PREDICTING PHYSICAL ACTIVITY BEHAVIOURS AMONG CHINESE UNIVERSITY STUDENTS: AN APPLICATION OF EXPANDED HEALTH ACTION PROCESS APPROACH

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by

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LIST OF ABBREVIATIONS

ACP	Action and Coping Planning
ACPS-PE	Action and Coping Planning Scale–Physical Exercise
ANOVA	Analysis of variance
AP	Action planning
AP-PE	Action Planning Scale–Physical Exercise
ASE	Action Self-efficacy
ASES-PE	Action Self-Efficacy Scale–Physical Exercise
BMI	Body Mass Index
CAD	Coronary Artery Disease
CFA	Confirmatory Factor Analysis
СР	Coping Planning
DUI	Driving Under the Influence
EFA	Exploratory Factor Analysis
EHAPA	Expanded Health Action Process Approach
EMU	Electronic media use
ESSS	Exercise Social Support Scale
НАРА	Health Action Process Approach
HBM	Health Belief Model
HIIT	High-intensity Interval Training
HRPS	Health Risk of an Inactive Lifestyle Scale
IPAQ-CSV	International Physical Activity Questionnaire Chinese Short Version
КМО	Kaiser-Meyer-Olkin's
LPA	Light Physical Activity
LSD	Least Significant Difference
METs	Metabolic Equivalent of Task
MG	Mindset Groups
MPA	Moderate Physical Activity
MVPA	Moderate-to-Vigorous Physical Activity
MSE	Maintenance Self-efficacy
MSES-PE	Maintenance Self-Efficacy Scale–Physical Exercise
NOE	Negative Outcome Expectancy

OE	Outcome Expectancy
OES-PE	Outcome Expectancy Scale–Physical Exercise
PA	Physical Activity
PAI	Physical Activity Intention
PASA	Physical Activity Staging Algorithm
PMT	Protection Motivation Theory
POE	Positive Outcome Expectancy
RP	Risk Perception
RSE	Recovery Self-efficacy
RT	Resistance Training
SCT	Social Cognitive Theory
SE	Self-efficacy
SES	School of Educational Studies
SEM	Structural Equation Modelling
SS	Social Support
TPA	Total Physical Activity
TPB	Theory of Planned Behaviour
TTM	Transtheoretical Model
T2DM	Diabetes Mellitus Type 2
USM	University Sains Malaysia
VPA	Vigorous Physical Activity
WHO	World Health Organization

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MERAMAL TINGKAH LAKU AKTIVITI FIZIKAL DALAM KALANGAN PELAJAR UNIVERSITI CHINA: APLIKASI PENDEKATAN PROSES TINDAKAN KESIHATAN YANG DIPERLUASKAN

ABSTRAK

Aktiviti fizikal (PA) yang tidak mencukupi dalam kalangan pelajar universiti China telah menjadi fenomena yang meluas dan merupakan punca utama tahap kecergasan fizikal yang rendah dan pelbagai masalah kesihatan mereka. Untuk mempromosikan PA secara efektif, adalah penting untuk mengenal pasti penentu psikologi dengan tepat dan memahami mekanisme psikologi yang mendasari pembentukan PA. Kajian ini menyelidiki peramal psikologi intrapersonal dan interpersonal tingkah laku PA dalam kalangan pelajar universiti China menggunakan Pendekatan Proses Tindakan Kesihatan yang diperluas (EHAPA). Teknik persampelan kelompok rawak berstrata digunakan untuk mengumpulkan respons tinjauan daripada 1,143 peserta di enam universiti di lima bandar di selatan Jiangsu, China. Reka bentuk kaedah campuran penjelasan berturutan digunakan, bermula dengan tinjauan kuantitatif diikuti dengan wawancara kualitatif untuk menjelaskan penemuan kuantitatif. Untuk penyelidikan kuantitatif, ANOVA dijalankan menggunakan IBM SPSS 26 untuk memeriksa perbezaan skor min dalam konstruk EHAPA merentasi kumpulan tahap PA dan kumpulan mindset yang berbeza. Pemodelan persamaan struktur menggunakan IBM AMOS 26 menilai peramal tingkah laku PA dan kesan pengantaraan perancangan. Analisis kumpulan berbilang memeriksa kesan moderasi jantina, Indeks Jisim Badan (BMI), dan kumpulan mindset pada laluan langsung yang meramalkan tingkah laku PA. Keputusan menunjukkan perbezaan yang signifikan dalam efikasi kendiri penyelenggaraan (MSE), perancangan, sokongan sosial (SS), dan efikasi kendiri pemulihan (RSE) dalam kalangan kumpulan tahap PA yang berbeza. Terdapat perbezaan yang signifikan dalam niat PA (PAI), MSE, RSE, dan tingkah laku PA dalam kalangan kumpulan mindset yang berbeza. Efikasi kendiri tindakan (ASE), jangkaan hasil, persepsi risiko, dan SS secara signifikan meramalkan niat PA. ASE, MSE, dan niat PA secara signifikan meramalkan perancangan. MSE, SS, RSE, dan perancangan secara signifikan meramalkan tingkah laku PA. Perancangan secara signifikan mengantarai hubungan antara PAI, ASE, MSE, dan tingkah laku PA. Jantina secara signifikan memoderasi hubungan antara MSE dan PA, dan RSE dan PA. BMI secara signifikan memoderasi hubungan antara MSE dan PA. Kumpulan mindset secara signifikan memoderasi hubungan antara MSE dan PA, perancangan dan PA, dan RSE dan PA. Wawancara kualitatif dengan 12 peserta memberikan wawasan yang lebih mendalam tentang keputusan kuantitatif. Penemuan ini menawarkan bukti teori dan empiris untuk mempromosikan PA dalam kalangan pelajar universiti China. Kajian ini menyediakan wawasan berharga untuk pembuat dasar dan pendidik dalam membangunkan strategi dan intervensi yang berkesan untuk meningkatkan PA dan memperbaiki kesihatan keseluruhan pelajar.

PREDICTING PHYSICAL ACTIVITY BEHAVIOURS AMONG CHINESE UNIVERSITY STUDENTS: AN APPLICATION OF EXPANDED HEALTH ACTION PROCESS APPROACH

ABSTRACT

Insufficient physical activity (PA) among Chinese university students has become widespread and is a major cause of their low levels of physical fitness and various health problems. Effectively promoting PA requires accurately identifying psychological determinants and understanding the psychological mechanisms underlying PA formation. This study investigates the intrapersonal and interpersonal psychological predictors of PA behaviours among Chinese university students using the expanded Health Action Process Approach (EHAPA). A stratified random cluster sampling technique was employed to collect survey responses from 1,143 participants across six universities in five cities in southern Jiangsu, China. An explanatory sequential mixed methods design was used, beginning with a quantitative survey followed by qualitative interviews to explain the quantitative findings. For the quantitative research, ANOVA was conducted using IBM SPSS 26 to examine mean score differences in EHAPA constructs across different PA level groups and mindset groups. Structural equation modelling using IBM AMOS 26 evaluated predictors of PA behaviour and the mediating effects of planning. Multiple-group analysis examined the moderating effects of gender, Body Mass Index (BMI), and mindset group on the direct pathways predicting PA behaviour. The results show significant differences in maintenance self-efficacy (MSE), planning, social support (SS), and recovery self-efficacy (RSE) among different PA level groups. Significant differences

in PA intention (PAI), MSE, RSE, and PA behaviour were found among different mindset groups. Action self-efficacy (ASE), outcome expectancy, risk perception, and SS significantly predicted PA intention. ASE, MSE, and PA intention significantly predicted planning. MSE, SS, RSE, and planning significantly predicted PA behaviour. Planning significantly mediated the relationships between PAI, ASE, MSE, and PA behaviour. Gender significantly moderated the relationships between MSE and PA, and RSE and PA. BMI significantly moderated the relationships between MSE and PA. The mindset group significantly moderated the relationships between MSE and PA, planning and PA, and RSE and PA. Qualitative interviews with 12 participants provided deeper insights into the quantitative results. These findings offer both theoretical and empirical evidence for promoting PA among Chinese university students. The study provides valuable insights for policymakers and educators to develop effective strategies and interventions to enhance PA and improve the overall health of Chinese university students.

CHAPTER 1

INTRODUCTION

1.1 Introduction

Physical activity (PA) is widely recognized for its health benefits, contributing to both physical and mental well-being (Warburton et al., 2017). It not only reduces the risk of non-communicable diseases—including cardiovascular diseases, type-2 diabetes, and various mental health disorders (WHO, 2020)—but also enhances academic performance (Kaneko et al., 2018). However, despite these advantages, physical inactivity is prevalent, especially as students transition from high school to university, leading to decreased PA levels (Tao et al., 2019).

The recommendation of PA advocated by the World Health Organization (WHO) for adults 18-64 in 2020: at least 150 minutes of moderate-intensity aerobic physical exercise per week, or at least 75 minutes of high-intensity aerobic PA per week, or the equivalent combination of both (WHO, 2020). A survey conducted in China by Zhan (2021) revealed that 70.48% of university students did not meet the WHO PA recommendations. Besides, a nationwide survey in China found that a significant proportion of 18-year-old male students (82.5%) and 21-year-old female students (89.8%) engaged in physical activity for less than one hour per day (Wang et al., 2017). The abovementioned evidence proves the high prevalence of insufficient PA among Chinese university students.

It's well known that insufficient PA and a sedentary lifestyle are the most critical factors that lead to low physical fitness. According to Wang (2018), data from the National Student Physical Fitness and Health Survey Report from 1985 to 2014 in China showed that due to insufficient PA and a sedentary lifestyle, the physical fitness level of university students has been on a downward trend for 30 consecutive years. In addition, health problems such as being overweight and obesity among Chinese university students due to lack of PA are also prominent (Chinanews, 2021), and even previous studies have found a strong correlation between anxiety and depressive symptoms of university students and inactive lifestyles (Huang et al., 2021a; Xiang et al., 2020).

To promote PA among Chinese university students, the government and higher education institutions have implemented massive macro-policy interventions, such as expanding sports facilities, offering physical education curriculums, and promoting extracurricular activities. However, follow-up surveys by the Ministry of Education of China indicate that these policies have not been significantly effective (Sun, 2021).

PA is conceptually simple yet challenging to practice consistently, as any external interventions require individuals to adopt and maintain them themselves (Hagger & Hamilton, 2020). Numerous studies have demonstrated that analysing the psychological determinants affecting the initiation and maintenance of PA through framework of the Health Action Process Approach (HAPA) can provide both theoretical and empirical underpinnings for effective interventions (Chiu et al., 2011; Hattar et al., 2016; Johnson et al., 2015; Parschau et al., 2014a; Teleki et al., 2019). Thus, this study focuses on utilising an expanded HAPA model to investigate the critical predictive variables influencing PA behaviours among Chinese university students, delving into the underlying psychological mechanisms. This study aims to furnish both theoretical and empirical justifications for educators and health practitioners to devise tailored intervention strategies.

Chapter One introduces the background of the study, problem statement, research objectives, research questions, and research hypotheses. The study's significance, operational definitions, and summary are included.

1.2 Background of the Study

Physical activity (PA), as defined by the World Health Organization (WHO), involves any bodily movement produced by skeletal muscles that requires energy expenditure (WHO, 2022). Regular participation in PA is crucial for health, offering protection against numerous non-communicable diseases and enhancing psychological well-being (WHO, 2020). According to WHO (2022), PA can be categorized into different domains such as leisure, commuting, occupational, and household activities. Each of these activities can be further classified based on intensity levels into light PA (LPA), moderate PA (MPA), and vigorous PA (VPA).

Murphy et al. (2019) identifies late adolescence and early adulthood as critical periods for engaging in PA, a time that coincides with university years. However, studies show a concerning trend among Chinese university students, where physical inactivity is prevalent and often persists into adulthood, leading to increased health risks (Wang, 2019). Despite efforts such as the National Student Physical Health Standards (2014 Revision) (Xu et al., 2015) and Healthy China 2030 (Liu et al., 2018) by Chinese government aimed at boosting students' PA levels, existing interventions in Chinese universities had limited success, as evidenced by high failure rates in physical fitness tests (Chinanews, 2021).

PA interventions commonly implemented at Chinese universities tend to adopt a uniform approach, focusing primarily on standardized exercise protocols without consideration for the diverse intrapersonal and interpersonal factors influencing students' engagement in PA (Si et al., 2017). For instance, although physical education curriculum is a compulsory course for Chinese university students, the limited frequency of just one session per week, overcrowded class sizes, and restricted range of sports activities result in minimal impact on promoting students' PA. Additionally, some universities seek to motivate students to participate in PA through morning exercises, extracurricular running, and competitive activities. Some even mandate a minimum amount of extracurricular exercise. However, interventions that fail to account for individual differences among students have not yielded significant results.

Such interventions typically emphasize a one-size-fits-all strategy, focusing only on the ease of PA organisation. This approach overlooks the important psychological and social factors that are essential for understanding and improving student participation in PA. Additionally, the theoretical basis and empirical support for these programs are often insufficiently addressed. Previous studies highlight that interventions based on theoretical frameworks, which focus on psychological determinants, are significantly more effective in improving PA compared to approaches that lack a theoretical basis. (Kahn et al., 2002; Scarapicchia et al., 2017a). Consequently, to effectively promote PA among university students, it is imperative to employ health behaviour theories that facilitate the identification of key predictors of PA. This approach should include both intrapersonal factors—such as motivation, belief, intention, and self-regulatory variables—and interpersonal factors, including social support (SS) and contextual influences. By integrating these dimensions, interventions can be tailored to meet the specific needs and circumstances of university students, thereby enhancing the efficacy of PA promotion strategies within this population.

Within the extensive array of models and theories pertaining to health behaviour, HAPA is distinguished by its unique structure that explicitly addresses both the formation of intentions and their translation into action (Zhang et al., 2019; Sniehotta et al., 2005). This dual-phase hybrid model, developed by Ralf Schwarzer (Schwarzer, 2008), is particularly well-suited for the domain of PA due to its comprehensive approach that considers the dynamic process of behaviour change (Hagger, 2019). Unlike models that focus solely on initial motivational factors or subsequent maintenance behaviours, HAPA integrates these components into a coherent framework that accounts for the entire spectrum of behaviour change. This makes it exceptionally applicable for interventions aimed at promoting PA, where both initiation and sustained engagement are critical. The continuum part of HAPA is structured into two sequential phases: the motivational phase, which culminates in the formation of intentions, and the volitional phase, which concerns the translation of intentions into actions (Schwarzer, 2008). Each phase is characterized by specific psychological constructs that influence an individual's progression towards behaviour change. In the motivational phase, three primary constructs are identified: risk perception (RP), outcome expectancy (OE), and action self-efficacy (ASE). RP relates to an individual's assessment of potential health risks associated with inactivity, enhancing their motivation to adopt health behaviours. OE reflects the individual's beliefs about the likely consequences of engaging in PA, weighing the benefits (e.g., improved health) against the potential costs (e.g., time and effort). ASE, or the confidence in one's ability to initiate PA despite challenges, is pivotal in the decision to perform behaviour change. These constructs collectively contribute to the formation of a firm intention to engage in PA.

The volitional phase, which begins after the establishment of intention, the focus is on how planning, maintenance self-efficacy (MSE), and recovery self-efficacy (RSE) directly predict behaviour (Schwarzer, 2016). Planning involves the development of detailed strategies about how to implement PA and respond to the barriers, addressing the specifics of when, where, and how to exercise. MSE and RSE are critical for sustaining long-term behaviour change; the former relates to persisting in activities despite obstacles, while the latter deals with resuming activities after disruptions. These constructs are essential for actual behaviour execution and for maintaining regular PA over time.

At the same time, the HAPA model as a stage model classifies the stages of behaviour change into three mindset groups, namely, non-intenders, intenders, and actors (Schwarzer, 2008). Non-intenders are those who have not yet considered the importance of PA and require motivation to recognize its benefits and the risks associated with inactivity. Intenders are aware of the importance and have decided to start but have not yet taken action. Actors are already actively engaged in PA and are focused on maintaining their behaviour over time. Previous studies have demonstrated that targeted interventions on the HAPA model variables corresponding to these three mindset groups can provide better intervention effects (Ginis et al., 2013; Lippke et al., 2010; Zhang et al., 2019).

Since its inception in 1992, the HAPA model has undergone several revisions to enhance its applicability and robustness in predicting a variety of health behaviors, as demonstrated across diverse studies (Miller, 2017; Schwarzer, 2008; Vergeld et al., 2021) and among varied populations (Adekeye & Sheikh, 2009; Aliabad et al., 2014; Caudroit et al., 2011; Duan et al., 2017; Payaprom et al., 2011; Xu et al., 2020). Particularly in the domain of PA promotion, the HAPA model has proven effective, with substantial empirical support (Schwarzer et al., 2011). Despite its widespread validation and demonstrated utility, the application of the HAPA model to understand and predict PA behaviours among Chinese university students remains limited. Considering the model's numerous strengths, this study aims to adapt and expand it as the foundational theoretical framework to specifically investigate the key psychological predictors of PA behaviours within this demographic. In the evolving landscape of health behaviour research, there is a growing emphasis on enhancing the explanatory and intervention capabilities of theoretical models by integrating multiple frameworks or incorporating additional constructs (Hagger & Chatzisarantis, 2014; Rhodes et al., 2019). This approach reflects a broader trend toward more holistic models that can address complex behavioural determinants more effectively.

Social support (SS) is increasingly recognized for its crucial role in public health behaviours, particularly as it compensates for individual deficits in selfregulation and self-efficacy related to behavioural planning and enactment (Cowie et al., 2018; Warner et al., 2016). SS provides both emotional and practical resources that facilitate health behaviour changes and strengthens an individual's belief in their ability to perform such behaviours (Hays, 2012). This is particularly pertinent in the context of contemporary Chinese university students, many of whom are only children. The emotional and material support from parents, friends, and relatives is crucial in shaping their health behaviours, as these support networks play a vital role in influencing and encouraging PA.

Building on this understanding, the current study proposes to incorporate SS into the HAPA model, thereby developing an expanded Health Action Process Approach (EHAPA). This revised model aims to leverage the well-documented benefits of SS to enrich the HAPA framework, enhancing its predictive power and applicability. The inclusion of SS as a stable construct within the HAPA model addresses a critical gap in the existing framework, providing a more comprehensive understanding of the factors influencing PA among Chinese university students.

Numerous studies have confirmed the effectiveness of HAPA model in explaining and facilitating interventions in PA (Chiu et al., 2011; Hattar et al., 2016; Johnson et al., 2015; Parschau et al., 2014a; Teleki et al., 2019). The role of planning as a mediator between intention and actual PA has also been well supported by research (Carraro & Gaudreau, 2015; Chiu et al., 2011; Hu et al., 2022; Johnson et al., 2015; Paech & Lippke, 2017; Paxton, 2016). Moreover, previous studies have shown that various demographic variables such as gender, age, ethnicity, and Body Mass Index (BMI) significantly influence the formation of Physical Activity Intentions (PAI) and the initiation and maintenance of actual PA behaviours (Annesi, 2018; Blanchard et al., 2007a; Blanchard et al., 2007b; Magoc et al., 2016). The mindset group, serving as a categorical variable, segments the stages of the HAPA model, and its role in moderating the prediction of PA merits further exploration.

Therefore, this study expands the HAPA model by incorporating SS variable to develop EHAPA model, aiming to evaluate its predictive capability for PA among Chinese university students. This study will identify critical psychological predictors of PA and examine the mediating role of planning in the PA formation, as well as the moderating effects of gender, BMI, and mindset group on the direct predictive pathways of PA. This investigation is expected to provide significant theoretical support, empirical evidence, and practical guidelines to enhance PA among Chinese university students.

1.3 Problem Statement

The prevailing lack of PA among Chinese university students is emerging as a significant public health concern, with far-reaching implications for individual health, social systems, and economic productivity. This demographic is particularly important as lifestyle habits formed during university years often persist into adulthood, setting the foundation for long-term health outcomes (Murphy et al., 2019). The consequences of insufficient PA are profound, encompassing an increased risk of obesity, reduced physical fitness, higher incidence of non-communicable diseases, and a variety of mental health issues (Ekelund et al., 2016; WHO, 2021).

Survey data from China highlights the serious status of insufficient PA among university students, indicating that a significant portion of this demographic engages in worryingly low levels of PA. For instance, a study by Wang et al. (2017) revealed that 82.5% of 18-year-old male students and 89.8% of 21-year-old female students reported engaging in less than one hour of physical activity per day. Complementing these findings, Wang et al. (2017) reported that over 40% of university students fall short of the WHO recommendations for weekly PA. Additionally, health problems such as being overweight and obesity among Chinese university students due to insufficient PA are also prominent (Chinanews, 2021), and even previous studies have found a strong correlation between anxiety and depressive symptoms of university students and inactive lifestyles (Huang et al., 2021a; Xiang et al., 2020). These evidence not only emphasizes the pressing public health challenges associated with inactivity but also highlights the urgent need for targeted interventions designed to enhance physical health and mental well-being among young adults.

Although government and higher education institutions have implemented various measures to promote PA among Chinese university students, most interventions have primarily focused on developing macro-level policies, enhancing physical education curricula, and expanding sports facilities. Moreover, existing research largely revolves around these themes, with a noticeable deficiency in studies investigating the psychological determinants and mechanisms that influence PA, which are crucial for initiating and maintaining such behaviours (Duan et al., 2012; Si et al., 2017). The HAPA model, known for its dual nature as a hybrid model, is increasingly recognized for its efficacy in the domain of PA (Hagger, 2019). This model effectively combines the explanatory power of continuous models for psychological determinants with the convenience of stage models for stage-matched interventions. The HAPA model is particularly noted for the role of planning as a bridge between intentions and behaviours, and its three stage-matched self-efficacies that reliably predict health behaviour change (Schwarzer, 2016). However, the HAPA model has not been fully explored in research targeting PA among Chinese university students, and studies that expand and apply this model using current methodologies are sparse.

SS from various sources, such as parents, friends, and relatives, can significantly enhance an individual's commitment to regular PA by providing emotional encouragement and practical assistance (van Luchene & Delens, 2021). Recognizing the critical efficacy of SS, this study aims to expand the HAPA model by integrating the SS variable and applying the EHAPA model to predict PA behaviours among Chinese university students. This study will explore key psychological predictors of PA and investigate the underlying psychological mechanisms of PA formation. By addressing these gaps, this study will provide a theoretical foundation for effective interventions to promote PA, offering empirical evidence and practical guidelines for designing targeted intervention measures.

1.4 Research Objectives

This study aims to determine the predictors of PA behaviour among Chinese university students using the EHAPA model that integrated SS into the original HAPA in predicting PA. The purpose of this study is also to investigate and elaborate on the psychological predictors of PA behaviour among Chinese university students and their differences across different PA level groups and mindset groups and elucidate the psychological mechanisms involved through the analysis of mediating and moderating effects. Detailed presentations are as follows:

1.4.1 Research Objectives 1

To investigate the variation in predictors of PA within the EHAPA model across different PA level groups among Chinese university students.

1.4.2 Research Objectives 2

To investigate the variations in the constructs of the EHAPA model across different mindset groups among Chinese university students.

1.4.3 Research Objectives 3

To evaluate the predictive power of EHAPA model for PA behaviour among Chinese university students.

1.4.4 Research Objectives 4

To investigate the mediating effects of planning on the relationships between intention, action self-efficacy, and maintenance self-efficacy with PA behaviour among Chinese university students.

1.4.5 Research Objectives 5

To investigate the moderating effects of gender, BMI, and mindset group on the relationships between maintenance self-efficacy, planning, social support, and recovery self-efficacy with PA behaviour among Chinese university students.

1.5 Research Questions

The following are the research questions that were addressed in this study:

1.5.1 Research Questions 1

Are there any significant differences in action self-efficacy, outcome expectancy, risk perception, maintenance self-efficacy, intention, planning, social support, and recovery self-efficacy across different PA level groups among Chinese university students?

1.5.2 Research Questions 2

Are there any significant differences in EHAPA constructs (action self-efficacy, outcome expectancy, risk perception, maintenance self-efficacy, intention, planning,

social support, recovery self-efficacy, and physical activity) across different mindset groups among Chinese university students?

1.5.3 Research Questions 3

Do the EHAPA Model's constructs significantly predict PA behaviours among Chinese university students?

1.5.4 Research Questions 4

Does planning significantly mediate the relationships between intention, action self-efficacy, and maintenance self-efficacy with PA behaviours among Chinese university students?

1.5.5 Research Questions 5

Do gender, BMI, and mindset group significantly moderate the relationships between maintenance self-efficacy, planning, social support, and recovery selfefficacy with PA behaviours among Chinese university students?

1.6 Research Hypotheses

The hypotheses of this study are listed below:

1.6.1 Research Hypothesis 1

There are no significant differences in action self-efficacy, outcome expectancy, risk perception, maintenance self-efficacy, intention, planning, social support, and recovery self-efficacy across different PA level groups among Chinese university students.

- H_0 1a There are no significant differences in action self-efficacy across different PA level groups among Chinese university students.
- H_0 1b There are no significant differences in outcome expectancy across different PA level groups among Chinese university students.
- H_01c There are no significant differences in risk perception across different PA level groups among Chinese university students.
- H_0 1d There are no significant differences in intention across different PA level groups among Chinese university students.
- H_01e There are no significant differences in maintenance self-efficacy across different PA level groups among Chinese university students.
- H_0 If There are no significant differences in planning across different PA level groups among Chinese university students.
- H_01g There are no significant differences in social support across different PA level groups among Chinese university students.
- H_0 1h There are no significant differences in recovery self-efficacy across different PA level groups among Chinese university students.

1.6.2 Research Hypothesis 2

There are no significant differences in EHAPA constructs (action self-efficacy, outcome expectancy, risk perception, maintenance self-efficacy, intention, planning, social support, recovery self-efficacy, and physical activity) across different mindset groups among Chinese university students.

- H_02a There are no significant differences in action self-efficacy across different mindset groups among Chinese university students.
- H_0 2b There are no significant differences in outcome expectancy across different mindset groups among Chinese university students.
- H_02c There are no significant differences in risk perception across different mindset groups among Chinese university students.
- H_0 2d There are no significant differences in intention across different mindset groups among Chinese university students.
- H_02e There are no significant differences in maintenance self-efficacy across different mindset groups among Chinese university students.
- H_02f There are no significant differences in planning across different mindset groups among Chinese university students.
- $H_0 2g$ There are no significant differences in social support across different mindset groups among Chinese university students.
- H_0 2h There are no significant differences in recovery self-efficacy across different mindset groups among Chinese university students.
- H_02i There are no significant differences in physical activity across different mindset groups among Chinese university students.

1.6.3 Research Hypothesis 3

It is hypothesised that the EHAPA model's constructs do not significantly predict PA behaviours among Chinese university students.

1.6.4 Research Hypothesis 4

It is hypothesised that planning does not have significant mediating effects on the relationships between intention, action self-efficacy, and maintenance self-efficacy with PA behaviours among Chinese university students.

- H_0 4a Planning does not have a significant mediating effect on the relationship between intention and PA behaviour.
- H_0 4b Planning does not have a significant mediating effect on the relationship between action self-efficacy and PA behaviour.
- H_0 4c Planning does not have a significant mediating effect on the relationship between maintenance self-efficacy and PA behaviour.

1.6.5 Research Hypothesis 5

It is hypothesised that gender, BMI, and mindset group do not have significant moderating effects on the relationships between maintenance self-efficacy, planning, social support, and recovery self-efficacy with PA behaviours among Chinese university students.

1.6.5(a) The Moderating Effects of Gender

- H_05a Gender does not have a significant moderating effect on the relationship between maintenance self-efficacy and PA behaviour.
- H_0 5b Gender does not have a significant moderating effect on the relationship between planning and PA behaviour.
- H_0 5c Gender does not have a significant moderating effect on the relationship between social support and PA behaviour.

 H_0 5d Gender does not have a significant moderating effect on the relationship between recovery self-efficacy and PA behaviour.

1.6.5(b) The Moderating Effects of BMI

- H_05e BMI does not have a significant moderating effect on the relationship between maintenance self-efficacy and PA behaviour.
- H_0 5f BMI does not have a significant moderating effect on the relationship between planning and PA behaviour.
- H_05g BMI does not have a significant moderating effect on the relationship between social support and PA behaviour.
- H_0 5h BMI does not have a significant moderating effect on the relationship between recovery self-efficacy and PA behaviour.

1.6.5(c) The Moderating Effects of Mindset Group

- H_05i Mindset group does not have a significant moderating effect on the relationship between maintenance self-efficacy and PA behaviour.
- H_05j Mindset group does not have a significant moderating effect on the relationship between planning and PA behaviour.
- H_0 5k Mindset group does not have a significant moderating effect on the relationship between social support and PA behaviour.
- H_0 51 Mindset group does not have a significant moderating effect on the relationship between recovery self-efficacy and PA behaviour.

1.7 Significance of the Study

This study marks the first application of the HAPA model specifically among Chinese university students, addressing a critical gap in the context of their notably low participation in PA. The current situation among these students is concerning; a significant majority do not engage in sufficient PA, which correlates with increased health risks such as obesity, cardiovascular diseases, and mental health issues. The importance of addressing this issue is amplified by the existing policies and interventions, which have largely been ineffective due to their focus on broad, nonpersonalized strategies such as infrastructural improvements and mandatory physical education curriculums.

Integrating SS into the HAPA model to create an expanded framework represents a novel approach in this research. SS is recognized for its potential to influence health behaviours significantly, particularly among young adults who may rely on their social networks for motivation and engagement in health-promoting activities. By adapting the HAPA model to include social support, this study not only extends the model's theoretical framework but also enhances its practical relevance by providing a more holistic view of the factors influencing PA among university students.

The EHAPA model developed in this study combines intrapersonal factors such as intention, planning and stage-matched self-efficacies with the interpersonal dynamics provided by SS. This comprehensive approach allows for a deeper understanding of the mechanisms through which students initiate and maintain PA. It addresses the psychological triggers and social reinforcements that are crucial for sustaining behaviour change, aspects often overlooked in previous policy-driven interventions.

This study delves into the psychological mechanisms within the EHAPA model by examining the mediating role of planning and the moderating effects of gender, BMI, and mindset group on PA behaviours among Chinese university students. Understanding how planning bridges the gap between intention and PA reveals critical points for intervention, enhancing adherence to PA routines. Additionally, exploring how variables such as gender, BMI, and mindset influence PA behaviour aids in tailoring interventions to accommodate individual differences and needs, ensuring that strategies are both effective and relevant. This approach not only strengthens the empirical evidence for personalized, psychology-based interventions but also improves the practical impact of health promotion programs by making them responsive to the diverse characteristics of the student population.

The practical implications of this research are substantial. By demonstrating how tailored, theory-based interventions can effectively promote PA, this study provides a strong foundation for future health policies and programs. It suggests that interventions should not only focus on creating opportunities for PA but also on enhancing SS systems that encourage active lifestyles. Moreover, the findings advocate for a shift in policy from general to more personalized strategies that consider the psychological and social realities of students' lives.

Ultimately, this research contributes to the broader field of health behaviour by applying a well-established theoretical model in a new demographic and cultural setting. It offers valuable insights into how modifications to health behaviour theories can be effectively implemented to address specific public health challenges, paving the way for more effective interventions that are grounded in a deep understanding of targeted population needs and behaviours.

1.8 Operational Definitions

The terminologies and definitions utilised in this study, especially the operational definitions, are as follows:

1.8.1 Physical Activity

According to the WHO, PA is defined as any skeletal muscle activity that requires energy expenditure, including occupational, sports, commuting, household, or other activities (WHO, 2022). This study used the Chinese short version of the International Physical Activity Questionnaire (IPAQ-CSV) (Macfarlane et al., 2007) to measure the PA behaviours of university students. The IPAQ-CSV comprises seven items, requiring participants to estimate the amount of time spent in PA in the past seven days. For example, "During the last seven days, how many days did you do moderate physical activity?" In this study, only the responses to six items were used as the outcomes of PA, namely item 1 and item 2 measured VPA, item 3 and item 4 measured MPA, and item 5 and item 6 measured LPA. Item 7 was used to measure sedentary time and was only presented descriptively. After participants responded to three intensities of PA, the total energy expenditure of PA was calculated as a continuous variable based on the metabolic equivalent of task (METs) associated with different types of PA. Subsequently, individuals were categorized into three total PA (TPA) levels, namely low, moderate, and high PA level, based on specific criteria regarding the total energy expenditure from PA.

1.8.2 Expanded Health Action Process Approach

1.8.2(a) Action Self-efficacy

Action self-efficacy (ASE) refers to the perception of an individual's ability to perform a specific behaviour (Schwarzer et al., 2011). This study measured ASE by the Chinese translation version of the Action Self-Efficacy Scale–Physical Exercise (ASES-PE) developed by Renner and Schwarzer (2005). This 4-item ASES-PE uses a 4-point Likert scale for measurement, ranging from 1 (Not at all true) to 4 (Exactly true).

1.8.2(b) Outcome Expectancy

Outcome expectancy (OE) is an individual's subjective expectation about the consequences of his actions, including two dimensions: positive outcome expectancy (POE) and negative outcome expectancy (NOE) (Bandura, 1997). This study measured OE for PA behaviour by the Outcome Expectancy Scale–Physical Exercise (OES-PE) (Renner & Schwarzer, 2005). The OES-PE comprises 13 items, among which ten items are for POE, and three are for NOE. The scale uses Likert's 4-point score, from 1 (Not at all true) to 4 (Exactly true).

1.8.2(c) Risk Perception

Risk perception (RP) in health behaviour models typically refers to two types of beliefs: perceived vulnerability (or susceptibility) to a threat and the perceived severity of a threat (Brewer et al., 2007). In this study, RP towards PA behaviour was measured by the Health Risk of an Inactive Lifestyle Scale (HRILS) developed by Wu (2019) and translated into the Chinese language version. The measurement of RP consists of five items. A 5-point Likert scale was employed to measure participants' responses. The response options ranged from 1 (Disagree) to 5 (Agree Very Much).

1.8.2(d) Maintenance Self-efficacy

Maintenance self-efficacy (MSE), also called coping self-efficacy, represents the individual's confidence or belief to cope with behavioural obstacles in the maintenance phase of action (Schwarzer, 2008). This study measured MSE by the Chinese translation version of the Maintenance Self-Efficacy Scale–Physical Exercise (MSES-PE) developed by Luszczynska and Sutton (2006). This 4-item MSES-PE uses a 4-point Likert scale for measurement, ranging from 1 (Not at all true) to 4 (Exactly true).

1.8.2(e) Intention

The intention, also known as behavioural intention (or goal intention), is an essential construct of most healthy behaviour theories and is usually formulated as the proximal predictor of behaviour by continuous models (Ajzen, 2012). Intention can mean a decision to perform a behaviour or the commitment to enact a behaviour (Rhodes & Rebar, 2017). This study used the Chinese translation version of the Physical Activity Intention Scale (PAIS) developed by González et al. (2012) to measure PA intention (PAI). This 4-item scale uses a 4-point Likert scale for measurement, ranging from 1 (Not at all true) to 4 (Exactly true).

1.8.2(f) Planning

Planning is the combination of action planning (AP) and coping planning (CP). AP means initiating behaviours and the detailed development about when, where, and how to conduct activities (Schwarzer, 2008). The intention is more likely to be translated into behaviours when people anticipate detailed plans, imagine success scenarios, and develop preparatory strategies for tackling a challenging task.

CP refers to the coping strategy when overcoming the problems or difficulties encountered, which is like the meaning of implementation intention and is considered a more effective self-regulatory strategy than AP (Schüz et al., 2006; Schwarzer, 2008).

This study used the Chinese translation version of the Action and Coping Planning Scale–Physical Exercise (ACPS- PE) developed by Renner and Schwarzer (2005) to measure planning. The ACPS-PE comprises 9 items, among which four items are for AP, and five are for CP. This scale uses a 4-point Likert scale for measurement, ranging from 1 (Not at all true) to 4 (Exactly true).

1.8.2(g) Social Support

Social support (SS) has been defined in the literature as the assistance and protection given to others, especially individuals (Langford et al., 1997). The SS variable includes the following types: instrumental support (e.g., providing tangible financial or material assistance); appraisal support (e.g., offering companionship, social comparison); informational support (e.g., providing advice or resources); and emotional (e.g., offering empathy, concern, encouragement, or nurturance) support. The various sources of support have been primarily identified to include family,