45 minutes long. Two days were allocated for aerobic sessions, while the other was set for light strength training. See Appendix 3 for a sample of the strength training workout. In total, 365 clients took part in this study. Two self-reported questionnaires, the Physical Activity Questionnaire and PAR-Q, were taken at baseline: these determined participants' health status, such as their health conditions, pain issues, drug information, symptoms and potential barriers.

The second study focused on two FFL subpopulations, the African Canadian and South Asian participants. The study examined how the RPP responded to 10 consecutive dance aerobic exercise sessions between the two groups. These sessions were done twice a week. It is important to note that while participants engaged in strength workouts, the study focused on the 10 aerobic dance sessions. In total, 160 participants (80 African Canadians and 80 South Asians) with cardiovascular conditions participated in this study. Of note, each study did not restrict participants' diet or medication.

1.3 Research Question

The central research question of this thesis examined the impact of a community-based exercise programme, FFL, theorised using the ecological model, on improving the cardiovascular health outcomes of the five ethnic groups. This inquiry was split into two studies: the first evaluated FFL's overall effectiveness in improving participants' health outcomes by assessing changes in their cardiovascular profiles (e.g., BP, HR, MAP, RPP and PP) and body anthropometrics (body mass, BMI, fat percentage and water percentage) from baseline to the completion of the 17-week exercise programme. The two self-reported questionnaire replies were collected at baseline and then analysed. The second study examined the RPP, a critical cardiovascular indicator responding to acute exercise. It involved 10 dance aerobic sessions conducted with two FFL subgroups of individuals: African Canadians and South Asians who had been diagnosed with hypertension, high blood pressure or other cardiovascular conditions. These groups were chosen to conduct Study 2 because they share similar cardiovascular health outcomes, and each group had more clients than the different groups. One important aim was to reduce BP disparities observed among the African descendants throughout the literature. Additionally, since healthy people typically have normal cardiovascular function, the impact of exercise on the RPP may not be significant or clinical. Thus, the study did not include healthy populations.

1.4 Hypothesis

In Study 1, the FFL exercise is hypothesised to affect blood pressure makers (systolic and diastolic blood pressure, mean arterial pressure, rate pressure product and pulse pressure) and body composition (weight, body mass index, fat and water percentages) among different ethnic populations. The effects are hypothesised to vary between ethnic groups, with measurable differences observed in pre and post intervention measurements. The association between changes in blood pressure components among participants in FFL and factors such as gender, age, and BMI is uncertain. However, these changes are expected to be significantly influenced by other factors (e.g., multiple barriers, health and medication status, exercise intensity, duration, and adherence). Moreover, Study 2 hypothesised that the rate pressure product and other blood pressure components will exhibit significant changes post intervention, indicating the usefulness of acute exercise bouts over ten sessions. These changes are hypothesised to differ between the subpopulations of African Canadians and South Asians participating in FFL. These differences are also likely influenced by the intensity of the exercise, duration, and drug prescriptions. Likewise, potential cultural, social, and environmental factors unique to each subpopulation can contribute to the differences in outcomes.

1.5 Literature Review

The literature review section features a comprehensive background for understanding current knowledge in the study area. As such, academic works on physical inactivity among selected ethnic groups mainly focus on African Canadians. The review covers evidence of inactivity in different parts of the world. Therefore, the global impact of inactive lifestyles, specifically on individuals of African descent, highlighting some health differences, is discussed. The benefits of and the different approaches and interventions (such as theoretical concepts and church-based health promotion programmes) implemented to cultivate sustainable, active lifestyles among inactive people are also reviewed. Lastly, details of the physiology of exercise on cardiovascular functions are described.

1.6 Study 1: The effect of exercise response on cardiovascular health outcomes among ethnic groups participating in a community-based intervention

1.6.1 Study Objective

The study looked at the impact of the FFL 17 week exercise programme by observing and measuring differences in cardiovascular system profiles BP, HR, MAP, RPP, and PP and body composition (body mass, BMI, fat mass and water %) with the different ethnic groups (i.e. African Canadians, South Asians, Middle Eastern, European, and Asians). A self-reported Physical Activity Questionnaire and Physical Activity Readiness Questionnaire (PAR-Q) are administered to examine participants' health status, such as their current medical history, symptoms, medication usage, pain issues, readiness to exercise safely, and potential exercise barriers.

1.6.2 Study Methodology

The study collected pre and post measurements of participants' cardiovascular profiles (BP, HR, MAP, and PP) and body composition while administering the two self-reported questionnaires. The inclusion criteria for participation in the study were individuals who identified as adults of African (including Black African, African Canadian, and Afro-Caribbean), South Asian (including those from India, Pakistan, Sri Lanka, and Bangladesh), European (including Italians, White Canadians, and Spanish), Middle Eastern (including Iranians, Iraqis, and Syrians), or Asian (including Chinese, Philippines, Japanese, Koreans) origin, and were 18 years of age or older.

Following the client's consent, the team collected BP and HR using the Omron Bronze Digital BP Monitor. The MAP, RPP, and PP were then collected using online calculators to evaluate each participant's pre and post scores. Moreover, the body weight, BMI, fat and water percentages were taken with a TANIA total analyser (TBF-410GS). Exercise sessions were held three times a week for 45 minutes. Two days were set aside for aerobic training and the other for light strength training. See Appendix 3 for a sample of the strength training workout. In addition to the exercise sessions, the study included health education workshops. The workshop presentations were designed to equip participants with knowledge and skills and help them make healthy choices. Participants completed two questionnaires: The Physical Activity Questionnaire and the Physical Activity Readiness Questionnaire (PAR-Q). The Physical Activity Questionnaire determined participants' pain issues, exercise barriers, medication history and usage, health conditions, whether they knew the benefits of exercise, Canada's Physical Activity Guidelines, and their reasons for not exercising. The PAR-Q assessed participants' exercise readiness and gathered information on their current symptoms, physical activity level and health status. In addition to exercise, participants attended healthy living workshops and were taught the Foundational Movement Skills (FMS). The FMS are simple, foundational motor skills that serve as the building blocks for specialised movements in various physical activities (Lander et al., 2017). Moreover, participants signed a consent form to participate in the study, while the RWC Director of Programming permitted the research at the Centre. The Staffordshire University Ethics Committee approved ethical considerations for the researcher's use of previously collected data.

Several statistical analyses were conducted. First, the Kolmogorov-Smirnov test was administered to evaluate data normality (normal distribution of scores). The test indicated that all data were not distributed normally, thus violating the normality assumption. Therefore, the non-parametric Kruskal-Wallis H test was used to examine the differences between cardiovascular profiles and body composition for all five cultural groups. The Chi-square tests were performed to identify significances ($p<0.05$) and correlations between nominal parameters, health conditions, and medications on the cultural profiles (groups) to exercise response. The Chi-square tests were also used to compare observed findings and expected counts on the Physical Activity Questionnaire and the PAR-Q responses. Multiple regression analyses were done to find a direct or substantial relationship between variables (i.e. gender, sex, and BMI) on the blood pressure profiles. All p-values were calculated using the two-sided method. A p-value $<$ 0.05 was considered significant for each test, while a p-value $>$ 0.05 was not considered statistically significant. The continuous data included cardiac profiles BP, SBP, DBP, HR, RPP, PP, MAP, body weight, BMI fat, and water percentages. The results for descriptive statistics were expressed as mean ± SD. All statistical procedures were performed using the Statistical Package for Social Sciences (SPSS) software (Version 21, IBM).

1.7 Study 2: The differences in cardiovascular response to 10 exercise sessions between African Canadian and South Asian cardiac patients

1.7.1 Study Objectives

The study examined and contrasted the responses of BP, HR, and RPP between two FFL subgroups, the African Canadian and South Asian cardiac patients diagnosed with hypertension, blood pressure (defined as 140/90) or other cardiovascular conditions. In total, 160 participants registered in this study (80 African Canadians and 80 South Asians). The objective was 1) to investigate how physiological responses, including RPP, HR, and BP, may influence the responses of African Canadian and South Asian participants to the 10 dance aerobic sessions and 2) to assess the degree of health improvements among the two groups.

1.7.2 Study Methodology

The study collected pre and post data from the two FFL subgroups: African Canadians and South Asians. A total of 160 participants were recruited for the study. The study eligibility criteria were as follows: 1) participants aged 30 or older; 2) participants of African origin, including individuals of Black African, Black Canadian, or Black Caribbean origin; 3) participants from South Asian backgrounds, encompassing India, Pakistan, Sri Lanka, and Bangladesh and 4) participants who had specific heart health conditions. These conditions could include chronic mild to moderate or stable hypertension or high blood pressure (defined as 140/90) or related hypertension heart conditions such as left ventricular hypertrophy or heart disease. Participants were also required to be sedentary when enrolling in the fitness programme or have had no prescribed exercise within the past six months or longer.

The study did not regulate medical prescriptions or dietary consumption. Lastly, each participant was provided with information about the study. If they agreed to participate, they signed an informed consent form. The Director of Programming endorsed and authorised the study at the Centre. Afterwards, the Staffordshire University Research Ethics Committee approved the use of previous data the researcher collected.

It is worth highlighting that the cardiovascular profiles and body composition measurements of African Canadians and South Asians were initially assessed at the beginning of the FFL. Participants' baseline BP and resting HR measurements were obtained using an automated digital electronic BP monitor (Omron BP monitor Model BP710CANN). After receiving the BP and HR measurements, the RPP was calculated using an online calculator. Participants' body composition measurements (i.e., weight, BMI, fat % and water content) were collected only at baseline using the Tanita TBF-410GS Body Composition Analyzer. Similarly, while Studies 1 and 2 included the administration of the Physical Activity Questionnaire and PAR-Q at baseline, the focus here was to analyse the data regarding participants' health conditions and medication usage. Finally, the exercise intervention consisted of a total of 10 workout sessions, which were done twice weekly. Although each group engaged in light strength training workouts, the study emphasised the dance aerobic sessions.

The Kolmogorov-Smirnov test was administered to check for normality (normal distribution). The test found that all data were not distributed normally, so the non-parameter statistics for the analysis were used instead. The data included SBP, DBP, HR, and RPP. The Mann-Whitney U test was done to determine the significant ($p<0.05$) differences between the two groups in the continuous cardiovascular parameters (i.e., pre-measurements, post-measurements, and pre/post-measurements). Similarly, the Wilcoxon test was utilised to detect significant differences ($p<0.05$) and to determine if there was a median difference between paired observations, such as pre and post-systolic blood pressure (SBP). Additionally, an analysis of the effect size (r) was conducted. Analysis was calculated by dividing the z value by the square root of the number of pairs (N). All p-values were calculated using the two-sided method. A p-value < 0.05 was considered significant for each test, while a p-value > 0.05 was not deemed statistically significant. All statistical procedures were performed using the Statistical Package for Social Sciences (SPSS) software (Version 21, IBM).

1.8 Significance of the study and potential impact

The research highlighted various challenges in executing and delivering long-lasting physical activity initiatives. Exercise interventions at the community level, particularly those informed by theoretical frameworks such as the social-ecological model, demonstrate high efficacy in specific groups. When these interventions are carefully structured to reflect the multiple layers of influence, they could be more successful in reaching and engaging diverse populations, including those defined by age, ethnicity, socioeconomic status, or health status. Considering the varied environments and social contexts in which these individuals operate, such interventions are better equipped to address the unique barriers and facilitators to exercise they may encounter for a more meaningful and sustained engagement in physical activity.

Fitness For Life is to illustrate the influence of exercise on health, particularly noting observable improvements across ethnic groups. This is very important for individuals from ethnic populations like the African Canadian group who are faced with higher hypertension and challenges in BP management. The progress in cardiovascular health and other profiles from the results will offer insights into creating effective health and exercise promotion strategies for ethnic groups, aiming to narrow health disparities and lead to better health outcomes. Likewise, the findings could support informing policymakers and health practitioners about supportable and innovative plans for delivering and implementing fitness programmes in ethnically diverse communities and programmes tailored to their needs.

Chapter 2: Literature Review

This literature review aims to capture scholarly works on physical inactivity among various ethnic groups, including African Canadians, South Asians, Middle Eastern, European, and Asian populations. The primary focus is on the African Diaspora, looking into past research to investigate the influence of physical activity and its absence on people from these diverse ethnicities. Reviewing the physical inactivity of these groups is crucial for developing targeted health interventions, addressing health disparities, formulating effective public health policies, and promoting overall well-being within these communities. This review discusses the benefits of exercise and various approaches or interventions implemented to encourage sustainable, active lifestyles among these groups. Lastly, it details the effects of exercise on cardiovascular functions.

2.1 Physical inactivity epidemiology

As the World Health Organization (WHO) (WHO, 2021) describes, physical inactivity is characterised by a suboptimal level of engagement in routine physical activities such as exercise. Specifically, it denotes an absence or inadequate involvement in activities that elicit elevations in heart rate and promote muscular strength and flexibility. The WHO (2021) and other health organisations have made provisions to promote worldwide physical activities. For example, the WHO proposed that adults aged 18 to 64 should engage in at least 150 minutes of moderate-intensity aerobic physical activity throughout the week or at least 75 minutes of vigorous-intensity aerobic physical activity or an equivalent combination of both (WHO, 2021). Muscle strengthening activities such as weight training should be performed at least twice weekly (WHO, 2021).

Popular modes to engage in habitual physical activity are also suggested. These include walking, cycling, sports, active recreation, exercise, and play. However, despite the recommendations and the noted benefits, approximately a quarter of the global adult population falls short of meeting physical activity guidelines, with many remaining inactive (Anderson & Durstine, 2019; Ding et al., 2017). Indeed, physical activity, which encompasses structured exercises and everyday tasks involving bodily movement, is critical to maintaining and enhancing overall health and well-being. Its health benefits range from reducing the risk of chronic diseases like heart disease, diabetes, and certain cancers to supporting mental health and cognitive function. Even with these advantages, Kohl et al. (2012) and Anderson et al. (2016) highlighted a global trend where a significant portion of individuals aged 15 and above do not meet the recommended physical activity levels. The dearth of physical activity arises from limitless causes, and its profound ramifications will be thoroughly explained in the subsequent thesis.

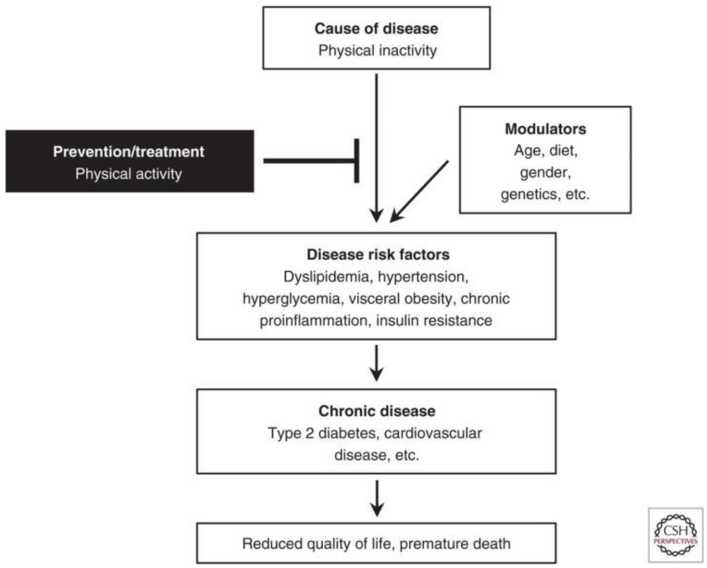
Regional disparities in physical inactivity rates have been observed, indicating variations across different areas. Data from 2001 to 2016 revealed the highest prevalence of inadequate physical activity among adults (≥18 years) in Latin America and the Caribbean, with a reported rate of 39.1% (Guthold et al., 2018). High-income Western countries followed this at 36%, high-income Asia Pacific at 35%, Central Asia, Middle East, and North African region at 32%, Central and Eastern Europe at 23%, Sub-Saharan Africa at 21%, East and Southeast Asia at 17%, and the Western Pacific at 16% (Guthold et al., 2018). These regional variations indicate differences in physical activity levels and recommend the need for more sustainable strategies to adopt specific challenges and barriers within each region.

2.2 Health Consequences of Physical Inactivity

The consequences of low physical activity levels are significant. It contributes to the development of chronic diseases, poor mental health, reduced quality of life, and increased mortality rates. This explains why many studies found a direct link between an inactive lifestyle and chronic diseases, with sedentary individuals having a significantly higher risk of developing non-communicable diseases (NCD) such as heart disease, stroke, and type 2 diabetes (Gonzalez et al., 2017; Booth et al., 2017). One study by several authors indicated that the absence of physical exercise might lead to an accumulation of abdominal fat buildup and obesity, a significant contributing factor to heart disease (Lavie et al., 2019). Another research reported the association between adopting a sedentary lifestyle and early death (Ekelund, 2016). Indeed, the lack of physical activity can be mitigated through participation in moderate intensity physical activity at elevated levels and where accessibility is prevalent.

In past eras, the intrinsic value of physical activity was universally recognised and often seamlessly integrated into daily life, whether through labour-intensive tasks, walking or cycling as primary modes of transport, or participation in communal physical activities. Over time, however, societal and technological shifts have transformed how people live and work, with a pronounced move toward sedentary lifestyles. Presented in Figure 2.1 is a sample illustration of the relationship between physical activity and the prevention of type 2 diabetes and its associated complications. As acknowledged, integrating regular exercise into one's routine offers a crucial preventative measure against developing conditions like type 2 diabetes for at-risk individuals. Additionally, for those already diagnosed, it serves as a method for managing and alleviating complications associated with the condition.

Figure 2.1 Physical Activity Participation



An overview example of how physical activity can prevent the development of type 2 diabetes and other complications. (Booth et al., 2012, as cited in Ruegsegger, G. N., & Booth, F. W. (2018). Health benefits of exercise. Cold Spring Harbor Perspectives in Medicine, 8(87).

An inactive lifestyle affects one's health, incurring significant economic costs. Some of these costs include direct healthcare expenses for treating non-communicable diseases (NCDs), indirect costs due to reduced work productivity, sickness absence, or premature mortality, as highlighted by Anderson et al. (2005). The literature noted that regular physical activity, especially exercise, can improve personal and economic health. On a personal level, regular exercise improves physical and mental well-being by reducing the risk of chronic conditions (e.g. cardiovascular diseases, type 2 diabetes, obesity, and certain cancers) (Warburton et al., 2017). It also increases mental health ability by alleviating symptoms of depression, anxiety, and stress while improving cognitive function and overall quality of life (Rebar et al., 2015).

From an economic perspective, increased physical activity is beneficial as it contributes to a healthier population, which in turn reduces medical interventions and long term treatment for chronic diseases (Ding et al., 2016). Adapting regular physical activity, individuals are less likely to develop these conditions or experience severe complications if they already have them, lowering overall healthcare expenditures for them and society. Reduced healthcare utilisation lightens the financial and operational burden on healthcare systems, allowing resources to be allocated more efficiently. This economic impact is significant at a societal level, as it can lead to reduced absenteeism, increased workplace productivity, and an overall boost in economic growth by maintaining a healthier workforce (Ding et al., 2016). It is then appropriate that the workplace environment has begun to promote active lifestyles by offering gym memberships, standing desks, and scheduled breaks for light physical activities (Griffiths, 1996; Bretland & Thorsteinsson, 2015). Such approaches could significantly reduce the likelihood of employees developing musculoskeletal problems such as neck and back discomfort, often associated with prolonged sitting and extensive computer usage (Beneka et al., 2015). Awareness of the health risks associated with sedentary jobs has led to the introduction of workplace wellness programmes, ergonomic furniture, and the promotion of regular breaks to encourage movement. Some workplaces now incorporate standing desks, treadmill desks, or regular physical activity breaks to combat the health risks of prolonged sitting. Greodimos and co-authors (2022) found that a well-structured six-week supervised exercise regimen effectively enhanced employees' physical and mental well-being. Such initiatives posed the potential to boost productivity in the workplace considerably.

As we see, promoting habitual physical activity can have broader societal benefits, such as lowering healthcare inequalities and enhancing community level economic resilience through lower public health expenditures and higher engagement in economic activities. Known benefits of regular exercise include improved cardiorespiratory fitness and maximal oxygen consumption (VO2 max), which contribute to better cardiovascular health and lower chronic disease risk (Ruegsegger & Booth, 2018; Wilmore & Knuttgen, 2015). Additionally, routine exercise can reduce body fat percentage, increase lean muscle mass, and improve physical appearance and overall health (Wilson et al., 2015). This thesis will further discuss the advantages of physical activity participation.

2.3 Determinants of Physical Inactivity

The determinants influencing physical inactivity or lack of exercise are manifold and complex, interlacing personal, social, environmental, and policy-level factors. Individual factors like age, health status, motivation, attitudes, knowledge, and psychological influences are significant (Roller, 2012; Collado-Mateo et al., 2021; Eynon et al., 2019). As people age, physical constraints or health related challenges can limit their ability to engage in exercise. Similarly, personal attitudes and motivations are key in determining exercise behaviour, as individuals may not prioritise it without an inherent drive to be active. Equally, people often perceive they lack time due to demanding careers, family responsibilities, psychological barriers, or other commitments that consume their day, preventing them from exercising (Bopp et al., 2006). Understanding the root causes of some of these views and directly addressing them through time management strategies, short but effective workouts, or a shift in priorities can help people integrate exercise into their busy lives. The challenge lies in striking a balance between commitments and the need for physical well being.

Lower self-efficacy, or an individual's belief in their capacity to carry out specific tasks, has been demonstrated to discourage participation in exercise (Warner et al., 2011). A lack of understanding concerning the manifold benefits of consistent physical activity often compounds this. In contrast with these factors, the apprehension of potential injury has been identified as a significant deterrent, especially among seniors and individuals who have experienced prior injuries (Bethancourt et al., 2014). Equally, unfamiliarity with heavy perspiration from a workout may deter some individuals from engaging in physical exercise (Huebschman et al., 2016; Joseph et al., 2015). Another prominent deterrent is the perception of inadequacy in certain physical activities, with potential participants fearing embarrassment or failure, thereby avoiding such activities (Stankov & Olds, 2012; Burnett et al., 2015; Ball et al., 2000). This reluctance may hinder an individual's potential physical progress and reinforce negative self beliefs. Sadly, this can create a cycle of avoidance and missed health and personal growth opportunities.

Fear of judgment about body image, particularly in public spaces, may reduce physical activity levels (Gaston & Porter, 2013). Additionally, the concern over maintaining hairstyles, a noted barrier for African American women (Im et al., 2012), suggests the need to promote hair-friendly activities and provide solutions that enable these women to exercise without compromising their hair. It is good to recognise such culturally specific obstacles as it supports designing sensitive interventions and meeting the needs of diverse communities.

Social support and cultural norms significantly shape exercise behaviours. A supportive social network can promote physical activity, whereas its absence, common in cultures undervaluing exercise, leads to activity deficits (Shuval et al., 2008; Sharara et al., Ghattas, & Makhlouf, 2018). Cultural norms and societal expectations can significantly limit physical activity, particularly for women, as they often navigate gender roles that discourage exercise. Factors like gender, religious beliefs, and prioritising other activities can constrain the opportunity and willingness to engage in physical exercise (Sosa et al., 2023).

Environmental determinants, including access to safe and affordable exercise facilities, neighbourhood safety, and climatic and geographical conditions, can either facilitate or hinder individuals' exercise routines (Lee & Cubbin, 2009). A study conducted among middle-aged and older women from various racial and ethnic backgrounds in the United States examined several factors, including environmental elements associated with sedentary behaviour, revealing the presence of multiple barriers (King et al., 2000). These barriers encompassed the absence of vitality and safety, the dearth of sloping terrain within their surroundings, and the unavailability of aesthetically appealing landscapes. Similarly, prior research conducted by Casagrande et al. (2009 found that individuals residing in lower-income neighbourhoods, where African Americans are disproportionately represented, encounter difficulties accessing safe and affordable recreational facilities, contributing to reduced exercise engagement within these communities (Casagrande et al., 2009). Conversely, individuals belonging to higher socioeconomic groups tend to enjoy improved access to resources such as fitness centres, sports clubs, and secure outdoor spaces conducive to physical activity

(Casagrande et al., 2009). This unequal access to facilities and resources underlines a disparity in opportunities for engaging in physical activity across different socioeconomic groups. It is then appropriate that several approaches, such as investments in public facilities, would provide more equitable access to spaces for physical activities.

Finally, the evolution of the workforce due to technological advancements has profoundly affected many individuals' daily physical activity. As technology progressed, many traditional roles that required manual labour and inherent physical exertion have been replaced by jobs that demand little to no physical movement. This transition primarily results from automation, computerisation, and other technological tools that simplify tasks, eliminating manual effort (Dane et al., 2011; Quinn et al., 2022).

2.4 Impact of COVID-19 and Physical Inactivity

The literature has shown a significant reduction in physical activity levels during the COVID-19 pandemic. Ammar and colleagues' (2020) survey highlighted a notable increase in sedentary behaviours due to lockdown measures and virus-related fears. The trend of reduced physical activity during the pandemic raised concerns about its potential health implications. This was noted in a study by Schuch and co-authors (2020), where they found a significant link between heightened inactivity and increased instances of mental health, including anxiety and depression. Canadian research sheds light on the impact of the COVID-19 pandemic on mental health (Woodruff et al., 2021). In this study, the levels of mental stress experienced by individuals during the initial two months of the pandemic were investigated. The findings showed a noteworthy increase in mental stress among a section of the Canadian population during this period (Woodruff et al., 2021).

The study also underscored the necessity of continuously monitoring individuals' health and well-being during the pandemic. Given the dynamic nature of the situation, ongoing assessment and intervention were important to meet the changing mental health needs of individuals and communities.

Moreover, many studies, including those by Stockwell et al. (2021), Cheval et al. (2021), and Runacres et al. (2021), have linked sedentary behaviour with worsened COVID-19 outcomes. Specifically, Stavridou and colleagues (2021) found that such behaviour led to weight gain across various age groups, especially among children, adolescents, and young adults, underlining the severe consequences of physical inactivity during the pandemic. These insights are vital for informing public health interventions to counteract the pandemic's adverse effects.

The research identified a significant increase in sedentary behaviour during the pandemic and its adverse health consequences. This alarming trend prompted health organisations and researchers globally to develop and implement innovative solutions to mitigate its impact and promote healthier lifestyles. Thus, home based exercise workouts and digital fitness programmes quickly gained popularity. Outdoor activities where social distancing can be maintained. For example, cycling and walking were encouraged, contributing to increased activity (Stockwell et al., 2021). Public health messaging was necessary to stress the importance of staying active during the pandemic. These campaigns played a central role in disseminating essential knowledge regarding the significance of physical activity during the pandemic. It also guided how individuals could adapt their exercise routines to comply with safety guidelines like practising social distancing, wearing masks, and utilising outdoor spaces effectively. Ultimately, the initiatives empowered individuals to make informed decisions about their physical well-being while prioritising public health measures.

2.5 Physical Inactivity in Different Ethnic Groups

Much research suggested substantial disparities in physical inactivity participation among different ethnic and racial groups in the United States, specifically regarding the intensity, frequency, and duration of exercise necessary to decrease cardiovascular risk factors (Kreadie et al., 2017; Smith et al., 2017). A report released in 2020 showed that physical inactivity was high across these populations (Fulton, 2020). The report indicated that Hispanic adults had the highest prevalence of physical inactivity at 31.7%, followed by non-Hispanic blacks at 30.3% and non-Hispanic whites at 23.4% (Fulton, 2020). One study found African Americans experiencing higher rates of physical inactivity and were less likely to meet the recommended physical activity guidelines than their White counterparts (Ellis & Thorsteinsson, 2019; Kokkinos et al., 2011; King et al., 2000). The demonstrated disparities bring attention to the importance of understanding broader health and wellness patterns in different racial groups and guiding public health initiatives to reduce these disparities.

Specific data on physical inactivity among Black British individuals is scarce in the United Kingdom. However, studies have highlighted disparities in physical activity levels across various ethnic groups (Ige-Elegbede et al., 2019; Koshoedo et al., 2015). A British survey found that ethnic minorities reported higher physical inactivity rates compared to the general population. Notably, it showed that 31% of Asians, 29% of Black British, and

30% from other ethnic minorities were physically inactive (Williams et al., 2015; Ige-Elegbede et al., 2019). This trend mirrors the situation in the United States, where related disparities in physical activity exist among different ethnic and racialised groups, as mentioned above.

A compelling, systematic review from Britain illustrated that second-generation South Asian adults exhibit higher physical activity than their predecessors (Bhatnagar et al., 2015). However, their activity levels still lagged behind those of White British descent. This observation points to an intriguing dynamic of increasing physical inactivity within the South Asian community across generations, yet a continued disparity when juxtaposed with other ethnic groups (Bhatnagar et al., 2015). In-depth research would be welcome to understand this phenomenon. Nonetheless, initial indications propose that second-generation South Asians may possess a more favourable disposition towards physical activity than the first-generation (Bhatnagar et al., 2015). This conjecture, if substantiated, holds profound implications for developing extensive physical activity interventions and suggests customising strategies tailored to cater to the specific needs and attitudes of different generations of UK South Asians that may be required to promote physical activity within these communities.

On the African continent, a systematic review and meta-analysis conducted in Nigeria also identified a concerning trend of decreased physical activity levels among the population segment, emphasising the importance of targeting interventions and health promotion strategies to address physical activity behaviours in the country (Adeloye et al., 2022). Another study showed that physical inactivity is the most prominent risk factor for hypertension in the stroke-free population of Ghana and Nigeria (Okekunkle et al., 2021). This finding amplifies the importance of physical activity in preventing hypertension, particularly in populations with high stroke incidence. The role of physical activity as a cardioprotective factor against hypertension stresses the need for public health interventions targeting the promotion of regular exercise, particularly in high-risk populations in Ghana, Nigeria and other regions on the continent.

Past research from Canada has suggested that newcomers from Asian or South Asian countries experience lower physical activity levels, facing a higher risk for obesity and weight-related issues (Mahmood et al., 2018). One hypothesis may be attributed to the increase in adopting a more Westernised diet, specifically in young adults and children. Immigrants to Canada may encounter adverse alterations in their food environment, precipitating dietary acculturation characterised by the increased intake of foods rich in sugar, sodium, and fat (Lane et al., 2019). Consequently, this may worsen South Asians' and other immigrant populations' well-being if appropriate measures are not taken. It may be prudent to develop tailored health promotion materials, such as a physical activity guide that cater specifically to the needs of newcomers. Support the promotion of accessibility for active lifestyles in different demographics; this strategy stresses that physical exercise is critical for holistic health and not just as a means for weight loss.

Moreover, the literature has begun to notice that Black African descendants and South Asians share similar cardiovascular profiles and lifestyle behaviours where they are less active and exhibit several chronic diseases. Certain factors have been identified in the research that may influence exercise adherence among individuals from each group. For example, researchers have found that discrimination and systemic inequities impact access to resources and opportunities, leading to disparities in physical activity among racial and ethnic groups (Wilson et al., 2008; Zenk et al., 2011; Macintyre, 2007; Lee & Cubbin, 2009). This is mainly seen in Black African descendant communities where systemic inequalities have led to less leisure time (Lee & Cubbin, 2009). As previously expounded, residing in communities perceived as unsafe or unsuitable for leisure activities substantially impedes physical activity opportunities. It is known in American research that a multitude of obstacles significantly inhibit African Americans' engagement in physical activities, affecting their overall health and wellness. Some of the barriers noted in African American communities will be elaborated on and discussed in subsequent sections of this thesis.

Previous studies indicated that cultural norms and beliefs prevalent within specific South Asian groups may shape exercise behaviours and perpetuate negative stereotypes or stigmatisation concerning certain forms of physical activity, specifically for females (Lear et al., 2018; Rajaraman & Correa, 2015; Caperchione et al., 2013). This is particularly pronounced among young South Asian and Muslim girls, who often encounter societal discouragement against physical activity (Lear et al., 2018; Smith et al., 2018). Notably, cultural attitudes towards physical activity can be diverse and often place other priorities above exercise (Horne et al., 2018). Concurrently, familial and work obligations might overshadow the emphasis on physical activity, especially in particular cultural settings, reducing participation among South Asian women (Curry et al., 2015). As an illustrative anecdote, several South Asian and Muslim women who participated in the FFL exercise intervention cited their responsibilities of preparing meals for their husbands and family as a reason for their absence.

Understanding that individuals of South Asian or Black African descent uniformly display specific health profiles or exercise behaviours is crucial. It is perhaps this variation is due mainly to migration, urbanisation, and acculturation playing significant roles in shaping health outcomes. Migration can lead to changes in lifestyle and exposure to different health systems and standards (Wireland et al., 2018). Urbanisation often brings about shifts in physical activity levels and dietary habits, potentially impacting health (Wireland et al., 2018). Likewise, acculturation, or the process of adapting to a new culture, can influence health behaviours and choices as individuals integrate elements of their original culture with those of the new environment (Gillespie et al., 2022). While there might be general observations about cardiovascular profiles and exercise behaviours in South Asian and Black African populations, it is important to recognise the diversity within these two groups. Environmental, cultural, and personal factors impact health profiles and behaviours, which can vary widely even within these demographic categories.

The person’s agency, or the capacity of individuals to act independently and make their own choices, is a key determinant in health outcomes. As indicated, people's diet, exercise, or healthcare decisions, influenced by their unique circumstances and beliefs, contribute significantly to their overall health. These factors together mean that health profiles and exercise behaviours are not homogenous within any racial or ethnic group but are instead influenced by a complex interplay of social, cultural, and personal factors. Appropriate measures to counteract health and exercise disparities remain to be adequately addressed. In this thesis, an evaluation of strategies to enhance physical activity among ethnic groups, focusing on the African Diaspora, will be explored, aiming to propose actionable solutions for these disparities.

2.6 Physical Activity Interventions

Promotion of physical activity or interventions is critical for improving overall health and reducing health disparities among populations. However, groups such as individuals from the African Diaspora face unique challenges and barriers keeping them from engaging in regular physical activity. Thus, understanding the effectiveness of exercise interventions in encouraging physical activity or exercise among groups from the Diaspora is necessary for developing evidence-based strategies to address the disparities. A common approach is community-based exercise interventions. These initiatives have shown promise in involving people in regular physical activity or exercise. The programmes leverage existing community resources and social support networks to create opportunities for exercise participation. Importantly, community-based programmes are often designed to be culturally relevant and incorporate community preferences, making them more appealing and effective (Koshoedo et al., 2015).

As noted, the rising prevalence of sedentary lifestyles and associated health complications highlight the imperative for targeted approaches to promote well-being and prevent chronic disease among populations. It is then appropriate that various theoretical frameworks have been formulated and applied to craft efficacious interventions to enhance physical activity across diverse populations. These theoretical paradigms offer a holistic methodology, elucidating the intrinsic determinants that shape physical activity tendencies and thereby directing the architecture of intervention strategies (Gillison et al., 2009; Batalik et al., 2021). For instance, several intervention approaches, such as community-based participatory research and implementation science methodologies, have been leveraged with African Americans (Ameling et al., 2014). These methodologies advocate for a collaborative approach, soliciting perspectives from a broad spectrum of stakeholders within the patients' care continuum, encompassing patients, families, community affiliates, healthcare providers, policymakers, and clinical practitioners. Indeed, such an inclusive stance facilitates the recognition of determinants essential for devising interventions that resonate culturally, possess longevity, and exhibit efficacy.

The decrease in physical activity, particularly among diverse populations, has prompted the development of initiatives to alter this trend with varying degrees of success. One promising approach for encouraging increased physical activity is the application of theoretical frameworks, as Epstein (1998) and Ntoumanis et al. (2018) suggested. These frameworks are notably practical and relevant as they consider individual cultural norms, the built environment and national policies related to physical movement (Ntoumanis et al., 2018). Furthermore, this multi-layered approach, which recognises the interplay between individual, cultural, environmental, and policy-level factors, adds sophistication and applicability to strategies to reverse the decline in physical activity.

In the subsequent sections, three well-known theoretical principles will be explored: 1) faith-based interventions, 2) the Transtheoretical Model or stages of change, and 3) the social-ecological model. These intervention applications are frequently employed to stimulate diverse populations to augment their participation in physical activity.

2.6.1 Faith Based Interventions

Faith-based interventions refer to programmes, activities, and initiatives implemented within a religious setting, primarily within a church or religious community. These interventions leverage the church's influence, resources, and networks to address various social, health, and community issues and employ a framework that aligns with the values and beliefs of the community (Dehaven et al., 2004; Pattillo-McCoy, 1998; Dessio et al., 2004; Taylor, Thoronto & Chatters, 1987). Faith-based places of worship like the African American church have historically played a key role in communities, providing a place of worship, social support, and a sense of belonging with strong community ties (Pattillo-McCoy, 1998; Dessio et al., 2004; Taylor, Thoronto, & Chatters, 1987). This allows the church to reach and engage diverse populations, including individuals who may be marginalised, isolated, or distrustful of traditional healthcare systems. Church leaders and volunteers can serve as trusted sources of information, providing culturally appropriate guidance and support to individuals and families (Pattillo-McCoy, 1998; Taylor, Thoronto & Chatters, 1987).

Researchers and practitioners have increasingly utilised churches and other religious organisations as platforms for implementing interventions to improve health outcomes, helping to promote well-being and address social concerns (Dessio et al., 2004; Taylor et al., 1987). For instance, many church-based research initiatives have been conducted in these institutions, focusing on racialised groups to address health disparities and improve outcomes within these populations (De Marco et al., 2014). Some church interventions prioritised promoting physical activity to enhance overall health and well-being, while others have smoking concessions or harm reductions (Taylor et al., 1987). Specifically, religious exercise programmes encouraged regular physical movement and generated positive outcomes within African American communities. (Peterson et al., 2002; Campbell et al., 2007; Yeary et al., 2012). The Faith-based Approaches in the Treatment of Hypertension (FAITH) trial (Schoenthaler et al., 2018) found that leveraging places of worship as intervention sites can increase physical activity. It was suggested that church-based programmes incorporating culturally relevant physical activities, such as African dance, effectively increase physical fitness and foster long-term exercise (Boop et al., 2012; Kreuter & Lukwago, 2003).

Employing a structured behavioural framework as the foundation for the intervention, the Project Joy initiative focused on cardiovascular health demonstrated promising results, particularly in its efficacy in boosting heart health well-being among African American women (Yankek et al., 2016). This targeted approach highlighted the initiative's success in addressing cardiac health concerns within a specific demographic, such as African American women. Several main components contributed to the success of the initiative. Firstly, culturally sensitive and community-engaged approaches were employed to ensure the programme's relevance and effectiveness. This involved incorporating cultural beliefs, traditions, and values into the intervention strategies, fostering trust and active participation among the target population. Secondly, participants reported increased levels of physical activity, improved dietary habits, and greater awareness of cardiovascular risk factors. Positive observed outcomes, including drops in blood pressure, improved cholesterol levels, and weight management, accompanied these behavioural changes. Finally, the scheme, guided by the behaviour model, fostered a sense of empowerment and self-efficacy among African American women, empowering them to take an active role in managing their cardiovascular health. Indeed, church-based interventions such as the Project Joy scheme offer a holistic approach that identifies the interconnectedness of physical, mental, and spiritual well-being, raising awareness, providing resources, and empowering individuals to make informed choices about their health with added cultural elements.

In addition to providing health promotion, church-based interventions often play a critical role in addressing various social issues such as poverty, homelessness, substance abuse, and domestic violence within African American communities. These interventions aim to improve physical well-being and create awareness and support for the challenges and situations that impact the lives of individuals and families in these communities. Indeed, black churches provide a safe and supportive environment for individuals and families facing these challenges, offering counselling services, support groups, and referrals to community resources.

Equally, the church plays a significant and vital role in advocacy efforts, particularly in raising awareness and mobilising communities to address systemic issues contributing to social disparities. This phenomenon is particularly evident in the African American church, where advocacy efforts are strong and influential (Pattillo-McCoy, 1998). The church's efforts in addressing health disparities can lead to meaningful change and a positive impact on the lives of marginalised individuals and groups, such as African

Americans. Furthermore, church-based interventions have the potential to be sustainable and create long-term impacts due to several key factors. First, these interventions often benefit from dedicated volunteers committed to serving their communities, contributing to ongoing support and continuity. Second, the presence of committed leaders within the church ensures that the interventions remain a priority and receive consistent attention. Third, the church's existing infrastructure provides a solid foundation for seamlessly embedding and integrating the interventions, enabling sustained engagement and community ownership. This sense of ownership fosters a deeper connection to the interventions, making them more effective and likely to endure over an extended period. By leveraging these strengths, church-based interventions can create lasting positive changes and contribute significantly to the well-being of the communities they serve.

2.6.2 Transtheoretical Model

The Transtheoretical Model (TTM) originated from the field of psychotherapy and was initially devised to address addictive behaviours (Prochaska & Velicer, 1997; Marcus & Simkin, 1994; Prochaska & Marcus, 1994). Over time, its applicability has been extended to encompass various health-related behaviours. The model's foundation can be traced to its origins in psychotherapy literature, primarily employed to guide interventions targeting addictive behaviours (Prochaska & Velicer, 1997; Prochaska & Marcus, 1994). Researchers and practitioners have utilised the TTM to understand and promote various health behaviours beyond addiction, recognising its potential as a comprehensive framework. This broadened scope has allowed the model to be applied to diverse areas of health promotion and behaviour change, making it a valuable tool for understanding and addressing numerous health related concerns such as exercise (Prochaska & Velicer, 1997; Marcus & Simkin, 1994; Prochaska & Marcus, 1994; Spencer et al., 2006).

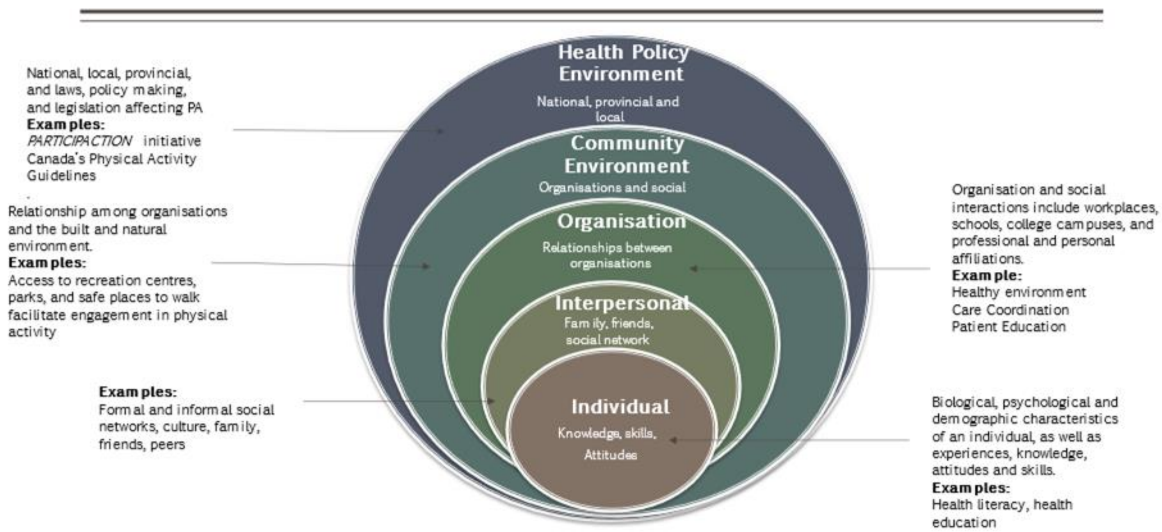
A previous study looking at three distinct populations (e.g., high school students, university students, employed adults) provided evidence of the TTM's usefulness in facilitating behavioural change across different stages of change, thereby supporting its applicability within these specific groups (Rogers et al., 2001). The study's results provided compelling evidence supporting the efficacy of the TTM in facilitating behavioural change across the different stages of change within the examined populations, suggesting the model can effectively guide behaviour modification interventions and promote positive outcomes in diverse groups.

Moreover, a recent systematic review by Shaver (2019) explored the role of exercise interventions in African American adolescents with TTM. The study examined the constructs of the TTM (stages of change, self-efficacy, decisional balance, and processes of change). The study evaluated the model's effectiveness in predicting physical activity among African American youth. The study results indicated that certain TTM constructs were associated with increased physical activity levels in the African American youth, which may also vary by gender. This study shows that aspects of the TTM can effectively inform the design and implementation of interventions specifically tailored to bring to attention individuals' distinct needs regarding physical activity engagement. Considering the stages of change outlined in the TTM, intervention programmes can be customised to meet adults at their respective readiness levels, reflecting their motivations, barriers, and individual preferences. The person-centred approach of the TTM effectively promotes physical activity, yielding successful and sustainable results.

2.6.3 Social Ecological Model

The ecological model by Urie Bronfenbrenner constitutes a framework utilised in implementing health promotion interventions, elucidating the various effects of the social milieu on an individual's capacity to engage in physical activity, and has been employed in numerous disciplines. (Lee & Park, 2021; Sallis et al., 1998; King & Gonzalez, 2018; Spence and Lee, 2003). The model is a common frame used in the research investigating health disparities among African Americans, highlighting the interplay of individual, interpersonal, organisation, community environment and health policy layers with different effects (Cooper & Boulware, 2013; King & Gonzalez, 2018). As seen in Figure 2.2, the ecological model is relatively complex, with multiple factors that can impact health disparities and inform the design and implementation of interventions to achieve equity, in this case, access to get populations moving, increasing physical movement, especially with socially at-risk groups. The root causes of disparities are the results of complex interactions of influences distributed across all facets (i.e. race, income, places of residence and physical and mental ability). Thus, it is critical to fully understand all the intersectionality’s so individuals can make sound decisions about their health. Often, interventions such as an exercise scheme may fail when the project does not address specific questions, adapt well to the organisation in which it is implemented or is unsuitable for the target audience (Spence & Lee 2003). It is no wonder implementation scientists suggest that interventions that address risk factors using multiple levels of the ecological model or others are more effective if more than one level is the target (Spence & Lee 2003).

Figure 2.2 The Social Ecological Model Levels



As mentioned earlier, the social ecological model is one of many exercise intervention tools used to motivate individuals towards physical activity and get them moving, offering a comprehensive framework for understanding the influence of the environment on an individual's health behaviours. The framework considers multiple layers of systematic influence. Starting with the most proximal system, the intrapersonal level focuses on individual characteristics such as knowledge, attitudes, and behaviours. Conversely, the interpersonal level considers the impact of small groups and networks that individuals frequently interact with (i.e. friends, family, and colleagues). The next layer, the organisation level, refers to the relationships between organisations and institutions within a community and encompasses social institutions organised. This level is also governed by specific rules and regulations, such as schools and places of worship. Up next is the community environment level, which consists of social beliefs and norms, economic conditions, availability of community resources, collective knowledge and attitudes toward specific issues, and the sense of empowerment and self-efficacy within a community. All these play a role in shaping individual and collective choices, decisions, and practices. Finally, the upper layer of the model recognises the significance of public policy at the local, state, and national levels in shaping health behaviours (Hasson et al., 2017; Mangione et al., 2022). See Figure 2.2

Adopting elements of the social-ecological model to plan and design exercise interventions enables researchers and healthcare professionals to implement a holistic approach that fosters physical activity behaviours in targeted populations (Essiet et al., 2017). This model is particularly effective due to its expansive focus, considering influences across multiple layers and environments, which allows for broader population impact compared to approaches that emphasise individual behaviour change. However, many interventions grounded in this model have not thoroughly examined the multilevel influences it proposes, as highlighted in a review of environmental strategies for physical activity interventions (Sallis et al., 1998). This limitation in research design restricts the ability to draw definitive conclusions regarding their effectiveness (Sallis et al., 1998).

Earlier reviews have demonstrated that environmentally based physical activity interventions produced promising results, contributing to the existing knowledge base. These interventions encompass a range of strategies, including the development of walking and recreational facilities (Giles-Corti et al., 2005), modifications to the built environment to encourage greater engagement in physical activity (Haggis et al., 2013), and the legislation of policy changes promoting active lifestyles (Heath et al., 2012).

Previous investigations employing the ecological model yielded insights into African American women's physical activity proclivities and behaviours (Fleury & Lee, 2006). More recent inquiries by Bjornsdottir Arnadottire and Halldorsdottir (2019) and Yen and Li (2019) delved into the interplay of social and physical environmental variables in influencing physical activity. While comprehensive empirical research in these ecological domains remains scant, existing literature has endeavoured to illuminate the multifarious factors potentially swaying physical activity behaviours. The investigation extends to integrating the social-ecological model with other theoretical paradigms, offering a multifaceted scrutiny of the interaction between individual determinants, such as attitudes and beliefs, and environmental and societal elements (Lee & Park, 2021).

In the present thesis, the Fitness for Life project drew upon several tenets of the social-ecological mode: individual, interpersonal, organisational, and community, with the aim of gathering an understanding of the participants' exercise behaviours and health profiles through designed questionnaires. For example, at the individual level, FFL created tailored educational materials (i.e., Fundamental Movement Skill (FMS) booklet, FMS posters, fitness demonstration postcards, and monthly newsletters). Barnett and colleagues (2016) described the FMS as basic acquired, innate movement patterns. These skills are posited to be the core for more complicated physical movement. Motor actions such as performing a bicep curl or squats present difficulties for individuals unaccustomed to physical exercise. Mastery of these skills provides them with foundational knowledge in correct biomechanical postures and lifting techniques. Thus, a peer committee encompassing ten leaders was established for the interpersonal dimension. These leaders underwent training to administer FMS proficiently and offer constructive feedback to enhance the exercise intervention. Furthermore, all the constructed resources were disseminated at the individual level. Concurrently, structured health education seminars were convened, during which guest speakers facilitated the workshops.

The organisational layer of this thesis centred on the systemic collection and analysis of participants' health metrics and outcomes stemming from the implemented exercise regimen. In addition to measuring the client's physiological changes, it captured their behavioural and psychological consequences, including adherence to the program and perceived well-being. The data generated provided a thorough understanding of the intervention's impact at the individual level, forming the foundation for evidence-based adjustments and future applications.

The programme emphasised cultural sensitivity at the community level to enhance engagement and relevance for participants. This was achieved by tailoring the intervention to align with the target population's cultural norms, values, and preferences. Peer leaders, who were representative of the community, were trained to facilitate the program, providing culturally competent guidance and fostering trust among participants. This approach supported empowering community members, enhancing the programme's accessibility and inclusivity. A rigorous evaluation plan was developed to assess the programme's usefulness. The proposal included process evaluations to monitor implementation reliability, participant satisfaction, and engagement and outcome evaluations to measure tangible health improvements and behavioural changes over time. Through the integration of these components, the intervention was designed to address immediate outcomes and long-term sustainability, ensuring that the programme was practical and meaningful to participants (see Figure 2.3). Furthermore, this dual-layered approach highlights the importance of combining organisational structures with culturally sensitive community engagement to create impactful and profoundly resonant interventions with the populations they serve.

Figure 2.3 Intervention Targets Using the Ecological Model

2.7 Benefits of Physical Activity

This section discusses the benefits of physical activity, including cardiovascular workouts and strength training. Frequently known as aerobic or cardio exercise, this form of physical activity aims to fortify the heart and lungs. During such workouts, the body relies on oxygen to fuel its efforts. On the other hand, strength training, also known as resistance training or weight training, is a type of physical exercise that uses resistance to induce muscular contraction. This type of training builds strength, anaerobic endurance, and size of skeletal muscles. The primary goal is to increase muscle strength, tone, and mass.

2.7.1 Cardiovascular Benefits

It is known that cardiovascular exercise is fundamental in improving heart health, enhancing fitness levels, and promoting overall well-being. Various studies demonstrated that the mode is the most efficient training for lowering blood pressure and its beneficial influence. Compared to high intensity exercise, low-intensity and moderate intensity activities such as walking and cycling lower BP (Costa et al., 2018). Additionally, many exercise studies highlighted the optimal effects of moderate intensity aerobic training, typically performed at around 40% to 60% of maximum work capacity or oxygen reserve, in lowering BP, with many producing positive outcomes (Jennings, 2001; Pescatello, 2004; Simons-Morton, 2008).

The debate regarding the most appropriate mode of cardiovascular exercise for effective BP reduction is ongoing. However, the American College of Sports Medicine (ACSM) recommends that individuals with hypertension engage in regular low to moderate aerobic training for at least 30 minutes, preferably on most days (Pescatello, 2004; ACSM, 2006). These guidelines provide valuable insights for individuals seeking to manage their blood pressure through exercise. Individuals can also harness the benefits of cardiovascular exercise and improve their overall cardiovascular well-being. Indeed, regular cardiovascular exercise is a robust activity in BP control, offering substantial benefits for individuals with hypertension and other cardiovascular conditions.

Aerobic activities promote cardiovascular health by improving cardiovascular function, such as resting BP, endothelial function, and peripheral resistance (Cao et al., 2019; Whelton et al., 2002). A study involving post-myocardial patients aged 59 to 88 years observed a statistically significant reduction in heart rate and systolic blood pressure after three and six weeks of consistent engagement in an exercise programme (Kazeminia et al., 2020). These heart rate and systolic blood pressure declines are reliable profiles of enhanced cardiac functionality, improving overall health. These research findings advocate for regular participation in physical activity to augment cardiac status and diminish the risk of coronary heart disease in individuals experiencing ailments.

2.7.2 Strength Training Benefits

Strength training, a form of exercise focused on building and toning muscles, is vital in improving overall health and fitness. Research suggests that strength training alone does not significantly reduce blood pressure (Hansen et al., 2019; Silva et al., 2021; Paulo et al., 2019). Therefore, it is not recommended as the sole exercise mode for individuals aiming to lower their blood pressure. Nevertheless, if strength training is incorporated into the workout regimen, performing one set of 10-15 repetitions with light weights is advisable to improve muscle tone over time (Maestroni et al., 2020). Appreciating the benefits and applying proper techniques enables individuals to unlock and experience the transformative power of strength training, paving the way to a healthier and more active lifestyle.

Integrating strength training into an exercise regimen is not merely about building large muscles; it encompasses a range of physiological and psychological advantages that are instrumental for holistic well-being. From a physiological point of view, resistance training promotes muscle strength, increases physical capacity and fortifies bone mineral density (Maestroni et al., 2020). This enhancement in bone density is particularly critical in countering conditions like osteoporosis, especially in ageing populations. On the psychological level, regular strength training has been associated with improved mental well-being, offering individuals a sense of accomplishment, heightened self-esteem, and a potential reduction in symptoms of anxiety and depression (Mikkelsen et al., 2017; Deslandes et al., 2009). Indeed, the regimen associated with consistent strength training promotes physical and mental resilience and encourages better adherence to medical recommendations and treatments.

2.8 Exercise Physiology

2.8.1 Cardiovascular Response to Exercise

During physical activity, an essential role of the cardiovascular system is the increase in oxygen (O2) delivery to the engaged musculature. The increased O2 availability generates the metabolic requirement for muscular contraction (Katayama & Saito, 2019; Williamson, 2015). This process results in an orchestrated interplay of several components, including the modulation of ventilation, systemic and pulmonary hemodynamic, and gas exchange dynamics, to name a few (Katayama & Saito, 2019;

Williamson, 2015). Additionally, the sympathetic nervous system plays a considerable role in this orchestration, which initiates numerous stimulatory mechanisms during exercise (Katayama & Saito, 2019; Christensen & Galbo, 1983). At the same time, neurotransmitters such as adrenaline and noradrenaline are released, significantly influencing HR and BP during exercise (Christensen & Galbo, 1983). The physiological adaptations and associated mechanisms facilitate the ability of individuals to engage in exercise or other physical activities while simultaneously promoting their health status.

In the scope of this doctoral thesis, I embarked on an in-depth investigation into the pivotal cardiovascular profiles in assessing cardiovascular health and its potential variations across different populations. These profiles encompassed blood pressure (BP), which plays a central role in cardiovascular risk; rate pressure product (RPP), a critical indicator of myocardial oxygen consumption and workload; mean arterial pressure (MAP), a weighted average of systolic and diastolic blood pressure, indicative of perfusion to vital organs; heart rate (HR), a foundational parameter reflecting cardiac function; and pulse pressure (PP), which provides insights into arterial stiffness and cardiovascular morbidity. Importantly, my research also explored the physiological responses to exercise performance, seeking to understand how the cardiovascular profiles respond to physical stress (i.e., exercise) across diverse ethnic groups.

2.8.2 Blood Pressure Response to Exercise

The scholarly landscape is replete with research exploring the impact of exercise on BP, revealing the behaviour of BP in response to exercise (Alpsoy, 2020; Sharman et al., 2019; Esmailiyan et al., 2021; Schultz et al., 2017; Hegde & Solomon, 2015).

However, ambiguity persists concerning the optimal exercise modes, intensities, and types that yield the most favourable outcomes (Boutcher & Boutcher, 2017). Continued research advancement could address these gaps, paving the way for identifying the ideal mode or intensity. It is pertinent to note that the reduction in BP observed in the literature is not universally applicable to all patients with hypertension, given the varying degrees of the condition experienced by different individuals. Nevertheless, the recommendations and guidelines offer a valuable resource for providing secure exercise training for individuals with hypertension and other related conditions.

Blood pressure is the force exerted by the blood against the arterial walls and is linearly related to systolic blood pressure (SBP) (Cornelissen & Smart, 2013; Xiang & Hester, 2011). It is modulated by cardiac output and peripheral resistance to blood flow and responds variably based on age, exercise modes, and types of workouts or intensities (Fletcher et al., 2001; Xiang & Hester, 2011). In contrast, cardiac output ($\dot{Q}$) refers to the amount of blood injected by the ventricle per minute equal to and determined by the product of HR and stroke volume (SV) ($\dot{Q} = SV \times HR$) (Vincent, 2008; Xiang & Hester, 2011). Cardiac output is important during the start of exercise. Thus, $\dot{Q}$ increases by an increase in SV mediated through the Frank-Starling mechanism and HR (Flecher et al., 2021; Xiang & Hester, 2011). After that, $\dot{Q}$ rises slightly until it reaches a plateau when blood flow meets the metabolic exercise requirements (Flecher et al., 2001). In healthy people, $\dot{Q}$ reacts linearly and rises with the workload from resting at approximately 5 L·min-1 to a limit of about 20 L·min-1 during erect exercise position (Flecher et al., 2021). The highest CO can be achieved in exercise performance depending on several considerations, including age, individual posture and body size, level of physical condition, and state of health (Fletcher et al., 2001). For instance, research by Fletcher et al. (2001) indicated that the CO could reach volumes of 20-2 5L/min in untrained individuals or those with cardiovascular disease. This metric suggests that the degree of efficiency, or the absence of it, in the heart's ability to circulate blood might deliver oxygen and nutrients to the body under specific activities or conditions. The academic literature offers a wealth of research concerning the influences of blood pressure BP and CO responses on various exercise modalities (e.g., different intensities or types of exercise). These investigations have contributed significantly to our understanding of physiological responses during exercise across diverse populations. For instance, in an early seminal work from 1961, researchers examined the effects of exercise modality (standing and treadmill walking versus cycling) on CO responses. The authors discovered that the alterations in the subjects' posture during exercise significantly influenced CO during the exercise regimen. The variances in CO were primarily attributable to the differential circulatory responses between rest and exercise conditions (Reeves et al., 1961).

A subsequent investigation conducted in 1991 involving patients with heart failure examined the effects of two distinct training models: whole-body ergometer cycling and localised training targeting a specific muscle group. The study demonstrated the importance of creating personalised exercise recommendations tailored to the unique physiological responses of individuals exhibiting a low CO response (as cited in Gordon et al., 1999). The individualisation ensures that the prescribed exercises are safe and effective, considering one's distinct cardiovascular capacities. Such an approach helps optimise the benefits of exercise while minimising potential risks, especially for patients whose hearts may not pump blood as efficiently during physical exertion.

Interestingly, in a study conducted by Sibenmann and colleagues (2015), there were notable outcomes regarding CO. What stood out was that when participants engaged in exercises targeting smaller muscle groups, there was a more pronounced increase in their CO compared to when they performed exercise focusing on larger muscle group (Sibenmann et al., 2015). This observation indicates that despite the intuition that larger muscle group exercises might elicit a more significant cardiovascular response in the study, the opposite appeared accurate. The implications of the finding also might be necessary in designing exercise protocols and understanding cardiovascular response in varied workout regimens and potentially in therapeutic interventions to lower BP.

Past research provides insufficient insight into the disparities in CO during physical activity among diverse ethnic populations. There exists a hypothesis that genetic factors may shape the structure and performance of the heart, thereby affecting cardiac output. Simultaneously, elements such as healthcare accessibility, nutritional status, environmental stress exposure, and fundamental living conditions play pivotal roles in cardiovascular health, which may account for observed differences across ethnic groups. Given the complexity of fully understanding the nuances of genetic variations, the factors mentioned above present foundational starting points for further inquiry. Therefore, this thesis will focus predominantly on these determinants.

2.8.3 Heart Rate Response to Exercise

The HR's response to exercise is contingent upon age, body position, fitness, type of activity, diseases, medications, blood volumes, and environmental factors (Lauer et al., 1996). The heart rate experiences a linear increment corresponding to the workload and oxygen uptake during physical exertion. The circulatory system initiates the response, stimulating the pacemaker to generate an electrical impulse in the sinoatrial node (SA node), responsible for the heart's rhythmic beat (Xiang & Hester, 2011). As observed, the sympathetic nervous system holds substantial significance in cardiac function during dynamic exercise and strenuous exertion (Pierpont et al., 2013). Activating the sympathetic system reduces vagal tone, enhances sympathetic outflow, and regulates exercise bouts.

Conversely, the parasympathetic component of the autonomic system enables a reduction in HR and stimulates sympathetic withdrawal upon the cessation of exercise (Flecther et al., 2001; Pierpont et al., 2013). The recovery period post exercise remains an area demanding further exploration, but initial research posits that sympathetic withdrawal contributes to heart rate recovery (HRR) (Pierpont et al., 2013). HRR enables the assessment of the stress experienced by the heart due to exercise training or physical activity (Jolly et al., 2011). Furthermore, a typical decline in HR following exercise signifies enhanced cardiovascular fitness in individuals without health conditions (Cole et al., 2000). This can also lead to improved BP regulations and circulation, reduced arrhythmias, reduced stress, and weight and cholesterol management (Lavie et al., 2015). However, a higher or extremely low heart rate following the cessation of exercise training has been associated with cardiovascular risk and mortality, as evinced in the literature encompassing cardiovascular patients and other populations (Cole et al., 2000).

2.8.4 Exercise Response to Mean Arterial Pressure

Mean Arterial Pressure is derived from CO and is considered an average BP throughout one cardiac cycle, playing a pivotal role in the heart's function (Xiang & Hester, 2011; Moran et al., 1995). It is a marker for organ perfusion, influenced by cardiac output and total peripheral resistance (TPR). This relationship is quantified by the equation MAP = CO × TRP (Xiang & Hester, 2011). In a resting state, the MAP range for healthy adults is between 70 – 100 mm Hg, with a higher score indicating more pressure in the arteries, leading to blood clots or damage to the heart muscle (Xiang & Hester, 2011).

MAP can fluctuate based on the type of exercise. For example, dynamic exercise such as running results in a modest rise in MAP, whereas static exercise (e.g., weight training) can lead to more significant surges partly due to the increased intrathoracic pressure during muscle contractions (Sainas et al., 2016). Moreover, there appears to be a higher demand for oxygen in working muscles as exercise intensity rises, prompting the heart to pump more blood to meet the requirement, consequently elevating MAP. Earlier research observed that as exercise duration continues and reaches a steady state, the working muscles' mechanisms, such as vasodilation (widening of blood vessels), in the working muscles can help stabilise or even reduce MAP despite the ongoing heightened demand (Moran et al., 1995). Previous observations like Moran et al., 1995 have significantly increased our knowledge of MAP with exercise training, specifically with the marker and pre-existing cardiovascular conditions (Craig et al., 2021). As such, MAP is now recognised as a critical hemodynamic measure and predictor of cardiovascular risk. Therefore, monitoring individuals' MAP profiles during exercise or prolonged sessions is crucial, particularly in at-risk populations.

2.8.5 Exercise Response to Rate Pressure Product

The RPP, or double product, is a crucial indicator of myocardial oxygen consumption (MVO2) and cardiac workload, offering insights without direct measurements (Fornitano and Godoy, 2006; Lamina, Okoye, Ezema, Anele, Ezugwu, 2013; Bagali, Khodnapur, Mullur, Sheikh, Aithala, 2012). It has proven effective in evaluating physical strain and recovery during exercise, particularly in cardiac patients.

Keyhani and colleagues (2013), for example, embarked on a study that dug deeper into this domain. Their investigation centred on cardiac patients, a demographic that understood exertion and ensured that safe recovery was paramount. What emerged from their research was that when these patients underwent training at levels below their maximum capacity, there were marked improvements in their cardiovascular parameters. The study validated using RPP and noted some likely benefits of sub maximal training, specifically in populations with cardiac concerns.

Gobel et al. (1978) demonstrated that RPP was a good measure of MVO2 during exercise than HR or SBP alone. This early observation was groundbreaking as it suggested that clinicians and exercise physiologists could use RPP as a proxy to understand the heart's oxygen demands during physical activity (Gobel et al., 1978). This is particularly vital when direct measurement is challenging or invasive. Research also indicated that age and sex impact RPP during physical activity, with variations attributed to hormonal and age related changes. One study attributed the increase in RPP to hormonal variations and the ageing process distinctive to each gender (Bagali et al., 2012). The relationship between RPP, age, and gender provides focal insights into cardiovascular health and exercise. It also stresses the need for individualised evaluations, considering the inherent physiological shifts to ageing and the distinct cardiovascular profiles of men and women.

The RPP plays a significant role in linking exercise physiology with cardiac health. From various studies in this review, we see that the measurement is instrumental in safely harmonising the advantages of physical activity with cardiovascular risk management. This aspect is particularly vital for individuals with heart conditions or those engaged in cardiac rehabilitation programmes. RPP's ability to provide insights into myocardial workload and oxygen consumption without direct measurements makes it a practical approach for ensuring exercise is beneficial and safe for these sensitive groups.

2.8.6 Exercise Response to Pulse Pressure

The calculation of PP is a measurement of arterial stiffness and left ventricular stroke volume. This assessment is a necessary marker of heart health, especially the health of the arteries. A normal pulse pressure ranges from 40 to 60 mm Hg, calculated as the difference between SBP and DBP (Heffernan et al., 2011). Liu et al. (2016) discovered that elevated PP can cause harm to small blood vessels in the heart and brain. This damage is associated with significant cardiovascular and cerebrovascular diseases, leading to increased morbidity and mortality. With exercise, PP increases due to a more significant rise in SBP than DBP. During exercise, the heart beats faster and harder to provide more blood to the muscles, and this causes an increase in SBP, whereas DBP remains the same, or it might decrease slightly because the arteries dilate or widen to accommodate the increase in blood flow (Sacre, Jennings and Kingwell, 2014). The surge in PP during exercise is considered normal and healthy as it indicates the heart is effectively pumping blood and the arteries are flexible enough to accommodate the changes in pressure. However, if pulse pressure becomes too high, it might indicate stiff or damaged arteries, which can be a risk factor for cardiovascular disease (Sacre, Jennings and Kingwell, 2014). Consequently, this may occur in people with cardiac conditions such as hypertension or coronary heart disease (Kingwell, 2002). However, a suitable exercise prescription can lower the risk and improve blood flow and perfusion.

The response of PP during exercise provides valuable information about cardiovascular health and the adaptability of the circulatory system. For example, young individuals are said to have more elastic and flexible arterial walls than older people due in part to the greater flexibility of their arteries (Roosow et al., 2010; Sacre, Jennings and Kingwell, 2014; Kingwell, 2002). Compared to older adults, when young people exercise, their arteries expand and contract more readily, accommodating the increased blood flow without increasing pressure (Roosow et al., 2010). Hence, the young may exhibit a more pronounced increase in PP during exercise. Moreover, certain medical conditions, like hypertension, can also affect pulse pressure response to exercise (Sacre, Jennings and Kingwell, 2014). Thus, they could show less flexibility in handling the added stress of increased blood flow throughout the exercise training. People with hypertension might already have higher resting PP due to increased resistance in the arteries or changes in arterial wall elasticity (Roosow et al., 2010). Such variations in response might serve as profiles for assessing cardiovascular risks and the effectiveness of therapeutic interventions.

Previous research has sporadically identified differences in PP across multiple ethnic groups. However, the existing literature offers limited clarity regarding the correlation between race and PP variability. A prominent investigation utilising data from the Third National Health and Nutrition Examination Survey spanning 1988 to 1994 indicated differences in PP scores with race and ethnic groups (Rogers & Onge, 2005). The data showed that African Americans experienced more elevated pulse pressures compared to non-Hispanic Whites, even after accounting for race. In this data, male participants also had higher PP than females, and it was more pronounced when adjusted for socioeconomic status and physical activity levels. Considering the adverse health impacts linked to high PP, these outcomes highlighted the need for deeper insight and targeted intervention for those with more significant PP risks within different demographic subgroups (Rogers & Onge, 2005). Additionally, a systematic review and meta analysis by Liu et al. (2016) found supportive evidence to establish that PP is an independent risk factor for stroke, but it does not predict mortality.

2.9 Summary of Literature Review

Abundant research highlights exercise's positive physiological and psychological impacts, leading to its endorsement as a universal health activity and the gold standard for reducing disease risk. Nonetheless, factors such as systemic racism and cultural practices might influence the commitment to regular exercise among certain groups, including individuals of African descent. This accentuates the importance of recognising and addressing these barriers to bolster exercise commitment. Tailored interventions for these groups should spotlight the myriad benefits of physical activity, grounding their guidance in empirical evidence about exercise's role in improving overall health and vitality. If we address potential exercisers' concerns and offer pragmatic solutions to tackle obstacles, such initiatives can empower ethnic communities to make knowledgeable choices and cultivate consistent exercise routines.

Furthermore, the efficacy of exercise programmes can be markedly increased when they are individualised, taking into consideration unique abilities, preferences, medical histories, and cultural traditions. The role of social support cannot be understated; establishing group exercise initiatives and providing accessible, culturally appropriate exercise facilities could strengthen exercise adherence. A shift in perception viewing exercise not merely as a regimen but as a holistic wellness activity can generate sustained participation. The implications of these strategies will be interpreted in the subsequent sections of this thesis.

Chapter 3:
The effect of exercise response on health outcomes among ethnic groups participating in a community based intervention

Abstract

Introduction: Exercise offers many benefits, including cardioprotection. However, many people neglect the activity. What is concerning is the low levels of exercise among ethnic populations, even though specific groups have higher rates of chronic illnesses. Few studies in Canada have investigated ethnic minorities' physical activity at a community level and applied a multifaceted approach. This gap in health research needs further examination. Thus, the Fitness for Life (FFL) initiatives provided an opportunity for the author to do a community-level exercise study with the different ethnic groups enrolled in the programme. Guided by the social-ecological model, the study investigated the effect of FFL, 17 week exercise programme, on the health outcomes among ethnic groups (Black Canadians, South Asians, Middle Eastern, Europeans, and Asians). The first objective was 1) to assess the intervention's effects on cardiovascular profiles (blood pressure (BP), heart rate (HR), mean arterial pressure (MAP), rate-pressure product (RPP), and pulse pressure (PP)) and body composition (body mass, body mass index, fat mass and water %) 2) to compare the impact of the exercise programme among the five ethnic groups and 3) to analyse the two self-reported questionnaires: Physical Activity Questionnaire and Physical Activity Readiness Questionnaire (PARQ) responses. **Materials and Methods:** The study involved pre and post intervention measurements, including two self-reported questionnaires, with 365 participants (W/M = 17:348, age 58.51 ± 13.7 years). Of these, 90% completed the 17 week exercise intervention. **Results and Discussion:** Significant improvements were observed in all cardiovascular profiles and body composition metrics from baseline to post-exercise ($p < 0.05$), with small effect sizes (0.2) for most of the measurements. Comparisons revealed more significant differences between South Asians and Black Canadians ($p < 0.05$). Regression analysis for pre-systolic blood pressure showed significant results (R^2 = 7.00%, F = 3,307, $p < 0.005$). The questionnaires indicated variability across all ethnic groups. **Conclusion:** The FFL intervention demonstrated that a tailored community-based exercise can significantly improve cardiovascular function and body composition across different ethnicities. It also uncovered variations in questionnaire responses, highlighting the need for interventions that cater to the unique characteristics and needs of diverse ethnic populations, particularly in managing blood pressure and weight.

3.1 Background

Despite the overwhelming benefits of regular exercise training, such as positive cardioprotective factors, many people do not regularly engage in the activity. (Cunningham et al., 2021). The World Health Organisation (WHO, 2019) reported physical inactivity as the fourth leading global morbidity and mortality risk factor. Inactivity was around 70% in some countries as technological advancement, transportation patterns, and urbanisation increased (Amin et al., 2021). While these factors can contribute to sedentary behaviours and reduced physical activity, they also offer opportunities to promote and facilitate active lifestyles. Addressing these causes, we can mitigate the negative impact and create environments that support and encourage regular physical activity, improving overall health and well-being. The WHO has played a significant role in promoting physical activity on a global scale and positively impacting population health. They initiated and launched the Global Action Plan on Physical Activity 2018-2030 (GAPP) in 2017 as a proactive measure to combat the persistent issue of physical inactivity (WHO, 2019). The primary objective of the plan was to achieve a reduction of 10% and 15% in the global prevalence of physical inactivity by 2025 and 2030 (WHO, 2019). However, a report by Guthold and colleagues noted that due to unfavourable pre-2018 trends, the 2025 worldwide physical activity target is unlikely to be attained (Guthod, Stevens, Riley and Bull, 2018). Consequently, the substantial burden associated with physical inactivity will continue to exist. The estimated scale determined that the expenses associated with physical inactivity amount to $US 54 billion annually in healthcare costs and $US 14 billion in productivity losses (WHO, 2018).

In the Canadian context, the 2019 ParticipACTION report card, an annual assessment of physical activity levels, found that the rates for inactive lifestyles remained relatively stable between 2011 and 2018, ranging from 22.9% to 23.4% for adults aged 18-79 (Macridis et al., 2020). In terms of demographics, the highest degree of physical inactivity comprised adults aged 65 years and older, of whom 47% were deemed inactive, with the subsequent highest levels observed in the 45-64 years age group, with 29% displaying inactivity (Macridis et al., 2020). As the statistical data showed, a variation in the incidence of physical inactivity across the Canadian provinces was noted. The figures showed that the lowest prevalence recorded was in British Columbia at 18%, whereas the highest incidence was documented in Newfoundland and Labrador at 32% (Macridis et al., 2020). The report also indicated that the annual cost of healthcare expenditure attributable to physical inactivity was estimated at $US 421 million globally, corresponding to $US 27 million for the overall expenses associated with this phenomenon (Macridis et al., 2020). The statistics above reflect a progressive escalation in health risks, prompting the WHO to forecast an amplification in the incidence of non-communicable diseases, such as heart disease, obesity, and diabetes unless swift and appropriate measures are adopted globally to encourage physical activity. If governments worldwide fail to prioritise physical exercise, the number of individuals affected by these diseases is projected to surpass 500 million by 2030 (Santos et al., 2023).

The increasing disease rates among racialised groups linked to an inactive lifestyle present a significant concern. These groups, as noted by Gee and Ford (2011) and Moy et al. (2017), often face a higher prevalence of chronic illnesses. Specifically, African descent populations are disproportionately affected by hypertension and exhibit less effective blood pressure control, leading to elevated morbidity and mortality rates (Carnethon et al., 2017). The more significant hypertension seen in African descendants has been reported to be associated with their low physical activity level (Jenkins et al., 2017; Williams et al., 2017). This situation has necessitated targeted interventions. Thus, precautions such as encouraging African descendants to make physical fitness habitual and incorporate it into their daily routine are possible means to control their BP. However, because of the many barriers that interplay, it is challenging for individuals in this group to become or remain active. Some cited obstacles hindering regular exercise among ethnic groups include varying perceptions about the benefits of physical activity, differing views on what constitutes exercise, community norms regarding participation, and sociocultural factors such as exclusion and discrimination (Such et al., 2016). These barriers could be particularly challenging for individuals new to exercising, who may feel overwhelmed or confused due to a lack of understanding of exercise concepts and practices.

In addition to the cardiovascular and disease risk, the COVID-19 pandemic made it challenging for people to stay active or engage in physical activity because of the global restrictions and the lockdowns (Farah et al., 2021; Lippi & Henry, 2020; Ricci et al., 2020; Amin et al., 2021). The closing of recreational and sports facilities, fitness studios, and gyms during the pandemic posed significant obstacles to maintaining an active lifestyle, leading to a greater likelihood of sedentary behaviour, such as prolonged television viewing and video game usage among the populace. Hence, it is reasonable to infer that the observed increase in the proportion of Canadians falling short of physical activity recommendations is an outcome of the pandemic (Lesser & Nienhuis 2020). However, the changes did allow some people to take advantage of outdoor activities and find accessible ways to stay active, keeping their bodies moving (Amin et al., 2021). This would be simple for the already active individual, but it would be difficult for others who never exercise or do physical activities. Indeed, the COVID-19 pandemic has led to more people adopting sedentary lifestyles, contributing to the chronic disease health crisis. At the same time, it should not have taken a world pandemic to appreciate health and well-being and commit to adopting active living. Nevertheless, it was a wake-up call to embrace active lifestyles and re-examine healthcare systems, specifically in countries where the system is fragile.

The need to remove health disparities, especially in chronic diseases, has always been identified as a goal of public health and other health organisations. It is then appropriate that interventions are implemented across the United States (US) to keep people physically active while increasing health seekers' knowledge and skills and reducing. These initiatives can also serve as a means of addressing the issues of inequality and inequity. Inequalities manifest as differences in health, healthcare, or access to health-related outcomes across different demographic groups caused by various factors, including social, economic, and environmental determinants of health (Donkin et al., 2018). In contrast, inequities pertain to those inequalities that are regarded as unfair or unjust, arising from avoidable and unnecessary differences in healthcare access or health outcomes between various population groups, resulting from systemic or structural injustices, such as discrimination, poverty, or inadequate access to education (Donkin et al., 2018).

The research employed several approaches ranging from community recreational activities to church-based health promotions to examine the efficacy of the interventions, with most studies finding significant and positive outcomes. Faith-based health programmes, for example, are readily available in African American churches, reaching a large population of health seekers who want to participate in physical movement and other lifestyle interests (Tomlinson, 2018; Young & Stewart, 2006). Studies testing the usefulness of church-based health promotions have shown promising outcomes. The success of many of the programmes is that they are designed with cultural relevance elements and are widely accessible to the community. Indeed, faith-based schemes have played a significant role in augmenting the well-being of helping African Americans (Newlin et al., 2012).

Interventions aim to enhance the well-being of marginalised groups and those at cardiovascular risk by addressing health inequalities that hinder healthy living. Despite knowledge of these interventions, a comprehensive understanding of the multi-layered factors causing disparities is lacking. Addressing the gaps demands a transdisciplinary approach, the involvement of all stakeholders across various levels, and strategies that integrate individual and systemic changes. While implementing interventions in diverse settings is complex, understanding specific needs and barriers is critical for effective translation and sustainability. A deeper insight into the causes of disparities will aid in developing more holistic, community-level strategies to eradicate ongoing inequalities, as discussed by Fleury and Lee (2006).

In light of the burgeoning prevalence of chronic conditions, particularly among socially vulnerable populations, multiple approaches are imperative to motivate and maintain physical activity levels. In contrast to the United States, where research and appropriate community action plans are employed to narrow the disparity gap, Canada lacks comprehensive efforts to comprehend the disparities at multiple levels. (Khan, Kobayashi, Lee and Vang, 2015). To the academic knowledge, no health research has been conducted in Canada to explore the impacts of inequalities on socially vulnerable populations utilising a multilevel approach and an intersectional lens. The magnitude of the gap is further compounded by the lack of complete research that examines the health outcomes of ethnic groups concerning their physical activity levels on a large scale. This area of research remains underexplored and has yet to undergo extensive examination. A common approach in Canadian physical activity research relies on self-reported questionnaires or health surveys, which provide limited insight into the multiple factors influencing individuals' behaviour. (Fleury & Lee, 2009; Tremblay et al., 2006; Mohmood, et al., 2019; Lesser & Nienhuis 2020). When examining the effects of physical activity on the lifelong health and well-being of socially at-risk populations, a more comprehensive methodology is necessary to address the variety of barriers that impede their ability to engage in physical activity (Lee, 2005).

The present research is a retrospective study that evaluated Fitness for Life (FFL), a physical literacy programme designed to promote exercise and recreational sports participation among immigrant and newcomer women, older adults, and seniors. Drawing from various components of the ecological model, FFL was developed using a multilevel approach. The objectives of the study are to investigate, compare and measure changes in cardiovascular profiles (BP, heart rate (HR), mean arterial pressure (MAP), rate pressure product (RPP), pulse pressure (PP) and body composition (including body mass, body mass index (BMI), percentage of body fat, and water percentage among different racialised groups (African Canadians, South Asians, Middle Eastern, Europeans, and Asians). Two self-reported questionnaires were also administered: 1) a Physical Activity Questionnaire and 2) a Physical Activity Readiness Questionnaire (PAR-Q) to determine participants' health status (e.g., health conditions, pain issues, medication usage, exercise barriers, symptoms, and safety to exercise).

3.2 Study Methodology

The study involved collecting participants' cardiovascular profiles and body composition measurements at baseline, following the exercise intervention, and gathering responses from the two questionnaires.

3.2.1 Recruitment process

The recruitment strategy for engaging clients in the FFL programme was to include diverse individuals interested in participating, irrespective of their current fitness exercise habits. As such, active people and those not exercising were encouraged to enrol. Additionally, the FFL included and encouraged individuals with or without health conditions or mobility issues to join the exercise sessions. This approach facilitated the capture of a broad spectrum of perspectives and experiences within the FFL programme.

Collaboration with community partners was a key recruitment strategy. Promotional materials were also disseminated to various organisations that directly contacted potential participants. These organisations included presenting information sessions to clients at the Language Instruction for Newcomers to Canada (LINC) programme, the community health centre, and libraries. FFL flyers were also distributed to local retail establishments. These outreach efforts significantly contributed to rising awareness and increased participation in FFL.

3.2.2 Inclusion and exclusion criteria

Upon registration with FFL, clients were informed verbally and in writing about the study. They were given an informed consent form, which they were required to complete and sign if they agreed to participate. The consent process was conducted in English and, if necessary, in the client's native language. The inclusion criteria for participation in the study were individuals who identified as adults of African (including black African, African Canadian, and Afro-Caribbean), South Asian (including those from India, Pakistan, Sri Lanka, and Bangladesh), European (including Italians, White Canadians, and Spanish), Middle Eastern (including Iranians, Iraqis, and Syrians), or Asian (including Chinese and Koreans) origin, and were 18 years of age or older. There were no restrictions on participants' fitness levels or health conditions, and their medical prescriptions or dietary intake were not controlled throughout the study. Eligible participants were assigned to their respective ethnic groups for analysis.

3.2.3 Intervention Design

Building upon the previously mentioned principles, FFL was created using a comprehensive, multilevel methodology, integrating various facets of the ecological model (Figure 2). The programme was meticulously designed to prioritise equity and cultural sensitivity. This entailed customising the FFL's policies, procedures, and safety protocols to meet the specific requirements of the targeted intervention. The approach also included adapting key components such as process evaluation, outcome evaluation, questionnaires, risk assessment, and management strategies to align seamlessly with the intervention's unique needs. Concerted efforts were made to collaborate with local community partners, fostering community engagement and ensuring active participation in FFL. To facilitate ease of access for participants, strategically located venues were selected, making it more convenient for clients to engage with the FFL activities.

A peer committee was established to involve the team in the decision-making process and to serve as a support network for other participants. This committee consisted of four clients who volunteered to join the peer committee board, which convened monthly to discuss concerns and offer suggestions for improving the FFL programme. To enhance the programme's effectiveness, 10 peer leaders and staff underwent training to proficiently administer Fundamental Movement Skills (FMS) as part of the intervention.

3.2.4 Blood Pressure Assessment

The heart profiles assessed were BP, HR, RPP, MAP, and PP. Hypertension was defined as having an average blood pressure greater than or equal to 140/90 mmHg. BP measurements were administered by kinesiology students trained to follow Hypertension Canada protocols. Thus, participants were instructed to sit quietly in a chair for five minutes before the first reading, keep their feet on the floor, rest at heart level, and not move or talk. Participants were provided with a Blood Pressure Log after the measurement. The device used was the Omron Bronze Digital BP Monitor. Additionally, the study utilised online calculators to calculate the participants' pre and post scores for

MAP, RPP, and PP. More detailed information about each cardiovascular system profile can be found in Appendix 1.

3.2.5 Fitness Assessment

Initially, a pre screening was conducted to identify participants with medical conditions that could potentially increase the risk of adverse events during the exercise intervention. The study assessments were collected one week before the exercise intervention, where all participants underwent a fitness appraisal. In order to assist with the administration of the fitness assessments, PAR-Q, intake forms, and translation for non-English speaking participants, two third-year kinesiology intern students from the South Asian community and CPR-trained personnel were recruited due to the study's size. The PAR-Q assessed participant exercise readiness and gathered information on their current physical activity level and health status. Body composition measurements, such as body mass, fat mass percentage, water percentage, and body mass index (BMI), were collected using the TANTIA total analyser (TBF-410GS), as detailed in Appendix 2. Additionally, participants completed a physical activity questionnaire and an intake form, which included questions about their medical history.

3.2.6 Group Exercise Sessions

Exercise sessions were held three times a week (51 sessions). Three sessions were held per day, two in the morning and another one in the afternoon. Because of cultural and religious considerations, separate fitness classes for women were established. Classes exclusively for men and sessions for couples were also introduced. These provisions allowed all clients to participate in the exercise classes.

The exercise classes were scheduled for one hour with 5- 10 min warm-up movements and then 45 min light dance aerobics, equivalent to 50% - 65% of the participant's age-related maximum heart rate. Two resting periods were required before the final 10-minute cooldown. The strength training sessions were done with light dumbbells and exercise bands. Appendix 3 provides a sample of the strength training workout. Participants with health conditions (such as blood pressure and diabetes) were monitored using a heart rate watch (i.e., Touch Pulse Heart Rate Monitor) throughout every exercise session. During resting breaks, the kinesiologists monitored these participants' heart rates to ensure they did not exceed their maximum heart rate.

All exercise sessions were conducted under the supervision of certified fitness instructors. After completing the FFL fitness programme, participants were scheduled to return to the Centre for a second assessment, which was expected to take one week to complete reassessment. Unfortunately, some participants did not attend the second assessment.

3.2.7 Health Education Workshops

In addition to the exercise sessions, the study included health education workshops to equip participants with knowledge and skills that could help them make healthier choices. Some workshop topics included teaching participants about the benefits of physical activity, how to safely and effectively exercise, and how to overcome the barriers to exercise. This educational information can also empower them to control their health and make long-term lifestyle changes, increasing motivation and adherence to exercise programmes. Participants may be more motivated to stick to their exercise training when they understand the health benefits of healthy living. Furthermore, the health education workshops were tailored to meet the groups' specific needs and provided culturally relevant information. It was good to see that many clients took advantage of the free sessions and attended.

Finally, the Rexdale Women's Centre Director of Programming approved the study to be conducted at the Centre. Meanwhile, Staffordshire University Ethics Committee approved the use of previously collected data.

3.3 Statistical Analysis

Various statistical analyses were conducted in the study to investigate differences in cardiovascular profiles and body composition and to analyse the results of the two questionnaires among the five ethnic groups. First, the Kolmogorov-Smirnov test was used to assess the normality of the data. The test indicated that all data were not distributed normally, thus violating the normality assumption. Therefore, given this violation, the non-parametric Kruskal-Wallis H test checked to see if there were any statistically significant differences in the medians of the cardiovascular profiles and body composition outcomes across all five ethnic groups. If the result were statistically significant, the Dunn’s Post Hoc test was then used to determine which ethnic groups differed.

Second, the Chi-square test was used to analyse participants’ symptoms, health conditions, and medications status and to assess the significance ($p<0.05$) concerning cultural profiles (groups) and exercise response. Third, an analysis was conducted to assess the counts recorded on the Physical Activity Questionnaire and the PAR-Q responses. Fourth, multiple regression analyses were conducted to investigate if there was a direct or strong relationship between gender, age, BMI, and blood pressure profiles on the exercise. The p-values were calculated using the two-sided method, with a p-value < 0.05 considered significant for each test, while a p-value > 0.05 was not considered statistically significant. Descriptive statistics were expressed as mean ± standard deviation (SD). Finally, applying Cohen's guidelines of Parson's *r* (where 1 = small effect, .3 = medium effect and 5= large effect), the effect size analysis was done to quantify the magnitude differences observed in the outcomes. To calculate, the value of *r* and the *z* score is used (i.e. *r* = *z*/square root of N (where N = total numbers of cases)) (Pallant, 2020).

The Statistical Package for Social Sciences (SPSS) software (Version 21, IBM) was used to perform the statistical analyses. SPSS is a widely used software package that provides various statistical tools and techniques for data analysis, allowing researchers to perform various statistical tests and generate meaningful insights from their data.

3.4 Study Results

At baseline, the study enrolled 365 clients, with 330 (90%) completing the entire exercise programme. The descriptive metrics from the pre-assessment are described in Table 3.1. As presented in the Table, the average age of the participants was 58.51 ± 13.7 years, and the mean height was 158 ± 6.7. Most participants, n=348 (87%), were females, while only n=17 (4.3%) were males. In terms of ethnic profiles, the highest proportion of participants belonged to the African Canadian group n=135 (33.8%), followed by South Asians n=131 (32.8%), Middle Eastern n=72 (18%), Europeans n=18 (4.5%), and Asians n=9 (2.3%).

Table 3.1 Descriptive Characteristics

Table 3.1 Descriptive Characteristics	**Counts = n**	**Per cent**	**Mean Age**
Female Male	348	87%	58.19 ± 13.92
	17	4.3%	65.06 ± 8.16
Ethnic profiles (participants)			
African Canadians	135	33.8%	58.90 ± 13.92
South Asian	131	32.8%	56.98 ± 12.61
Middle Eastern	72	18%	57.61 ± 14.99
Europeans	18	4.5%	57.89 ± 12.30
Asians	9	2.3%	58.51 ± 13.77

3.4.1 Physical Activity Questionnaire

The outcomes of the counts and p values concerning the responses to the Physical Activity Questionnaire are shown in Table 3.2. As outlined, this Table showed significance for most of the responses (p = .001). Additionally, when asked about their medications, n=116 (29%) participants reported taking dietary supplements. The most prescribed medications were calcium channel blockers n= 41 (11.1%), diuretics n=35 (9.58%), insulin metformin n=23 (6.3%), glucose n= 23 (6.3%), and beta-blockers n=21 (5.7%).

Table 3.2 Physical Activity Questionnaire

Table 3.2 – Participant Response to Physical Activity Questionnaire				
1. What are the reasons for you not exercising?	**Number of Respondents N= 365**		**Summarised results**	
	Yes	**No**	**Chi-Square test value**	**p-value**
trouble walking	12 (3.29%)	353 (96.7%)	148	.001
back pain	50 (13.6%)	315 (86.3%)	63.3	.001
knee pain	37 (10.1%)	328 (89.8%)	88.3	.001
shoulder pain	13 (3.5%)	350 (98.8%)	145.5	.001
ankle pain	20 (5.7%)	345 (94.5%)	127.4	.001
muscle pain	32 (8.7%)	333 (91.2%)	99.1	.001
trouble stretching	27 (6.5%)	338 (92.1%)	110.4	.001
ankle swells	25 (6.8%)	340 93.1%)	115.2	.001
heart palpitation	10 (2.7%)	355 (97.2%)	153.7	.001
exercise tiring	65 (17.8%)	299 (81.9%)	222.5	.001
family obligations	165 (45.2%)	200 (54.7%)	23.1	.001
lack of time	133 (36.4%)	232 (63.5%)	1.5	.001
work obligations	113 (30.9%)	252 (69.0%)	.926	.001
exercise boring	40 (10.9%)	325 (89.0%)	82.2	.001
exercise painful	7 (1.9%)	358 (98.0%)	162.1	.001
no motivation	290 (79.4%)	75 (20.5%)	349.3	.001
personal problems	12 (3.2%)	353 (96.7%)	148.2	.001
no transportation	135 (36.9%)	230 (63.0%)	2.1	.139
already physically active	12 (3.2%)	353 (96.7%)	148.2	.001

2. Do you know the benefits of exercise?	362 (99.1%)	3 (0.8%)	712.1	.001
3. Do you know about Canada's Physical Activity Guide?	24 (6.5%)	341 (93.4%)	117.6	.001
4. **Health Conditions –** *do you have any health conditions?*				
Hypertension	154 (42.1%)	211 (57.8%)	12.8	.001
Diabetes	60 (16.4%)	305 (83.5%)	46.8	.001
Cholesterol	36 (9.8%)	329 (90.1%)	90.4	.001
Thyroid	16 (4.3%)	349 (95.6%)	137.6	.001
Arthritis	45 (12.3%)	320 (87.6%)	72.4	.001
5. **Medications –** *are you taking any medications?*				
Beta Blockers	21 (3.2%)	344 (94.2%)	124.9	.001
Calcium Channel Blockers	41 (11.2%)	324 (88.7%)	80.2	.001
Diuretics	35 (9.5%)	330 (90.4%)	92.6	.001
ACE Inhibitors	31 (8.4%)	334 (91.5%)	101.3	.001
ARBs	19 (5.2%)	346 (94.7%)	129.9	.001
Aliskrien	9 (2.4%)	355 (97.2%)	156	.001
Glucose	23 (6.3%)	342 (93.6%)	120	.001
Sylfonyureas	9 (2.4%)	356 (97.5%)	156.4	.001
Metformin	23 (6.3%)	342 (93.6%)	120	.001
Sitagliptin	1 (0.2%)	364 (99.7%)	140.2	.001
Insulin	25 (6.8%)	340 (93.1%)	115.2	.001
Statins	15 (4.1%)	350 (95.8%)	140.2	.001
Mylan-ezetimibe	8 (2.1%)	357 (97.8%)	159.2	.001
Methimazole	1 (0.2%)	364 (99.7%)	179.5	.001
Levothyroxine	3 (0.8%)	362 (99.1%)	173.6	.001
Antidepressants	7 (1.9%)	358 (98.0%)	162.1	.001
IBS drugs	5 (1.3%)	360 (98.6%)	167.8	.001
NSAIDS	16 (4.3%)	349 (95.6%)	137.6	.001
Dietary Supplement	116 (31.7%)	249 (68.2%)	.396	.529

Table 3.3 displays all the Chi-square independent tests with variance in p values. In this Table, hypertension was more prevalent among African Canadians (n= 76, 20.8%) and statistically significant (x^2 = 25.608, p = .001). In comparison, diabetes (n=28, 7.7%) was more prevalent among South Asians, but this was not significant (x^2 = 5.571, p = .234). South Asian participants with cholesterol (n=13, 3.6%) were reported, while Europeans had the second highest cholesterol count (n=7, 1.9%), African Canadians was (n=6, 1.6%) and was statistically significant (x^2 = 22.096, p = .001). The African Canadian group also stated a higher prevalence for arthritis (n=37,10.1%), which was statistically significant (x^2 = 45.697, p = .001). African Canadians were reported to be prescribed more BP medications, including ACE inhibitors (n=16, 4.4%) with statistical significance (x^2 = 14.89, p = .005). The chi-square independent test also showed that more African Canadians were aware of the Canadian Physical Activity Guidelines (n =12, 3.3%) and was significant (x^2 = 32.722, p = .001).

Table 3.3 Physical Activity Questionnaire – Health Conditions

Table 3.3 – Participant Response to Physical Activity Questionnaire – Health Conditions						
1. Health Conditions – *do you have any health conditions?*		**Summarised results**				
		Yes	**No**	**Chi-square test value X^2**	**df**	**p-value**
Hypertension	African Canadians	76 (20.8%)	59 (16.2%)	25.608	4	.001
	South Asians	40 (11.0%)	91 (24.9%)			
	Middle Eastern	22 (6.0%)	50 (13.7%)			
	Europeans	11(3.0%)	7 (3.3%)			
	Asians	5 (1.4%)	4 (1.9%)			
Diabetes	African Canadians	20 (5.5%)	115 (31.5%)	5.571	4	.234
	South Asians	28 (7.7%)	103 (28.2%)			
	Middle Eastern	7 (1.9%)	65 (17.8%)			
	Europeans	4 (1.1%)	14 (3.8%)			
	Asians	1 (0.3%)	8 (2.6%)			
Cholesterol	African Canadians	6 (1.6%)	129 (35.3%)	22.096	4	.001
	South Asians	13 (3.6%)	118 (32.3%)			
	Middle Eastern	9 (2.5%)	63 (17.3%)			
	Europeans	7 (2.5%)	11 (3.0%)			
	Asians	1 (0.3%)	8 (2.2%)			
Thyroid	African Canadians	10 (2.7%)	125 (34.2%)	9.155	4	.057
	South Asians	4 (1.1%)	127 (34.8%)			
	Middle Eastern	0 (0.0%)	72 (19.7%)			
	Europeans	2 (0.5%)	16 (4.4%)			
	Asians	0 (0.0%)	9 (2.5%)			
Arthritis	African Canadians	37 (10.1%)	98 (26.8%)	45.697	4	.001
	South Asians	3 (0.08%)	128 (35.1%)			
	Middle Eastern	4 (1.1%)	68 (18.6%)			
	Europeans	1 (0.3%)	17 (18.6%)			
	Asians	0 (0.0%)	9 (2.5%)			
2. Do you know about Canada's Physical Activity Guide?				32.722	4	.001
African Canadians		12 (3.3%)	123 (33.7%)			
South Asians		1 (0.3%)	130 (35.6%)			
Middle Eastern		3 (0.8%)	69 (18.9%)			
Europeans		5 (1.4%)	13 (3.6%)			
Asians		3 (0.8%)	6 (1.6%)			
3. Medications – *are you taking any medications?*						
Beta Blockers	African Canadians	11 (3.0%)	124 (34.0%)	15.708	4	.003
	South Asians	6 (1.6%)	125 (34.2%)			
	Middle Eastern	0 (0.0%)	72 (19.7%)			
	Europeans	4 (1.1%)	14 (3.8%)			
	Asians	0 (0.0%)	9 (2.5%)			
Calcium Channel Blockers	African Canadians	15 (4.1%)	120 (32.9%)	5.559	4	.235
	South Asians	11 (3.0%)	120 (32.9%)			
	Middle Eastern	11 (3.0%)	61 (16.7%)			
	Europeans	4 (1.1%)	14 (3.8)			
	Asians	0 (0.0%)	9 (2.5%)			
Diuretics	African Canadians	15 (4.1%)	120 (32.9%)	14.984	4	.005
	South Asians	8 (2.2%)	123 (33.7%)			
	Middle Eastern	6 (1.6%)	66 (18.1%)			
	Europeans	6 (1.6%)	12 (3.3%)			
	Asians	0 (0.0%)	9 (2.5%)			
ACE Inhibitors	African Canadians	16 (4.4%)	119 (32.6%)	14.89	4	.005
	South Asians	6 (1.6%)	125 (34.2%)			
	Middle Eastern	4 (1.1%)	68 (18.6%)			
	Europeans	5 (1.4%)	13 (3.6%)			
	Asians	0 (0.0%)	9 (2.5%)			
ARBs	African Canadians	8 (2.2%)	127 (34.8%)	9.604	4	.048
	South Asians	2 (0.5%)	129 (35.3%)			
	Middle Eastern	5 (1.4%)	67 (18.4%)			
	Europeans	3 (0.8%)	15 (4.1%)			
	Asians	1 (0.3%)	8 (2.2%)			
Aliskrien	African Canadians	5 (1.4%)	126 (35.4%)	1.934	4	.748
	South Asians	3 (0.8%)	128 (35.2%)			
	Middle Eastern	1 (0.3%)	71 (19.5%)			
	Europeans	0 (0.0%)	18 (4.9%)			

	Asians	0 (0.0%)	9 (2.5%)			
Glucose	African Canadians	3 (0.8%)	132 (36.2%)	23.491	4	.001
	South Asians	19 (5.2%)	112 (30.7%)			
	Middle Eastern	1 (0.3%)	71 (19.5%)			
	Europeans	0 (0.0%)	18 (4.9%)			
	Asians	0 (0.0%)	9 (2.5%)			
Sylfonyureas	African Canadians	7 (1.9%)	128 (35.1%)	8.492	4	.075
	South Asians	1 (0.3%)	130 (35.6)			
	Middle Eastern	0 (0.0%)	72 (19.7%)			
	Europeans	1 (0.3%)	17 (4.7%)			
	Asians	0 (0.0%)	9 (2.5%)			
Metformin	African Canadians	6 (1.6%)	129 (35.3%)	3.376	4	.497
	South Asians	11 (3.0%)	120 (32.9%)			
	Middle Eastern	3 (0.8%)	69 (18.9%)			
	Europeans	2 (0.5%)	16 (4.4%)	4.081	4	.395
	Asians	1 (0.3%)	8 (2.2%)			
Sitagliptin	African Canadians	0 (0.0%)	135 (37.0%)			
	South Asians	0 (0.0%)	131 (35.9%)			
	Middle Eastern	1 (0.3%)	71 (19.5%)			
	Europeans	0 (0.0%)	18 (4.9%)			
	Asians	0 (0.0%)	9 (2.5%)			
Insulin	African Canadians	12 (3.3%)	123 (33.7%)	7.980	4	.092
	South Asians	12 (3.3%)	119 (32.6%)			
	Middle Eastern	0 (0.0%)	72 (19.7%)			
	Europeans	1 (0.3%)	17 (4.7%)			
	Asians	0 (0.0%)	9 (2.5%)			
Statins	African Canadians	6 (1.6%)	126 (35.3%)	4.498	4	.343
	South Asians	3 (0.8%)	128 (35.1%)			
	Middle Eastern	3 (0.8%)	69 (18.9%)			
	Europeans	2 (0.5%)	16 (4.4%)			
	Asians	1 (6.7)	8 (2.3%)			
Mylan-ezetimibe	African Canadians	1 (0.3%)	134 (36.7%)	3.047	4	.550
	South Asians	4 (1.1%)	127 (34.8%)			
	Middle Eastern	2 (0.5%)	70 (19.2%)			
	Europeans	1 (0.3%)	17 (4.7%)			
	Asians	0 (0.0%)	9 (2.5%)			
Methimazole	African Canadians	1 (0.3%)	134 (36.7%)	1.708	4	.789
	South Asians	0 (0.0%)	131 (35.9%)			
	Middle Eastern	0 (0.0%)	72 (19.7%)			
	Europeans	0 (0.0%)	18 (4.9%)			
	Asians	0 (0.0%)	9 (2.5%)			
Levothyroxine	African Canadians	1 (0.3%)	134 (36.7%)	1.630	4	.083
	South Asians	2 (0.5%)	129 (35.3%)			
	Middle Eastern	0 (0.0%)	72 (19.7%)			
	Europeans	0 (0.0%)	18 (4.9%)			
	Asians	0 (0.0%)	9 (2.5%)			
Antidepressants	African Canadians	2 (0.5%)	133 (36.4%)	8.614	4	.072
	South Asians	2 (0.5%)	129 (35.3%)			
	Middle Eastern	1 (0.3%)	71 (19.5%)			
	Europeans	2 (0.5%)	16 (4.4%)			
	Asians	0 (0.0%)	9 (2.5%)			
IBS drugs	African Canadians	2 (0.5%)	133 (36.4%)	6.375	4	.173
	South Asians	0 (0.0%)	131 (35.9%)			
	Middle Eastern	3 (0.8%)	69 (19.9%)			
	Europeans	0 (0.0%)	18 (4.9%)			
	Asians	0 (0.0%)	9 (2.5%)			
NSAIDS	African Canadians	12 (3.3%)	123 (33.7%)	14.746	4	.005
	South Asians	2 (0.5%)	129 (35.3%)			
	Middle Eastern	0 (0.0%)	72 (91.7%)			
	Europeans	2 (0.5%)	16 (4.4%)			
	Asians	0 (0.0%)	9 (2.5%)			
Dietary supplement	African Canadians	53 (14.5%)	82 (22.5%)	6.904	4	141
	South Asians	39 (10.7%)	92 (32.9%)			
	Middle Eastern	16 (4.4%)	56 (22.5%)			
	European	5 (1.4%)	13 (3.6%)			
	Asians	3 (0.8%)	6 (2.4%)			

3.4.2 PAR-Q

Moreover, the PAR-Q answers are detailed in Table 3.4. The Table showed that the p values were significant (.001) with differences in Chi-square values. As noted, only n=9 (2.4%) respondents indicated their family physician recommended they exercise or engage in some physical activity because they have a heart condition. When asked if any participants had a bone or joint problem that made it worse when engaging in physical activity, n = 63 (17.2%) answered “yes” and statistically significant (x2 =42.4, p = .001). Fortunately, none of the participants reported having any pain in the chest when engaging in physical activity.

Table 3.4 PAR Q

Table 3.4 – Participants' responses from the PAR- Q

PAR-Q Questions	**Number of Respondents N= 365**		**Summarised results**	
	Yes	**No**	**Chi-square test value**	**P-Value**
Has a doctor ever said you have a heart condition and that you should only do physical activity recommended by a doctor?	9 (2.45%)	356 (97.5%)	156	.001
Do you lose balance because of dizziness or lose consciousness?	4 (1.09%)	361(98.9%)	170.6	.001
Do you have a bone or joint problem (e.g. back, knee, hip) that could be made worse by a change in your physical activity?	63 (17.2 %)	302 (82.7%)	42.4	.001
Is your doctor currently prescribing medications (e.g. water pills) for your high blood pressure or health condition?	215 (58.9%)	150 (41.0%)	107.3	.001
Do you feel pain in your chest when you do physical activity?	0 (0.0%)	365 (100%)	N/A	N/A
Do you know any other reasons why you should not do physical activity?	5 (1.3%)	360 (98.6%)	167	.001
In the past month, have you had chest pain when you were not doing physical activity?	11(3.0%)	352 (96.4%)	150.0	.001

3.4.3 Differences in Pre and Post Conditions for Body Composition

The body composition data are shown in Table 3.5. The Table shows significant differences in body composition across different ethnic groups (African Canadians, South Asians, Europeans, Middle Eastern and Asians. The Kruskal Wallis H test was utilised to assess the differences, and the results revealed overall statistically significant differences for each group on all pre and post measurements (p<0.05). For example, both pre and post water % were significant among groups: (H) (4) =11.282, p =.024) and (H) (4) =22.036, p = .001). Median values were compared, and it was found that the African Canadian group had higher pre-weight (Kg) (Md =74.4 and range =66.3), pre-BMI (Md =28 and range =25.3), and pre-body fat % (Md =38 and range =40.7) (Table 4). The median score for pre-water % varied across the groups, with African Canadians (Md =69 and range 123), South Asians (Md =69 and 74.3), Middle Eastern (Md =73 and range =66), Europeans (Md =69 and range =42), and Asians (Md =73 and range =31). Post-exercise median values for all body composition variables improved across all groups from baseline, as shown in Table 3.5.

Table 3.5 Group pre, post and pre-post - Body Composition

Table 3.5 - Group pre, post and pre-post median, range, effect size and P-values for Kruskal Wallis H Test – Body Composition Test

Categorical Variables	Cultural Indicator	Pre-Median ± Range	Post Median ± Range	Pre-Post Median ± Range	Pre Effect Size	Post Effect Size	Pre-post Effect size	Pre P - Value	Post-P-Value	Pre-post P-Value
Weight (kg)	African Canadians	74.4 ± 66.3	70.8 ± 68.3	3.4 ± 48.4	0.207	0.154	4.693	0.000	0.000	0.653
	South Asians	59 ± 37.4	55.6 ± 47.8	3.6 ± 48.12						
	Middle Eastern	63.8 ± 35.6	59.5 ± 37.6	4.0 ± 16.40						

	European	65.6 ± 20.4	60.9 ± 48.5	4.5 ± 40.06						
	Asians	55.3 ± 16.9	45.25 ± 17.0	3.36 ± 7.90						
Body Mass Index (BMI)	African Canadians	28 ± 25.3	27 ± 40.7	1.4 ± 38.10	0.251	0.195	1.558	0.000	0.000	0.625
	South Asians	24.4 ± 16.7	22.6 ± 14.9	1.5 ± 12.10						
	Middle Eastern	25.4 ± 11.5	24.1 ± 9.6	1.7 ± 6.10						
	European	25 ± 11.3	24 ± 8.4	1.3 ± 8.3						
	Asians	23.5 ± 5.9	19 ± 11.3	.95 ± 6.40						
Fat %	African	38 ± 43	35 ± 60	33.5 ± 33.5	0.134	0.101	0.024	0.000	0.000	0.014
	South Asians	29 ± 47.0	28.2 ± 47.0	1.4 ± 20						
	Middle Eastern	32.9 ± 27.5	29.9 ± 23.9	1.9 ± 12						
	European	37.4 ± 21.0	35.6 ± 21.0	2.0 ± 5.40						
	Asians	28 ± 21.0	16.25 ± 21.0	2.0 ± 2.50						
Water %	African	69 ± 123.6	76 ± 117.6	-7.0 ± 113	2.311	0.047	5.332	0.024	0.000	0.157
	South Asians	69 ± 74.3	76.9 ± 859.5	-7.5 ± 820.50						
	Middle Eastern	73 ± -9.0	83.5 ± 76.20	-9.0 ± 36.70						
	European	69 ±42	76.6 ± 38.10	-7.6 ± 13.5						
	Asians	73 ± 31	86 ± 26.80	-5.9 ± 10.10						

*P values <0.05 indicate a significant association. P values > 0.05 indicate no significant association. **weight, BMI = body mass index, fat %, water.

3.4.4 Dunn's Post Hoc Pairwise Test Difference Across Ethnic Groups – Body Composition

A Dunn's post hoc test of pairwise contrasts was performed to see if there were differences among any ethnic groups. The analysis showed there were significant variances in values between some groups. For instance, a significant comparison was noted for all the pre and post variables between the African Canadian group and South Asians ($p<0.05$). Similarly, significant differences were also shown in the African Canadians and Middle Eastern ($p<0.05$) for all variables. African Canadians paired with the European group reported statistically significant differences in pre and post weight ($p<0.05$), but pre and post body fat % was not statistically significant ($p >0.05$). However, there was a statistically significant difference in pre and post BMI ($p<0.05$). Another statistically significant comparison was found between the South Asians and the European group on pre weight, pre fat% and pre-water % ($p<0.05$). Still, no significant differences were observed for post-weight and pre-BMI ($p >0.05$). Post BMI results were just below the threshold for significance. All pairwise comparison results for ethnic profiles are described in Table 3.6.

Table 3.6 Pairwise Comparison Pre and Post Body Composition

Table 3. 6 - Kruskal Wallis Post Hoc Test - Pairwise Comparison of Ethnicity for Pre and Post Body Composition

	Pre-Body Composition Measurements					**Post-Body Composition Measurements**				
Categorical Variables	**Comparison**	**Test Stats**	**Std Er**	**Std. Stats**	**Sig**	**Comparison**	**Test Stats**	**Std Error**	**Std. Stats**	**Post sig**
Weight	Asians-South Asians	59.353	36.357	1.632	.103	Asians-South Asians	83.776	45.856	1.827	.068
	Asians-Middle Eastern	100.826	37.303	2.703	.007	Asians-Europeans	102.978	50.130	2.054	.040
	Asians-Europeans	109.583	43.073	2.544	.011	Asians-Middle Eastern	103.887	46.560	2.231	.026
	Asians-African Canadians	189.152	36.323	5.208	<.011	Asians-African Canadians	177.783	45.910	3.872	.000
	South Asians-Middle Eastern	-41.473	15.479	-2.679	.007	South Asians-Europeans	-19.202	23.389	-.821	.412
	South Asians-Europeans	-50.230	26.522	-1.894	058	South Asians-Middle Eastern	-20.111	14.205	-1.416	.157
	South Asians-African Canadians	129.799	12.940	10.031	.000	South Asians-African Canadians	94.006	11.904	7.897	.001
	Middle Eastern-Europeans	8.757	27.804	.315	.753	Europeans-Middle Eastern	-.909	24.740	-.037	.971
	Middle Eastern-African Canadians	88.325	15.397	5.737	<.001	Europeans-African Canadians	74.805	23.494	3.184	.001
	Europeans-African Canadians	79.569	26.474	3.005	.003	Middle Eastern-African Canadians	73.895	14.378	5.140	.001
Body Mass Index (BMI)	Asians-South Asians	47.085	36.252	1.299	.194	Asians-South Asians	42.310	45.704	.926	.355
	Asians-Europeans	95.039	43.368	2.191	.028	Asians-Middle Eastern	83.109	46.406	1.791	.073
	Asians-Middle Eastern	108.104	37.195	2.906	.004	Asians-Europeans	90.375	50.261	1.798	.072
	Asians-African Canadians	182.178	36.218	5.030	<.001	Asians-African Canadians	149.855	45.758	3.275	.001

	South Asians-Europeans	-47.954	27.121	-1.768	.077	South Asians-Middle Eastern	-40.799	14.158	-2.882	.004
	South Asians-Middle Eastern	-61.019	15.434	-3.954	<.001	South Asians-Europeans	-48.065	23.941	-2.008	.045
	South Asians-African Canadians	135.093	12.902	10.470	.000	South Asians-African Canadians	107.545	11.864	9.065	.000
	Europeans-Middle Eastern	-13.065	28.368	-.461	.645	Middle Eastern-Europeans	7.266	25.254	.288	.774
	Europeans-African Canadians	87.139	27.074	3.218	.001	Middle Eastern-African Canadians	66.746	14.330	4.658	.001
	Middle Eastern-African Canadians	74.074	15.353	4.825	<.001	Europeans-African Canadians	59.480	24.043	2.474	.013
Fat %	Asians-South Asians	41.838	36.343	1.151	.250	Asians-South Asians	70.592	46.413	1.521	.128
	Asians-Middle Eastern	78.035	37.288	2.093	.036	Asians-Middle Eastern	89.576	47.138	1.900	.057
	Asians-Europeans	125.444	43.057	2.913	.004	Asians-Europeans	142.688	51.055	2.795	.005
	Asians-African Canadians	152.952	36.309	4.213	<.001	Asians-African Canadians	152.673	46.459	3.286	.001
	South Asians-Middle Eastern	-36.196	15.473	-2.339	.019	South Asians-Middle Eastern	-18.984	14.341	-1.324	.186
	South Asians-Europeans	-83.606	26.512	-3.154	.002	South Asians-Europeans	-72.096	24.295	-2.967	.003
	South Asians-African Canadians	111.113	12.935	8.590	.000	South Asians-African Canadians	82.081	11.921	6.886	.001
	Middle Eastern-Europeans	47.410	27.793	1.706	.088	Middle Eastern-Europeans	53.112	25.653	2.070	.038
	Middle Eastern-African Canadians	74.917	15.391	4.868	<.001	Middle Eastern-African Canadians	63.097	14.488	4.355	.001
	Europeans-African Canadians	27.507	26.464	1.039	.299	Europeans-African Canadians	9.986	24.382	.410	.682
Water %	Europeans-African Canadians	.868	4.495	27.076	.166	African Canadians-Europeans	-8.463	25.673	-.330	.742
	Europeans-South Asians	.573	15.286	27.122	.564	African Canadians-South Asians	-12.204	12.313	-.991	.322
	Europeans-Asians	.343	-41.150	43.370	-.949	African Canadians-Asians	-37.469	44.056	-.850	.395
	Europeans-Middle Eastern	.061	-53.185	28.369	-1.875	African Canadians-Middle Eastern	-66.660	14.682	-4.540	.001
	African Canadians-South Asians	.403	-10.791	12.903	-.836	Europeans-South Asians	3.741	25.649	.146	.884
	African Canadians-Asians	.312	-36.656	36.219	-.012	Europeans-Asians	-29.006	49.470	-.586	.558
	African Canadians-Middle Eastern	.002	-48.690	15.353	-.171	Europeans-Middle Eastern	-58.197	26.867	-2.166	.030
	South Asians-Asians	.476	-25.864	36.254	-.713	South Asians-Asians	-25.265	44.042	-.574	.566

	South Asians-Middle Eastern	.014	-7.899	15.434	- .455	South Asians-Middle Eastern	-54.456	14.640	-3.720	.001
	Asians-Middle Eastern	.746	12.035	37.196	.324	Asians-Middle Eastern	29.191	44.763	.652	.514

3.4.5 Differences in Pre and Post Conditions for Cardiovascular Profiles

Initial cardiovascular profiles at baseline and changes after the exercise intervention are shown in Table 3.7. The Kruskal-Wallis test found that there were statistical differences across the ethnic profiles for five of the cardiovascular system profiles, SBP, DBP, MAP and PP, all ($p<0.05$) at baseline and post-exercise, but not for HR ($p>0.05$). For instance, pre-SBP (H) (4) =23.031, p .001, and post-SBP (H) (4) =18.651, p .001) values were statistically different within the groups. Even though the RPP was significant, it was not for post-exercise RPP ($p>0.05$). All group pre and post median range and p values results are highlighted in Table 3.7. As the Table indicates, the African Canadian group recorded greater results for pre-SBP (*Md* =137 and *range* =88), with post-evaluation SBP (Md =126 and range =59) significantly improving. However, no significant differences in DBP were observed across all ethnic groups, which is consistent with the fact that DBP does not typically change significantly with exercise.

Table 3.7 Group pre, post and pre-post – Cardiovascular Profiles

Table 3.7 - Group pre, post and pre-post Median, Range, Effect Size and P-Value for Kruskal Wallis H test – Cardiovascular Profiles

Categorical Variables	**Ethnic Indicator**	**Pre Median ± Range**	**Post Median ± Range**	**Pre-Post Median ± Range**	**Pre Effect Size**	**Post Effect Size**	**Pre-post Effect size**	**Pre P - Value**	**Post P-Value**	**Pre-post P-Value**
systolic blood pressure (SBP)	African Canadians	137 ± 88	126 ± 44	7 ± 55	0.134	0.032	6.419	0.00	0.001	.775
	South Asians	133 ± 80	125 ± 57	9 ± 44						
	Middle Eastern	126 ± 54	116 ± 32	8.5 ± 24						
	European	134 ± 58	125 ± 28	8 ± 24						
	Asians	123 ± 43	112 ± 20	13 ± 12						
	African	80 ± 59	77 ± 37	4 ± 37	3.638	0.016	8.399	.001	0.006	.589

Diastolic Blood Pressure (DBP)	Canadians									
	South Asians	79 ± 65	76 ± 54	4 ± 74						
	Middle Eastern	79 ± 62	73 ± 62	4 ± 40						
	European	80 ± 48	71 ± 25	3 ± 21						
	Asians	71 ± 31	68 ± 10	-3.5 ± 10						
Heart Rate (HR)	African Canadians	79 ± 58	76 ± 52	4 ± 74	4.855	8.135	0.019	0.239	0.288	.244
	South Asians	79 ± 56	75 ± 53	5 ± 71						
	Middle Eastern	76 ± 49	73 ± 58	7 ± 58						
	European	69 ± 54	71 ± 33	7 ± 69						
	Asians	79 ± 35	69 ± 20	14 ± 12						
Rate Pressure Product (RPP)	African Canadians	10614 ± 13934	9620 ± 11571	1199 ± 11423	0.015	0.016	9.061	0.014	0.006	.271
	South Asians	10522 ± 8430	9176 ± 7498	1179 ± 8966						
	Middle Eastern	9625 ± 8719	8694 ± 7210	1509 ± 6642						
	European	9588 ± 11160	9052 ±6600	11463 ± 10112						
	Asians	10944 ± 3940	8483 ± 2720	2427 ± 1884						
Pulse Pressure (PP)	African Canadians	53 ± 86	49 ± 61	5.5 ± 68	0.024	0.021	0.015	0.008	0.004	.270
	South Asians	52 ± 86	46 ± 63	5 ± 70						
	Middle Eastern	46 ± 73	42 .50 ± 65	7 ± 53						
	European	53 ± 33	49 ± 64	3 ± 41						
	Asians	56 ± 44	41 ± 28	16.5 ± 22						
Mean Arterial Pressure (MAP)	African Canadians	99 ± 44	94 ± 37	5.4 ± 39	0.017	8.529	8.444	0.000	0.014	.826
	South Asians	97 ± 117	91 ± 73	5.3 ± 132						
	Middle Eastern	95 ± 34	89 ± 45	4.5 ± 30						
	European	98 ± 36	91 ± 29	5 ± 22						
	Asians	87 ± 20	83 ± 15	3 ± 4.6						

*P values <0.05 indicate a significant association. P values > 0.05 indicate no significant association.
**SBP = systolic blood pressure, DBP = diastolic blood pressure, HR= heart rate, MAP = mean arterial blood pressure, RPP = rate pressure product, PP = pulse pressure.

3.4.6 Dunn's Post Hoc Pairwise Test Across Ethnic Groups – Cardiovascular Profiles

After running the pairwise comparisons post hoc tests to identify similarities or differences between groups on the cardiovascular variables, the post hoc test results showed significant variances (p<0.05) in several of the groups on the cardiovascular variables (see Table 3.8). As shown in the Table, the South Asians and African

Significant differences were observed among the Canadians in terms of pre SBP, pre DBP, and MAP, all (p<0.05), but not for and post-SBP (>0.05). A significant comparison between the Middle Eastern and African Canadians for both pre and post SBP; MAP, RPP and PP all (p<0.05) were also found. See Table 3.8 for all pairwise comparisons.

The pre/post comparison of cardiac profiles across all ethnic groups showed no statistically significant differences (p>0.05). Consequently, a pairwise comparison of pre/post cardiac profiles was deemed unnecessary as the overall test did not show significant differences between groups. Notably, among the African Canadian group, the median and range results for pre/post-SBP (Md =7.0 and range =55), and DBP (Md =4.0 and range =37), while pre/post HR (Md = 4.0 and range =74.), pre-post MAP (Md =5.4 and range =39), pre/post-PP (Md =5.5 and range = 68), and RPP (Md =1199 and range =11423). Table 3.7 summarises the median values for all pre/post conditions of cardiovascular profiles.

Table 3.8 Pairwise Comparison Pre and Post – Cardiovascular Profiles

Table 3.8 - Kruskal Wallis Post Hoc Test - Pairwise Comparison of Ethnicity for Pre and Post-Cardiovascular Profiles										
	Pre Assessment					**Post Assessment**				
Categorical Variables	**Comparison**	**Test Stats**	**Std Error**	**Std. Stats**	**Sig**	**Comparison**	**Test Stats**	**Std Error**	**Std. Stats**	**Sig**
systolic blood pressure (SBP)	Asians-Middle Eastern	4.174	37.292	.112	.911	Asians-Middle Eastern	30.411	46.969	.647	.517
	Asians-South Asians	43.386	36.347	1.194	.233	Asians-South Asians	69.279	46.282	1.497	.134
	Asians-Europeans	45.417	43.061	1.055	.292	Asians-Europeans	70.132	50.596	1.386	.166
	Asians-African Canadians	74.589	36.312	2.054	.040	Asians-African Canadians	88.666	46.322	1.914	.056
	Middle Eastern-South Asians	39.213	15.474	2.534	.011	Middle Eastern-South Asians	38.868	14.260	2.726	.006
	Middle Eastern-Europeans	41.243	27.796	1.484	.138	Middle Eastern-Europeans	39.721	24.926	1.594	.111
	Middle Eastern-African Canadians	70.415	15.393	4.575	<.001	Middle Eastern-African Canadians	58.255	14.389	4.048	<.001
	South Asians-Europeans	-2.030	26.514	-.077	.939	South Asians-Europeans	-.853	23.607	-.036	.971
	South Asians-African Canadians	31.203	12.936	2.412	.016	South Asians-African Canadians	19.387	11.959	1.621	.105
	Europeans-African Canadians	29.172	26.467	1.102	.270	Europeans-African Canadians	18.534	23.685	.783	.434

Diastolic Blood Pressure (DBP)	Asians-Middle Eastern	108.049	37.275	2.899	.004	Asians-Europeans	46.559	50.252	.926	.354
	Asians-Europeans	112.778	43.042	2.620	.009	Asians-Middle Eastern	64.919	46.650	1.392	.164
	Asians-South Asians	115.687	36.331	3.184	.001	Asians-South Asians	83.685	45.967	1.821	.069
	Asians-African Canadians	142.526	36.296	3.927	<.001	Asians-African Canadians	103.757	46.021	2.255	.024
	Middle Eastern-Europeans	4.729	27.783	.170	.865	Europeans-Middle Eastern	-18.361	24.757	-.742	.458
	Middle Eastern-South Asians	7.639	15.467	.494	.621	Europeans-South Asians	37.126	23.446	1.583	.113
	Middle Eastern-African Canadians	34.477	15.386	2.241	.025	Europeans-African Canadians	57.198	23.552	2.429	.015
	Europeans-South Asians	2.910	26.502	.110	.913	Middle Eastern-South Asians	18.766	14.164	1.325	.185
	Europeans-African Canadians	29.748	26.455	1.124	.261	Middle Eastern-African Canadians	38.837	14.337	2.709	.007
	South Asians-African Canadians	26.838	12.930	2.076	.038	South Asians-African Canadians	20.072	11.932	1.682	.093
Heart Rate (HR)	Europeans-Middle Eastern	-37.042	27.790	-1.333	.183	Europeans-Asians	-.838	50.429	-.017	.987
	Europeans-African Canadians	51.883	26.462	1.961	.050	Europeans-Middle Eastern	-20.064	24.801	-.809	.419
	Europeans-South Asians	53.487	26.509	2.018	.044	Europeans-South Asians	35.668	23.528	1.516	.130
	Europeans-Asians	-72.139	43.053	-1.676	.094	Europeans-African Canadians	41.115	23.634	1.740	.082
	Middle Eastern-African Canadians	14.842	15.390	.964	.335	Asians-Middle Eastern	19.226	46.791	.411	.681
	Middle Eastern-South Asians	16.446	15.471	1.063	.288	Asians-South Asians	34.830	46.129	.755	.450
	Middle Eastern-Asians	-35.097	37.285	-.941	.347	Asians-African Canadians	40.277	46.183	.872	.383
	African Canadians-South Asians	-1.604	12.933	-.124	.901	Middle Eastern-South Asians	15.604	14.139	1.104	.270
	African Canadians-Asians	-20.256	36.305	-.558	.577	Middle Eastern-African Canadians	21.051	14.314	1.471	.141
	South Asians-Asians	-18.651	36.340	-.513	.608	South Asians-African Canadians	5.447	11.974	.455	.649
Mean Arterial Pressure (MAP)	Asians-Middle Eastern	73.863	37.052	1.993	.046	Asians-Europeans	59.853	50.287	1.190	.234
	Asians-South Asians	99.873	36.056	2.770	.006	Asians-Middle Eastern	63.210	46.682	1.354	.176
	Asians-Europeans	101.028	42.717	2.365	.018	Asians-South Asians	85.382	46.000	1.856	.063
	Asians-African Canadians	130.561	36.030	3.624	<.001	Asians-African Canadians	102.266	46.053	2.221	.026
	Middle Eastern-South Asians	26.010	15.491	1.679	.093	Europeans-Middle Eastern	-3.357	24.774	-.135	.892
	Middle Eastern-Europeans	27.164	27.652	.982	.326	Europeans-South Asians	25.529	23.463	1.088	.277
	Middle Eastern-African Canadians	56.698	15.431	3.674	<.001	Europeans-African Canadians	42.413	23.568	1.800	.072
	South Asians-Europeans	-1.155	26.302	-.044	.965	Middle Eastern-South Asians	22.173	14.173	1.564	.118
	South Asians-African Canadians	30.688	12.856	2.387	.017	Middle Eastern-African Canadians	39.056	14.347	2.722	.006
	Europeans-African Canadians	29.534	26.267	1.124	.261	South Asians-African Canadians	16.883	11.941	1.414	.157
	Middle Eastern-Europeans	1.168	27.655	.042	.966	Asians-Middle Eastern	36.129	46.686	.774	.439
	Middle Eastern-South Asians	34.884	15.513	2.249	.025	Asians-Europeans	42.956	50.292	.854	.393

Rate Pressure Product (RPP)	Middle Eastern-Asians	-46.002	37.056	-1.241	.214	Asians-South Asians	73.351	46.004	1.594	.111
	Middle Eastern-African Canadians	50.487	15.413	3.276	.001	Asians-African Canadians	82.827	46.058	1.798	.072
	Europeans-South Asians	33.716	26.317	1.281	.200	Middle Eastern-Europeans	6.827	24.776	.276	.783
	Europeans-Asians	-44.833	42.721	-1.049	.294	Middle Eastern-South Asians	37.222	14.175	2.626	.009
	Europeans-African Canadians	49.319	26.258	1.878	.060	Middle Eastern-African Canadians	46.698	14.349	3.255	.001
	South Asians-Asians	-11.118	36.069	-.308	.758	Europeans-South Asians	30.395	23.465	1.295	.195
	South Asians-African Canadians	15.603	12.859	1.213	.225	Europeans-African Canadians	39.871	23.570	1.692	.091
	Asians-African Canadians	4.485	36.025	.125	.901	South Asians-African Canadians	9.476	11.942	.793	.427
	Middle Eastern-South Asians	39.923	15.486	2.578	.010	Middle Eastern-Asians	-3.613	46.810	-.077	.938
	Middle Eastern-Europeans	48.486	27.643	1.754	.079	Middle Eastern-South Asians	34.191	14.212	2.406	.016
Pulse Pressure (PP)	Middle Eastern-African Canadians	53.956	15.426	3.498	<.001	Middle Eastern-African Canadians	50.983	14.364	3.549	<.001
	Middle Eastern-Asians	-76.625	37.040	-2.069	.039	Middle Eastern-Europeans	67.863	24.842	2.732	.006
	South Asians-Europeans	-8.563	26.294	-.326	.745	Asians-South Asians	30.578	46.126	.663	.507
	South Asians-African Canadians	14.033	12.852	1.092	.275	Asians-African Canadians	47.371	46.173	1.026	.305
	South Asians-Asians	-36.702	36.045	-1.018	.309	Asians-Europeans	64.250	50.426	1.274	.203
	Europeans-African Canadians	.5.470	26.258	.208	.835	South Asians-African Canadians	16.793	11.946	1.406	.160
	Europeans-Asians	-28.139	42.703	-659	.510	South Asians-Europeans	-33.672	23.527	-1.431	.152
	African Canadians-Asians	-22.669	36.019	-629	.529	African Canadians-Europeans	-16.879	23.619	-.715	.475

3.4.7 Predicated Cardiovascular profiles on gender, age, and BMI

The multiple regression predicted cardiovascular profiles based on gender, age, and BMI with exercise training. The model indicated that at the 5% significance level, the dependent variable pre-SBP increased with age and post-BMI, but this was unaffected by gender. The coefficient of determination was R^2 = .070 or 7.00% F (3,307) = 7.7, p < .005 and was jointly significant. Only post-BMI showed a slight increase with pre-DBP. This was unchanged by age and gender. The coefficient was R^2 =.025 or 2.5% F (3,307) = 2.6, p < .005 on pre DBP. Moreover, none of the predictors in the model (post-BMI, age, and gender) significantly affected pre HR. Next, post-BMI and age showed significant predictors of MAP but were unchanged by gender. The model was significant R^2 =.058 or 5.8%, F (3,307) = 6.2, p < .001. Pre-PP increased with age but was unchanged by post-BMI and gender. Whereas the coefficient analysis was significant R^2 =.053 or 5.3%, F (3,307) = 5.7, p < .001. Age and post BMI were significant predictors of RPP without connection to gender. The analysis was R^2 = .047 or 4.7, %, F (3,307) = 5.0, p< .002 was noted. No interactions were observed between age and ethnicity. All predictors of the cardiovascular profiles are presented in Tables 3.9 - 3.14.

Table 3.9 Linear Regression Results for Predicting Pre-Systolic Blood Pressure (SBP)

Predictor	Beta (ß)	Standard Error (SE)	t-value	p-value
Post-BMI	1.38	1.81	2.525	0.012
Age	1.77	0.66	3.180	0.002
Gender	1.05	3.819	1.886	0.060

Table 3.10 Linear Regression Results for Predicting Pre-Diastolic Blood Pressure (DBP)

Predictor	Beta (ß)	Standard Error (SE)	t-value	p-value
Post-BMI	1.54	1.09	2.731	0.007
Age	-0.004	0.040	-0.063	0.949
Gender	0.031	2.303	0.550	0.582

Table 3.11 Linear Regression Results for Predicting Pre Heart Rate (HR)

Predictor	Beta (ß)	Standard Error (SE)	t-value	p-value
Post-BMI	0.95	1.51	1.678	0.094
Age	0.019	0.055	0.323	0.747

Predictor	Beta (ß)	Standard Error (SE)	t-value	p-value
Gender	-0.032	3.17	-0.558	0.577

Table 3.12 Linear Regression Results for Predicting Pre Mean Arterial Pressure (MAP)

Predictor	Beta (ß)	Standard Error (SE)	t-value	p-value
Post-BMI	183	1.29	3.289	0.001
Age	1.32	0.047	2.355	0.019
Gender	-0.049	2.71	-0.881	0.379

Table 3.13 Linear Regression Results for Predicting Pre Pulse Pressure (PP)

Predictor	Beta (ß)	Standard Error (SE)	t-value	p-value
Post-BMI	0.31	1.67	0.552	0.581
Age	1.90	0.061	3.381	0.001
Gender	1.00	3.524	1.779	0.376

Table 3.14 1Linear Regression Results for Predicting Pre Rate Pressure Product (RPP)

Predictor	Beta (ß)	Standard Error (SE)	t-value	p-value
Post-BMI	1.55	26.096	2.772	0.006
Age	1.31	9.482	2.324	0.021
Gender	0.44	548.618	0.773	0.440

3.5 Discussion

To the researcher's knowledge, the current study was the first in Canada to present research on an exercise programme delivered at the community level to investigate differences in multiple health profiles. Thus, the study found significant results across different populations. The current research compared variations between individuals from various ethnic groups on cardiovascular system profiles, body composition measurements, and self-reported questionnaires.

3.5.1 The Physical Activity Questionnaire

The physical activity questionnaire found many differences in responses across the ethnic groups. Thus, when asked about their medical conditions, participants responded that they had one or more. Some participants also responded that they had comorbidities and were prescribed medications for various health issues. For example, 20.8% of the African Canadians responded that they had hypertension in comparison to the other groups. This finding was predictable since the current research identified African descendants with elevated BP (≤ 140/90 mm Hg) despite residing in different geographical spaces (Hicken et al., 2019; Schutte et al., 2023). The persistent and widespread nature of elevated BP among individuals of African descent, regardless of their geographic location, highlights the importance of addressing hypertension within this demographic group on a global scale. It also suggests supporting and advocating for targeted interventions like FFL and healthcare policies to reduce cardiovascular health disparities.

Moreover, 7% of South Asians said they had diabetes, whereas 5.5% of African Canadians, 1.1% of Europeans and 1.9% of Middle Eastern reported the condition. Cholesterol was slightly higher among the South Asians, followed by participants in the Middle Eastern category, at 2.5%. In the current study, the noticeable variations across ethnicities in disease distribution reinforced suggestions for possible ethnic-specific disease risk prevention programmes and health services (Chiu et al., 2010). When adequately executed, implementing these might yield some reductions in health risks among specific populations.

The findings from the Physical Activity Questionnaire demonstrated common barriers to exercise seen across the studied groups. Participants cited several barriers in this study, including lack of transportation, time constraints, low motivation, and family responsibilities. Notably, these challenges aligned with those identified in previous research investigating impediments to physical exercise, particularly among women and older adults, corroborating the existing literature (Lauderdale et al., 2015; Kirkland et al., 2011). An illustrative example highlighting the influence of gender on exercise barriers was observed in a study by Grillison et al. (2006), examining gender differences among college students. The results saw female participants with lower self-determination exercise adherence than their male counterparts, concerning body image as a contributing factor. They also encountered obstacles linked to their responsibilities as mothers, wives, and professionals working outside. These responsibilities often led to lower their leisure time, potentially hindering women's ability to participate in regular exercise.

An intriguing insight was noticed. Some of the women verbally expressed that they were sweating too much from the exercise. Some factors can explain this. Firstly, many women wore clothing and shoes inappropriate for exercise. Many women wore dress shoes, skirts, pants, and thick sweaters to exercise. Pictures around the fitness area were posted to correct this, showing how to dress when exercising. Images of Muslim women in hijabs working out in exercise gear were included in the photos. We also gave all participants bottled water and explained the importance of hydration during exercise. Secondly, from the questionnaire, many participants had not previously exercised and perhaps did not understand that sweating is part of exercise.

Only 12 participants reported they were already active before joining FFL. Nine of them were from the African Canadian group. Finally, some African Canadian women said they did not appreciate sweating because it caused their hair to become "fuzzy". This observation is similar to previous American studies, which found African American women reluctant to participate in physical exercise due to concerns related to their hairstyles. This is a trend where many African American women see sweating as detrimental to their hairstyles, causing a vast hindrance to exercise and impacting their health (Joseph et al., 2018). Unfortunately, hair management was not considered for the Black women in the current study. Acknowledging and suggesting these women's use of protective hairstyles may have provided insights into Black women's hair concerns from the Canadian perspective. Nonetheless, the similarities with other African American studies, the issue of sweating presents a unique challenge for Black women, balancing health and hair care.

A striking finding in FFL was that most participants were unfamiliar with the Canadian Physical Activity Guide, with only 4.3% of all respondents being aware of the guide. It is assumed that the guide might not reach as many ethnic groups as thought, which is concerning. Could the language barrier in reading the guide contribute to its unfamiliarity among certain groups? Unfortunately, health resources are habitually not packaged with cultural elements, although some efforts have been made to incorporate them. Linguistic challenges might make it difficult for a non-English speaker to understand, specifically if the resources are Eurocentric focused (Abdi et al., 2020). This study's results further highlight the need to encourage more health promotion resources (i.e. information about a health condition) to be printed in specific languages. A previous study by Kreuter and Haughton (2006) suggested integrating cultural components, such as making information more understandable into health literacy, reinforces and recognises the target population's beliefs and values. Therefore, health promotions aimed at minority groups are successful if cultural materials are supplementary. The provision of health literacy information in Canada targeting minority groups has increased through the media and health promotion campaigns done by provincial, federal, and private entities. It is evident in FFL that more provisions are needed. At the same time, if public health policies are to encourage exercise among populations, promoting the guide in all communities is very important.

3.5.2 *Physical Activity Readiness Questionnaire*

The PAR-Q was used in this study to determine clients' eligibility to participate in the exercise intervention, identify participants' unique limitations and ensure that it was safe for clients to exercise, reducing adverse events. Based on the responses to the PAR-Q in Table 3.4, all group participants were eligible to join the fitness class. During the examination of participants' responses concerning their health, it was discovered that nine individuals within groups were informed by their doctors about a heart condition and were advised to engage in exercise (refer to Table 3.4). Upon looking at the differences between groups, it was observed that six of the participants were of South Asian descent. Only three clients were from the African Canadian group. Specific outcomes in the FFL study were similar to those reported in the Health Assessment and Risk in Ethnic Groups study by Anand et al. (2000). This early research investigated the differences in risk factors and cardiovascular disease among three ethnic groups (South Asians, Europeans and Asians). The authors cited that out of the three groups, South Asians (10.7%) had an intermediate level of risk factors and higher profiles for heart disease and stroke, with Asians having the least (Anand et al., 2000). In FFL, it was observed that South Asians had a higher prevalence of diabetes compared to other ethnic groups. This elevated incidence of diabetes within the South Asian population could potentially contribute to their increased risk of developing heart disease compared to other populations, as indicated. The risk continues even when considering the higher prevalence of cardiovascular risk factors, such as hypertension and elevated blood pressure, among individuals in the African diaspora.

Aside from participants' responses, the study observations indicated a noteworthy relationship in cardiovascular characteristics between African Canadians and South Asians, as evidenced by the proximity of their respective outcome measurements. At the same time, it is important to note that these are speculative explanations. More research would be required to collect interesting data and understand the specific influences contributing to the similarities in cardiovascular profiles observed between African Canadians and South Asians, as a complex interaction of multiple features influences everyone's cardiovascular health.

While it may seem counterintuitive to prescribe exercise to participants with past cardiovascular problems, studies have shown that regular physical activity can improve heart function, reduce symptoms, and increase the overall quality of life (Winzer et al., 2018; Ozemek et al., 2018; Lavie et al., 2009; Shephard & Balady, 1999; Whelton et al., 2002). Participants who responded that they had heart conditions and were told to exercise by their physician were still eligible for the study despite their conditions. None of the participants mentioned they experienced chest pain during exercise or physical activity, making them eligible to participate in the exercise intervention. The prescribed exercise was also low to moderate intensity to avoid causing severe adverse effects and because many participants were new exercisers. In addition, all participants with cardiovascular concerns were monitored during and after exercise with heart rate monitors. This meticulous approach was adopted to ensure the participants' safety during exercise and mitigate any potential health risks associated with their preexisting cardiovascular conditions.

Moreover, administering the PAR-Q before the FFL exercise programme strengthened the understanding of how cardiac risk factors are modulated concerning training among diverse groups. Previous studies identified individuals from the African diaspora showing a higher HBP prevalence (Zibermine et al., 2019). Whereas South

Asians disproportionately experience heart disease and diabetes, possibly linked to exercise-induced complications or injuries (Misra et al., 2019). These risk factors significantly impact their ability to engage in exercise safely. Thus, through pre-screening tools, specifically the PAR-Q, FFL established a suitable supervisory protocol to assess participants' exercise responses during training. This enabled the prompt notification of emerging symptoms or potential complications. Risk stratification pre screening questionnaires, such as the PAR-Q, are practical measures for special populations with underlying health concerns, effectively identifying likely risks or contraindications that necessitate closer attention or further evaluation before initiating exercise programmes.

3.5.3 Body Composition Assessment

FFL data observed some positive effects on weight loss, BMI, and fat improvements in body composition measurements, although some were modest. Results also saw differences across the groups, with the African Canadians showing a slight decrease in weight. The median was (pre = 74.5 kg) and (post = 70 kg). The South Asians' weight loss was pre 55.3 kg and post = 45.2 kg. The Europeans saw a significant weight reduction. From the study's body composition results, it is safe to say that the FFL model positively affected participants' weight loss, BMI, and body fat reduction, even though the outcomes were slight. The minor improvement may have also been due to participants' age, health conditions, and medications. On the regression analysis, age and post-BMI significantly correlated with BP profiles, while gender was not, indicating that metabolism slows down with age regardless of ethnicity and where body weight and composition are critical factors in BP regulation (McCarron & Reusser, 1996; Harsha & Bray, 2008).

Additionally, participants, primarily the African Canadian group, experienced higher hypertension and were taking more BP medications. This could have made it more difficult for them to lose weight, as shown in Table 3.3.

At the same time, the weight loss seen in the African Canadian group in the present study is consistent with previous research on African American women who also saw weight loss following exercise interventions, as noted in McNabb et al.'s 1997 article. Another study by Kumanyika and Charleston (1992) found that an eight-week exercise intervention led to positive changes in dietary habits and physical activity levels, resulting in an average weight loss of 2.7 kg among female participants who completed the intervention. While the present study did not impose any dietary restrictions, participants were encouraged to adopt healthier eating habits through the health education workshops. Health education in the programme was included to support and increase awareness, promote healthy behaviour change and support lifestyle modifications.

Dietary practices can also vary significantly across ethnic and racial groups, with differences in cuisine, cultural practices, and historical influences. A descriptive example of these disparities is within the African diaspora, where dietary patterns commonly feature high levels of carbohydrates, sodium, fat, and calories, contributing to heightened weight, BMI, and body fat percentages (Dirks & Duran, 2001). Conversely, Middle Eastern cuisine typically includes lower calorie meals, such as whole grains, legumes, fruits, vegetables, and lean protein sources, which reflect the principles of a Mediterranean-style diet (Mora & Golden, 2017). Therefore, it is plausible to posit that the observed differences in weight loss, BMI, and body fat % outcomes among various ethnic groups in this study were shaped by dietary practices.

At baseline, the African Canadian, European, and Middle Eastern groups were classified as overweight according to the BMI chart, with the African Canadian group scoring closer to the obese line (Appendix 2). Several authors have offered some hypotheses saying that Black women tend to have higher bone density and more muscle mass than European women. These observations suggest they play a role in a higher BMI even though their body fat percentage is similar to other ethnicities (Hochberg, 2007; Castro et al., 2005; Carroll et al., Chiapa, 2008). These differences also highlight the importance of individualised approaches to health assessments, moving beyond generalised metrics like BMI. As such, health and fitness professionals need to be aware of the differences in body composition to avoid misclassifying obesity and related health risks in specific populations.

While genetics might have played some role in body composition, the subjective is sensitive and multifaceted to interpret. Other factors, such as lifestyle behaviours, attitudes towards body size, and cultural beliefs surrounding body weight, may have contributed to the present study's diverse outcomes. Regarding the body size esteem issue, some research suggests that Black women may be less likely to internalise societal beauty standards and have a more positive attitude than women of other racial and ethnic groups when it comes to body figure (Demarest & Allen, 2000; Averett & Korenman, 1999). For instance, many of the Black women in FFL verbally expressed concerns about losing too much weight because they did not want to lose their figure or "shape." In contrast, European and Middle Eastern women desired to appear "skinny." This perspective challenges the notion that beauty standards are universal and highlights the diversity of cultural attitudes towards body sizing. It also implies that Black women may have a stronger sense of self-acceptance and confidence in their physical appearance in terms of size, which could stem from cultural influences, historical contexts, and community values that differ from those prevalent in others. Further studies are required in this area to shed more light on the topic and potentially support modifying the existing physical activity guidelines to accommodate diverse groups. For example, adjustments to the current guidelines could focus on tailoring recommendations to suit Black women's preferences and cultural backgrounds, ensuring they receive appropriate guidance for maintaining their health and well-being through physical activity.

The current study saw significant differences within groups in water percentage pre- and post-water percentage among certain ethnic groups, including Middle Eastern and South Asians, Middle Eastern and European, and Middle and African Canadians. Several factors, such as participant age and medication use, may have contributed to these differences. For example, body water percentage typically decreases with age, reaching 60% and 50% in adult men and women, respectively (Puga et al., 2019). The inclusion of older adults and seniors in the study may have contributed to the observed differences in water percentage. In addition, certain medications, such as specific antihypertensives, have been associated with reduced hydration levels in individuals with hypertension (Puga et al., 2019). The physical activity questionnaire uncovered that the African Canadian group took a variety of BP tablets, which could have affected their water levels. However, this cannot confirm adherence to medication schedules. Further research is needed to understand better the effects of age medication use in different ethnic groups.

The dietary practices and lifestyles of participants may also need to be considered, as highlighted by Leow et al. (2022), who demonstrated that hydration practices could vary across cultures. For exmaple, beverages like tea, coffee, or fruit juices may be preferred over water for hydration and may be consumed in larger quantities in many cultures (Leow et al., 2022). Nevertheless, the authors noted the limited scientific evidence regarding the impact of cultural hydration practices on rehydration, exercise performance, and recovery, suggesting the need for further research to establish culturally sensitive, evidence-based hydration guidelines while accounting for various factors like age, diet, and lifestyle that could influence hydration levels.

3.5.4 Cardiovascular System Profiles

None of the groups' BP measurements at baseline was defined as stage 1 hypertension (140/90 – 159/99 mmHg), as presented in Appendix 2. Still, the African Canadians' pre-BP were categorised as high normal (137/88 mmHg) and higher than the other ethnicities. The current research agrees with past studies demonstrating the effectiveness of exercise to lower BP among ethnic populations (Bersaoui et al., 2020; Igarashi et al., 2018). Specifically, the African Canadians experienced a significant BP reduction of -10/-3mmHg following the exercise. Indeed, this outcome further highlights the efficacy of exercise as an intervention for lowering BP with individuals from the African Canadian group.

The overall BP results from the present study are comparable to those of previous intervention programmes targeting African Americans. For example, in a study by Whelton et al. (2002), participants lowered their BP to -12.5/-4 mmHg following exercise. Similarly, the current outcomes align with the Project Joy initiative by Yankek and colleagues (2016). In the research, African American women reduced their SBP by -8.1 mmHg. They achieved improvement in their physical fitness and dietary habits after participation, endorsing the role of exercise in reducing BP (Yanek et al., 2016). The Yanek et al., 2016 study offers compelling evidence supporting the efficacy of lifestyle modifications (increased fitness and healthier dietary choices) in managing hypertension and improving health outcomes. Particularly noteworthy is the study's focus on African American women, a demographic group disproportionately affected by hypertension and its associated complications, as implied.

A notable distinction between FFL and Yanek's research is the absence of a control group. Therefore, the observed changes in FFL participants' BP cannot be unequivocally attributed solely to exercise training. As suggested, participants' adherence to prescribed medication could also have decreased their BP. The results showed that African Canadians demonstrated a higher prevalence of hypertension and received a greater frequency of prescribed antihypertensive medications. This specific group showed more pronounced reductions in BP when compared to the remaining ethnic clusters under investigation. Their elevated baseline BP levels may have also contributed to a comparatively diminished response to the exercise intervention.

Concerning the RPP, the parameter at baseline saw differences across all ethnic profiles but not for HR. For instance, by the conclusion of the FFL, there were improvements in RPP across all groups. Following the exercise, the African Canadian group experienced a change, decreasing from RPP 10614 mmHg to 9620 mmHg per minute, seeing a difference of RPP 994 mmHg per minute. In contrast, the South Asian group demonstrated a more substantial change than the African Canadians, falling from RPP 10522 mmHg per minute to RPP 9176 mmHg per minute, resulting in a difference of RPP1346 mmHg minute. Equally, the Middle Eastern group experienced variation, with a reduction from RPP 9625 mmHg per minute to RPP 8694 mmHg per minute, indicating a difference of RPP 931 mmHg per minute. Notably, baseline RRP levels display total p values but did not yield positive significance for post-exercise. This discrepancy could arise due to participants' medications, health conditions, or race-related physiological functions, all confounding the results. Medications that lower HR and BP, such as beta-blockers or antihypertensive drugs, can decrease myocardial oxygen demand, thus affecting RPP levels (Medeiros & de Luca, 2018).

Although the research is limited to racial groups, it highlights the significant impact of racial or ethnic differences on cardiovascular health on RPP. Specifically, a study by Chaturvedi et al. (2012) investigated racial disparities in RPP recovery and found suboptimal recovery among South Asian participants compared to Europeans. This observation prompted hypotheses centred around intrinsic physiological factors, such as aortic stiffness or rigidity, which could contribute to these differences (Chaturvedi et al., 2012). In FFL, Kruskal-Wallis post hoc tests revealed no significant pairing for post-exercise RPP between South Asians and Europeans, indicating that the exercise intervention might not lead to meaningful changes in RPP between these two groups. Similarly, matching between African Canadians and South Asians did not yield significant results. However, a significant pairing was observed between African Canadians and the Middle Eastern group. The RPP results are a reminder of the complexity of racial or ethnic disparities in cardiovascular health outcomes and support that interventions targeting cardiovascular health may have varying effects across different racial or ethnic groups. It is evident that further research is warranted to explore the underlying physiological mechanisms contributing to these disparities and to develop more tailored interventions that address the specific needs of diverse populations.

FFL results align with prior research, such as that conducted by Madhusudhan (2018), which demonstrated the favourable impact of exercise on improving RPP. Madhusudhan (2018) cited an expert who indicated that an RPP value of 12,000 or below, coupled with HR between 60–120 beats per minute (bpm) and an SBP ranging from 100–140 mmHg, is considered normal in individuals without any existing or future cardiovascular complications. In FFL, all five groups exhibited an RPP below 12,000 before and post-exercise, signalling a low cardiovascular risk among all participants. A low RPP indicates heightened parasympathetic activity, widely acknowledged as cardioprotective. Detrano et al. (1989) argued that RPP of 16,300 mmHg to 28,000 mmHg were values to detect any degree of coronary obstruction higher than 50%. Meanwhile, Fornitano and Godoy (2006) noted that RPP greater than 35,000 indicated a list of cardiovascular events, including systolic or diastolic dysfunction. FFL further accentuates the cardiovascular benefits of aerobic training as participants' RPP improved and was not over the recommended limit.

The slight decrease in HR post-exercise observed across all ethnicities, while not as significant, is an anticipated finding given the reported health conditions and medication usage among participants. These factors influence individuals' responses to exercise and contribute to variations in HR dynamics following exercise (Elshazly et al., 2018; Taylor et al., 2019). The research conducted by May and Nagle (1984) and other notable studies by Ehsani (1981) and Gobel et al. (1978) have shed light on the possible negative impacts of HR recovery on individuals with heart conditions following exercise. The findings from these studies and the insight gained from FFL contributed to a better understanding of cardiovascular disease mechanisms with exercise responses. Understanding these mechanisms allows exercise specialists to identify strategies to mitigate associated risks and optimise individual care during exercise. The HR outcomes from FFL can inform the development of appropriate exercise protocols explicitly tailored for safety monitoring, assessing recovery, and evaluating exercise tolerance in individuals with cardiac issues.

The MAP scores showed variability among the ethnic groups at baseline and after the exercise intervention. For example, the African Canadians had a slightly higher MAP than the other groups. In contrast, the South Asians and Europeans exhibited comparable scores following the exercise intervention. Similarly, the PP scores varied across all ethnic groupings, ranging from 49 mm Hg to 53 mm Hg. An earlier study from the United Kingdom (UK) found that African descent exhibited higher PP, whereas South Asians, notably Bangladeshi and Pakistani men, tend to have lower PP levels (Agyemang, Bhopal & Redekop, 2007). In other research, MAP was reported to have more MAP compared to the Europeans, even though the PP was related (Eastwood et al., 2015). These figures are analogous to the results in FFL, but none of the recorded values for MAP and PP were associated with cardiovascular risk. Thus, the scores remained within the normal range for MAP (70-100 mm Hg) and PP (40-60 mm Hg), which is fortunate and indicative of the overall cardiovascular health of the participants (Appendix 2). The cardiovascular health information presented in FFL further highlights the importance of considering ethnic diversity when investigating cardiovascular responses to exercise. FFL emphasises that research efforts must continue to prioritise understanding how different ethnic groups may respond differently to exercise interventions, particularly concerning blood pressure parameters. Moreover, FFL's results reinforce the need to maintain BP parameters within normal ranges to support optimal cardiovascular well-being, especially among at-risk ethnic populations. Doing so can mitigate the risk of heart-related impairments and improve overall health outcomes for these communities.

The findings from regression analysis revealed cardiac profiles associated with age post-exercise, while gender did not correlate significantly. This absence of gender correlation might be linked to the gender imbalance observed in the study, where a notably higher proportion of women participated compared to men, potentially impacting the outcomes of cardiovascular profile assessment. The observed association between age and cardiovascular profiles aligns with hemodynamic principles, as these parameters typically increase with age. For instance, various studies such as Sikiru & Okoye (2013), Eastwood et al. (2015), Kingwell (2014), and Roosow et al. (2010) have highlighted these physiological changes associated with ageing and their implications for cardiovascular health with all demonstrated the progressive stiffening of arteries and the consequent rise in BP as individuals age. At the same time, some researchers argue that there is no definitive evidence suggesting that the effects of exercise are more evident with advancing age (Cornelissen & Smart, 2013; Peralta et al., 2010). This perspective challenges the notion that age necessarily dictates the effectiveness of exercise on cardiovascular health outcomes. Regardless of the debate surrounding the physiological effects of ageing and exercise, community-level exercise interventions, such as the FFL, are important in improving BP control beyond age-related physiological changes, irrespective of the specific pathways through which this improvement is achieved.

It is important to note that some study outcomes, while demonstrating measurable differences between groups, did not reach statistical significance. However, the absence of statistical significance does not necessarily imply the lack of meaningful impact. In this context, the clinical significance of the findings was more pronounced and held more excellent value. Clinical significance refers to the practical implications of observed changes in health outcomes, particularly regarding disease prevention and risk reduction. Across each of the studies, the results demonstrated tangible improvements. Specifically, the changes in blood pressure components were clinically meaningful and have the potential to support reducing the risk of cardiac events and enhancing long-term survival, particularly in those individuals with pre-existing conditions such as hypertension or coronary artery disease.

3.6 Study limitations

Some missing data are recognised as significant limitations of this study. For example, some participants did not complete all aspects of the programme. Thus, they did not return to the Centre for their post-exercise assessments as requested. The missing data could be due to a lack of time, work, or other matters. Likewise, there were more women than men and an older population in the study. The researcher would recommend recruiting more males for future study planning.

Another issue was that the result of the study had low generalisability. Thus, the research is limited to racialised and ethnic groups residing mainly in North Etobicoke and does not reflect or be comparable to other places. As a result, the research on this population is minimal, and more exercise studies with racialised and ethnic groups in Canada will expand our knowledge in the area. Future exercise studies can also consider investigating more ethnic groups, such as African Canadians elsewhere in Canada or globally. A study in a university or clinical environment would also be ideal for testing metabolic outcomes (blood lipids or direct ECG) to exercise responses instead of just looking at blood pressure profiles.

Still, a limitation was that there were no in-depth interviews, focus groups, or appropriate questionnaires to determine information on psychosocial factors. This would have provided valuable insights into how participants perceived and experienced the exercise intervention. This information can help to understand clients' exercise behaviour thoroughly. Finally, another drawback was that the primary researcher was also the programme manager for FFL, which had the potential to create biases and socially objectionable attitudes or behaviours. However, the researcher was very mindful of establishing a professional relationship with all participants so as not to gain any influence and to encourage the participants' responses to the questionnaires and feedback survey.

3.7 Conclusion

This study was the first to examine a community-level exercise intervention guided by the ecological model on training response to physiological measures between African Canadians and individuals from other racial groups, namely South Asians, Middle Eastern, Europeans and Asians.

The Physical Activity questionnaire demonstrated variations in health outcomes among African Canadians and individuals from other ethnic backgrounds, as evidenced by the different answers provided for medical prescriptions, distribution of health risks, exercise experience, and knowledge and barriers. The valuable insights derived from each group's responses can serve as a basis for informing the implementation of tailored interventions to foster exercise within ethnic populations, thereby addressing the unique concerns and obstacles they may encounter. Furthermore, identifying a lack of knowledge concerning exercise and little awareness of the Canadian Physical Activity Guidelines across ethnicities highlights the importance of translating the guide into varied languages to improve adherence and engagement within these populations.

The diverse responses from the PAR-Q saw variations in preexisting cardiovascular conditions among the different ethnic groups before the exercise. However, the findings did not impact their exercise readiness as all participants participated in the fitness programme. While it is important to pre screen individuals to ensure safe exercise, it would be possible to identify potential cultural biases that might affect ethnic groups' participation in exercise. In addition, exploring the validity and reliability of the PAR-Q across ethnic groups can determine whether the questionnaire measures exercise readiness consistently and accurately.

Concerning body composition across ethnicities, participants improved weight loss, BMI, and fat %. African Canadians in FFL had greater BMI for pre-exercise but lower post-intervention, further stressing exercise for weight management. The variances and changes found for all groups can be attributed to several reasons, with dietary practices and lifestyle habits garnering greater attention than genetic factors. However, it is imperative to do additional investigations to deepen and widen our understanding of body composition differences among ethnic groups and extend our knowledge of the relationship between hydration status and its impact on specific populations.

The analysis of cardiovascular profiles showed variations across all five ethnicities in response to exercise, with a significant decline in BP observed. Additionally, improvements were seen in other cardiovascular profiles (i.e., MAP, RPP, and PP), which stayed within the normal range for all ethnic groups, indicating low cardiovascular risk with exercise. The African Canadian group presented more obvious reductions in BP compared to the other ethnic groups, which could be attributed to their higher baseline BP levels and greater utilisation of BP medications. Further investigation would be warranted to gain better insights into these observed differences and their potential implications for health outcomes. In conclusion, the findings from this study highlight the efficacy of exercise to promote good cardiovascular health and prevent severe heart conditions among diverse populations. This would also include individuals from various ethnic backgrounds.

FFL study contributed to the existing knowledge on exercise interventions targeting specific populations. Anchored in the ecological model, the findings from the current study emphasise the importance of implementing tailored, community-level fitness interventions that are culturally appropriate and responsive to these populations' unique needs and characteristics. Establishing more types of this intervention could support mor practical solutions for improving health statuses, including body composition and BP management within ethnic communities.

Chapter 4:
Ethnic differences in the rate pressure product to dance aerobic exercise with African Canadian and South Asian cardiac patients

Abstract

Introduction: The rate pressure product (RPP) is a non-invasive method used as an index to measure myocardial oxygen consumption (MVO2) on physiological responses. It is the product of heart rate (HR) and systolic blood pressure (SBP) (RPP = HR x SBP/100). Past studies have investigated the RPP on exercise response and produced positive outcomes where improvements in the measurement. However, the data is limited for racialised groups such as individuals of Black African descent and South Asians. This is despite their experiencing similar cardiovascular risk**. Objective:** This study sought to accomplish two key goals: 1) to investigate the physiological responses (i.e., RPP, HR, and BP), of African Canadian and South Asian participants during 10 dance aerobic sessions and how these responses may impact their health and 2) to assess the degree of health improvements among the two groups. **Methods:** 160 patients, divided evenly between African Canadians and South Asians, all with hypertension or associated conditions, were encouraged to participate in 10 consecutive dance exercise sessions. A range of variables were recorded before and after the exercise sessions. Subsequently, a multitude of statistical methodologies were leveraged to dissect the collected data. **Results:** The study unveiled substantial differences in SBP and HR ($p < 0.05$) between the two groups before and after the exercise sessions. However, the shifts in RPP ($p > 0.05$) did not yield statistical significance. Improvements were also observed in mean arterial pressure (MAP) and pulse pressure (PP) measurements from the baseline to after exercise. **Conclusion:** Differences were observed in the responses of African Canadians and South Asians to the effect of blood pressure (BP) measurements following the 10 dance aerobics. For instance, the South Asian group experienced a slightly greater decrease in BP, with a reduction of 11 mm Hg, compared to a reduction of 10 mm Hg in the African Canadian group. This difference has clinical significance. These results underline the importance of recognising the variances in BP and RPP responses to exercise across different ethnicities. This understanding allows for the identification of specific groups predisposed to an increased risk of severe cardiovascular conditions. Tailored exercise interventions can then be formulated to tailor to these groups' needs, thereby contributing to the overall reduction of the cardiovascular disease burden.

4.1 Background

The double product, often called the rate pressure product (RPP), is a non-invasive method used as an index of myocardial oxygen consumption (MVO_2) to assess the heart's function and serve as an important metric for clinical applications and exercise physiology (Borer, 2008; Tomlinson, 2017; Segan et al., 2013; Forjaz, 1998; Coelho., 1982; Juillard et al., 1982). The measurement is determined from two cardiovascular parameters: heart rate (HR) and systolic blood pressure (SBP), both of which are risk factors for cardiovascular diseases (Borer, 2008; Tomlinson, 2017; Segan et al., 2013). In calculating the RPP, the HR and SBP are multiplied, and then dividing the result by 100, as represented by the formula RPP = HR x SBP/100 (Segan et al., 2013; Forjaz, 1998; Coelho et al., 1982; Juillard et al., 1982; El-Dosouky ll, 2019).

In the context of clinical practice, the RPP is helpful to diagnose and treat cardiovascular disease patients. For example, clinical experts can use the measurement to determine those patients at a higher risk of potential cardiac incidents like impaired left ventricular (LV) systolic function (Coelho et al., 1982). Recognising these cardiovascular risks with the RPP enables clinicians to modify therapeutic strategies more effectively and efficiently, ensuring optimal patient-centred care and positive outcomes (El-Dosouky II, 2019). Moreover, many other scholarly inquiries have illuminated a correlation between RPP values and cardiovascular disease (CVD), further establishing the relevance of RPP in exercise physiology and cardiovascular health domains. Most of these investigations have posited that the RPP is an appropriate metric for evaluating a cardiac patient's heart function. It surpasses the singular compared to using of SBP or HR alone in forecasting various health outcomes, including all-cause mortality, cardiovascular disease, stroke-induced mortality, and non-CVD-related mortality, as Figueroa et al. (2013) noted. Indeed, the evidenced utility of RPP in research contexts suggests a potential impetus for healthcare professionals to incorporate this measurement tool into their clinical practices in addition to the traditional measurement metrics. This includes its usage in risk stratification, the formulation of treatment strategies, and the continuous surveillance of patients with cardiovascular conditions (El-Dosouky ll, 2019). Such integration supports and boosts the precision of cardiovascular healthcare delivery.

Within the fitness and training environment, the RPP provide insights into the changes in the heart's oxygen uptake variation during rest, exercise testing, and training sessions (El-Dosouky II, 2019; Madhusudhan, 2018; Keyhani et al., 2013; Figueroa, 2012). For individuals participating in high-intensity exercise regimes or strenuous training protocols, such as elite athletes, monitoring RPP is paramount for optimal performance. This is predicated on the understanding that any elevation in HR and BP beyond conventional thresholds during physical exertion warrants clinical attention (Coelho et al., 1982). Consequently, RPP emerges as a pragmatic and practical instrument for fitness professionals, trainers, or exercise physiologists in such contexts. It assists the customisation of training or exercise programs, striking a critical equilibrium between cardiovascular safety and maximising performance outcomes.

Additionally, previous fitness research demonstrated the efficacy of the RPP on physical exertion and recuperation phases, leading to positive results. A seminal investigation by Keyhani et al. (2013) showcased the significant role of RPP in training contexts. This study observed enhancements in performance following training at sub-maximal workloads among participants with cardiac ailments, supporting exercise on the physical fitness of individuals with cardiac conditions. Integrating RPP as a cardiovascular measurement to estimate an exerciser's workload in fitness settings is beneficial. This is partly because it enables the monitoring and evaluating cardiovascular health and the adaptations that occur due to exercise interventions.

As reported in the research, elevated RPP is closely linked to an increased risk of cardiovascular events (Stoshitzky, 2022). This could be of concern for minority women, specifically women of African descent. According to the literature cited, African American women have a higher prevalence of heart disease (Ebong & Breathett, 2020). Heart disease affects an estimated 47.3% of African American women, making them experience more conditions like hypertension, high blood pressure, stroke, heart failure and obesity compared to other ethnic groups in the United States (Ebong & Breathett, 2020).

Elevated RPP levels in African American women can significantly exacerbate cardiovascular disease, especially given the additional barriers they face in effectively managing their cardiovascular health. Given these challenges; it is then imperative to consider implementing more targeted interventions that address both clinical and intersectionality of social determinants of health to reduce the incidence and impact of heart disease among minority women (Divens & Chatmon, 2019). Clinically, this entails the rigorous management of hypertension and other cardiovascular risk factors through a combination of medication, lifestyle modifications, and regular monitoring. Socially, this could involve initiatives to improve access to healthcare or implementing community-level health promotion programs.

Thus, community-based programmes designed with cultural sensitivity and including exercise and nutrition education for blood pressure management, for example, are critical components of a comprehensive strategy to reduce the burden of heart disease in minority women (Divens & Chatmon 2019). It is evident that supporting and enhancing these women's physical, mental, and social well-being is necessary to improve their overall health outcomes.

Depending on the specific chart or reference used, the values assigned to the RPP can vary. As such, different studies or clinical guidelines may have slightly different thresholds or ranges for interpreting RPP values. For instance, some experts cite that an RPP value above 10,000 at rest signals increased MVO2, causing a high risk for cardiac diseases or other complications. In contrast, an RPP falling between 7,000 to 9,000 is deemed acceptable. This average score can mean many things, including a balanced MVO2, reduced cardiac risk, healthy cardiovascular response, efficient ventricular function and absence of cardiovascular issues (Madhusudhan, 2018). On the other hand, a score below 7,000 may compromise coronary blood supply, potentially impacting ventricular function (i.e., the heart's main pumping chambers). This low RPP score suggests that the heart may not receive adequate oxygen, affecting its ability to pump efficiently and may lead to conditions such as ischemia or other cardiac dysfunctions (Madhusudhan, 2018). Furthermore, using the appropriate RPP chart or reference for evaluation is noteworthy in ensuring accurate assessment and interpretation.

Despite its significance, RPP is relatively underexplored in the literature concerning physiological responses to BP. Likewise, limited research has inquired into the effects of exercise on the RPP with ethnic groups. While most existing studies target European demographics, there is a notable lack of representation for other racialised communities. This oversight is especially significant considering groups like Black individuals of African origin or South Asians present similar cardiovascular profiles and tend to engage less in regular physical activity or structured exercise (Gezmu et al., 2014; Cappuccio, 1997). Understanding the variances in cardiovascular reactions to exercise among different racial communities and identifying those at higher risk can offer worthy insights for crafting suitable exercise recommendations. Such understanding is critical, as it benefits in mitigating cardiovascular risks for racialised individuals with chronic conditions engaging in physical activities. There remains a pronounced research void concerning the influence of exercise response on RPP among racialised groups in Canada. This gap is pressing because of the increased potential risks populations like African Canadians and South Asians might face from cardiovascular complications during physical exercise, although small.

The current study investigates the effects of 10 dance aerobic exercise sessions on BP and the RPP in African Canadians and South Asians diagnosed with hypertension (defined as a blood pressure of 140/90 mm Hg) or other cardiovascular ailments, participating in a community-based fitness programme. The two subpopulations were participating in the FFL exercise programme. The objective of this study was 1) to examine the RPP on the 10 sessions of low-impact dance aerobics and 2) to assess the degree of health improvements in RPP and other blood pressure components among the two groups.

4.2 Methods

The research was conducted at a community centre in a Toronto, Ontario, Canada suburb. The surrounding area boasts a rich tapestry of ethnicities, including individuals from the Caribbean, Asia, Africa, and the Middle East. Given the community's demographics and the clients already signed up for the new Fitness for Life (FFL) exercise initiative, recruiting participants for the study was relatively straightforward. We then provided each participant with information about the study, and if they agreed to participate, they signed an informed consent.

The Centre's Director of Programming endorsed and approved their involvement, while the University Research Ethics Committee approved the principal researcher's use of previously gathered data. A total of 160 participants, split evenly between African Canadians and South Asians, enrolled for the research. After consenting, they were briefed about the study's objectives and procedures. The study required participants to attend ten consecutive aerobic dance sessions spread out over five weeks, with two sessions per week.

4.2.1 Inclusion and Exclusion Criteria

The study eligibility criteria were as follows: 1) participants aged 30 or older; 2) participants were of African origin, including individuals of black African, black Canadian, or black Caribbean origin; 3) those from South Asian backgrounds, encompassing India, Pakistan, Sri Lanka, and Bangladesh and 4) participants who had specific health conditions. These conditions could include chronic mild to moderate or stable hypertension or related hypertension heart conditions such as left ventricular hypertrophy or heart disease. Furthermore, participants had to be sedentary when enrolling in this study or have had no prescribed exercise within the past six months or longer. The study did not regulate medical prescriptions or dietary consumption. Participants were also required to complete a Physical Activity Questionnaire (Appendix 6).

4.2.2 Baseline Assessment

It is important to highlight that the cardiovascular profiles and body composition measurements of African Canadians and South Asians were initially assessed at the beginning of the FFL. As such, two Kinesiology placement students obtained participants' baseline BP and resting HR measurements using an automated digital electronic BP monitor (Omron BP monitor Model BP710CANN). Similarly, while Studies 1 and 2 included the administration of the Physical Activity Questionnaire and PAR-Q at baseline, this study focused on collecting data about the participants' health conditions and medication usage in this study.

The BP measurements followed the protocols recommended by Hypertension Canada. The directions required participants to be seated in a quiet environment for accuracy and allowed a rest time for ten minutes before the BP readings. BP readings were taken on the left arm, following the standardised procedure. Three separate BP measurements were recorded for each participant while they remained in a seated position, and the average was recorded. After obtaining the BP and HR measurements, the RPP was calculated using an online calculator. The values were determined at baseline and after the ten exercise sessions to assess the changes in cardiovascular response. The online calculator allowed for calculating the RPP by entering and multiplying the HR and systolic BP numbers.

Additionally, the mean arterial blood pressure (MAP) and pulse pressure (PP) were calculated using online calculators. Participants' body composition measurements (i.e., weight, BMI, fat % and water content) were collected at baseline using the Tanita TBF-410GS Body Composition Analyzer. We did not gather any data on body composition assessment after the intervention concluded, given that there were only ten exercise sessions. Thus, with only ten exercise sessions, significant body composition changes might be minimal or insignificant. Moreover, it often takes longer durations of consistent exercise to observe substantial alterations in body composition.

4.2.3 Exercise Programme

The exercise intervention consisted of shorter exercise bouts of just 10 workout sessions, which were done twice weekly. Notably, the 10 sessions were a sublet of the exercise used in Study 1. This allowed us to evaluate the impact of acute exercise on BP components. Each participant had the flexibility to choose two preferred days to attend the exercise sessions at the designated Centre. The exercise classes commenced with a 5 to 8 minute warm up routine, followed by 30 to 45 minutes of low-impact aerobic dance movements. The intensity of the aerobic dance movements was targeted to achieve 50% - 65% of the participant's maximum heart rate (HRmax). Participants' heart rates were monitored throughout each exercise session using heart rate watches to ensure they were within the desired intensity range.

Moreover, the aerobic dance movements were specifically designed to be low impact, with each move lasting for approximately 20-28 counts. This approach aimed to minimise joint stress and provide participants with a safe and effective workout environment. It is important to note that while participants also engaged in strength workouts, the study focused on the 10 aerobic dance sessions.

A volunteer certified fitness instructor from the Black Afro-Caribbean community led the aerobic classes. At the same time, the kinesiology students monitored participants during the workouts, ensuring their safety and adherence to the exercise program. No data on the cardiovascular profiles were collected for each exercise session due in part to the limited time constraints. Following the 10 exercise sessions, participants underwent a second measurement, during which all cardiovascular profiles were reassessed using the same format as the first assessment.

4.3 Statistical analysis

The *Kolmogorov-Smirnov test* was administered to check for normality (normal distribution). The test found that all data were not distributed normally; therefore, non-parameter statistics were used to do the analysis. The Mann-Whitney U test determined the significant differences between the two groups on cardiovascular parameters (i.e., pre-measurements, post-measurements, and pre/post-measurements). Meanwhile, the Wilcoxon test compared the median differences between the groups on SBP, DBP, HR, and RPP and identified significant differences with exercise training. This test also reported the strength of noted relationships. The effect size (r) was applied using Pearson's r values of 0.1, 0.3, and 0.5 as small, medium, and large effect sizes, respectively, thus calculating r and dividing the z value by the square root of the number of pairs (N). A chi-square test was performed to examine if there were significant correlations between the health statuses (i.e., hypertension, diabetes, thyroid conditions, cholesterol levels, chronic pain, and medications) and ethnicity (African Canadians and South Asians) during exercise. *P*-values were calculated using the two-sided method. Therefore, a p-value < 0.05 was considered significant for each test, while a *p*-value > 0.05 was not deemed statistically significant. All statistical procedures were performed using the Statistical Package for Social Sciences (SPSS) software (Version 21, IBM).

4.4 Results

A total of 160 participants enrolled in the study, 80 identified as African Canadians and 80 as South Asians. All participants had hypertension or high blood pressure (140/90 mm Hg) at baseline assessment. Most of the participants were under some medication prescriptions. All the participants completed the mandatory 10 exercise sessions. As shown in Table 1, the median age for the two groups was 66. Baseline body composition results were significant (< 0.05). The African Canadian group had a higher body weight (md = 71.89 and range of 60), while the South Asian reported a lower score (md = 66 and a range of 57). BMI (md = 30 and range of 28) was greater for the African Canadians (Table 4.1). This count was considered overweight as defined on the BMI chart (see Appendix 1). In contrast, the South Asians recorded a lower BMI (md = 27 and a range of 26 (Table 4.1) and were considered overweight as defined on the BMI chart (see

Appendix 1). The body fat percentage was not statistically significant for either group, $p>0.05$. However, the African Canadians had a slightly high body fat ratio (md = 40 and range of 57) in comparison to the South Asian group (md =39 and range of 42) (see Table 4.1).

Table 4.1 Baseline Characteristics

Table 4.1: Baseline characteristics of the participants, including age, weight, BMI, fat, weight and body fat %.

Variables	African Descendants (G1)	South Asians (G2)	*P*-value
	Baseline Median ± Range	Baseline Median ± Range	
Age (year)	66 ± 58	66 ± 41	0.362
Weight (kg)	71.89 ± 60	66 ± 57	0.003
BMI (kg/m²)	30 ± 28	27 ± 26	0.002
Body fat (%)	40 ± 57	38 ± 42	0.106
Male (%)	7 (8.8 %)	5 (6.3%)	
Female (%)	73 (91.3 %)	75 (93.8 %)	

*P values <0.05 indicate a significant association. P values > 0.05 indicate no significant association. **BMI = body mass index.

4.4.1 Difference Between the Pre and Post Conditions

The median was used for data comparison in the analysis. According to existing literature, this approach was selected because it prefers median ranks over mean ranks when using nonparametric measurements (Pallant, 2020).

4.4.2 Difference Between Pre and Post in African Canadian Population

Pre measurements for cardiovascular profiles for the African Canadian group saw SBP =143, DBP = 88, HR =75, RPP =10740, MAP =105 and PP = 55 (see Table 4.2). BP was categorised as stage 2 hypertension (defined as SBP ranging from 140 mm Hg or higher or DBP ranging from 90 mm Hg or higher), a reference classification from the

American Heart Association (AHA) (see Appendix 1). The result observed in MAP was considered abnormal, while the PP was viewed as normal. The MAP and PP reference chart is available in Appendix 1. The effect size was small. A notable difference was found between the post and pre-exercise conditions. Specifically, there were significant differences between post and pre in SBP =132 and DBP = 80, whilst a slight elevation was noted in HR = 82 and RPP = 10796 on the exercised condition (see Table 4. 2). The effect size was small. The pattern of change further extended in MAP = 99 and PP = 50 from baseline, with each having a small effect size. All pre and post median results, ranges, effect sizes, and p-values are presented in Table 4.2.

Table 4.2 Mann U Whitney Test for Cardiovascular Profiles

Table 4.2: Mann U Whitney test - pre, post and pre-post, range, effect size and p-value for cardiovascular profiles

Categorical Variables	Ethnicity	Pre-Median ± Range	Post Median ± Range	Pre – Post Median ± Range	Pre Effect Size	Post Effect Size	Pre-post Effect size	Pre P - Value	Post P-Value	Pre-post P-Value
systolic blood pressure (SBP)	South Asians	138 ± 72	127 ± 58	10 ± 48	0.120	0.078	0.000	0.003	0.012	0.822
	African Canadians	143 ± 50	133 ± 51	9 ± 37						
diastolic blood pressure (DBP)	South Asians	80 ± 55	77 ± 55	7 ± 47	0.181	0.067	0.000	0.000	0.020	0.835
	African Canadians	88 ± 38	81 ± 46	8 ± 42						
Heart Rate (HR)	South Asians	78 ± 55	81 ± 55	9 ± 42	0.006	0.001	0.029	0.482	0.711	0.127
	African Canadians	75 ± 61	82 ± 62	13 ± 34						
Rate Pressure Product (RPP)	South Asians	10397 ± 10045	10269 ± 7503	1346 ± 14562	0.000	0.011	0.012	0.890	0.329	0.312
	African Canadians	10740 ± 1183	10768 ± 9068	1450 ± 7874						
Pulse Pressure (PP)	South Asians	57 ± 59	50 ± 75	9 ± 48	0.144	0.000	0.002	0.282	0.898	0.647
	African Canadians	55 ± 55	50 ± 63	8 ± 35						
Mean Arterial Pressure (MAP)	South Asians	98 ± 40	95 ± 95	9 ± 3	0.155	0.113	0.011	0.000	0.003	0.344
	African Canadians	105 ± 35	99 ± 77	8 ± 35						

*P values <0.05 indicate a significant association. P values > 0.05 indicate no significant association. **SBP = systolic blood pressure, DBP = diastolic blood pressure, HR = heart rate, RPP = rate pressure product.

4.4.3 Difference Between Pre and Post in South Asian Population

Pre assessment for the South Asian group saw BP at stage 1 hypertension (defined as SBP ranging from 131-139 mm Hg or DBP ranging from 80-89 mm Hg). Median scores obtained from the Mann-Whitney U test were: SBP =138, DBP = 80, HR = 78, RPP = 10397, MAP = 98 and PP = 57, with a small effect size (see Table 4.2).

Upon comparing the differences between post versus pre exercise among the South Asians, a reduction was observed in SBP =127, DBP = 77, and RPP =10268. A slight increase was also noted in HR, which rose to 81 beats per minute at post exercise, whereas the effect size was small. Differences were also reported in MAP = 95 and PP = 50 from preconditions with small effect sizes. Both scores were within the normal range based on their respective classification charts and can be found in Appendix 1. All pre and post median data, ranges, effect sizes, and p-values are presented in Table 4.2.

4.4.4 Difference Between Pre and Post in All Population

In the pre and post exercise measurements across all participants, statistical differences between African descendants and South Asians were noted. Specifically, significant differences were seen in pre measurements: SBP ($p= 0.003$), DBP ($p= 0.000$), and MAP ($p= 0.000$); all $p < 0.05$. However, no significant differences were found for HR ($p= 0.482$), RPP ($p = 0.890$), and PP ($p = 0.282$), all $p > 0.05$. At post training, the results were significant for SBP ($p = 0.012$), DBP ($p = 0.020$), and MAP ($p = 0.003$), all $p < 0.05$. Table 4.2 presents all pre and post cardiovascular outcomes for each group.

4.4.5 Difference Between the Two Groups

4.4.6 The Difference in Pre Exercise

The Wilcoxon test for the cardiovascular profiles compared the differences between the two groups in pre to post exercise outcomes. The median scores for pre cardiac profiles were SBP = 140, DBP = 83, HR = 76, and RPP = 10611, suggesting variations before the exercise intervention initiation. The BP values also indicated that participants were classified as having stage 2 hypertension. The results of all the Wilcoxon tests are presented in Table 4.3.

Table 4.3 Wilcoxon Test for Cardiovascular Profiles

Table 4.3: Wilcoxon test - pre, post median, effect size (*r*) and p-value for cardiovascular profiles.

Categorical Variables	**Ethnicity**	**Pre Median**	**Post Median**	**Effect Size**	**P Value**
systolic blood pressure (SBP)	South Asians	138	127	0.554	0.000
	African Canadians	143	133	0.576	0.000
	All	140	129	0.565	0.000
diastolic blood pressure (DBP)	South Asians	80	77	0.226	0.041
	African Canadians	88	81	0.403	0.000
	All	83	78	0.317	0.000
Heart Rate (HR)	South Asians	78	81	0.183	0.199
	African Canadians	75	82	0.001	0.025
	All	76	82	0.214	0.001
Rate Pressure Product (RPP)	South Asians	10397	10269	0.132	0.937
	African Canadians	10740	10768	7.589	9235
	All	10611	10578	0.066	.2387
Pulse Pressure (PP)	South Asians	57	50	0.354	0.000.
	African Canadians	55	50	0.343	0.000
	All	56	50	0.364	0.000
Mean Arterial Pressure (MAP)	South Asians	98	95	0.351	0.000
	African Canadians	105	99	0.380	0.000

	All	101	97	0.035	0.000

*P values <0.05 indicate a significant association. P values > 0.05 indicate no significant association. **SBP = systolic blood pressure, DBP = diastolic blood pressure, HR = heart rate, RPP = rate pressure product.

4.4.7 The Difference in Post Exercise

The median values for various cardiovascular profiles were lower at the postcondition, indicating a significant difference from the baseline measurements. There was also a statistically significant shift from post to pre-conditions for the following: SBP ($p = 0.000$), (DBP $p = 0.000$), HR ($p = 0.001$, MAP ($p = 0.000$), and PP ($p = 0.000$), all $p < 0.05$. However, this change was not statistically significant for RPP ($p = 0.2387$), $p > 0.05$. Pre/post effect sizes were as follows: SBP ($r = 0.565$), DBP ($r = 0.317$), HR ($r = -0.214$), RPP ($r = 0.066$), MAP ($r = 0.364$), and PP ($r = 0.350$) and ranged from 0.1 (small effect) to 0.3 (moderate effect) and 0.5 (large effect). All pre and post exercise results are presented in Table 4.3.

Concerning the interaction of medication and ethnicity, the Parson's Chi-Squared test produced non-significant outcomes, demonstrating an absence of a significant link between medication usage and ethnicity on the exercise. Nonetheless, the test showed a significant relationship between thyroid conditions and ethnic background ($\chi^2 = 7.828$, $p = 0.005144$) and the drug levothyroxine and race ($\chi^2 = 6.782$, $p = 0.009208$).

4.5 Discussion

This study represented an original investigation of how BP, HR, and RPP affect the acute response of low-impact aerobic dance between African Canadian and South Asian participants engaged in the FFL exercise initiative. The findings showed differences in cardiovascular characteristics before and after exercise within and between each group. Specifically, post exercise improvement was observed in the SBP and DBP, with each group corroborating the outcome from similar studies, such as Fornitano and Godoy (2006) and Segan et al. (2013). For example, following the 10 exercise sessions, the South Asians saw a reduction in BP by an 11 mm Hg decrease while the African Canadian group dropped to 10 mm Hg. This observation is not a huge difference between the groups, but it reinforces that exercise can effectively lower BP and overall cardiovascular profiles, even if the response is acute.

Interestingly, the RPP scores in this study were not significant enough and somewhat differed from those of other research. For instance, a study by Lamina and co-authors examined predominantly involved African American male participants. This study evaluated clinical stress levels and baroreflex sensitivity among the participants. The results reported notable RPP scores, suggesting that participants may have experienced higher myocardial oxygen consumption during the study, influencing the RPP outcomes (Lamina et al., 2013). The study's conclusion also noted the importance of considering individual and group differences in physiological responses to exercise and the potential impact of factors such as stress and baroreflex sensitivity. Importantly, the study underlines the usefulness of RPP as a simple assessment to measure myocardial oxygen demand during exercise with populations other than Europeans.

Yet, another study, this time by Chaturvedi et al. (2012), investigated ethnic differences in post-exercise BP and myocardial oxygen consumption and noted suboptimal recovery of the RPP among the South Asian group versus other groups. The study's inference found that South Asians had a slower return to baseline cardiovascular workload after exercise, indicating a higher risk for cardiovascular complications.

When determining the probable effects of RPP recovery among South Asian participants, Chaturvedi and colleagues proposed several hypotheses (e.g., intrinsic physiological factors) for the outcome. Firstly, they suggested that the stiffness or rigidity of the aorta could be a significant factor in RPP recovery after exercise (Chaturvedi et al., 2012). Secondly, the authors considered the possibility of disruptions or anomalies in autonomic function as contributing factors that could likely impair cardiovascular response to exercise, manifesting as prolonged recovery times or altered HR and BP responses post-exercise (Chaturvedi et al., 2012). These proposed premises highlight the intricate interactions among different physiological systems that influence cardiovascular responses to exercise. In the current study, the RPP results may have been influenced by physiological differences and proposed hypotheses explained in Chaturvedi et al.'s (2012) research. Further study using direct measurements of the RPP can determine this study's outcomes. Moreover, the modest improvement observed in both groups' RPP could also be ascribed to the brief duration of the intervention, consisting of merely 10 sessions or intensity. Likewise, participants had pre-existing health conditions in addition to experiencing cardiovascular issues, which may have influenced their overall exercise capacity, potentially resulting in differences in RPP. Nonetheless, the findings demonstrate the need to understand how physiological exercise responses differ in different ethnic groups. This could significantly support establishing appropriate health and fitness strategies for specific populations, such as

African peoples who experience more significant hypertension and higher blood pressure.

Previous research undertaken by White (1998) accentuated that RPP values below 12,000, accompanied by HR ranging from 60 to 120 beats per minute (bpm) and SBP between 100 and 140 mmHg, are considered within the normal range. RPP levels below this threshold indicate increased parasympathetic activity, leading to a cardioprotective effect and optimal vascular tone (White, 1998). The baseline and post-exercise RPP scores obtained for the African Canadian and South Asian groups did not raise concerns, as the values remained relatively moderate and were not markedly elevated. However, the African Canadian group displayed a slight increase, while the South Asian group exhibited a modest reduction from baseline levels to the exercise response. Variations in genes related to cardiac function, BP regulation, or autonomic nervous system activity are observed to contribute to differences in RPP values (Bagali et al., 2012). The impact of genetic circumstances on the diverse cardiovascular responses to exercise represents a complicated matter that requires further inquiry, as the precise etiological mechanisms remain incompletely elucidated.

Several investigations have been undertaken to study the impact of age and sex on MVO2 and RPP. In a particular study, the connections between left ventricular mass, the ageing process, and disparities in hormonal profiles were examined, and it demonstrated that some studies with decreased MVO2 and RPP were linked to ageing, with women exhibiting a comparatively smaller decline than men (Mayer et al., 2012). These findings not only highlight a gender disparity but also suggest potential variations in cardiac output, heart rate, or stroke volume as contributing factors (Mayer et al., 2012). While this may be the case for the RPP difference, the observation in this study did not specifically account for age-related or gender differences between the two groups. This is because of an imbalance in the number of women and men. Future research endeavours could address this limitation and examine the potential impact of age and gender on MVO2 and RPP by including an equal representation of both genders. This way, researchers can gain valuable insights into the underlying mechanisms contributing to these differences and their implications for cardiovascular health outcomes. Conducting studies with a balanced gender distribution would also allow a more thorough understanding of how age-related changes and gender-specific factors influence MVO2 and RPP.

Regarding HR responses to the exercise training, each group exhibited a slight increase in recovery. Observing a modest HR response was expected, given that many participants had pre-existing chronic conditions. Previous studies, like those of May and Nagle (1984), demonstrated potential negative impacts of HR recovery on cardiac patients after exercise. Ehsani (1981) and Gobel et al. (1978) found delayed HR recovery and other heart injuries in cardiac patients. Although severe cardiac events such as heart attacks are relatively rare and present a low risk, there is evidence that prolonged exercise and improved physical fitness can significantly enhance RPP and reduce heart rate following exercise (Segan et al. (2013). Given some of the adverse incidences, it becomes crucial to rigorously monitor patients during and post-exercise sessions using indirect tools like the RPP, especially for those with pre existing cardiac conditions. This vigilant monitoring is necessary to minimise potential risks and ensure the safety of the patients during exercise.

Another factor that could have influenced participants' HR responses was beta-adrenergic medications, commonly known as beta-blockers. These hypertension drugs decrease HR and BP, which in turn reduce oxygen demand. This helps to lower RPP (Medeiros & de Luca, 2018; Oliver & D’Ocon, 2019). Such effects can benefit individuals with hypertension and angina, reducing the risk of adverse cardiovascular events (Medeiros & de Luca, 2018). However, in some cases, excessively low RPP levels could indicate inadequate oxygen supply to the heart, potentially harming an individual's health. These observations suggest that RPP and beta-blockers can guide treatment decisions for individuals with cardiovascular conditions (Oliver & D’Ocon, 2019). Sharing knowledge with those with cardiovascular conditions on the role of RPP and the potential benefits of beta blockers in managing their heart problems could empower them to be more active in their healthcare decisions. The current study found no relationship between post-exercise HR recovery and beta blockers. More inquiry could produce thought-provoking insights into any hypothetical link between the use of levothyroxine and exercise.

The Parson's Chi-Squared test results found no significant differences in medication usage between the two groups, suggesting that the prescription might not significantly affect the exercise. Despite this, there was a significant relationship between thyroid and the drug levothyroxine on ethnicity, suggesting that patients' medication should be considered when designing exercise interventions for specific populations.

Further research would be needed to understand the relationship between levothyroxine or other medications and how it affects different ethnicities' exercise responses.

The BMI measurements between the two groups saw the African Canadians with a higher score for preconditions, which was suggestive of obesity, while the South Asians were identified as overweight. BMI is a known predictor of cardiovascular risks, with higher values associated with hypertension, heart disease or stroke (Garber, 2019). However, regular exercise has decreased the risk of these cardiovascular conditions, even in individuals with higher BMI levels (Garber, 2019). Indeed, with the correct prescription, it is possible to reduce one's BMI with consistent exercise. A difference in body weight at baseline was found. The African Canadians' body weight was more than that of the South Asians. The African Canadian group's greater body weight and BMI could be linked to their hypertension prevalence, perhaps reflecting the slight rise in RPP recovery.

Beyond the RPP results, the MAP for the South Asian group was within the normal range before and after exercise, as indicated in the MAP table (see Appendix 1). The African Canadians' MAP was slightly above the normal range at baseline but improved after exercise. This enhancement is likely attributed to the exercise intervention, which helped control blood pressure in this group after just 10 sessions. The PP values for each group also fell within the normal range for pre- and post-exercise (see Appendix 1). This suggests that even short-term or acute exercise could effectively maintain healthy arterial compliance and elasticity across different ethnic groups. Past research demonstrated differences in PP between ethnic groups, where the Africans exhibited higher PP, while the South Asians had lower PP values (Agyemang et al., 2007). In the present study, PP was modestly similar between groups. This parallel could potentially influence their respective risks of developing cardiovascular disease and the higher incidence of hypertension reported in the African Canadian group. Additionally, maintaining normal MAP and PP levels after the 10 sessions suggested that the exercise effectively promoted cardiovascular health and could minimise the likelihood of serious adverse cardiac events, such as arterial stiffness, with more prolonged bouts (Sacre et al., 2014; Craig et al., 2021; Agyemang et al., 2007).

Finally, the intensity and duration of the exercise played a significant role in the physiological responses, such as immediate increases or decreases in HR and BP, which in turn affected the RPP. One study found that BP reductions were similar regardless of whether the exercise bout lasted 10 minutes or 30 minutes, whereas another noted that a longer exercise duration led to a more significant decrease in BP following exercise (Perdomo et al., 2019). These findings demonstrate that over time, the physiological adaptations from exercise are more beneficial for improving cardiovascular health in African Canadians and South Asians with heart conditions, irrespective of the variations in exercise prescription. In the current study, the low to moderate exercise produced changes in RPP, although the differences between the two groups were minor. Another factor that could have affected the intensity is that not all participants moved in the same direction during the exercise, significantly impacting the blood pressure components and body composition outcomes.

4.6 Limitations

There are limitations worth noting in the current study. Firstly, the research duration was limited to 10 exercise sessions. As such, more extended intervention periods may be needed to establish the long-term effects of exercise training on RPP. Secondly, participants were not required to stop taking their medication, and we did not collect data on medication adherence, which may have impacted our results. The study relied on self-reported medication use, and it is possible that some participants may not have accurately reported their medication use. Thirdly, participants had no dietary restrictions in adhering to consuming foods. Fourth, the sample size was relatively small, which may limit the generalisability of the findings. It also included only African Canadian and South Asian participants; therefore, the findings may not apply to other populations. Fifth, the study did not directly measure the subjects' VO2 max as the research occurred in a community centre, not a clinical or exercise laboratory environment. Sixth, the body of research concerning investigating the response of the RPP to exercise is currently limited, with only a few studies available in this area. Finally, the present study did not control for confounding factors like age, gender, and physical activity levels. Most of the participants were also females, with few males. These factors may have influenced the outcomes and limited the ability to produce meaningful conclusions. Future studies can address some of these constraints.

4.7 Conclusion

This study represented an effort to examine exercise-induced RPP responses among African Canadian and South Asian populations. Although the RPP did not yield significant scores, the research uncovered noteworthy differences in the metric response to exercise between and within these ethnic groups. From the 10 acute exercise sessions, the South Asian group slightly lowered their BP more than the African Canadians; nonetheless, BP was reduced. Improvements in SBP and DBP were observed from pre to post exercise conditions, highlighting the effectiveness of exercise in improving BP control and managing other cardiovascular profiles.

This study features the importance of understanding the differential responses of BP and RPP to exercise across various ethnic groups. Identifying these unique physiological responses is critical for recognising individuals within a specific ethnicity who may be at a higher risk for cardiovascular diseases and other health complications. From a clinical perspective, it is necessary to consider RPP and other exercise related differences when assessing cardiovascular health and designing interventions. These findings highlight the potential to develop and implement tailored exercise interventions and preventative strategies that address the specific needs of ethnic populations, such as African Canadians or South Asians. Perhaps personalised approaches may effectively mitigate the burden of cardiovascular disease within these communities. Additionally, this study advocates for future research involving larger sample sizes and extended aerobic exercise programmes. These investigations would provide a more comprehensive understanding of the long-term effects of exercise on RPP and other cardiac functions across diverse ethnic groups.

Chapter 5: Discussion

5.1 Summary of Outcomes

In this thesis, the FFL initiative was investigated to determine its effectiveness and health outcomes of individuals from different ethnic backgrounds enrolled in the programme. The intervention applied principles of the ecological model in creating an inclusive and supportive fitness programme while addressing the social and environmental factors affecting the health of diverse communities. The thesis 1) evaluated the overall efficacy of FFL, 2) compared health outcomes across different ethnicities, 3) identified any ethnic specific response to the exercise regimen and 4) investigated any differences between two subpopulations, African Canadian and South Asians, to understand how ethnicity might influence the efficacy of ten dance exercise sessions. These goals were accomplished through the execution of two distinct studies.

5.1.1 *Study 1:*

Chapter 3 illustrated the ability to prescribe an efficient exercise regimen, FFL. The programme was a physical literacy initiative designed to promote, encourage exercise and involve recreational sports participation among immigrant and newcomer women, older adults, and seniors. However, because of the limited research regarding ethnic groups' lack of exercise and high incidence of chronic illness, FFL provided the opportunity to do a study. Thus, the study captured data on the health trajectories of African Canadians, South Asians, Middle Eastern, Europeans, and Asian participants from the start and end of the 17 week programme. The social-ecological model influenced the programme design, incorporating interpersonal, community, and organisational levels.

The study objectives assessed changes from baseline to post-exercise on the cardiac profiles and the anthropometric measurements, with two distinct questionnaires: the Physical Activity Readiness Questionnaire (PAR-Q) and the Physical Activity Questionnaire. The measured health outcomes of interest encompassed cardiovascular risk profiles: blood pressure (BP), heart rate (HR), mean arterial pressure (MAP), rate pressure product (RPP), and pulse pressure (PP). Additionally, body composition measurements included weight, BMI, fat percentage, and water percentage before and after the exercise. The self-reported questionnaires identified participants' risk factors, health conditions, medication usage and potential exercise barriers. Various statistical methodologies were employed for the comprehensive data analysis, containing the Kruskal-Wallis test, post-hoc pairwise comparison, Mann-Whitney U, Chi-square, and regression test.

The results demonstrated noteworthy differences among the five ethnic groups. A total of 365 individuals enrolled in the intervention, which spanned 17- weeks. However, 330 (90%) of the participants completed FFL. The average age of the participants was 58.5 ± 13.7 years. All study characteristics (e.g., age, ethnicity, etc) are presented in Table 3.1 of the Chapter. Participants' responses for each questionnaire are found in Tables 3.2 to 3.4. The Physical Activity Questionnaire revealed health conditions, pain issues, and common barriers participants might face when exercising regularly. For example, when participants were asked about their medical history, a range of medical conditions were identified: hypertension n= 154 (38.5%), followed by diabetes (15%), cholesterol (9%), thyroid (4%), and arthritis (11.3%). The African Canadians notably reported a higher prevalence of hypertension (20.8%) and greater frequency of prescribed blood pressure medications, including ACE inhibitors (4.4%), calcium channel blockers (4.1%), and beta-blockers (3.0%).

When asked why participants did not exercise, several responses were provided, varying from lack of time (33%) and lack of motivation (72.5%) to family obligations (45%). All descriptive results from the Physical Activity Questionnaire are presented in Table 3.2. A distinct barrier found was that the Black women said sweating made their hair "fuzzy". The PAR-Q was used to identify eligible participants and their limitations and symptoms and ensure exercise safety. Some of the PAR-Q responses included 17.2% saying they had a bone or joint problem that gets worse with exercise, with 58.8% prescribed medications for hypertension or other heart conditions. None of the participants responded that they experienced chest pain during physical exertion. All descriptive results from the PARQ are presented in Table 3.4.

After analysing the Kruskal-Wallis test for cardiovascular profiles, statistical differences across the ethnic profiles for pre-SBP, DBP, MAP, PP, and RPP ($p<0.05$) and post-exercise but not for HR ($p>0.05$) were found. Pre-SBP measurement was 137 ± 88 mm Hg for the African Canadian group, whereas post-SBP was 126 ± 59 mm Hg. All cardiac pre and post-cardiac outcomes are presented in Table 3.7. The pairwise comparisons post-hoc tests showed significant variances ($p<0.05$) with the South Asians and African Canadians for pre-SBP (p= .016) and post-SBP (p =.105), pre-DBP (p =.038), and MAP (p=.017). All pairwise results are given in Table 3.8. The pre/post comparison of cardiac profiles across all ethnic groups did not exhibit any statistically significant differences (p>0.05) (Table 3.7).

The next item reported was participants' weight, BMI, fat, and water percentage. The BMI was used as a measure of body fat to assess participants' health status, placing them into four categories: underweight (BMI < 18.5-24.9), normal weight (BMI = 18.5-24.9), overweight (BMI 25-29), obesity (BMI 30-39), and extreme obesity (40-55) (Weir & Jan 2023). Again, we saw the African Canadians with higher pre-weight (74.4 ± 66.3 kg) and BMI (28 ± 25.3) with a slightly higher pre-fat percentage (38 ± 43) in comparison to the European 37.4 ± 21.0. Interestingly, the Middle Eastern and Asian participants' baseline water percentages (73 ± -9.0 and 73 ± 31) were alike. At post-exercise, there was a significant variation in improvements from baseline. All body composition results for pre and post are presented in Table 3.4 of the Chapter. The Kruskal-Wallis pairwise comparison test was significant for the pre and post-variables with the African Canadian group and South Asians (p<000). Similarly, significant differences were shown among the African Canadians and Middle Eastern (p<0.05) for all variables. All pairwise comparison tests are given in Table 3.6.

Finally, the multiple regression model indicated that at the 5% significance level, the dependent variable pre-SBP increased with age and post-BMI but was unaffected by gender. The coefficient of determination was R2 = .070 or 7.00% F (3,307) = 7.7, < .005 and was jointly significant. Only post-BMI slightly increased with pre-DBP and was unchanged by age and gender. The coefficient was R2 =.025 or 2.5% F(3,307) = 2.6, p

< .005 on pre DBP. All predictors on the cardiovascular profiles (SBP, DBP, HR, MAP, PP and RPP) are presented in Tables 3.9 to 3.14.

5.1.2 Study 2:

The second study, Chapter Four, focused on an in-depth analysis of how African Canadians and South Asians diagnosed with hypertension or other health conditions responded to exercise. This study compared BP, HR and RPP following 10 low-impact dance aerobics sessions. Participants' cardiovascular profiles (BP, HR, RRP, MAP and PP) were collected at the start of and after the 10 sessions. The researcher decided to do only 10 exercises due to time and measured participants' acute physiological responses (i.e., RPP) to exercise, identifying the short-term changes. Body composition assessments were conducted exclusively at baseline before the start of FFL. For this study,160 participants enrolled (i.e. 80 African Canadians and 80 South Asians). All demographics are displayed in Table 4.1 of the Chapter. The collected data was then analysed using the Mann-Whitney U and the Chi-square tests.

The outcomes on the cardiovascular profile showed improvements from baseline to the end of the 10 exercise sessions. SBP decreased from 143 ± 50 mmHg to 133 ± 51 mmHg in the African Canadian group, whereas the South Asians recorded 138 ±72 mm Hg to 127 ± 58 mmHg. Like Chapter 3, the post-exercise HR RPP did not differ significantly from baseline measures (p>0.05). The results of the cardiovascular profiles for pre- and post-exercise are presented in Table 4.2 of the chapter. The Mann U Whitney test found significant differences across the two groups for post-exercise outcomes in SBP, DBP, MAP, and PP, whilst the Wilcoxon test reported the same for the pre/post paired results ($p<0.05$). The Mann U Whitney and Wilcoxon tests failed to demonstrate significance for RPP ($p>0.05$). (all Mann U Whitney tests are given in Table 4.2, and the Wilcoxon pre/post paired analysis is given in Table 4.3). At the end of the short intervention, both the African Canadians and South Asians exhibited improvements, highlighting the value of exercise, even from just 10 sessions. One significant relationship was observed between individuals with thyroid issues, racial background ($\chi^2 = 7.828$, $p = 0.005144$), and the drug levothyroxine and race ($\chi^2 = 6.782$, $p = 0.009208$). Further research can look at the potential impact of physical activity on thyroid health and how this might vary across different racial groups, particularly in the context of levothyroxine treatment.

5.2 Discussion of the outcomes of study 1 and 2

There is a universal burden of chronic diseases on the populations concerning global health. In addition to COVID-19, chronic conditions like diabetes, cardiovascular disease, stroke, obesity, and cancer continue to rise, affecting millions worldwide (Laires et al., 2021). The disparity gap remains wide for specific groups living in first-world communities that are poorly served by healthcare systems. The high prevalence is worrisome for lower-income countries, causing more strain on the region's fragile health systems. Without more sustainable policymaking processes or approach guidelines, disparities will persist in the years to come, declining one's quality of life and well-being. The question is: How do we reduce disparities and increase community members' quality of life, specifically among underserved populations? A straightforward approach establishes and promotes increased physical movement or leisure activities. This can comprise regular exercise through inclusive community-based initiatives. Exercise is the foundation of health promotion and one of the most effective ways to lower the risk of chronic disease, increasing overall health (Nystoriak & Bhatnagar, 2018). Regular participation in physical activity among those in good health has been demonstrated to decrease the risk of cardiovascular diseases, reduce blood pressure, lessen body fat, and yield additional advantages, as reported by some researchers like Nystoriak and Bhatnagar (2018) and Tian and Meng (2019).

This thesis collected data from the two studies uncovering the health outcomes of individuals of different ethnic backgrounds following their participation in a community-based physical literacy programme, FFL. The programme was designed and guided by integrating components of the social-ecological model. This was the first study to investigate health outcomes with different ethnic groups in a community centric setting. The study adds to the research and shows that a modified community based exercise could play a huge part in providing accessible opportunities for physical activity, tailored to meet the needs of diverse populations and designed to address specific health disparities.

In Chapter 3, cardiovascular profiles and body composition were measured. Two self-reports were administered at baseline: The Physical Activity Questionnaire and the Physical Activity Readiness Questionnaire (PAR-Q). Following the intervention, improvements were found among the different ethnic groups, specifically focusing on African Canadians. The exercise programme underwent periodic evaluations, during which all participants' cardiovascular profiles, including systolic and diastolic blood pressure and heart rate, were assessed alongside exploring their body composition. For example, the African Canadian group had a higher BMI at baseline than the other groups.

Interestingly, South Asians, Europeans, and Middle Easterners showed similar pre BMI and pre fat percentages. This observation might suggest differences in dietary habits or lifestyles that might have influenced their BMI. Research exploring variations in body composition across races indicated that factors like age, sex, environment, lifestyle, and height could contribute to racial or ethnic disparities in BMI (Heymsfiel et al., 2016). Concerning this study, more research would be necessary to understand further how different ethnic groups' body shapes and composition variants are associated with health risks.

Based on the results of the cardiovascular profiles, distinct differences were found across ethnicities, with certain groups producing significant changes. Specifically, the post-exercise BP improvements showed important similarities among African Canadians, South Asians, and Middle Eastern groups. These likenesses were reflected in post SBP, with African Canadians having an average of 126 ± 44 mm Hg, South Asians at 125 ± 57 mm Hg, and Middle Eastern individuals at 125 ± 28 mm Hg. The pattern suggests that, regardless of their diverse ethnic backgrounds, these groups displayed comparable SBP to the exercise, indicating a possible shared physiological reaction to exercise across the demographics. The improvement in SBP is especially salient for African Canadians, who are inherently faced with a prominent risk of hypertension or related complications, as highlighted in studies by Gower and Fower (2020) and Cynthia et al. (2020).

The decline in all post cardiovascular profiles across ethnicities could be due to participants' age, diet, health status or medication. Factors like these can affect how the body responds to exercise, potentially reducing participants' cardiac profiles for post-exercise. However, beyond these personal health influences, the exercise intensity, mode or duration or even the different movements during the workouts in the current study might have caused a reduction in the profiles for all participants. Participants were prescribed the same exercise (i.e., low to moderate intensity and light strength training), perhaps adding to a decrease in profiles observed across all participants. In previous studies, it has been found that exercise modalities and intensities can elicit different cardiovascular responses (Sugawara et al., 2015; Park et al., 2020; Way et al., 2022). This means that how the heart responds to physical activity varies depending on the nature and intensity of the exercise, as shown in FFL.

Additionally, cardiovascular adaptation to exercise could have influenced participants' training over time. Such physiological response has been demonstrated throughout the literature, where regular exercise improves heart functions, overall fitness, and performance (Park et al., 2020). Future research incorporating a more inclusive range of direct measurements, including ECG, would enhance our understanding of how various conditions might impact exercise responses in different ethnic groups. With more in-depth details on cardiovascular function and adaptation, such studies would validate and build upon previous findings, offer critical, tailored insights, and be instrumental in developing more effective, personalised exercise interventions specifically adapted to meet the cardiovascular needs of diverse ethnic populations.

Several anecdotal discussions merit attention because of the implications. For instance, a common sentiment among many African Canadian women was the concern that excessive exercise and weight loss might lead to a less curvaceous figure, mainly resulting in "flatter buttocks, or give the appearance of being unwell". This notion is parallel to other studies, which showed that women of African descent often have distinct perspectives on body size compared to other cultures. Unlike other cultural groups, women of African descent perceive a fuller body shape as a sign of prosperity, health or beauty, and their attitudes toward weight management are different (Knapp et al., 2019; Enyioha et al., 2022; Bantham et al., 2021). Conversely, the other women from different ethnic backgrounds desired to appear "skinny." These views further highlight the complex interaction between sociocultural norms, historical context, and health and body size perceptions in women from varied cultural backgrounds. Thus, it becomes important to consider these diverse viewpoints when designing exercise interventions for women of different racial backgrounds.

As shown throughout the literature, individuals belonging to the African Diaspora are confronted with higher rates of physical inactivity and obesity, in addition to experiencing more BP (Cynthia et al., 2020). These became evident in the responses derived from the self-reported Physical Activity Questionnaire, PARQ, where we saw more BP drug usage among the Black Canadian group. Likewise, compared with other groups, they recorded elevated metrics for initial body weight, BMI, and body fat percentage. Some improvements were seen following the conclusion of FFL. The positive outcomes in anthropometric and cardiac function are nowhere isolated and aligned with other findings documented in previous exercise research involving African American participants but are still meaningful (Cynthia et al., 2020). The similarities also highlight the potential universality of exercise benefits across African descendant populations and emphasise the importance of physical activity engagement in adopting cardiovascular health. Such parallels strengthen the assertion that structured exercise regimens can lead to optimistic health outcomes in response to regular exercise.

Chapter 3 also observed distinct characteristics between the completers (participants who finished FFL and did the second fitness assessment) and non-completers (those who dropped out of FFL and did not return to do the second fitness assessment). Several factors may have contributed to some of the non completers not finishing FFL. As noted in the questionnaires, health issues, time constraints, and a lack of motivation could have played a significant role in those not completing FFL. Some other factors, such as unexpected life events, social influences, or environmental conditions, also likely influenced participants' ability to complete the programme.

Chapter 4's rationale for exploring the RPP response to exercise within the African Canadian and South Asian groups was twofold. First, the assessment of RPP is considered a prominent predictor of cardiac workload and the heart's oxygen demand during physical exertion, as corroborated by Jenkins et al. (2020) and Valtoren et al. (2022). The similarity in cardiovascular disease risks between African descendants and South Asians underpins the second motivation for this focus. Despite the heterogeneity in their geographical origins, South Asians consistently manifest an enhanced predisposition towards CVD (Cainzos-Achirica et al., 2019; Kumar & Sinha, 2020; Wang et al., 2020; Zhao, 2021). Corresponding to this, individuals from the African Diaspora, notably those domiciled in the United States, grapple with hypertension prevalence, a factor exacerbating cardiovascular differences (Maraboto & Ferdinand, 2020; Zilbermint et al., 2019). Understanding how exercise modulates cardiac profiles like the RPP among African Canadians and South Asians is quintessential to helping shape public health directives, paving the way for adjusted therapeutic strategies such as exercise and fortifying the quest for exercise equitability across racial lines. For example, the differed RPP reactions to the training responses offer a roadmap and allow individualising exercise prescriptions, considering the patient's ethnic background when used with healthcare professionals. Such modified treatments might necessitate adjusting exercise intensity, duration, or modality to avoid overexertion for individuals with a higher baseline RPP, or it might involve slowly lengthening the duration of activity for those who can tolerate it well. Each study in this thesis prescribed low to moderate impact dance movements lasting 45 minutes for safety because most participants were new to exercise and had health conditions.

With an inclusive understanding of ethnic specific responses to exercise, the training can be modified to address these groups' distinctive cardiovascular health challenges, as noted in the study. This also aligns with medical care goals, which aim to customise healthcare with appropriate medical decisions and practices tailored to the individual patient. The appreciation of the RPP and other cardiovascular profiles advances a shift from a 'one size fits all' solution to pre-health screening and monitoring exercise sessions, promoting a more equitable, inclusive, and effective health and fitness model. Moreover, our investigation uncovered improved RPP scores and other cardiac metrics after the ten exercise sessions. Notably, the African Canadian group demonstrated a marginally reduced RPP at the outset compared to that of the South Asians. Concurrently, the African Canadian group's BP profiles were more accentuated. Significant differences were also observed in the post-exercise BP readings, even though such marked changes were not mirrored in the RPP measurements. The specific elements underlying the differential RPP changes between African Canadians and South Asians remain challenging to explain, even though the existing literature speculates that distinct ethnic groups may harbour some genetic factors influencing their cardiovascular functionalities, metabolic processes, and overarching physiological attributes. As with the findings in Chapter 3, the role of genetics is intricate due to the diversified nature of genetic determinants. It is plausible that there were differences in the baseline physical activity levels of the two groups before the commencement of the prescribed exercise regimen. Such a premise suggests that if one group inherently exhibits a higher activity level, the ensuing RPP response to exercise sessions might exhibit differential outcomes. This assumption is also implied in Chapter 3 within the ethnic groups.

The Physical Activity Questionnaire, which relied on self-reporting, showed that out of 12 participants with a history of engaging in exercise, 9 were African Canadian. This predominance among African Canadians may have affected their RPP scores. There also appears to be a potential link between the participants' racial background, their previous levels of physical activity, and their RPP scores. Further research is needed to comprehend this connection's extent and consequences fully. Nevertheless, the results indicated that exercise could enhance RPP even after ten sessions. Additional study on nutritional intake and potential correlation with the RPP is warranted. What is known thus far is that dietary intakes characterised by elevated saturated fats, trans fats, and simple carbohydrates are associated with deleterious cardiovascular outcomes, including the RPP (Caldwell et al., 2020). More research will help to improve clinical decision-making, enhance persistent care, and contribute to the overall understanding of cardiovascular physiology in health and disease.

Antihypertensives, such as beta-blockers and cardiovascular medications, are established to modulate RPP with exercise responses. Preliminary data from the two studies in this dissertation found a higher proclivity of blood pressure medication consumption within the African Canadian groups, thus perhaps impacting their cardiovascular makers, such as the RPP. As such, we can reinforce that the resultant outcomes and the reason for the differences may have influenced the medication variance on the RPP between African Canadians and South Asians. This hypothesis posits that with continued research, it may be possible to establish more personalised benchmarks for RPP levels that appropriately consider factors such as age, gender, fitness level, and other health conditions. Within the two studies presented in this dissertation, the RPP values for pre and post exercise remained within the normative parameters allocated by the established RPP chart and caused no concern.

Furthermore, although some of the collected data in each study did not yield statistical significance, the evaluated clinical significance could inform tailored healthcare strategies. As noted, FFL demonstrated tangible improvements in participants' health metrics like their blood pressure, weight, and body mass index through a culturally adapted exercise intervention and highlighted the importance of personalised healthcare approaches that could be implemented to reduce chronic conditions. The findings from each study are valuable for communities traditionally underrepresented in clinical research, offering evidence-based recommendations that can be implemented to enhance public health outcomes. Additionally, from a clinical perspective, the study's unique benefits across different ethnicities lay the groundwork for establishing more programmes tailored to specific communities. Such initiatives can potentially improve the quality of life and address health inequities. Consequently, they can improve the daily experiences and overall health outcomes of these groups.

5.2.1 African Canadians Focused

The focus on the African Canadian group in each study was intentional. Firstly, because different racial and ethnic groups may have distinct histories, experiences, and cultural contexts, we wanted to understand their unique experiences with exercise. For African Canadians, this includes centuries of systemic racism, from enslavement to segregation, which has significantly influenced their socioeconomic status, health outcomes, and experiences in the Americas (Prather et al., 2018; Taylor & Richards, 2019; Hall, 2018). We know little about their physical leisure or exercise habits as there are few studies conducted on this topic with African descendants. Therefore, the research in this thesis can help shed some light on this community's specific challenges and strengths, allowing for targeted interventions and policies relating to physical activity. Secondly, addressing health disparities is very important. African descendants often have higher rates of cardiovascular conditions, specifically hypertension and other health issues like diabetes and certain cancers (Maraboto & Ferdinand, 2020). Thirdly, representation and equity in research are critically important. Historically, populations such as individuals of African descent, particularly African Canadians, have been underrepresented in research (Vuong et al., 2020). For example, African Canadians' responses to exercise remain largely unexplored in Canadian health studies. Focusing attention on this demographic and ensuring their perspectives and unique health needs are incorporated into scholarly discourse supports to enrich our understanding of their physiological responses to exercise, particularly in relation to cardiac indices.

Conducting research with different ethnicities and sometimes focusing mainly on a specific group, like African descendants, ensures that interventions, like exercise and health promotion policies, are inclusive and equitable. Given the unique historical, socioeconomic, and cultural context of the African descendant communities, such focus is imperative in addressing longstanding disparities and promoting positive change.

5.2.2 Community-Based Fitness Programme

In an era characterised by multiculturalism and global connectedness, the one-size-fits-all approach to health and fitness is becoming increasingly outdated. While the importance of regular physical activity for maintaining health is universally recognised, how it is approached, understood, and practised varies across cultures. This research thesis successfully garnered a substantial sample size. It implemented a meticulously modified, community-oriented fitness initiative encompassing diverse groups. Fitness sessions, health and well-being workshops, fitness resources and training participants in fundamental movement skills (FMS) were infused with cultural features. Through the programme's design, participants received the necessary tools, skills and a fresh understanding of the significance of embracing a healthy lifestyle. Moreover, exercise promotions of this scale have the potential to significantly engage a large segment of the community, which is often elusive when promoting physical activity.

5.2.3 Limitations

The two studies in this thesis contribute to the body of research supporting the viability and effectiveness of a modified community exercise programme for racialised communities. Nonetheless, these studies had selected shortcomings. Many of these limitations are discussed in the respective chapters. However, the subsequent section offers a more detailed exploration of these limitations.

The absence of complete data from some participants, who did not fulfil every part of the programme or return for their follow-up evaluations at the Centre, represents a notable constraint of this research. Several potential explanations for the incomplete data may include time constraints, occupational commitments, or personal issues on the participant's part. Each of these reasons can cause the challenge of collecting complete data from participants in a study. Understanding these issues is needed for designing research that minimises barriers to follow-up and encourages complete participation. In future studies, researchers can address these issues by scheduling more flexible follow-up times, providing incentives, offering transportation vouchers, ensuring clear communication about the importance of follow-up, and considering participants' convenience and comfort.

Additionally, the demographic imbalance, with a predominance of women and an older age group in the study sample, is acknowledged. While this offers valuable insights into these groups, it also limits the generalisability of the findings. Different age groups and genders may respond differently to the same exercise interventions, both physiologically and psychologically. Therefore, the current study's results are more reflective of its specific demographic and may not apply to a broader population. It is suggested that potential research designs should aim to enrol more male participants to address this disparity. Retaining more male participants in future studies is necessary for several reasons. Men and women often exhibit different health patterns and responses to exercise due to biological differences, lifestyle factors, and social determinants of health. For instance, hormonal variations, muscle mass distribution, cardiovascular risk factors, and social attitudes towards exercise and health can differ significantly between genders. Including a more balanced gender representation, the research could provide a comprehensive understanding of how various interventions impact men and women differently.

5.2.4 Future Directions

This thesis provided convincing evidence supporting community-based exercise among racialised populations guided by a theoretical framework, in this case, the ecological model. However, from a Canadian standpoint, there is a gap in the literature that needs further exploration to understand its benefits fully. Given the rising prevalence of chronic diseases that disproportionately affect specific ethnic communities, it is crucial to expand research on the effectiveness of community-level programs and explore the factors influencing exercise participation across diverse ethnic populations. For example, there is a lack of comprehensive and targeted studies that specifically address how African Canadians are affected by and manage hypertension with exercise. This absence of focused research limits our understanding of their unique healthcare needs and challenges. It also hinders the development of suited interventions and guidelines that could effectively address the specific cardiovascular health concerns of African Canadians. Extensive research could open options for more customised or ethnic-specific physical activity guidance.

A proposal would be to increase the number of exercise sessions to improve participants' cardiovascular outcomes and body composition. The suggestion is based on the idea that increasing the frequency or duration of physical activity can lead to more significant health benefits, thus promoting overall well-being. In Chapter 4, 10 dance exercise sessions were conducted, and the results provided insights into the short-term effects of exercise on RPP. This finding was important for an insight into how quickly exercise can manifest cardiovascular benefits. However, long-term exercise lasting perhaps a year can provide a more comprehensive understanding of how regular exercise affects cardiac workload (i.e., RPP) and efficiency. Increasing the number of sessions also provides the opportunity to tailor programmes more specifically to different groups who may respond differently to exercise, as seen in each study of this thesis.

Educating FFL clients on how to use heart rate watches or fitness applications is a good way to routinely monitor exercise and overall fitness. For instance, the approach could empower clients to actively engage in their own exercise regimen by enabling real-time monitoring of their intensity and workout, as highlighted by Higgins (2016) and Pires et al. (2020). In the Chapter 3 study, a heart rate watch was provided to each participant with high blood pressure or those experiencing other cardiovascular issues. Such checking ensured that clients exercised within safe and training zones, preventing overexertion and reducing the risk of adverse events. Observing and seeing tangible improvements can also be highly motivating for some new individuals and can inform adjustment in the exercise regimen as their fitness level improves.

Incorporating the measurement and monitoring of cardiovascular parameters such as MAP, RPP, PP, and BP during and after exercise can significantly improve the efficacy and relevance of community level fitness programmes. As demonstrated in initiatives like FFL, these indirect assessments support individual health and fitness goals and align with broader public health objectives, including cardiovascular disease prevention and health promotion. Furthermore, this approach fosters inclusivity by addressing individuals' diverse health monitoring needs, particularly in communities at higher risk of cardiovascular diseases. The data collected using non-invasive measurements during and after exercise sessions are also invaluable for healthcare providers, enabling them to manage existing health conditions more effectively and make informed decisions regarding exercise promotion.

A further attempt worth considering is the redefinition of the concept of exercise, broadening its perception beyond just a means of weight loss to encompass a tool for enhancing overall wellness. Reforming the term exercise would be beneficial for new exercisers who often do not understand what exercise is about, regardless of ethnicity. Exercise should be promoted as an enjoyable, cost free activity that contributes to holistic well-being. Such a perspective could significantly boost exercise participation across diverse ethnic groups. Presenting exercise as accessible and gratifying, this strategy may foster greater engagement and aid in addressing disparities in physical activity. Reframing the concept of exercise is also vital in helping ethnic women, especially those from the African Diaspora, as highlighted in Chapter 3, understand sweating as a natural response to physical activity. This study observed that concerns about sweat-related issues such as "messy hair" or body odour, similar to the barriers identified in Mbilishaka and Lacery's (2019) research with African American women, could deter exercise participation. Therefore, providing hair care advice with the utmost respect and empowerment is crucial, ensuring that such guidance is perceived as supportive and aimed at enhancing comfort and engagement in exercise rather than as a mandatory requirement.

In the FFL, many participants across ethnicities were identified with mobility and functional challenges, with back pain being the most reported. Recognising this, introducing exercise therapy or a rehabilitation programme in a community setting would be beneficial. Providing free of charge rehabilitation exercises is a great way to increase accessibility for those who might otherwise face barriers to accessing such services, such as those living in underserved areas or lacking transportation to distant healthcare facilities. Availability also supports groups often marginalised in terms of healthcare services. Likewise, exercise rehabilitation at the community level can be tailored to meet the specific needs of diverse groups, including older adults, individuals with disabilities, or those with chronic health conditions.

In summary, the studies presented in this thesis demonstrate that community-based fitness programmes effectively improve health profiles, such as cardiovascular profiles and body composition, among ethnic groups while offering cultural adaptability. These findings stress the positive relationship between structured exercise and overall health, highlighting the need for inclusive, culturally tailored fitness programmes to significantly enhance diverse communities' well-being. Furthermore, the importance of adopting a multi-level approach in designing these programs is emphasised, as it is critical for achieving sustainable health outcomes, addressing complex public health challenges, and reducing the risk of chronic diseases.

Chapter 6: Conclusion

In this thesis, Fitness for Life (FFL), a physical literacy programme structured around the ecological model, demonstrated the usefulness of delivering tailored, community level exercise interventions for different ethnic groups were investigated. The programme's effectiveness was explored through two studies. The first study assessed participants' pre and post cardiovascular profiles: blood pressure (BP), heart rate (HR), mean arterial pressure (MAP), rate pressure product (RPP), and pulse rate (PP). Body composition assessments (i.e., body weight, body mass index (BMI), fat and water percentage) were also measured and supplemented with two questionnaires. Study 1 included the 17 week exercise programme, incorporating light aerobic and strength training exercises. Within FFL, an integral component was the workshops, designed to impart knowledge on diverse facets of healthy living, encompassing topics on nutrition, stress management, lifestyle choices, and exercise. The outcomes from the programme unveiled variations in health metrics across ethnic groups: African Canadians, South Asians, Middle Eastern, Europeans, and Asians, underscoring the intricate diversity within these groups' health profiles. The second study in this thesis specifically focused on comparing the RPP responses of South Asian and African Canadian individuals following a series of ten dance aerobic sessions. This investigation highlighted noticeable disparities between the two groups in BP, HR, and RPP, providing evidence of distinct exercise responses to 10 dance aerobics. Each study successfully demonstrated FFL efficacy in accommodating and addressing the unique fitness requirements of various ethnic groups. It is suggested that the FFL programme's adaptability and sensitivity to the needs of these communities could have been key to its effectiveness while showing the importance of a culturally aware fitness intervention.

Clients involved in FFL gained a valuable appreciation of the importance of fitness and health improvement. Their quest for fresh knowledge was evident among those who recognised the value of adopting a healthy lifestyle and exercise but lacked a clear starting point. Their understanding and confidence in health related matters grew as they engaged in the FFL intervention. The workshops, covering a broad spectrum of health themes, could have empowered the participants to take charge of their health choices. Similarly, the instruction in fundamental movement skills provided the groups with tailored guidance on appropriate physical movements for exercise, further enriching their understanding and ability to engage in practical and culturally relevant physical activities. Although not a primary focus of the study, including recreational activities (i.e., badminton and basketball) could have provided increased physical activity, promoting lifelong fitness. The journey through the FFL could also bolster participants' needs, fostering a profound sense of communal pride and resilience. The participants showed noteworthy improvements in their cardiovascular profiles and body composition attributable to the prescribed exercise regimen. Improving cardiovascular well-being and physical assessment has implications for reducing health disparities in underserved or ethnic communities. FFL demonstrated participants' steadfast dedication to ongoing self-improvement and highlighted the programme's significant impact on individual and community well-being.

In the first study of FFL, the use of the Physical Activity Questionnaire and the Physical Activity Readiness Questionnaire (PAR-Q) was extended beyond simply gathering participant responses. These tools allowed an insightful analysis of each participant's health status, offering a comprehensive data collection that demonstrated part of their lifestyle choices, barriers to exercise, medical history, and existing health conditions. For example, data collected from African Canadian participants in the Physical Activity Questionnaire found distinctive barriers. Some barriers identified in the study were mainly related to logistical attributes. Consequently, this could have hindered their exercise participation. Recognising the obstacles is fundamental as it sheds light on the group's distinct needs and challenges in maintaining an active lifestyle. In future research, gaining a more thorough understanding of these disparities is essential. This expanded knowledge will be instrumental in devising exercise interventions that are not only culturally sensitive but also practically feasible for this demographic.

Another outcome found in Study 1 was a significant knowledge gap among participants regarding Canadian Physical Activity Guidelines. Most participants responded that they were unfamiliar with the Canadian Physical Activity Guidelines. The Canadian Physical Activity Guidelines highlight the recommended frequency, intensity, and types of exercise for different age groups (Mitra et al., 2020). These guidelines are designed to educate the public about healthy physical activity practices to improve overall health and well-being among Canadians. As mentioned earlier, most participants in this thesis were either unaware of or had not previously known the Canada Physical Activity Guidelines, which was notable, though not entirely unexpected. This lack of familiarity with a critical fitness resource designed to guide Canadians in achieving optimal physical activity indicates a broader issue. It highlights the need for more dissemination of such information, especially within ethnic communities. The gap in knowledge presents an opportunity for increased collaboration between public health and community-level initiatives like FFL. In national health campaigns, these entities can support and play a role in actively promoting and increasing awareness of these important guidelines, bridging the information divide and fostering a more informed public about healthy physical activity practices. Partnerships with public health agencies could be instrumental in bridging the information gap and ensuring that valuable health resources are accessible to a broader audience. This is particularly true for ethnic groups who may not be familiar with such fitness guides and are unclear about how to initiate an exercise regimen. Practical communication efforts help boost the knowledge and application of the guidelines, contributing to diverse communities' overall health and well-being.

Across ethnicities, participants' responses in Study 1 of this thesis were constructive and a critical reflection of real-world insights into their health situations. This information reported is important for several reasons. First, it offers a window into ethnic populations' health, risks and challenges. Such information collected about participants' health conditions, medication usage, and medical history (e.g., chest pain from exercise, incident of a heart attack) or specific barriers can be challenging to gauge if they were to attend a local fitness programme at a gym facility. Second, understanding ethnic population health outcomes helps identify strengths to be reinforced and weaknesses to be addressed. The survey responses can also be instrumental in refining future iterations of community-based programmes. This might include the programme's accessibility, the relevance of its content to diverse community members, or the effectiveness of its delivery methods. Finally, participants' responses can inform broader public health solutions. Health planners and policymakers, for example, can invest in supporting more targeted exercise interventions. This may also involve allocating resources to priority areas and enacting policy changes that promote healthier lifestyles for ethnic groups. As previously cited, building alliances with community organisations to increase healthy habits or exercise among ethnic groups or underserved populations represents a step in the right direction, fostering sustainable health improvement for these groups.

The integration of rehabilitative exercises into fitness programmes at the community level is strongly recommended for diversity and easy access in the general population. This thesis found prevalent in health conditions like back, shoulder, or knee pain across ethnicities. Investment funds in rehabilitative exercises at the community level could markedly improve the quality of life for people of different ethnicities by addressing their specific health challenges. Such initiatives present a proactive strategy for managing chronic pain and other physical issues through focused exercises. Combining rehabilitative exercise into fitness routines can also make it safe and therapeutically effective, especially for individuals with existing health conditions. An approach with this is highly indicative as it would indeed promote inclusivity and accessibility, helping to reduce healthcare disparities by offering support to ethnic groups who may lack access to specialised rehabilitation services outside a community setting. For example, chiropractic or physiotherapy treatment is costly for most people, especially if they do not have work insurance coverage. The Ontario Health Insurance Plan (OHIP) is available to Ontario residents but does not fully cover these services. Specific steps are underway to facilitate eligible patients' access to chiropractic or physiotherapy care.

Community-level rehab exercise programmes are not entirely new, but their prominence and usage have evolved. Several studies have assessed the effectiveness and impact of community-level exercise rehabilitation programmes. One significant study was a systematic review by (Mulligan et al., 2019) that examined health services for individuals with chronic conditions and identified core components and clinically meaningful measures for generic rehabilitation programmes. The authors found that community exercise rehabilitation is effective if implemented for at least 4-6 weeks, led by health professionals in combination with lay leaders, and includes an education component (Mulligan et al., 2019). Indeed, therapeutic exercise services within community settings and integrating health literacy sessions may offer greater accessibility and a less intimidating experience for ethnic groups than in traditional clinical environments. For example, community exercise rehabilitation may be more culturally sensitive and attuned to African Canadians' unique needs and preferences. The programmes may combine cultural elements into the exercise routines and communication, making clients feel more comfortable and engaged. Culturally adapted exercise rehabilitation targeting ethnic populations can also effectively reduce disparities, improve healthcare trust, and promote consistent health practices if implemented appropriately, contributing to increased fitness and exercise equity.

The current thesis emphasised the importance of consistently assessing cardiovascular metrics before and after exercise across various ethnic groups. This approach was displayed in each study. Different outcomes across ethnicities were found. Therefore, the advocation for routinely evaluating these measurements in future implementation would be ideal for understanding the cardiovascular responses in diverse populations and for safe exercise. Monitoring heart metrics aids in the early detection and prevention of potential health issues that may occur because of exercise. The implementation of vigilant community-level monitoring of critical cardiovascular profiles is particularly advantageous for distinct demographic groups, notably African Canadian and South Asian populations, who are predisposed to elevated cardiovascular risk factors. This strategic approach facilitates the early identification and management of potential cardiovascular anomalies, contributing significantly to targeted preventive health measures. Proactive surveillance of cardiovascular health within these communities serves a dual purpose: it benefits individuals with existing cardiovascular concerns and educates them about the critical importance of heart health. The cardiovascular outcomes observed in Studies 1 and 2 provided insights into managing pre existing heart conditions with exercise. This information can guide the development of tailored community exercise programmes to reduce cardiovascular risks effectively. Moreover, these observations seen in FFL can inform public health policies aimed at supporting heart health in ethnic communities, given their higher incidences of cardiovascular conditions. Community level fitness programmes such as FFL are instrumental in preventing the progression of health issues in these populations, as reported in the results.

The notable reduction in body composition measurement observed among participants in FFL, particularly concerning obesity-related risks, was significant and demonstrated beneficial effects. This decrease positively impacted the monitoring of BP profiles (i.e. MAP, RPP, and PP). This significance is underscored by the fact that many local fitness or gym facilities lack the infrastructure for conducting direct or indirect cardiovascular assessments. FFL effectively bridged this gap by providing free and easily accessible resources for monitoring vital signs during exercise. The capacity to share this pertinent health data with healthcare providers or family physicians enables a more complete health management strategy and informed approach to health management. This underlines the importance of specialised community-level interventions like FFL for improving cardiovascular health within ethnic communities.

Partnering with local health organisations, the barbershop BP control initiative, as referenced in the study by Victor et al. (2018), represents an innovative and successful approach to managing hypertension at the community level. Specifically targeting African American men, this initiative leverages the unique communal space of barbershops to reach and engage a demographic often at higher risk for hypertension. The programmes also include educational materials and discussions about diet, exercise, and lifestyle changes necessary for blood pressure management, making them appealing to community members (Victor et al., 2018). Like the African American church, barbershops have long been community hubs. They are places of trust, social interaction, and cultural exchange, which makes them ideal venues for health related interventions. Barbershops provide convenient access to health care services and health awareness in a familiar environment. Furthermore, just as barbershops have become a vector in controlling blood pressure, community fitness programmes can also monitor an individual's cardiovascular health, ensuring a well-rounded approach to heart healthcare.

In the endeavour to boost the fitness levels of certain ethnic groups, it becomes imperative to reframe the concept of exercise, viewing it not merely as a tool for weight loss but as a vital component of overall wellness. This paradigm shift towards a more holistic and positive view of health in community-based programmes will likely inspire individuals to adopt a lifestyle that equally values physical, mental, and emotional well-being. Buder, Zick and Waitzman (2018) noted that different cultures hold varied interpretations of health and fitness. Consequently, a wellness-focused approach is more inclusive and culturally sensitive, extending beyond weight reduction. This broader perspective is more likely to resonate with diverse cultural values and beliefs, recognising that health and fitness encompass far more than physical appearance or body weight. As shown throughout the literature, ethnic groups often have different risk profiles for chronic diseases. A wellness oriented exercise regime can be tailored to prevent or manage specific health conditions in these communities, like heart disease or diabetes.

Likewise, emphasising overall wellness, exercise becomes a means for good physical health, managing stress, improving mental health and fostering a sense of community. An excellent example of long-term exercise commitment can involve health and fitness professionals educating individuals and highlighting the health benefits of regular exercise engagement. Thus, informing individuals about the benefits of walking for better heart health (e.g. using cardiovascular exercises for stronger heart muscle) or the importance of stretching exercises to maintain strength and mobility as they age is a pragmatic approach. These activities can be seamlessly woven into everyday routines and adapted to accommodate the cultural practices of different individuals, making them universally relevant and effective for promoting sustained physical activity. Exercise becomes more approachable and attractive to a broader audience by emphasising wellness over mere weight loss. This includes those who may feel excluded by conventional fitness culture, which often prioritises weight loss and is associated with high gym fees. This broader, more inclusive perspective on exercise extends its appeal and nurtures an inclusive comprehension of health and well-being. Considering the findings from the FFL programme, combining a diverse array of fitness options and educational resources on healthy living is backed. This approach holds relevance for ethnic communities, as the intervention addressed their distinctive fitness needs, thus advocating for greater inclusivity and effectiveness within fitness initiatives.

Other innovative approaches in further community-level fitness programmes to support exercise include telehealth exercise and engaging in physical fitness routines or activities remotely facilitated by digital communication technologies (Flynn et al., 2023; Chien et al., 2020). This innovative approach allows people to receive personalised exercise guidance and support from fitness professionals or therapists without needing in-person visits to a facility (Flynn et al., 2023; Chien et al., 2020). Tele exercise is particularly beneficial for those with mobility issues, chronic health conditions, or in areas with limited access to fitness facilities. As noted, many participants attending FFL had multiple health concerns, with some using mobile devices (e.g., walkers and canes). Telehealth exercise would benefit them as they can do their fitness online without leaving home. One study examining the efficacy of telehealth exercise was a randomised controlled trial that focused on individuals with cardiometabolic multimorbidity. The authors found increased patient physical activity (Chien et al., 2020). Telehealth exercise is a very creative way of engaging clients to exercise.

Indeed, combining a telehealth exercise scheme into the FFL would have been useful for those participants who cannot physically attend the exercise at the Centre. This can also be advantageous for some ethnic groups, providing them with more accessible options to participate in fitness activities. Telehealth exercise services offer the convenience and flexibility needed to ensure that more people maintain consistent exercise routines. Hence, this supports extending the reach and effectiveness to a larger audience, including those with limited access to in person facilities and overcoming barriers such as transportation issues, time constraints or cultural sensitivities.

Finally, teaching clients how to use and track their fitness and vital signs with a mobile application could be another proposal to increase exercise among ethnic groups. Participants with cardiovascular concerns in both FFL studies were given heart rate watches. This allowed safety monitoring of their workouts. In studies, mobile applications positively supported and motivated participants to exercise (Lee et al., 2018; Beatty, Magnusson, and Fortney, 2018). Teaching participants in FFL how to use smartphone apps for tracking fitness, like the pedometer feature, would have been highly beneficial because it would allow participants to monitor their progress outside the Centre, set realistic goals, and maintain motivation. For instance, they could track their walking exercise independently by utilising the pedometer component. This strategy could boost both accessibility and effectiveness of health interventions, as Newton et al. (2019) noted, making it a practical addition to community-based fitness such as FFL.

In summary, the utility of exercise interventions for achieving long-term health benefits is straightforward. FFL adeptly catered to the unique needs of various ethnic groups, thereby improving physical health and contributing to cultural sensitivity and inclusiveness. The FFL evaluation involved two studies that monitored participants' health outcomes from different ethnic backgrounds. These studies revealed improvements in cardiovascular health and anthropometric measurements, although the extent of these improvements varied among the groups. Each study observed the effectiveness of adaptable fitness programmes in positively influencing the health of diverse ethnic communities. Furthermore, these findings highlighted the critical role of promoting physical activity, tailoring exercises to cultural preferences, and establishing supportive social networks. These elements are particularly crucial in addressing the distinct fitness needs and overcoming specific challenges faced by racialised groups, advancing a more inclusive and practical approach to overall fitness.

Moreover, implementing policies to promote physical activity by creating safe and accessible exercise environments is crucial. In tandem with these policies, educational initiatives are vital in boosting exercise participation, especially among diverse populations often underrepresented in exercise promotion campaigns. These programmes must be executed with a deep understanding of and respect for cultural distinctions to ensure they are inclusive and effective. Finally, redefining the concept of exercise as an integral component of overall well-being, rather than solely focusing on physical fitness, is essential. This broader perspective encourages a more holistic approach to health. Introducing innovative and sustainable plans within frameworks like FFL can significantly contribute to improving the health and fitness levels of ethnic communities, ensuring long-term benefits and a more inclusive approach to health and wellness.

Reflective Analysis

Embarking on a doctoral journey is akin to setting sail on an uncharted sea, brimming with promise, uncertainty, and intellectual adventure. My journey commenced in 2020 with an application to Staffordshire University's Professional Doctorate in Health Science programme, marking the beginning of a transformative experience that inspires awe. From the initial spark of curiosity to the culmination of rigorous research, my doctoral voyage has been a testament to resilience, dedication, and an unyielding pursuit of knowledge.

Central to my journey was the process of scholarly inquiry, a voyage marked by moments of revelation and introspection. Delving deeper into the literature, I uncovered new insights and perspectives that challenged my preconceptions and broadened my intellectual horizons. Through rigorous empirical research, I honed my analytical skills and cultivated a nuanced understanding of my chosen subject matter. I focused on examining the Fitness for Life (FFL) physical literacy programme, paying particular attention to its impact on different ethnic populations, with a specific emphasis on individuals of Black African descent. The focus on black individuals stemmed from the dearth of research concerning this demographic, particularly regarding the impact of exercise on their health outcomes. In addition to individuals of African descent, the study also explored four other groups: South Asians, Middle Easterners, Europeans, and Asians. I collected data on all the participants' cardiovascular profiles (i.e., blood pressure, heart rate, mean arterial pressure, rate pressure product and pulse pressure) and body composition (i.e., weight, body mass index, fat percentage and water percentage) and administered two questionnaires. Every dataset analysed, every hypothesis, and every conclusion provided me with valuable insights into the effectiveness of the fitness programme and its implications for various demographic groups. I identified patterns, trends, and disparities, shedding light on the unique challenges and opportunities faced by different ethnic groups, particularly individuals of African descent, within the context of community fitness initiatives.

As I drew conclusions from the research findings, I was struck by the significance of my academic aspirations coming to fruition. Each conclusion represented a culmination of diligent scholarship and a contribution to the broader body of knowledge in the complex interplay of factors influencing health outcomes among different ethnic populations. I aim to contribute and support policy, practice, and future research endeavours, ultimately striving to make a meaningful impact on community-based fitness programmes, especially with disease-risk populations and uplifting Black communities.

The path to academic enlightenment is seldom smooth sailing. Along the way, I encountered formidable challenges that tested my resolve and stretched my capabilities. From navigating complex theoretical frameworks to grappling with methodological and statistical intricacies, each obstacle became a crucible for growth and learning. Choosing which statistics to apply and creating the appropriate tables and charts proved to be particularly challenging aspects of my doctoral journey, especially given my limited proficiency in statistical methods. My lack of expertise in this area compounded this task's complexity, leading to frustration and apprehension. Despite these challenges, I approached each obstacle with determination and perseverance. Seeking guidance from mentors and consulting relevant literature, I gradually began to understand statistical principles and data visualisation techniques better. Through trial and error, I honed my skills and developed strategies to overcome the difficulties I encountered. Ultimately, while the process of applying statistics and creating tables and charts may have been arduous, it also served as a valuable learning experience.

Even at specific points, I contemplated withdrawing from the programme. Nevertheless, amidst the rigours of scholarship, my doctoral journey was also a personal odyssey of self-discovery. It was a journey of reflection as I grasped the profound questions underpinning my research and shaping my scholarly identity. Through moments of doubt and uncertainty, I learned to trust myself and my abilities and embrace the inherent ambiguity of academic inquiry. In doing so, I discovered not only the depths of my intellectual curiosity but also the resilience of my spirit.

As I approach the end of my journey, I am filled with sincere gratitude for the experiences that have shaped me along the way. From the wisdom and patience of mentors to the insights and perspectives of others, I am indebted to the vibrant intellectual community that supported me throughout this endeavour and my family and friends who stood by me every step of the way. Their encouragement and guidance were instrumental in helping me navigate the challenges and uncertainties that inevitably arise in the pursuit of a doctoral degree. Above all, I am grateful for the opportunity to contribute to the body of knowledge in my field, engage in meaningful dialogue with fellow scholars, and make a tangible impact on the world around me.

In conclusion, my doctoral journey has been a voyage of discovery, challenges, and growth. While it took me an additional year to complete this journey than I initially anticipated, every moment spent chasing my doctoral degree was worthwhile. It taught me the value of patience, persistence, and dedication in pursuing academic excellence. The extended duration of my doctoral studies also allowed me to develop my skills further, broaden my academic network, and engage more deeply with the scholarly community. I seized this opportunity to collaborate on several research projects and seek mentorship from seasoned academics, all of which enriched my doctoral experience and contributed to my growth as a scholar.

Furthermore, this voyage has highlighted the transformative power of education, the resistance of the human spirit, and the limitless potential of intellectual curiosity. As I stand on the brink of this academic milestone, I am filled with hope for the adventures that lie ahead. While my journey has culminated, lifelong learning has only just begun.

Glossary

Aerobics - Also known as cardiovascular exercise, aerobic exercise involves increasing your heart rate and breathing while engaging large muscle groups. Examples include running, swimming, cycling, brisk walking, and dancing. Aerobic exercise helps improve cardiovascular fitness, endurance, and overall stamina.

Blood pressure (BP) - Blood pressure is the force of blood pushing against the walls of the arteries as the heart pumps it around the body.

Body Mass Index (BMI) - Body Mass Index (BMI) is a numerical value calculated from an individual's height and weight. BMI is expressed as a number and is used to classify individuals into different categories, which can help assess their risk of various health conditions. The formula for calculating BMI is as follows: BMI = weight (kg) / (height (m) * height (m))

Cardiovascular diseases - Cardiovascular diseases (CVDs) are a group of disorders that affect the heart and blood vessels.

Chronic disease - Chronic diseases, or non-communicable diseases (NCDs), are long-term health conditions that persist over an extended period and typically progress slowly.

Community-based - Community-based refers to programs, services, initiatives, or activities that are designed to take place within a specific community or locality, with the primary goal of addressing the unique needs, challenges, and strengths of that community.

Cultural sensitivity - Cultural sensitivity," also known as cultural awareness or cultural competence, refers to the ability to recognise, understand, and respect the cultural beliefs, values, practices, and needs of individuals from diverse cultural backgrounds.

Diastolic blood pressure (DBP)- This is the lower number and represents the pressure in the arteries when the heart is at rest between beats, filling with blood for the next contraction.

Exercise - Exercise is a physical activity that is planned, structured, and repetitive to improve or maintain physical fitness and overall health. It involves various forms of movement and muscular exertion and is essential to a healthy lifestyle.

Exercise prescription - Exercise prescription is a structured and personalized plan developed by a healthcare professional, such as a physician, physical therapist, or exercise physiologist, to recommend and guide an individual's physical activity and exercise routine.

Heart rate (HR) - Heart rate refers to the number of times your heart beats per minute (bpm). It is a vital sign and an important indicator of cardiovascular health. Heart rate can vary depending on various factors, including your age, physical activity level, emotional state, and overall health.

High blood pressure - High blood pressure, also known as hypertension, is a common medical condition in which the force of blood against the walls of the arteries is consistently too high.

Hypertension - Hypertension, commonly known as high blood pressure, is a medical condition in which the force of blood against the walls of the arteries is consistently too high.

Intervention - intervention refers to a purposeful and often planned action or strategy to address a specific problem, situation, or issue. The goal of an intervention is typically to bring about positive change, improve outcomes, or address a particular need or concern.

Mean arterial pressure (MAP) – Mean arterial pressure measures the average pressure within the arteries during one cardiac cycle. MAP is calculated using the formula: MAP = [(2 * Diastolic Blood Pressure) + Systolic Blood Pressure] / 3.

Outcomes - refer to the results or consequences of a specific action, intervention, event, or process.

Physical activity - Physical activity refers to any bodily movement that requires energy expenditure. It encompasses many activities, from simple movements like walking and standing to more vigorous activities like running, swimming, and playing sports.

Pulse pressure (PP)- Pulse pressure is the difference between the systolic and diastolic blood pressure values and is an important measure in cardiovascular health.

Rate pressure product (RPP) - The Rate Pressure Product (RPP) is a calculated value used to assess the workload or oxygen demand of the heart. It often indicates the heart's stress during physical activity or exercise. The RPP is calculated by multiplying the heart rate (HR) by the systolic blood pressure (SBP). The RPP estimates the myocardial oxygen consumption, which is the amount of oxygen the heart muscle requires to function.

Social Ecology Model - The Social Ecology Model, also known as the Ecological Systems Theory, is a theoretical framework developed by psychologist Urie Bronfenbrenner. This model is used to understand how individuals are influenced by their social and environmental surroundings, emphasising the complexity of human development within various interconnected systems.

Strength training - Strength or resistance training involves lifting weights, using resistance bands, or performing bodyweight exercises to strengthen muscles and improve muscle tone. This exercise helps build and maintain muscle mass, increase metabolism, and enhance physical strength.

Systolic blood pressure (SBP) is the higher number and represents the pressure in the arteries when the heart contracts or beats, pumping blood into the arteries.

References

1. Abdi, I., Murphy, B., & Seale, H. (2020). Evaluating the health literacy demand and cultural appropriateness of online immunisation information available to refugee and migrant communities in Australia. Vaccine, 38(41), 6410-6417.

2. Abou Elmagd, M. (2016). Benefits need and importance of daily exercise. Int. J. Phys. Educ. Sports Health, 3(5), 22-27.

3. Adams, J., Hubbard, M., McCullough-Shock, T., Simms, K., Cheng, D., Hartman, J., Strauss, D., Anderson, V., Lawrence, A., & Malorzo, E. (2010). Myocardial work during endurance training and resistance training: a daily comparison, from workout session 1 through completion of cardiac rehabilitation. Proceedings (Baylor University. Medical Center), 23(2), 126–129. https://doi.org/10.1080/08998280.2010.11928599

4. Agyemang, C., Bhopal, R., & Redekop, W. K. (2007). Does the pulse pressure in people of European, African and South Asian descent differ? A systematic review and meta-analysis of UK data. Journal of human hypertension, 21(8), 598-609.

5. Alpsoy, S. (2020). Exercise and hypertension. Physical Exercise for Human Health, 153-167.

6. Ameling, M. J. M., Ephraim, M. P. L., Bone, M. L. R., Levine, D. M., Roter, D. L., Wolff, J. L., ... & Boulware, L. E. (2014). Adapting hypertension self-management interventions to enhance their sustained effectiveness among urban African Americans. Family & community health, 37(2), 119.

7. Amini, H., Habibi, S., Islamoglu, A. H., Isanejad, E., Uz, C., & Daniyari, H. (2021). COVID-19 pandemic-induced physical inactivity: the necessity of updating the Global Action Plan on Physical Activity 2018-2030. Environmental Health and Preventive Medicine, 26(1), 1-3.

8. Anand, S. S., Yusuf, S., Vuksan, V., Devanesen, S., Teo, K. K., Montague, P. A., ... & McQueen, M. (2000). Differences in risk factors, atherosclerosis, and

cardiovascular disease between ethnic groups in Canada: the Study of Health Assessment and Risk in Ethnic groups (SHARE). The lancet, 356(9226), 279-284.

9. Andersen, L. B., Mota, J., & Di Pietro, L. (2016). Update on the global pandemic of physical inactivity. The Lancet, 388(10051), 1255-1256

10. Anderson, E., & Durstine, J. L. (2019). Physical activity, exercise, and chronic diseases: A brief review. Sports Medicine and Health Science, 1(1), 3-10.

11. Anderson, L. H., Martinson, B. C., Crain, A. L., Pronk, N. P., Whitebird, R. R., O'Connor, P. J., & Fine, L. J. (2005). PEER REVIEWED: Health Care Charges Associated With Physical Inactivity, Overweight, and Obesity. Preventing chronic disease, 2(4).

12. Andrade, C. (2023). Physical exercise and health, 1: an overview of terminology, guidance, benefits, and risks. The Journal of Clinical Psychiatry, 84(5), 49298.

13. Averett, S., & Korenman, S. (1999). Black-white differences in social and economic consequences of obesity. International journal of obesity, 23(2), 166-173.

14. Bagali, S. C., Khodnapur, J. P., Mullur, L. M., Sheikh, G. B. U., & Aithala, M. R. (2012). Aging and gender effects on rate-pressure product: an index of myocardial oxygen consumption. International Journal of Biomedical and Advance Research, 3(3), 175-178.

15. Balfour, P. C., Rodriguez, C. J., & Ferdinand, K. C. (2015). The role of hypertension in race-ethnic disparities in cardiovascular disease. Current cardiovascular risk reports, 9, 1-8. Available at doi: 10.1007/s12170-015-0446-5

16. Ball, K., Crawford, D., & Owen, N. (2000). Obesity as a barrier to physical activity. Australian and New Zealand journal of public health, 24(3), 331-333.

17. Bantham, A., Ross, S. E. T., Sebastião, E., & Hall, G. (2021). Overcoming barriers to physical activity in underserved populations. Progress in cardiovascular diseases, 64, 64-71.

18. Barnett, L. M., Stodden, D., Cohen, K. E., Smith, J. J., Lubans, D. R., Lenoir, M., ... & Morgan, P. J. (2016). Fundamental movement skills: An important focus. Journal of Teaching in Physical Education, 35(3), 219-225.

19. Batalik, L., Winnige, P., Dosbaba, F., Vlazna, D., & Janikova, A. (2021). Home-based aerobic and resistance exercise interventions in cancer patients and survivors: a systematic review. Cancers, 13(8), 1915.

20. Beatty, A. L., Magnusson, S. L., Fortney, J. C., Sayre, G. G., & Whooley, M. A. (2018). VA FitHeart, a mobile app for cardiac rehabilitation: usability study. JMIR human factors, 5(1), e8017.

21. Beneka, A., Malliou, P., & Gioftsidou, A. (2014). Neck pain and office workers: An exercise program for the workplace. ACSM's Health & Fitness Journal, 18(3), 18-24.

22. Bersaoui, M., Baldew, S. S. M., Cornelis, N., Toelsie, J., & Cornelissen, V. A. (2020). The effect of exercise training on blood pressure in African and Asian populations: A systematic review and meta-analysis of randomized controlled trials. European Journal of Preventive Cardiology, 27(5), 457-472.

23. Bethancourt, H. J., Rosenberg, D. E., Beatty, T., & Arterburn, D. E. (2014). Barriers to and facilitators of physical activity program use among older adults. Clinical medicine & research, 12(1-2), 10-20.

24. Bhatnagar, P., Shaw, A., & Foster, C. (2015). Generational differences in the physical activity of UK South Asians: a systematic review. International Journal of Behavioral Nutrition and Physical Activity, 12, 1-19.

25. Bjornsdottir, G., Arnadottir, S. A., & Halldorsdottir, S. (2021). Physical activity of older women living in retirement communities: capturing the whole picture through an ecological approach. Journal of Geriatric Physical Therapy, 44(1), 35-44.

26. Booth, F. W., Roberts, C. K., Thyfault, J. P., Ruegsegger, G. N., & Toedebusch, R. G. (2017). Role of inactivity in chronic diseases: evolutionary insight and pathophysiological mechanisms. Physiological reviews.

27. Bopp, M., Peterson, J. A., & Webb, B. L. (2012). A comprehensive review of faith-based physical activity interventions. American Journal of Lifestyle Medicine, 6(6), 460-478.

28. Borer, J. S. (2008). Heart rate: from risk marker to risk factor. European heart journal supplements, 10(suppl_F), F2-F6.

29. Boutcher, Y. N., & Boutcher, S. H. (2017). Exercise intensity and hypertension: what's new?. Journal of human hypertension, 31(3), 157-164.

30. Bretland, R. J., & Thorsteinsson, E. B. (2015). Reducing workplace burnout: The relative benefits of cardiovascular and resistance exercise. PeerJ, 3, e891.

31. Buder, I., Zick, C., Waitzman, N., Simonsen, S., Sunada, G., & Digre, K. (2018). It takes a village coach: Cost-effectiveness of an intervention to improve diet and physical activity among minority women. Journal of Physical Activity and Health, 15(11), 819-826.

32. Burnett, E., White, J., & Scurr, J. (2015). The influence of the breast on physical activity participation in females. Journal of Physical Activity and Health, 12(4), 588-594.

33. Cainzos-Achirica, M., Fedeli, U., Sattar, N., Agyemang, C., Jenum, A. K., McEvoy, J. W., ... & Pinto, X. (2019). Epidemiology, risk factors, and opportunities for prevention of cardiovascular disease in individuals of South Asian ethnicity living in Europe. Atherosclerosis, 286, 105-113.

34. Caldwell, J. T., Sutterfield, S. L., Post, H. K., Lovoy, G. M., Banister, H. R., Turpin, V. R. G., ... & Ade, C. J. (2020). Impact of high sodium intake on blood pressure and functional sympatholysis during rhythmic handgrip exercise. Applied Physiology, Nutrition, and Metabolism, 45(6), 613-620.

35. Campbell, M. K., Hudson, M. A., Resnicow, K., Blakeney, N., Paxton, A., & Baskin, M. (2007). Church-based health promotion interventions: evidence and lessons learned. Annu. Rev. Public Health, 28, 213-234.

36. Cao, L., Li, X., Yan, P., Wang, X., Li, M., Li, R., ... & Yang, K. (2019). The effectiveness of aerobic exercise for hypertensive population: a systematic review and meta-analysis. The Journal of Clinical Hypertension, 21(7), 868-876.

37. Caperchione, C. M., Chau, S., Walker, G. J., Mummery, W. K., & Jennings, C. (2015). Gender-associated perceptions of barriers and motivators to physical activity participation in south Asian Punjabis living in western Canada. Journal of Physical Activity and Health, 12(5), 686-693.

38. Cappuccio F. P. (1997). Ethnicity and cardiovascular risk: variations in people of African ancestry and South Asian origin. Journal of human hypertension, 11(9), 571–576. https://doi.org/10.1038/sj.jhh.1000516

39. Carnethon, M. R., Pu, J., Howard, G., Albert, M. A., Anderson, C. A., Bertoni, A. G., ... & Yancy, C. W. (2017). Cardiovascular health in African Americans: a scientific statement from the American Heart Association. Circulation, 136(21), e393-e423. Available at https://www.ahajournals.org/doi/full/10.1161/CIR.0000000000000534

40. Casagrande, S. S., Whitt-Glover, M. C., Lancaster, K. J., Odoms-Young, A. M., & Gary, T. L. (2009). Built environment and health behaviors among African Americans: a systematic review. American journal of preventive medicine, 36(2), 174-181.

41. Castro, J. P., Joseph, L. A., Shin, J. J., Arora, S. K., Nicasio, J., Shatzkes, J., ... & McFarlane, S. I. (2005). Differential effect of obesity on bone mineral density in

White, Hispanic and African American women: a cross sectional study. Nutrition & metabolism, 2(1), 1-7.

42. Coelho, E. M., Monteiro, F., Da Conceição, J. M., Cruz, J., Cunha, D., Almeida, A., & De Sousa, T. (1982). The rate pressure product: fact of fallacy?. Angiology, 33(10), 685–689. https://doi.org/10.1177/000331978203301008

43. Chaturvedi, N., Bathula, R., Shore, A. C., Panerai, R., Potter, J., Kooner, J., Chambers, J., & Hughes, A.D. (2012). South Asians have elevated postexercise blood pressure and myocardial oxygen consumption compared to Europeans despite equivalent resting pressure. Journal of the American Heart Association, 1(5), e000281. https://doi.org/10.1161/JAHA.111.000281.

44. Cheng, L. T., Chen, H. M., Tang, L. J., Tang, W., Huang, H. Y., Gu, Y., & Wang, T. (2008). The study of aortic stiffness in different hypertension subtypes in dialysis patients. Hypertension research : official journal of the Japanese Society of Hypertension, 31(4), 593–599. https://doi.org/10.1291/hypres.31.593.

45. Cheval, B., Sivaramakrishnan, H., Maltagliati, S., Fessler, L., Forestier, C., Sarrazin, P., ... & Boisgontier, M. P. (2021). Relationships between changes in self-reported physical activity, sedentary behaviour and health during the coronavirus (COVID-19) pandemic in France and Switzerland. Journal of sports sciences, 39(6), 699-704.

46. Chiang, S. L., Shen, C. L., Chen, L. C., Lo, Y. P., Lin, C. H., & Lin, C. H. (2020). Effectiveness of a home-based telehealth exercise training program for patients with cardiometabolic multimorbidity: A randomised controlled trial. Journal of Cardiovascular Nursing, 35(5), 491-501.

47. Chiu, M., Austin, P. C., Manuel, D. G., & Tu, J. V. (2010). Comparison of cardiovascular risk profiles among ethnic groups using population health surveys between 1996 and 2007. Cmaj, 182(8), E301-E310.

48. Cleland, V., Cocker, F., Canary, J., Teychenne, M., Crawford, D., Timperio, A., & Ball, K. (2020). Social-ecological predictors of physical activity patterns: a longitudinal study of women from socioeconomically disadvantaged areas. Preventive Medicine, 132, 105995.

49. Collado-Mateo, D., Lavín-Pérez, A. M., Peñacoba, C., Del Coso, J., Leyton-Román, M., Luque-Casado, A., ... & Amado-Alonso, D. (2021). Key factors associated with adherence to physical exercise in patients with chronic diseases and older adults: an umbrella review. International journal of environmental research and public health, 18(4), 2023.

50. Cornelissen, V. A., & Smart, N. A. (2013). Exercise training for blood pressure: a systematic review and meta-analysis. Journal of the American heart association, 2(1), e004473.

51. Costa, E. C., Hay, J. L., Kehler, D. S., Boreskie, K. F., Arora, R. C., Umpierre, D., ... & Duhamel, T. A. (2018). Effects of high-intensity interval training versus moderate-intensity continuous training on blood pressure in adults with pre-to established hypertension: a systematic review and meta-analysis of randomised trials. Sports Medicine, 48, 2127-2142.

52. Craig, J. C., Broxterman, R. M., Cerbie, J. F., La Salle, D. T., Roundy, C. S., Jarrett, C. L., ... & Trinity, J. D. (2021). The dynamic adjustment of mean arterial pressure during exercise: A potential tool for discerning cardiovascular health status. Journal of Applied Physiology, 130(5), 1544-1554.

53. Cunningham, C., O'Sullivan, R., Caserotti, P., & Tully, M. A. (2020). Consequences of physical inactivity in older adults: A systematic review of reviews and meta-analyses. Scandinavian journal of medicine & science in sports, 30(5), 816-827.

54. Curry, W. B., Duda, J. L., & Thompson, J. L. (2015). Perceived and objectively measured physical activity and sedentary time among South Asian women in the UK International journal of environmental research and public health, 12(3), 3152-3173.

55. Daniel, M., & Wilbur, J. (2011). Physical activity among South Asian Indian immigrants: an integrative review. Public Health Nursing, 28(5), 389-401.

56. De Marco, M., Kearney, W., Smith, T., Jones, C., Kearney-Powell, A., & Ammerman, A. (2014). Growing partners: building a community–academic partnership to address health disparities in rural North Carolina. Progress in community health partnerships: research, education, and action, 8(2), 181-186.

57. Demarest, J., & Allen, R. (2000). Body image: Gender, ethnic, and age differences. The Journal of social psychology, 140(4), 465-472.

58. Deslandes, A., Moraes, H., Ferreira, C., Veiga, H., Silveira, H., Mouta, R., ... & Laks, J. (2009). Exercise and mental health: many reasons to move. Neuropsychobiology, 59(4), 191-198.

59. Dessio, W., Wade, C., Chao, M., Kronenberg, F., Cushman, L. F., & Kalmuss, D. (2004). Religion, spirituality, and healthcare choices of African-American women: Results of a national survey. Ethnicity & Disease, 14(2), 189-197.

60. Detrano, R., Gianrossi, R., & Froelicher, V. (1989). The diagnostic accuracy of the exercise electrocardiogram: a meta-analysis of 22 years of research. Progress in cardiovascular diseases, 32(3), 173-206.

61. Ding, D., Lawson, K. D., Kolbe-Alexander, T. L., Finkelstein, E. A., Katzmarzyk, P. T., van Mechelen, W., & Pratt, M. (2016). The economic burden of physical inactivity: A global analysis of major non-communicable diseases. The Lancet, 388(10051), 1311-1324. https://doi.org/10.1016/S0140-6736(16)30383-X

62. DiPietro, L., Al-Ansari, S. S., Biddle, S. J., Borodulin, K., Bull, F. C., Buman, M. P., ... & Willumsen, J. F. (2020). Advancing the global physical activity agenda: recommendations for future research by the 2020 WHO physical activity and sedentary behavior guidelines development group. International Journal of Behavioral Nutrition and Physical Activity, 17(1), 1-11.

63. Dirks, R. T., & Duran, N. (2001). African American dietary patterns at the beginning of the 20th century. The Journal of nutrition, 131(7), 1881-1889.

64. Divens, L. L., & Chatmon, B. N. (2019). Cardiovascular Disease Management in Minority Women: Special Considerations. Critical Care Nursing Clinics of North America, 31(1), 39-47.

65. Donkin, A., Goldblatt, P., Allen, J., Nathanson, V., & Marmot, M. (2018). Global action on the social determinants of health. BMJ global health, 3(Suppl 1), e000603.

66. Eastwood, S. V., Tillin, T., Chaturvedi, N., & Hughes, A. D. (2015). Ethnic differences in associations between blood pressure and stroke in South Asian and European men. Hypertension, 66(3), 481-488.

67. Ebong, I., & Breathett, K. (2020). The cardiovascular disease epidemic in African American women: recognizing and tackling a persistent problem. *Journal of Women's Health*, *29*(7), 891-893.

68. Ehsani, A. A., Heath, G. W., Hagberg, J. M., Sobel, B. E., & Holloszy, J. O. (1981). Effects of 12 months of intense exercise training on ischemic ST-segment depression in patients with coronary artery disease. Circulation, 64(6), 1116–1124. https://doi.org/10.1161/01.cir.64.6.1116

69. El-Dosouky II. Rate Pressure Product and Severely Impaired Systolic Function in Heart Failure Patients (Heart Failure and Severe Systolic Dysfunction), Clinical & Experimental Cardiology. 2019;10(632):2.

70. Eldridge, M., Burrowes, K., & Spauster, P. (2019). Investing in equitable urban park systems: emerging funding strategies and tools.

71. Ellis KR, Hecht HK, Young TL, Oh S, Thomas S, Hoggard LS, et al. Chronic Disease Among African American Families: A Systematic Scoping Review. Prev Chronic Dis 2020;17:190431. DOI: http://dx.doi.org/10.5888/pcd17.190431

72. Elshazly, A., Khorshid, H., Hanna, H., & Ali, A. (2018). Effect of exercise training on heart rate recovery in patients post anterior myocardial infarction. The Egyptian Heart Journal, 70(4), 283-285.

73. Epstein, L. H. (1998). Integrating theoretical approaches to promote physical activity. American journal of preventive medicine, 15(4), 257-265.

74. Esmailiyan, M., Amerizadeh, A., Vahdat, S., Ghodsi, M., Doewes, R. I., & Sundram, Y. (2021). Effect of different types of aerobic exercise on individuals with and without hypertension: An updated systematic review. Current problems in cardiology, 101034.

75. Essiet, I. A., Baharom, A., Shahar, H. K., & Uzochukwu, B. (2017). Application of the Socio-Ecological Model to predict physical activity behaviour among Nigerian University students. The Pan African Medical Journal, 26.

76. Eynon, M., Foad, J., Downey, J., Bowmer, Y., & Mills, H. (2019). Assessing the psychosocial factors associated with adherence to exercise referral schemes: A systematic review. Scandinavian Journal of Medicine & Science in Sports, 29(5), 638-650.

77. Farah, B. Q., do Prado, W. L., Malik, N., Lofrano-Prado, M. C., de Melo, P. H., Botero, J. P., ... & Ritti-Dias, R. M. (2021). Barriers to physical activity during the COVID-19 pandemic in adults: a cross-sectional study. Sport Sciences for Health, 17(2), 441-447.

78. Ferdinand, K., Batieste, T., & Fleurestil, M. (2020). Contemporary and future concepts on hypertension in African Americans: COVID-19 and beyond. Journal of the National Medical Association, 112(3), 315-323.

79. Figueroa, M. A., Demeersman, R. E., & Manning, J. (2012). The autonomic and rate pressure product responses of tai chi practitioners. North American journal of medical sciences, 4(6), 270–275. https://doi.org/10.4103/1947-2714.97208

80. Fletcher, G. F., Landolfo, C., Niebauer, J., Ozemek, C., Arena, R., & Lavie, C. J. (2018). Promoting physical activity and exercise: JACC health promotion series. Journal of the American College of Cardiology, 72(14), 1622-1639.

81. Fleury, J., & Lee, S. M. (2006). The social ecological model and physical activity in African American women. American Journal of community psychology, 37(1), 129-140.

82. Flynn, J. I., Bassett, D. R., Fouts, H. N., Thompson, D. L., & Coe, D. P. (2017). Active Families in the Great Outdoors: A program to promote family outdoor physical activity. Journal of Adventure Education and Outdoor Learning, 17(3), 227-238.

83. Flynn, A., Preston, E., Dennis, S., Canning, C. G., & Allen, N. E. (2023). Utilising telehealth to support exercise and physical activity in people with Parkinson disease: a program evaluation using mixed methods. BMC Health Services Research, 23(1), 1-12.

84. Forde, A. T., Sims, M., Muntner, P., Lewis, T., Onwuka, A., Moore, K., & Diez Roux, A. V. (2020). Discrimination and hypertension risk among African Americans in the Jackson Heart Study. Hypertension, 76(3), 715-723. Available at https://www.ahajournals.org/doi/full/10.1161/HYPERTENSIONAHA.119.14492

85. Forjaz, C. L., Matsudaira, Y., Rodrigues, F. B., Nunes, N., & Negrão, C. E. (1998). Post-exercise changes in blood pressure, heart rate and rate pressure product at different exercise intensities in normotensive humans. Brazilian journal of medical and biological research = Revista brasileira de pesquisas medicas e biologicas, 31(10), 1247–1255. https://doi.org/10.1590/s0100-879x1998001000003

86. Fornitano, L. D., & Godoy, M. F. D. (2006). Increased rate-pressure product as predictor for the absence of significant obstructive coronary artery disease in patients with positive exercise test. Arquivos brasileiros de cardiologia, 86, 138-144.

87. Garber C. E. (2019). The Health Benefits of Exercise in Overweight and Obese Patients. Current sports medicine reports, 18(8), 287–291. https://doi.org/10.1249/JSR.0000000000000619

88. Gee, G. C., & Ford, C. L. (2011). Structural racism and health inequities: Old issues, New Directions1. Du Bois review: social science research on race, 8(1), 115-132.

89. Gerodimos, V., Karatrantou, K., Papazeti, K., Batatolis, C., & Krommidas, C. (2022). Workplace exercise program in a hospital environment: an effective strategy for the promotion of employees physical and mental health. A randomised

controlled study. International Archives of Occupational and Environmental Health, 95(7), 1491-1500.

90. Gezmu, T., Schneider, D., Demissie, K., Lin, Y., & Gizzi, M. S. (2014). Risk factors for acute stroke among South Asians compared to other racial/ethnic groups. PloS one, 9(9), e108901. https://doi.org/10.1371/journal.pone.0108901

91. Giles-Corti, B., & Donovan, R. J. (2002). The relative influence of individual, social and physical environment determinants of physical activity. Social science & medicine, 54(12), 1793-1812.

92. Gillespie, S., Eales, L., Simpson, D. D., & Ferguson, G. M. (2022). Remote acculturation and physical activity among adolescent-mother dyads in Jamaica: a developmental dyadic moderation. Journal of Cross-Cultural Psychology, 53(6), 643-658.

93. Gillison, F. B., Skevington, S. M., Sato, A., Standage, M., & Evangelidou, S. (2009). The effects of exercise interventions on quality of life in clinical and healthy populations; a meta-analysis. Social science & medicine, 68(9), 1700-1710.

94. Gillison, F., Standage, M., & Skevington, S. (2006). Relationships among 'adolescents' weight perceptions, exercise goals, exercise motivation, quality of life and leisure-time exercise behaviour: Aself-determination theory approach. Health Education Research,21, 836–847

95. Gobel, F. L., Norstrom, L. A., Nelson, R. R., Jorgensen, C. R., & Wang, Y. (1978). The rate-pressure product as an index of myocardial oxygen consumption during exercise in patients with angina pectoris. Circulation, 57(3), 549-556.

96. González, K., Fuentes, J., & Márquez, J. L. (2017). Physical inactivity, sedentary behavior and chronic diseases. Korean journal of family medicine, 38(3), 111.

97. Gordon, A., Tyni-Lenné, R., Jansson, E., Jensen-Urstad, M., & Kaijser, L. (1999). Beneficial effects of exercise training in heart failure patients with low cardiac

output response to exercise–a comparison of two training models. Journal of internal medicine, 246(2), 175-182.

98. Gower, B. A., & Fowler, L. A. (2020). Obesity in African Americans: The role of physiology. *Journal of Internal Medicine*, *288*(3), 295-304

99. Griffiths, A. (1996). The benefits of employee exercise programmes: a review. Work & Stress, 10(1), 5-23.

100. Guthold, R., Stevens, G. A., Riley, L. M., & Bull, F. C. (2018). Worldwide trends in insufficient physical activity from 2001 to 2016: a pooled analysis of 358 population-based surveys with 1· 9 million participants. The lancet global health, 6(10), e1077-e1086.

101. Haggis, C., Sims-Gould, J., Winters, M., Gutteridge, K., & McKay, H. A. (2013). Sustained impact of community-based physical activity interventions: key elements for success. BMC Public Health, 13, 1-8.

102. Hall, C. (2018). Doing reparatory history: Bringing 'race'and slavery home. Race & Class, 60(1), 3-21.

103. Hansen, D., Abreu, A., Doherty, P., & Völler, H. (2019). Dynamic strength training intensity in cardiovascular rehabilitation: is it time to reconsider clinical practice? A systematic review. European journal of preventive cardiology, 26(14), 1483-1492.

104. Harden, S. M., Johnson, S. B., Almeida, F. A., & Estabrooks, P. A. (2017). Improving physical activity program adoption using integrated research-practice partnerships: an effectiveness-implementation trial. Translational behavioral medicine, 7(1), 28-38.

105. Harsha, D. W., & Bray, G. A. (2008). Weight loss and blood pressure control (Pro). Hypertension, 51(6), 1420-1425.

106. Hasson, R. E., Brown, D. R., Dorn, J., Barkley, L., Torgan, C., Whitt-Glover, M., Ainsworth, B., & Keith, N. (2017). Achieving Equity in Physical Activity Participation: ACSM Experience and Next Steps. Medicine and science in sports and exercise, 49(4), 848–858. https://doi.org/10.1249/MSS.0000000000001161

107. Heath, G. W., Parra, D. C., Sarmiento, O. L., Andersen, L. B., Owen, N., Goenka, S., Montes, F., Brownson, R. C., & Lancet Physical Activity Series Working Group (2012). Evidence-based intervention in physical activity: lessons from around the world. Lancet (London, England), 380(9838), 272–281. https://doi.org/10.1016/S0140-6736(12)60816-2

108. Heffernan, K. S., Maron, M. S., Patvardhan, E. A., Karas, R. H., Kuvin, J. T., & Vascular Function Study Group. (2011). Relation of pulse pressure to blood pressure response to exercise in patients with hypertrophic cardiomyopathy. The American journal of cardiology, 107(4), 600-603.

109. Hegde, S. M., & Solomon, S. D. (2015). Influence of physical activity on hypertension and cardiac structure and function. Current hypertension reports 17, 1-8.

110. Heymsfield, S. B., Peterson, C. M., Thomas, D. M., Heo, M., & Schuna Jr, J. M. (2016). Why are there race/ethnic differences in adult body mass index–adiposity relationships? A quantitative critical review. Obesity reviews, 17(3), 262-275.

111. Hicken, M. T., Lee, H., Morenoff, J., House, J. S., & Williams, D. R. (2019). Racial/ethnic disparities in hypertension prevalence. Community Health Equity: A Chicago Reader, 173.

112. Higgins, J. P. (2016). Smartphone applications for patients' health and fitness. The American journal of medicine, 129(1), 11-19.

113. Hochberg M. C. (2007). Racial differences in bone strength. Transactions of the American Clinical and Climatological Association, 118, 305–315.

114. Horne, M., Tierney, S., Henderson, S., Wearden, A., & Skelton, D. A. (2018). A systematic review of interventions to increase physical activity among South Asian adults. Public health, 162, 71-81.

115. Huebschmann, A. G., Campbell, L. J., Brown, C. S., & Dunn, A. L. (2016). "My hair or my health:" overcoming barriers to physical activity in African American women with a focus on hairstyle-related factors. Women & health, 56(4), 428-447.

116. Igarashi, Y., Akazawa, N., & Maeda, S. (2018). Regular aerobic exercise and blood pressure in East Asians: A meta-analysis of randomized controlled trials. Clinical and Experimental Hypertension, 40(4), 378-389.

117. Ige-Elegbede, J., Pilkington, P., Gray, S., & Powell, J. (2019). Barriers and facilitators of physical activity among adults and older adults from Black and Minority Ethnic groups in the UK: A systematic review of qualitative studies. Preventive medicine reports, 15, 100952.

118. Jenkins, C., Bartlett, T., Kitto, S., Ranjan, S., Jesuthasan, B., Dahiya, A., ... & Whitman, M. (2020). 398 Rate Pressure Product, Age-Predicted Maximum Heart Rate and Heart Rate Reserve: Which One Will Reign Supreme as a Predictor of Cardiovascular Events following Exercise Treadmill Testing? Heart, Lung and Circulation, 29, S217.

119. Jenkins, F., Jenkins, C., Gregoski, M. J., Magwood, G. S. (2017). Interventions promoting physical activity in African American women: An integrative review. Journal of Cardiovascular Nursing, 32(1), 22-29. https://doi.org/10.1097/ JCN .0000000000000298

120. Joseph, R. P., Ainsworth, B. E., Keller, C., & Dodgson, J. E. (2015). Barriers to physical activity among African American women: an integrative review of the literature. Women & health, 55(6), 679-699.

121. Joseph, R. P., Coe, K., Ainsworth, B. E., Hooker, S. P., Mathis, L., & Keller, C. (2018). Hair As a Barrier to Physical Activity among African American Women: A

Qualitative Exploration. Frontiers in public health, 5, 367. https://doi.org/10.3389/fpubh.2017.00367

122. Juillard, A., Fernandez, F., Belfante, M., & Gerbaux, A. (1982). Double produit et besoins myocardiques d'oxygène [Rate-pressure product and myocardial oxygen requirements]. Archives des maladies du coeur et des vaisseaux, 75(3), 293–301.

123. Kaplan, J. B., & Bennett, T. (2003). Use of race and ethnicity in biomedical publication. Jama, 289(20), 2709-2716.

124. Katzmarzyk, P. T., Friedenreich, C., Shiroma, E. J., & Lee, I. M. (2022). Physical inactivity and non-communicable disease burden in low-income, middle-income and high-income countries. British Journal of sports medicine, 56(2), 101-106.

125. Katzmarzyk, P. T., Gledhill, N., & Shephard, R. J. (2000). The economic burden of physical inactivity in Canada. CMAJ: Canadian Medical Association Journal, 163(11), 1435-1440. https://doi.org/https://www.ncbi.nlm.nih.gov/pmc/articles/PMC80410/

126. Kazeminia, M., Daneshkhah, A., Jalali, R., Vaisi-Raygani, A., Salari, N., & Mohammadi, M. (2020). The effect of exercise on the older adult's blood pressure suffering hypertension: systematic review and meta-analysis on clinical trial studies. International Journal of Hypertension, 2020.

127. Keadle, S. K., McKinnon, R., Graubard, B. I., & Troiano, R. P. (2016). Prevalence and trends in physical activity among older adults in the United States: a comparison across three national surveys. Preventive medicine, 89, 37-43.

128. Kepper, M. M., Myers, C. A., Denstel, K. D., Hunter, R. F., Guan, W., & Broyles, S. T. (2019). The neighborhood social environment and physical activity: a systematic scoping review. International Journal of Behavioral Nutrition and Physical Activity, 16(1), 1-14.

129. Keyhani, D., Kargarfard, M., Sarrafzadegan, N., & Sadeghi, M. (2013). Autonomic function change following a supervised exercise program in patients with congestive heart failure. ARYA atherosclerosis, 9(2), 150.

130. Key Statistics and Facts (2022). ParticpAction. Available at https://www.participaction.com/the-science/key-facts-and-stats/

131. King, A. C., Castro, C., Wilcox, S., Eyler, A. A., Sallis, J. F., & Brownson, R. C. (2000). Personal and environmental factors associated with physical inactivity among different racial–ethnic groups of US middle-aged and older-aged women. Health psychology, 19(4), 354.

132. King, A. C., Whitt-Glover, M. C., Marquez, D. X., Buman, M. P., Napolitano, M. A., Jakicic, J., ... & Tennant, B. L. (2019). Physical activity promotion: highlights from the 2018 physical activity guidelines advisory committee systematic review. Medicine & Science in Sports & Exercise, 51(6), 1340-1353.

133. King, K. M., & Gonzalez, G. B. (2018). Increasing physical activity using an ecological model. ACSM's Health & Fitness Journal, 22(4), 29-32.

134. Kingwell, B. A. (2002). Large artery stiffness: implications for exercise capacity and cardiovascular risk. Clinical and Experimental Pharmacology and Physiology, 29(3), 214-217.

135. Kirkland, R. A., Karlin, N. J., Stellino, M. B., & Pulos, S. (2011). Basic psychological needs satisfaction, motivation, and exercise in older adults. Activities, adaptation & aging, 35(3), 181-196.

136. Knapp, M., Gustat, J., Darensbourg, R., Myers, L., & Johnson, C. (2019). The relationships between park quality, park usage, and levels of physical activity in low-income, African American neighborhoods. International journal of environmental Research and public health, 16(1), 85.

137. Kokkinos, P., Sheriff, H., & Kheirbek, R. (2011). Physical inactivity and mortality risk. Cardiology research and practice, 2011.

138. Koorts, H., Eakin, E., Estabrooks, P., Timperio, A., Salmon, J., & Bauman, A. (2018). Implementation and scale up of population physical activity interventions for clinical and community settings: the PRACTIS guide. International Journal of Behavioral Nutrition and Physical Activity, 15(1), 1-11.

139. Koshoedo, S. A., Paul-Ebhohimhen, V. A., Jepson, R. G., & Watson, M. C. (2015). Understanding the complex interplay of barriers to physical activity amongst black and minority ethnic groups in the United Kingdom: a qualitative synthesis using meta-ethnography. BMC public health, 15, 1-16.

140. Kreuter, M. W., Lukwago, S. N., Bucholtz, D. C., Clark, E. M., & Sanders-Thompson, V. (2003). Achieving cultural appropriateness in health promotion programs: targeted and tailored approaches. Health Education & Behavior, 30(2), 133-146.

141. Kreuter, M.W., & Hughton, LT (2006). Integrating Culture into Health Information for African American Women. American Behavioral Scientist, 49 (6), 794-811.

142. Kumanyika, S. K., & Charleston, J. B. (1992). Lose weight and win: a church-based weight loss program for blood pressure control among black women. Patient education and counseling, 19(1), 19-32. DOI: 10.1016/0738-3991(92)90099-5

143. Kumar, A. S., & Sinha, N. (2020). Cardiovascular disease in India: a 360 degree overview. medical journal armed forces india, 76(1), 1-3.

144. Kurl, S., Laukkanen, J. A., Rauramaa, R., Lakka, T. A., Sivenius, J., & Salonen, J. T. (2001). Systolic blood pressure response to exercise stress test and risk of stroke. Stroke, 32(9), 2036-2041.

145. Laar, R. A., Shi, S., & Ashraf, M. A. (2019). Participation of Pakistani female students in physical activities: Religious, cultural, and socioeconomic factors. Religions, 10(11), 617.

146. Laires, P. A., Dias, S., Gama, A., Moniz, M., Pedro, A. R., Soares, P., ... & Nunes, C. The Association Between Chronic Disease and Serious COVID-19 Outcomes and Its Influence on Risk Perception: Survey Study and Database Analysis. JMIR public health and surveillance. 2021; 7 (1): e22794. Epub 2021/01/13. https://doi. org/10.2196/22794 PMID: 33433397.

147. Lamina, S., Okoye, G., Ezema, C., Anele, T., & Ezugwu, A. (2013). Effect of interval training program on rate-pressure product in the management of hypertension in black African male subjects: A randomised controlled trial. Nigerian Journal of Basic and Clinical Sciences, 10(1), 17-17.

148. Lander, N., Eather, N., Morgan, P. J., Salmon, J., & Barnett, L. M. (2017). Characteristics of teacher training in school-based physical education interventions to improve fundamental movement skills and/or physical activity: A systematic review. Sports medicine, 47, 135-161.

149. Lane, G., Nisbet, C., & Vatanparast, H. (2019). Dietary habits of newcomer children in Canada. Public Health Nutrition, 22(17), 3151-3162.

150. Lauderdale, M. E., Yli-Piipari, S., Irwin, C. C., & Layne, T. E. (2015). Gender differences regarding motivation for physical activity among college students: A self-determination approach. The Physical Educator, 72(5). DOI:10.18666/TPE-2015-V72-I5-4682

151. Lavie, C. J., Arena, R., Swift, D. L., Johannsen, N. M., Sui, X., Lee, D. C., ... & Blair, S. N. (2015). Exercise and the cardiovascular system: clinical science and cardiovascular outcomes. Circulation research, 117(2), 207-219.

152. Lavie, C. J., Ozemek, C., Carbone, S., Katzmarzyk, P. T., & Blair, S. N. (2019). Sedentary behavior, exercise, and cardiovascular health. Circulation research, 124(5), 799-815

153. Lavie, C. J., Thomas, R. J., Squires, R. W., Allison, T. G., & Milani, R. V. (2009, April). Exercise training and cardiac rehabilitation in primary and secondary prevention of coronary heart disease. In Mayo Clinic Proceedings (Vol. 84, No. 4, pp. 373-383). Elsevier.

154. Lee, M., Lee, H., Kim, Y., Kim, J., Cho, M., Jang, J., & Jang, H. (2018). Mobile app-based health promotion programs: a systematic review of the literature. International journal of environmental research and public health, 15(12), 2838.

155. Lee, R. E., & Cubbin, C. (2009). Striding toward social justice: the ecologic milieu of physical activity. Exercise and sport sciences reviews, 37(1), 10.

156. Lee, S.M. (2005). Physical activity among minority populations: What health promotion

157. Lee, Y., & Park, S. (2021). Understanding of physical activity in social ecological perspective: application of multilevel model. Frontiers in Psychology, 12, 622929.

158. Leow, C. H. W., Tan, B., Miyashita, M., & Lee, J. K. W. (2022). Cultural differences in hydration practices among physically active individuals: a narrative review. Journal of the International Society of Sports Nutrition, 19(1), 150-163.

159. Lesser, I. A., & Nienhuis, C. P. (2020). The impact of COVID-19 on physical activity behavior and well-being of Canadians. International journal of environmental research and public health, 17(11), 3899.

160. Lippi, G., Henry, B. M., & Sanchis-Gomar, F. (2020). Physical inactivity and cardiovascular disease at the time of coronavirus disease 2019 (COVID-19). European journal of preventive cardiology, 27(9), 906-908.

161. Liu, F. D., Shen, X. L., Zhao, R., Tao, X. X., Wang, S., Zhou, J. J., ... & Liu, J. R. (2016). Pulse pressure as an independent predictor of stroke: a systematic review and a meta-analysis. Clinical research in cardiology, 105, 677-686.

162. Macintyre, S. (2007). Deprivation amplification revisited, or is it always true that poorer places have poorer access to resources for healthy diets and physical activity? International Journal of Behavioral Nutrition and Physical Activity, 4(1), 1-7.

163. Madhusudhan U. (2018). Effect of high and low intensities of aerobic training on rate pressure product. National Journal of Physiology, Pharmacy and Pharmacology, 8(4):550-3. Available from: http://www.njppp.com/fulltext/28-1511516150.pdf

164. Maestroni, L., Read, P., Bishop, C., Papadopoulos, K., Suchomel, T. J., Comfort, P., & Turner, A. (2020). The benefits of strength training on musculoskeletal system health: practical applications for interdisciplinary care. Sports Medicine, 50(8), 1431-1450.

165. Mahmood, B., Bhatti, J. A., Leon, A., & Gotay, C. (2019). Leisure time physical activity levels in immigrants by ethnicity and time since immigration to Canada: Findings from the 2011–2012 Canadian Community Health Survey. Journal of immigrant and minority health, 21, 801-810.

166. Manage Health Behaviors: A Population-Based Survey. Journal of medical Internet research, 19(4), e101. Retrieved from https://doi.org/10.2196/jmir.6838

167. Mangione, C. M., Nicholson, W., & Davidson, K. W. (2022). Addressing Gaps in Research to Reduce Disparities and Advance Health Equity: The USPSTF Incorporation of the NASEM Taxonomy on Closing Evidence Gaps in Clinical Prevention. JAMA, 328(18), 1803-1804.

168. Maraboto, C., & Ferdinand, K. C. (2020). Update on hypertension in African Americans. Progress in cardiovascular diseases, 63(1), 33-39.

169. Marcus, B. H., & Simkin, L. R. (1994). The transtheoretical model: applications to exercise behavior. Medicine & Science in Sports & Exercise.

170. May, G. A., & Nagle, F. J. (1984). Changes in rate-pressure product with physical training of individuals with coronary artery disease. Physical therapy, 64(9), 1361–1366. https://doi.org/10.1093/ptj/64.9.1361

171. Mbilishaka, A., & Lacey, A. (2019). Don't sweat your hair out: The frequency of exercise for african american women with natural hair. Journal of Exercise and Nutrition, 2(1).

172. McCarron, D. A., & Reusser, M. E. (1996). Body weight and blood pressure regulation. The American journal of clinical nutrition, 63(3), 423S-425S.

173. McNabb, W., Quinn, M., Kerver, J., Cook, S., & Karrison, T. (1997). The PATHWAYS church-based weight loss program for urban African-American women at risk for diabetes. Diabetes care, 20(10), 1518-1523.

174. Medeiros, W. M., de Luca, F. A., de Figueredo Júnior, A. R., Mendes, F. A., & Gun, C. (2018). Heart rate recovery improvement in patients following acute myocardial infarction: exercise training, β-blocker therapy or both. Clinical physiology and functional imaging, 38(3), 351-359.

175. Mendoza-Vasconez, A. S., Linke, S., Muñoz, M., Pekmezi, D., Ainsworth, C., Cano, M., ... & Larsen, B. A. (2016). Promoting physical activity among underserved populations. Current sports medicine reports, 15(4), 290.

176. Meyer, K., Samek, L., Schwaibold, M., Westbrook, S., Hajric, R., Lehmann, M., Essfeld, D., & Roskamm, H. (1996). Physical responses to different modes of interval exercise in patients with chronic heart failure--application to exercise training. European heart journal, 17(7), 1040–1047. https://doi.org/10.1093/oxfordjournals.eurheartj.a015000

177. Mikkelsen, K., Stojanovska, L., Polenakovic, M., Bosevski, M., & Apostolopoulos, V. (2017). Exercise and mental health. Maturitas, 106, 48-56.

178. Milat, A. J., Bauman, A. E., Redman, S., & Curac, N. (2011). Public health research outputs from efficacy to dissemination: a bibliometric analysis. BMC Public Health, 11(1), 1-9. McCulloch, C. L., Koopmans, A., & Pelletier, C. A. (2005). Building awareness of barriers to exercise in rural and remote areas. Health, 21, 239-244.

179. Millar, J. A., Lever, A. F., & Burke, V. (1999). Pulse pressure as a risk factor for cardiovascular events in the MRC Mild Hypertension Trial. Journal of hypertension, 17(8), 1065-1072.

180. Misra, A., Jayawardena, R., & Anoop, S. (2019). Obesity in South Asia: phenotype, morbidities, and mitigation. Current Obesity Reports, 8, 43-52.

181. Mitra, R., Moore, S. A., Gillespie, M., Faulkner, G., Vanderloo, L. M., Chulak-Bozzer, T., ... & Tremblay, M. S. (2020). Healthy movement behaviours in children and youth during the COVID-19 pandemic: Exploring the role of the neighbourhood environment. Health & Place, 65, 102418.

182. Mora, N., & Golden, S. H. (2017). Understanding cultural influences on dietary habits in Asian, Middle Eastern, and Latino patients with type 2 diabetes: a review of current literature and future directions. Current diabetes reports, 17, 1-12.

183. Moy, E., Garcia, M. C., Bastian, B., Rossen, L. M., Ingram, D. D., Faul, M., ... & Iademarco, M. F. (2017). Leading causes of death in nonmetropolitan and metropolitan areas—United States, 1999–2014. MMWR Surveillance Summaries, 66(1), 1.

184. Mugele, H., Freitag, N., Wilhelmi, J., Yang, Y., Cheng, S., Bloch, W., & Schumann, M. (2019). High-intensity interval training in the therapy and aftercare of cancer patients: a systematic review with meta-analysis. Journal of Cancer Survivorship, 13(2), 205-223.

185. Mulligan, H., Wilkinson, A., Chen, D., Nijhof, C., Kwan, N., Lindup, A., & Dalton, S. (2019). Components of community rehabilitation programme for adults with chronic conditions: a systematic review. International journal of nursing studies, 97, 114-129.

186. Newlin, K., Dyess, S. M., Allard, E., Chase, S., & Melkus, G. D. E. (2012). A methodological review of faith-based health promotion literature: advancing the science to expand delivery of diabetes education to Black Americans. Journal of religion and health, 51, 1075-1097.

187. Newton Jr, R. L., Carter, L., Romain, J. S., Jerrod, T., Griffith, D. M., & Myers, V. (2019). Development of a mobile phone app to maintain physical activity in African American men: MobileMen. Mhealth, 5.

188. Ntoumanis, N., Thørgersen-Ntoumani, C., Quested, E., & Chatzisarantis, N. (2018). Theoretical approaches to physical activity promotion. In Oxford research encyclopedia of psychology.

189. Nystoriak, M. A., & Bhatnagar, A. (2018). Cardiovascular effects and benefits of exercise. Frontiers in cardiovascular medicine, 5, 135.

190. Okekunle, A., Akpa, O., Akinyemi, R., Sarfo, F., Ogbole, G., Akpalu, A., ... & Owolabi, M. (2021). Is sedentary lifestyle a critical driver for hypertension burden in Sub-Saharan Africa?: evidence from a community-based population in Ghana and Nigeria. European Journal of Preventive Cardiology, 28(Supplement_1), zwab061-153.

191. Oliver, E., Mayor Jr, F., & D'Ocon, P. (2019). Beta-blockers: historical perspective and mechanisms of action. Revista Española de Cardiología (English Edition), 72(10), 853-862.

192. Owusu, C., Nock, N. L., Hergenroeder, P., Austin, K., Bennet, E., Cerne, S., ... & Berger, N. A. (2020). IMPROVE, a community-based exercise intervention versus support group to improve functional and health outcomes among older African American and non-Hispanic White breast cancer survivors from diverse socioeconomic backgrounds: Rationale, design and methods. Contemporary clinical trials, 92, 106001.

193. Ozemek, C., Laddu, D. R., Lavie, C. J., Claeys, H., Kaminsky, L. A., Ross, R., ... & Blair, S. N. (2018). An update on the role of cardiorespiratory fitness, structured exercise and lifestyle physical activity in preventing cardiovascular disease and health risk. Progress in cardiovascular diseases, 61(5-6), 484-490.

194. Pallant, Julie. (2016). SPSS Survival Manual : a step by step guide to data analysis using IBM SPSS (Ed. 6th).

195. Park, W., Jung, W. S., Hong, K., Kim, Y. Y., Kim, S. W., & Park, H. Y. (2020). Effects of moderate combined resistance-and aerobic-exercise for 12 weeks on body composition, cardiometabolic risk factors, blood pressure, arterial stiffness,

and physical functions, among obese older men: a pilot study. International Journal of Environmental Research and Public Health, 17(19), 7233.

196. Participarks - participaction. (n.d.). https://www.participaction.com/programs/participarks/

197. Pattillo-McCoy, M. (1998). Church culture as a strategy of action in the black community. American Sociological Review, 767-784.

198. Paulo, A. C., Tricoli, V., Queiroz, A. C., Laurentino, G., & Forjaz, C. L. (2019). Blood pressure response during resistance training of different work-to-rest ratio. The Journal of Strength & Conditioning Research, 33(2), 399-407.

199. Peralta, C. A., Risch, N., Lin, F., Shlipak, M. G., Reiner, A., Ziv, E., ... & Bibbins-Domingo, K. (2010). The association of African ancestry and elevated creatinine in the Coronary Artery Risk Development in Young Adults (CARDIA) study. American journal of nephrology, 31(3), 202-208.

200. Peterson, J., Atwood, J. R., & Yates, B. (2002). Key elements for church-based health promotion programs: outcome-based literature review. Public Health Nursing, 19(6), 401-411.

201. Pinckard, K., Baskin, K. K., & Stanford, K. I. (2019). Effects of exercise to improve cardiovascular health. Frontiers in cardiovascular medicine, 69. Salvo, G., Lashewicz, B. M., Doyle-Baker, P. K., & McCormack, G. R. (2018). Neighbourhood built environment influences on physical activity among adults: A systematised review of qualitative evidence. International journal of environmental research and public health, 15(5), 897.

202. Pires, I. M., Marques, G., Garcia, N. M., Flórez-Revuelta, F., Ponciano, V., & Oniani, S. (2020). A research on the classification and applicability of the mobile health applications. Journal of personalised medicine, 10(1), 11.

203. Lee, M, S. (2005). Physical activity among minority popluations: practitioners should know- A commentary. Health Promotion Practice, 6(4), 447-452.

204. Prather, C., Fuller, T. R., Jeffries IV, W. L., Marshall, K. J., Howell, A. V., Belyue-Umole, A., & King, W. (2018). Racism, African American women, and their sexual and reproductive health: a review of historical and contemporary evidence and implications for health equity. Health equity, 2(1), 249-259.

205. Prochaska, J. O., & Marcus, B. H. (1994). The transtheoretical model: Applications to exercise.

206. Prochaska, J. O., & Velicer, W. F. (1997). The transtheoretical model of health behavior change. American journal of health promotion, 12(1), 38-48. Quinn, T. D., Pettee Gabriel, K., Siddique, J., Aaby, D., Whitaker, K. M., Lane-Cordova, A., ... & Barone Gibbs, B. (2020). Sedentary time and physical activity across occupational classifications. American Journal of Health Promotion, 34(3), 247-256.

207. Puga, A. M., Lopez-Oliva, S., Trives, C., Partearroyo, T., & Varela-Moreiras, G. (2019). Effects of drugs and excipients on hydration status. Nutrients, 11(3), 669.

208. Rajaraman, D., Correa, N., Punthakee, Z., Lear, S. A., Jayachitra, K. G., Vaz, M., & Swaminathan, S. (2015). Perceived benefits, facilitators, disadvantages, and barriers for physical activity amongst South Asian adolescents in India and Canada. Journal of physical activity and health, 12(7), 931-941.

209. Rebar, A. L., Stanton, R., Geard, D., Short, C., Duncan, M. J., & Vandelanotte, C. (2015). A meta-meta-analysis of the effect of physical activity on depression and anxiety in non-clinical adult populations. Health Psychology Review, 9(3), 366-378. https://doi.org/10.1080/17437199.2015.1022901

210. Reifenstein, K. (2018). A Commentary: Will We Ever Get Enough? Strategies to Enhance Minority Participation in Research. ABNF Journal, 29(1).

211. Ricci, F., Izzicupo, P., Moscucci, F., Sciomer, S., Maffei, S., Di Baldassarre, A., ... & Gallina, S. (2020). Recommendations for physical inactivity and sedentary behavior during the coronavirus disease (COVID-19) pandemic. Frontiers in public health, 8, 199.

212. Rodgers, W. M., Courneya, K. S., & Bayduza, A. L. (2001). Examination of the transtheoretical model and exercise in 3 populations. American Journal of Health Behavior, 25(1), 33-41.

213. Rogers, R. G., & Saint Onge, J. M. (2005). Race/ethnic and sex differentials in pulse pressure among us adults. Ethnicity & disease, 15(4), 601.

214. Roller, M. (2012). Motivators and barriers to exercise adherence. Nursing & Residential Care, 14(9), 482-485.

215. Rossow, L., Fahs, C. A., Guerra, M., Jae, S. Y., Heffernan, K. S., & Fernhall, B. (2010). Acute effects of supramaximal exercise on carotid artery compliance and pulse pressure in young men and women. European journal of applied physiology, 110, 729-737.

216. Ruegsegger, G. N., & Booth, F. W. (2018). Health benefits of exercise. Cold Spring Harbor perspectives in medicine, 8(7), a029694.

217. Runacres, A., Mackintosh, K. A., Knight, R. L., Sheeran, L., Thatcher, R., Shelley, J., & McNarry, M. A. (2021). Impact of the COVID-19 pandemic on sedentary time and behaviour in children and adults: a systematic review and meta-analysis. International journal of environmental research and public health, 18(21), 11286.

218. Sacre, J. W., Jennings, G. L., & Kingwell, B. A. (2014). Exercise and dietary influences on arterial stiffness in cardiometabolic disease. Hypertension, 63(5), 888-893.

219. Sallis, J., Bauman, A., & Pratt, M. (1998). Environmental and policy interventions to promote physical activity. American journal of preventive medicine, 15(4), 379-397.

220. Santos, A. C., Willumsen, J., Meheus, F., Ilbawi, A., & Bull, F. C. (2023). The cost of inaction on physical inactivity to public healthcare systems: a population-attributable fraction analysis. The Lancet Global Health, 11(1), e32-e39.

221. Schoenthaler, A. M., Lancaster, K. J., Chaplin, W., Butler, M., Forsyth, J., & Ogedegbe, G. (2018). Cluster randomised clinical trial of FAITH (FAITH-based approaches in the treatment of hypertension) in blacks: main trial results. Circulation: Cardiovascular Quality and Outcomes, 11(10), e004691.

222. Schuch, F. B., Bulzing, R. A., Meyer, J., Vancampfort, D., Firth, J., Stubbs, B., ... & Smith, L. (2020). Associations of moderate to vigorous physical activity and sedentary behavior with depressive and anxiety symptoms in self-isolating people during the COVID-19 pandemic: A cross-sectional survey in Brazil. Psychiatry Research, 292, 113339.

223. Schultz, M. G., La Gerche, A., & Sharman, J. E. (2017). Blood pressure response to exercise and cardiovascular disease. Current hypertension reports, 19, 1-7.

224. Schutte, A. E., Jafar, T. H., Poulter, N. R., Damasceno, A., Khan, N. A., Nilsson, P. M., ... & Tomaszewski, M. (2023). Addressing global disparities in blood pressure control: perspectives of the International Society of Hypertension. Cardiovascular research, 119(2), 381-409.

225. Sebastian, S. A., Avanthika, C., Jhaveri, S., Carrera, K. G., Camacho L, G. P., & Balasubramanian, R. (2022). The Risk of Cardiovascular Disease Among Immigrants in Canada. Cureus, 14(2), e22300. https://doi.org/10.7759/cureus.22300

226. Segan, R., Walia, L., & Mittal, N. (2022). Rate Pressure Product in Diabetic Cardiac Autonomic Neuropathy at Rest and Under Stress. Group, 100(15), 91-6.

227. Sharara, E., Akik, C., Ghattas, H., & Makhlouf Obermeyer, C. (2018). Physical inactivity, gender and culture in Arab countries: a systematic assessment of the literature. BMC public health, 18(1), 1-19.

228. Sharman, J. E., Smart, N. A., Coombes, J. S., & Stowasser, M. (2019). Exercise and sport science australia position stand update on exercise and hypertension. Journal of human hypertension, 33(12), 837-843.

229. Shephard, R. J., & Balady, G. J. (1999). Exercise as cardiovascular therapy. Circulation, 99(7), 963-972.

230. Shuval, K., Weissblueth, E., Amira, A., Brezis, M., Faridi, Z., Ali, A., & Katz, D. L. (2008). Peer Reviewed: The role of culture, environment, and religion in the promotion of physical activity among Arab Israelis. Preventing chronic disease, 5(3).

231. Sikiru, L., & Okoye, G. C. (2013). Effect of interval training programme on pulse pressure in the management of hypertension: a randomised controlled trial. African health sciences, 13(3), 571-578.

232. Silva, A. L. D., de Oliveira, S. N., Vieira, B. A., Leite, C., Martins, D. M., Moro, A. R., ... & Delevatti, R. S. (2021). Acute effect of bodyweight-based strength training on blood pressure of hypertensive older adults: A randomised crossover clinical trial. Clinical and experimental hypertension, 43(3), 223-229.

233. Smith, L., López Sánchez, G. F., Díaz Suárez, A., Stubbs, B., Dowling, M., Scruton, A., ... & Pardhan, S. (2018). Barriers and facilitators of physical activity in children of a South Asian ethnicity. Sustainability, 10(3), 761.

234. Smith, M., Hosking, J., Woodward, A., Witten, K., MacMillan, A., Field, A., ... & Mackie, H. (2017). Systematic literature review of built environment effects on physical activity and active transport–an update and new findings on health equity. International journal of behavioral nutrition and physical activity, 14(1), 1-27.

235. Sosa, M. V., Chin, E., & Sethares, K. A. (2023). Perspectives Regarding Engagement in Physical Activity in Women: Traditional Gender Role–Based Themes. Journal of Cardiovascular Nursing, 10-1097.

236. Spence, J. C., & Lee, R. E. (2003). Toward a comprehensive model of physical activity. Psychology of sport and exercise, 4(1), 7-24.

237. Spencer, L., Adams, T. B., Malone, S., Roy, L., & Yost, E. (2006). Applying the transtheoretical model to exercise: a systematic and comprehensive review of the literature. Health promotion practice, 7(4), 428-443.

238. Stankov, I., Olds, T., & Cargo, M. (2012). Overweight and obese adolescents: what turns them off physical activity?. International journal of behavioral nutrition and physical activity, 9(1), 1-15.

239. Statistics Canada. (2021). Canadian Health Measures Survey, Cycle 6 [2018 and 2019], custom tabulation. Retrieved from https://www150.statcan.gc.ca/n1/en/catalogue/82-003-X201900800001

240. Stavridou, A., Kapsali, E., Panagouli, E., Thirios, A., Polychronis, K., Bacopoulou, F., ... & Tsitsika, A. (2021). Obesity in children and adolescents during COVID-19 pandemic. Children, 8(2), 135.

241. Stockwell, S., Trott, M., Tully, M., Shin, J., Barnett, Y., Butler, L., ... & Smith, L. (2021). Changes in physical activity and sedentary behaviours from before to during the COVID-19 pandemic lockdown: a systematic review. BMJ open sport & exercise medicine, 7(1), e000960.

242. Stoschitzky, K. (2022). Blood pressure, heart rate, or the Rate Pressure Product: what is the best predictor of clinical outcome?. European Heart Journal Open, 2(5), oeac063.

243. Such, E., Salway, S., Copeland, R., Haake, S., Domone, S., & Mann, S. (2017). A formative review of physical activity interventions for minority ethnic populations in England. Journal of Public Health, 39(4), e265-e274.

244. Sugawara, J., Komine, H., Miyazawa, T., Imai, T., & Ogoh, S. (2015). Influence of single bout of aerobic exercise on aortic pulse pressure. European journal of applied physiology, 115, 739-746.

245. Taylor, J. L., Holland, D. J., Spathis, J. G., Beetham, K. S., Wisløff, U., Keating, S. E., & Coombes, J. S. (2019). Guidelines for the delivery and monitoring of high

intensity interval training in clinical populations. Progress in cardiovascular diseases, 62(2), 140-146.

246. Taylor, D., & Richards, D. (2019). Triple jeopardy: Complexities of racism, sexism, and ageism on the experiences of mental health stigma among young Canadian Black Women of Caribbean descent. Frontiers in Sociology, 4, 43.

247. Taylor, R. J., Thornton, M. C., & Chatters, L. M. (1987). Black Americans' perceptions of the sociohistorical role of the church. Journal of Black Studies, 18(2), 123-138.

248. Tian, D., & Meng, J. (2019). Exercise for prevention and relief of cardiovascular disease: prognoses, mechanisms, and approaches. Oxidative Medicine and Cellular Longevity, 2019.

249. Tomlinson, S. (2018). Church-based Health Promotion in Jamaica for the Ageing Population. West Indian Medical Journal, 67(5). 10.7727/wimj.2018.180

250. Tomlinson, S. (2017). The Usefulness of the Rate Pressure Product (RPP) for Cardiac Rehabilitation Exercise Prescription. Internal Medicine Research Open Journal, 2017 2(1): 1–3. 0.31038/IMROJ.2017212.

251. Tremblay, M. S., Bryan, S.N., Pérez, C.E., Ardern, C. I., & Katzmarzyk, P.T. (2006). Physical activity and immigrant status. Revue Canadienne De Santé Publique; 97(4).

252. Valtonen, R. I., Hintsala, H. H., Kiviniemi, A., Kenttä, T., Crandall, C., van Marken Lichtenbelt, W., ... & Ikäheimo, T. M. (2022). Cardiovascular responses to dynamic and static upper-body exercise in a cold environment in coronary artery disease patients. European Journal of Applied Physiology, 1-10.

253. Van Domelen, D. R., Koster, A., Caserotti, P., Brychta, R. J., Chen, K. Y., McClain, J. J., ... & Harris, T. B. (2011). Employment and physical activity in the US American Journal of preventive medicine, 41(2), 136-145.

254. Viola, P. D. D., Torres, J., & Cardoso, L. (2021). Determinants of urban cycling from the perspective of Bronfenbrenner's ecological model. Revista Produção e desenvolvimento, 7.

255. Vuong, I., Wright, J., Nolan, M. B., Eggen, A., Bailey, E., Strickland, R., ... & Downs, T. (2020). Overcoming barriers: Evidence-based strategies to increase enrollment of underrepresented populations in cancer therapeutic clinical trials—A narrative review. Journal of Cancer Education, 35, 841-849.

256. Walker, A., Hing, W., & Lorimer, A. (2020). The influence, barriers to and facilitators of anterior cruciate ligament rehabilitation adherence and participation: a scoping review. Sports medicine-open, 6, 1-22.

257. Wallen, M. P., Hennessy, D., Brown, S., Evans, L., Rawstorn, J. C., Wong Shee, A., & Hall, A. (2020). High-intensity interval training improves cardiorespiratory fitness in cancer patients and survivors: A meta-analysis. European Journal of cancer care, 29(4), e13267. Available at: https://doi.org/10.1111/ecc.13267

258. Wang, M., Menon, R., Mishra, S., Patel, A. P., Chaffin, M., Tanneeru, D., ... & Khera, A. V. (2020). Validation of a genome-wide polygenic score for coronary artery disease in South Asians. Journal of the American College of Cardiology, 76(6), 703-714.

259. Warburton, D. E. R., Nicol, C. W., & Bredin, S. S. D. (2017). Health benefits of physical activity: The evidence. CMAJ: Canadian Medical Association Journal, 174(6), 801-809. https://doi.org/10.1503/cmaj.051351

260. Warner, L. M., Ziegelmann, J. P., Schüz, B., Wurm, S., & Schwarzer, R. (2011). Synergistic effect of social support and self-efficacy on physical exercise in older adults. Journal of ageing and physical activity, 19(3), 249-261.

261. Way, K. L., Sultana, R. N., Sabag, A., Baker, M. K., & Johnson, N. A. (2019). The effect of high Intensity interval training versus moderate intensity continuous training on arterial stiffness and 24 h blood pressure responses: A systematic review and meta-analysis. *Journal of science and medicine in sport*, *22*(4), 385-391.

262. Weir, C. B., & Jan, A. (2019). BMI classification percentile and cut off points. In Statpearls Publishing.

263. Whelton, S. P., Chin, A., Xin, X., & He, J. (2002). Effect of aerobic exercise on blood pressure: a meta-analysis of randomised, controlled trials. Annals of internal medicine, 136(7), 493-503.

264. White W. B. (1999). Heart rate and the rate-pressure product as determinants of cardiovascular risk in patients with hypertension. American journal of hypertension, 12(2 Pt 2), 50S–55S. https://doi.org/10.1016/s0895-7061(98)00280-5

265. Williams, D. R., & Wyatt, R. (2015). Racial bias in health care and health: challenges and opportunities. Jama, 314(6), 555-556.

266. Williams, E. D., Stamatakis, E., Chandola, T., & Hamer, M. (2011). Assessment of physical activity levels in South Asians in the UK: findings from the Health Survey for England. Journal of Epidemiology & Community Health, 65(6), 517-521.

267. Williams, W. M., Alleyne, R., & Henley, A. T. (2017). The root of physical inactivity among African-American women: Identifying exercise friendly hairstyles. Journal of National Black Nurses' Association, 28(2), 26-31. https://pubmed.ncbi.nlm.nih.gov/30282138/

268. Williamson, J. W. (2015). Autonomic responses to exercise: where is central command?. Autonomic Neuroscience, 188, 3-4.

269. Wilmore, J. H., & Knuttgen, H. G. (2003). Aerobic exercise and endurance: improving fitness for health benefits. The Physician and sportsmedicine, 31(5), 45-51.

270. Wilson, M. G., Ellison, G. M., & Cable, N. T. (2015). Republished: Basic science behind the cardiovascular benefits of exercise. Postgraduate Medical Journal, 91(1082), 704-711.

271. Wilson, S. M., Heaney, C. D., Cooper, J., & Wilson, O. (2008). Built environment issues in unserved and underserved African-American neighborhoods in North Carolina. Environmental Justice, 1(2), 63-72.

272. Winzer, E. B., Woitek, F., & Linke, A. (2018). Physical activity in the prevention and treatment of coronary artery disease. Journal of the American Heart Association, 7(4), e007725.

273. Woodruff, S. J., Coyne, P., & St-Pierre, E. (2021). Stress, physical activity, and screen-related sedentary behaviour within the first month of the COVID-19 pandemic. Applied Psychology: Health and Well-Being, 13(2), 454-468.

274. World Health Organization (2019). Global Action Plan on Physical Activity 2018–2030: More Active People for a Healthier World. https://apps.who.int/iris/handle/10665/272722.

275. World Health Organization. (2020). WHO guidelines on physical activity and sedentary behaviour.

276. World Health Organization. (2021). Physical activity fact sheet (No. WHO/HEP/HPR/RUN/2021.2). World Health Organization.

277. World Health Organization. Global status report on physical activity 2022. 2022. Accessed 31 January 2023. www.who.int/publications/i/item/97892400

278. Yanek, L. R., Becker, D. M., Moy, T. F., Gittelsohn, J., & Koffman, D. M. (2016). Project Joy: faith-based cardiovascular health promotion for African American women. Public health reports.

279. Yen, H. Y., & Li, C. (2019). Determinants of physical activity: A path model based on an ecological model of active living. PloS one, 14(7), e0220314.

280. Young, D. R., & Stewart, K. J. (2006). A church-based physical activity intervention for African American women. Family and Community Health, 103-117. DOI: 10.1097/00003727-200604000-00006

281. Zenk, S. N., Schulz, A. J., Matthews, S. A., Odoms-Young, A., Wilbur, J., Wegrzyn, L., ... & Stokes, C. (2011). Activity space environment and dietary and physical activity behaviors: a pilot study. Health & place, 17(5), 1150-1161.

282. Zhao, D. (2021). Epidemiological features of cardiovascular disease in Asia. JACC: Asia, 1(1), 1-13.

283. Zilbermint, M., Hannah-Shmouni, F., & Stratakis, C. A. (2019). Genetics of hypertension in African Americans and others of African descent. International journal of molecular sciences, 20(5), 1081.

Appendix 1: Blood Pressure Profiles

Blood Pressure – Blood pressure measurement refers to the force of blood pushing against the artery's walls when the heart beats and contracts.

Blood Pressure Category	Systolic mm Hg		Diastolic mm Hg
Normal	Less than 120	and	Less than 80
Prehypertension	120 - 139	or	80 - 90
High Blood Pressure (Hypertension) Stage 1	140 - 159	or	90 - 99
High Blood Pressure (Hypertension) Stage 2	160 or higher	or	100 or higher
Hypertensive Crisis (Emergency care needed)	Higher than 180	or	Higher than 100

Heart Rate (HR) – HR is the number of times the heart beats per minute (bpm), measuring the heart's ability to pump blood through the circulatory system.

	Resting Heart Range (male)		Resting Heart Range (female)	
Age in yrs**.**	Average Range (bpm)	Total Range (bpm)	Average Range (bpm)	Total Range (bpm)
Under 1	118 - 137	104 - 158	115 - 137	102 - 155
1	110 - 125	95 - 139	107 - 122	95 - 137
2-3	98 - 114	88 - 125	96 - 112	85 - 124
4-5	87 - 104	76 - 117	84 - 100	74 - 112
6-8	79 - 94	69 - 106	76 - 92	66 - 105
9-11	76 - 91	66 - 103	70 - 86	66- 97
12-15	70 - 87	60 - 99	70 - 87	60 - 99
16-19	69 - 85	58 - 99	66 - 83	57 - 97
20-39	66 - 82	57 - 95	61 - 78	52 - 92
40-59	64 - 79	56 - 92	61 - 77	52 - 89
60-79	64 - 78	56 - 92	60 - 75	50 - 91
80 or over	64 - 77	56 - 93	61 - 78	51 - 94

* Resting heart rate data is based on the Center for Disease Control and Prevention, National Health Statistics Reports, no. 41, 2011.

Mean Arterial Pressure (MAP) - MAP is calculated as the average pressure in a person's arteries during one cardiac cycle. To maintain adequate tissue perfusion, the normal MAP in healthy individuals should be between 70 and 100 mmHg and not fall below 60 mmHg. The standard chart for MAP readings is as follows:

Mean Arterial Pressure Category	Range (mmHg)
High Level	100 mmHg
Normal Level	70 - 100 mmHg
Low Level	60 - 70 mmHg
Very Low Level	≥40 mmHg

Adapted from https://www.icliniq.com/tool/blood-pressure-and-mean-arterial-pressure-calculator

Rate Pressure Product (RPP) - RPP is the product of the heart rate and the systolic blood pressure values and is used as an indirect measure of myocardial oxygen demand. Normal rate pressure product (RPP) should not exceed 10,000. The Table below shows the ranges for the RPP index.

Hemodynamic Response	Rate Pressure Product
High	>30,000
High Intermediate	25,000 - 29,999
Intermediate	20,000 -24,999
Low Intermediate	15,000-19,999
Low	≤14,999

Adapted from https://www.omnicalculator.com/health/rate-pressure-product

Pulse Pressure (PP) - PP is the numeric difference between your systolic and diastolic blood pressure measured in millimetres of mercury (mmHg). It represents the force that the heart generates each time it contracts. A normal PP range is between 40 and 60 mm Hg. PP reading is considered low when it is less than 40 mm Hg. A PP reading is considered high when it is more than 60 mm Hg.

Pulse Pressure Category	mmHg
Normal	40 - 60 mmHg
High	> 60 mmHg
Low	< 40 mmHg

Adapted from https://www.healthline.com/health/pulse-pressure#low-vs-normal-vs-high

Appendix 2: Body Composition Profile

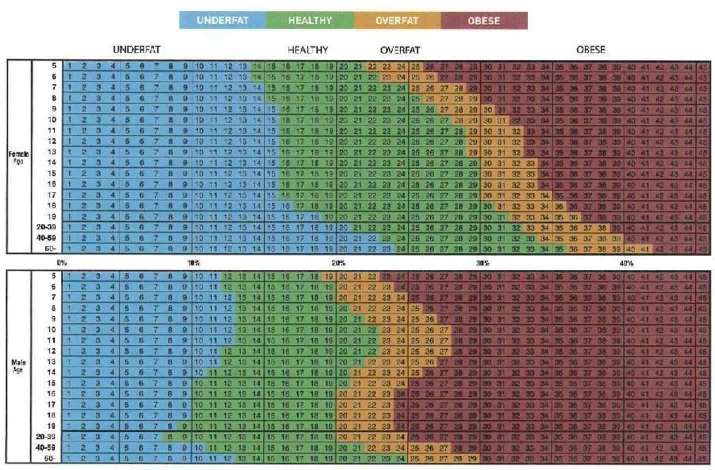
TANITA® Monitoring Your Health

Eat healthy, exercise regularly and monitor your body composition

Initial Measurements:	Weight / % Body Fat
Initial Date:	

Target Measurements:	Weight / % Body Fat
Target Date:	

How much body fat is healthy?



Body Fat Ranges for Standard Children [1] [1] Susan Jebb et al. Obesity Research[o2] 2004;12:A156-157 "New Body Fat Reference Curves for children"

Body Fat Ranges for Standard Adults [2] [2] Gallagher D et al. Am J Clin Nutr 2000,72:694-701. "Healthy percentage body fat ranges:an approach for developing guidelines based on body mass index."

Women: Average of Estimated Bone Mass			
Weight	< 110 lb (50 kg)	110 lb - 165 lb (50 kg - 75 kg)	> 165 lb (75 kg)
Bone Mass	4.3 lb (1.95 kg)	5.3 lb (2.40 kg)	6.5 lb (2.95 kg)

Men: Average of Estimated Bone Mass			
Weight	< 143 lb (65 kg)	143 lb - 209 lb (65 kg - 95 kg)	> 209 lb (95 kg)
Bone Mass	5.9 lb (2.66 kg)	7.3 lb (3.29 kg)	8.1 lb (3.69 kg)

Source: Tanita Body Weight Institute

Visceral Fat Rating	
Healthy Level	1 - 12
Excess Level	13 - 59

Source: Columbia University (New York)
Tanita Institute (Tokyo)

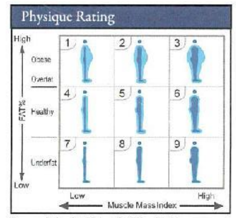
Body Mass Index	WHO Classification
<18.5	Underweight
18.5 - 24.9	Healthy Weight
25.0 - 29.9	Overweight
30+	Obese

Source: Report of a WHO Consultation on Obesity Geneva, 3-5 June 1997
Adapted from WHO, 1995, WHO, 2000 and WHO 2004

Body Water Ranges*	
Female	45 - 60 %
Male	50 - 65 %

*Based on Tanita's current research

Physique Rating



Source: Columbia University (New York)
Tanita Institute (Tokyo)

anita Corporation of America, 2625 S. Clearbrook Drive, Arlington Heights, IL 60005
47-640-9241 • Fax 847-640-9261 • E-mail: 4health@tanita.com • www.tanita.com

To learn how to monitor your body composition at home, call Tanita at 847-640-9241

Appendix 3: Strength Training Workout

Exercise	Repetitions	Sets
Chair Squats	8 – 20	3 - 4
Bicep curls w/dumbbells	8 - 20	3 - 4
Tricep kickback w/dumb bells	8 - 20	3 - 4
Hamstring curl w/TheraBand	8 - 20	3 - 4
Shoulder press w/dumbbells	8 - 20	3 - 4
Lateral shoulder raise w/dumbbells	8 - 20	3 - 4
Chest press w/TheraBand	8 - 20	3 - 4
Marching in place/w punches between sets	15 – 30 sec	

Appendix 4: Consent Form & Information Sheet

CONSENT TO PARTICIPATE IN RESEARCH

This is to state that I________________________________ agree to participate in a research program conducted by Sherldine Tomlinson of Rexdale Women's Centre. The research will contribute to a thesis project.

A. PURPOSE

I have been informed that the research aims to understand how exercise training affects blood pressure and other cardiovascular indicators.

B. PROCEDURES

I have read all the procedures for the study that were provided on the information sheet.

C. RISKS AND BENEFITS

There is the possibility of specific adverse changes if I decide to exercise. These include muscle soreness, physical exertion, abnormal blood pressure, fainting, irregular, fast or slow heart rhythm and in rare instances, heart attack, stroke, or cardiac death. However, suppose I do decide to begin exercising. In that case, benefits could include lower blood pressure, reduced total body fat, reduced insulin needs, improved glucose tolerance, increased physical function, enhanced work performance, enhanced well-being, and decreased anxiety and depression.

D. CONDITIONS OF PARTICIPATION

- I understand that I am free to withdraw my consent and discontinue my participation at anytime without negative consequences.
- I understand that my participation in this study is confidential.
- I understand that the data from this study may or may not be published.

I HAVE CAREFULLY STUDIED THE ABOVE AND UNDERSTAND THIS AGREEMENT. I FREELY CONSENT AND VOLUNTARILY AGREE TO PARTICIPATE IN THIS STUDY.

________________________________ ____________________

Participant signature Date

________________________________ ____________________

Researcher Signature Date

INFORMATION SHEET

Invitation paragraph

You are being invited to take part in a research project. Before you decide, it is important to understand why the research is done and what is involved. Please take time to read the following information carefully and discuss it with others if you wish. If anything is not clear or you would like more information, ask the principal investigator (Sherldine Tomlinson). Take time to decide whether you wish or not to take part in the study.

What is the project's purpose?

The principal investigator wants to understand how exercise training affects blood pressure.

Do I have to take part?

It is up to you to decide whether or not to take part. If you choose to participate, you will be given this information sheet to keep (and be asked to sign a consent form). You can still withdraw at any time without it affecting any benefits that you are entitled to in any way. Please note that you do not have to give a reason to withdraw from the study.

What will happen to me if I take part?

During the project, you will be asked to complete a participant assessment form, a physical activity questionnaire, the Physical Activity Readiness Questionnaire (PARQ) and a fitness assessment before participating. After you fill out these forms and do the fitness assessment, you will begin exercising. Exercise is done two or three times a week and consists of 45 minutes of low impact aerobics.

What are the possible disadvantages and risks of taking part in exercise?

There is the possibility of specific adverse changes if you decide to exercise. These include muscle soreness, physical exertion, abnormal blood pressure, fainting, irregular, fast or slow heart rhythm and in rare instances, heart attack, stroke, or cardiac death. Please note that exercise only provokes cardiovascular events in people with pre-existing heart disease, whether diagnosed or occult. Exercise training does not cause cardiac events in people with typical cardiovascular systems.

Please be aware that when you are exercising and experiencing any discomfort, stop immediately and seek medical attention. You should seek immediate medical attention if you feel severe pain after exercising.

What are the possible benefits of taking part?

There are no immediate benefits for those people participating in the project. However, suppose you decide to participate in Fitness for Life; some exercise benefits could include lowered blood pressure, reduced total body fat, reduced insulin needs, improved glucose tolerance, improved mental health, increased physical function and decreased anxiety and depression.

What happens if the research study stops earlier than expected?

If the study ends early, the principal investigator (Sherldine Tomlinson) will thoroughly explain each participant's reasons.

Will my taking part in this project be kept confidential?

All the information the principal investigator collects about participants during the research will be strictly kept confidential. You will not be able to be identified in any reports or publications.

Who has ethically reviewed the project?

The Director of Programming has approved this study at the Rexdale Women's Centre.

Thank you for taking the time to take part in this study.

If you require further information or questions, please contact Sherldine Tomlinson at 416 745-0062 ex 310 or by email at stomlinson@rexdalewomen.org.

Appendix 5: Physical Activity Readiness Questionnaire (PARQ)

Questionnaire - PAR-Q

Physical Activity Readiness

(revised 2002)

PAR-Q & YOU

(A Questionnaire for People Aged 15 to 69)

Regular physical activity is fun and healthy, and increasingly more people are starting to become more active every day. Being more active is very safe for most people. However, some people should check with their doctor before they start becoming much more physically active.

If you are planning to become much more physically active than you are now, start by answering the seven questions in the box below. If you are between the ages of 15 and 69, the PAR-Q will tell you if you should check with your doctor before you start. If you are over 69 years of age, and you are not used to being very active, check with your doctor.

Common sense is your best guide when you answer these questions. Please read the questions carefully and answer each one honestly: check YES or NO.

YES	NO	
☐	☐	**1. Has your doctor ever said that you have a heart condition and that you should only do physical activity recommended by a doctor?**
☐	☐	**2. Do you feel pain in your chest when you do physical activity?**
☐	☐	**3. In the past month, have you had chest pain when you were not doing physical activity?**
☐	☐	**4. Do you lose your balance because of dizziness or do you ever lose consciousness?**
☐	☐	**5. Do you have a bone or joint problem (for example, back, knee or hip) that could be made worse by a change in your physical activity?**
☐	☐	**6. Is your doctor currently prescribing drugs (for example, water pills) for your blood pressure or heart condition?**
☐	☐	**7. Do you know of any other reason why you should not do physical activity?**

If you answered

YES to one or more questions

Talk with your doctor by phone or in person BEFORE you start becoming much more physically active or BEFORE you have a fitness appraisal. Tell your doctor about the PAR-Q and which questions you answered YES.

- You may be able to do any activity you want — as long as you start slowly and build up gradually. Or, you may need to restrict your activities to those which are safe for you. Talk with your doctor about the kinds of activities you wish to participate in and follow his/her advice.
- Find out which community programs are safe and helpful for you.

NO to all questions

If you answered NO honestly to all PAR-Q questions, you can be reasonably sure that you can:

- start becoming much more physically active – begin slowly and build up gradually. This is the safest and easiest way to go.
- take part in a fitness appraisal – this is an excellent way to determine your basic fitness so that you can plan the best way for you to live actively. It is also highly recommended that you have your blood pressure evaluated. If your reading is over 144/94, talk with your doctor before you start becoming much more physically active.

→ **DELAY BECOMING MUCH MORE ACTIVE:**

- if you are not feeling well because of a temporary illness such as a cold or a fever – wait until you feel better; or
- if you are or may be pregnant – talk to your doctor before you start becoming more active.

PLEASE NOTE: If your health changes so that you then answer YES to any of the above questions, tell your fitness or health professional. Ask whether you should change your physical activity plan.

CSEP SCPE

Appendix 6: Physical Activity Questionnaire

Physical Activity Questionnaire

Ontario

Name: ____

Adresss: ____

Phone:____

DOB:____

Date: ____

1. Check Yes or No. Do you have a physical limitation? (If you answered YES, check all your physical limitation)

Yes ☐ No ☐

☐1 I have trouble walking
☐2 I have trouble walking for a long time
☐3 I don't see too well
☐4 I have trouble hearing
☐5 I have back pain
☐6 I have knee pain
☐7 I have ankle pain
☐8 I have joint pain
☐9 I have trouble stretching
☐10 I have muscle pain
☐11 Other physical limitation you have ______________________

2. Check Yes or No. Do you have any of the following? (If you answered YES, check all that you have)

☐ ☐

1

Yes No

☐1 I get pain in my chest, neck, jaw or arms

☐2 Sometimes I get dizziness

☐3 Sometimes my ankle swells

☐4 Sometimes my heart beats fast

☐5 Sometimes I get very tired

☐6 Sometimes I get shortness of breath

☐7 Name other health problem ____

3. Check Yes or No. Do you have health condition like diabetes, heart problem, high blood pressure or other health conditions?

Yes ☐ No ☐

If you answered YES, what is your health condition? ________________________

4. Check Yes or No. Do you take medication?

Yes ☐ No ☐

List all the medications you are currently taking as well as the milligram (mg):

____

____

____

____

____

5. Please tell us why you do not exercise? (Check all that apply to you).

☐1 Exercising is too tiring

☐2 I have to take care of my family

☐3 I don't have the time

☐4 I have to go to work

☐5 Exercise is boring

☐6 Exercise is too painful

☐7 I have no motivation to exercise

☐8 I have personal problems and don't want to exercise

☐9 I don't like to exercise

☐10 I have no transportation to go to a gym

☐11 Name another reason no exercise ________________________________

6. Do you know the benefits of exercise?

Yes ☐ No ☐

7. If you answered NO to question 6 would you like to learn more about the benefits of exercise?

Yes ☐ No ☐

8. Do you know about Canada's Physical Activity Guide?

Yes ☐ No ☐

Thank you for your time and co-operation.

Appendix 7: Infographic

AN INVESTIGATION INTO THE HEALTH OUTCOMES OF CANADIAN ETHNIC MINORITIES FOLLOWING A 17-WEEK COMMUNITY-BASED EXERCISE PROGRAMME

PART A - OVERVIEW

Fitness for Life (FFL) was a physical literacy programme that promoted exercise and recreational sports participation among ethnic minorities. Two studies were conducted to evaluate the programme's efficacy.

STUDY 1 — PART B — STUDY 2

Study 1: The effect of exercise response on cardiovascular health outcomes among ethnic groups participating in a community-based intervention

Study 2: The differences in cardiovascular response to 10 exercise sessions between African Canadian and South Asian cardiac patients

PART C - PARTICIPANTS

Study 1: African Canadians, South Asians, Middle Eastern, Europeans, Asians

Study 2: African Canadians and South Asians

PART D - OBJECTIVES

Study 1:

- To investigate, compare, and evaluate variations in cardiovascular indicators across the five ethnic groups.
- To assess the health status of participants, including health conditions, pain issues, medication usage, barriers to exercise, symptoms, and exercise safety.

Study 2:

- Evaluate the results of the 10 acute sessions of low-impact dance aerobics on RPP.
- Analyze the health improvements in RPP and other blood pressure components among African Canadians and South Asians.

PART E - CULTURAL COMPONENTS

Study 1:

- Dance aerobic exercise
- Religious considerations (e.g. separate classes for men and women
- Designing multicultural promotional materials in 10 different languages
- Providing health education workshops
- Interpreters, if needed

Study 2:

- Dance aerobic exercise
- Religious considerations (e.g., separate classes for men and women.
- Interpreters, if needed

PART F - PRE/POST MEASUREMENTS

Study 1: Systolic blood pressure, diastolic blood pressure, heart rate, mean arterial pressure, rate pressure product, and pulse pressure. Body composition: body weight, BMI, fat and water %. Two questionnaires: PAR-Q and Physical Activity Questionnaire.

Study 2: Systolic blood pressure, diastolic blood pressure, heart rate, mean arterial pressure, rate pressure product, and pulse pressure. Physical Activity Questionnaire.

PART G - EXERCISE PROTOCOL

Study 1: 17 week low to moderate dance aerobics 2x per week and strength training 1x per week.

Study 2: 10 sessions (acute exercise) low to moderate dance aerobic sessions 2x per week.

PART- H CONCLUSION

Study 1:

- FFL demonstrated that a tailored community-based exercise can significantly improve cardiovascular function and body composition across different ethnicities.
- It also uncovered variations in questionnaire responses, highlighting the need for interventions that cater to the unique characteristics and needs of diverse ethnic populations, particularly in managing blood pressure and weight.

Study 2:

- Differences were observed in the responses of African Canadians and South Asians to the effect of blood pressure (BP) following acute exercise.
- The differences have clinical significance, highlighting the importance of recognising the variances in BP and RPP responses to exercise across different ethnicities.
- This understanding allows identifying groups predisposed to an increased risk of severe heart conditions.
- Tailored exercise interventions can then be formulated to cater to these groups' needs, thereby contributing to the overall reduction of the cardiovascular disease burden.