THE INFLUENCE OF CAMPUS BUILT ENVIRONMENT AND PSYCHOSOCIAL FACTORS ON WALKING BEHAVIOUR AMONG UNIVERSITY STUDENTS IN ANYANG, CHINA

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by

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Time flies, and the long journey of my doctoral studies has swiftly come to an end. As I near the completion of my dissertation, I find it difficult to fully express the emotions that come with reflecting on this journey. Chief among these emotions is gratitude. I am deeply thankful for the support and assistance from my supervisor and peers, whose warmth and guidance have accompanied me through this significant yet challenging period of my life.

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LIST OF ABBREVIATIONS

UN	United Nations
WHO	World Health Organization
SDG	Sustainable Development Goals
SEM	Socio-Ecological Model
HBM	Health Belief Model
SCT	Social Cognitive Theory
TPB	Theory of Planned Behaviour
AIT	Anyang Institute of Technology
ANU	Anyang Normal University
BE	Built Environment
LU	Land Use Diversity
AC	Accessibility
CO	Connectivity
IF	Infrastructure
AE	Aesthetics
SA	Safety
SE	Self-efficacy
AT	Attitude
PE	Perceived Benefits
PB	Perceived Barriers
SU	Subjective Norm
PW	Purposeful Walking
RW	Recreational Walking
TW	Total Walking
SPSS	Statistical Package for the Social Sciences
IBM	International Business Machines Corporation
KMO	Kaiser-Meyer-Olkin
ANOVA	Analysis of Variance
M	Mean
SD	Standard Deviation
VIF	Variance Inflation Factor

LIST OF APPENDICES

PENGARUH PERSEKITARAN BINAAN KAMPUS DAN FAKTOR PSIKOSOSIAL TERHADAP TINGKAH LAKU BERJALAN KAKI DALAM KALANGAN PELAJAR UNIVERSITI DI ANYANG, CHINA

ABSTRAK

Dengan peningkatan pesat rentak kehidupan moden, pelajar universiti telah mengalami penurunan dalam aktiviti fizikal, yang membawa kepada pelbagai masalah kesihatan. Isu ini telah menjadi kebimbangan yang signifikan dalam bidang kesihatan awam dan perancangan bandar, terutamanya di China yang mempunyai populasi pelajar universiti terbesar di dunia. Berjalan kaki merupakanaktiviti fizikal yang mudah dan berkesan, serta penting untuk memperbaiki kesihatan fizikal dan mental pelajar universiti, menjadikannya strategi utama dalam menangani cabaran ini. Walaupun banyak kajian telah mengkaji tingkah laku berjalan kaki dari perspektif tunggal sama ada faktor psikologi individu atau persekitaran, masih terdapat kurang penyelidikan yang menganalisis secara menyeluruh pengaruh pelbagai faktor terhadap tingkah laku berjalan kaki. Oleh itu, berdasarkan model sosio-ekologi, kajian ini memberi tumpuan kepada pelajar universiti di China dan bertujuan untuk mengkaji secara menyeluruh kesan faktor individu, psikososial, dan persekitaran kampus terhadap tingkah laku berjalan kaki. Kajian ini menggunakan reka bentuk penyelidikan kuantitatif, dan melibatkan 687 pelajar dari dua universiti di Anyang, China menggunakan kaedah soal selidik. Penemuan utama kajian ini termasuk: Pertama, data menunjukkan bahawa berjalan kaki merupakan mod pengangkutan harian utama bagi pelajar universiti, dengan berjalan kaki berfokuskan tujuan menyumbang kepada sebahagian besar daripada jumlah keseluruhan berjalan kaki. Manakala berjalan kaki rekreasi, yang menawarkan manfaat kesihatan yang lebih besar, jumlahnya adalah jauh

lebih rendah. Selain itu, tingkah laku berjalan kaki yang berbeza menunjukkan perbezaan yang ketara merentasi pelbagai ciri demografi, menunjukkan bahawa ciri-ciri ini memainkan peranan penting dalam mempengaruhi tingkah laku berjalan kaki. Kedua, faktor persekitaran binaan dan psikososial menunjukkan kesan yang berbeza terhadap tingkah laku berjalan kaki yang berbeza. Hasil regresi hierarki menunjukkan bahawa jumlah keseluruhan berjalan kaki dan berjalan kaki berfokuskan tujuan terutamanya dipengaruhi oleh faktor persekitaran binaan, dengan kurang pengaruh dari faktor psikososial. Sebaliknya, berjalan kaki rekreasi lebih kuat dipengaruhi oleh faktor psikososial, dengan pengaruh yang lebih lemah dari persekitaran binaan. Ketiga, kajian ini mendapati kesan interaksi yang signifikan antara faktor persekitaran binaan dan faktor psikososial terhadap tingkah laku berjalan kaki yang berbeza, dengan mekanisme yang konsisten merentasi tingkah laku ini. Penemuan ini menunjukkan bahawa dalam kalangan pelajar dengan faktor psikososial yang agak negatif, persekitaran binaan yang direka dengan baik lebih ketara mempromosikan tingkah laku berjalan kaki mereka. Akhirnya, berdasarkan penemuan ini, kajian ini mencadangkan strategi-strategi yang relevan untuk mempromosikan tingkah laku berjalan kaki dalam kalangan pelajar universiti. Secara keseluruhan, penyelidikan ini menyediakan bukti empirikal untuk perancang kampus dan promoter kesihatan dalam mereka bentuk intervensi yang lebih berkesan untuk menggalakkan gaya hidup sihat dalam kalangan pelajar universiti, meletakkan asas yang kukuh untuk pembuatan dasar pada masa depan.

THE INFLUENCE OF CAMPUS BUILT ENVIRONMENT AND PSYCHOSOCIAL FACTORS ON WALKING BEHAVIOUR AMONG UNIVERSITY STUDENTS IN ANYANG, CHINA

ABSTRACT

With the acceleration of modern life's pace, university students have experienced a decline in physical activity, leading to numerous health problems. This issue has become a significant concern in public health and urban planning, particularly in China, which has the largest population of university students in the world. Walking, as a simple and effective form of physical activity, is crucial for improving the physical and mental health of university students, making it a key strategy in addressing this challenge. Although many studies have explored walking behaviour from a single perspective of individual psychological or environmental factors, there is still limited research that comprehensively analyzes the influence of multiple factors on walking behaviour. Therefore, based on the socio-ecological model, this study focuses on Chinese university students and aims to comprehensively investigate the effects of individual, psychosocial, and campus environmental factors on walking behaviour. This study employed quantitative research design, and involved 687 students from two universities in Anyang, China using survey questionnaires method. The main findings of this study include: First, the data show that walking is the main daily mode of transportation for university students, with purposeful walking accounting for the majority of total walking. While, recreational walking, which offers greater health benefits, is significantly lower. Additionally, different walking behaviours exhibit significant differences across various demographic characteristics, indicating that these characteristics play a crucial role in influencing walking

behaviour. Second, built environment and psychosocial factors exhibit different impacts on different walking behaviours. Hierarchical regression results indicate that total walking and purposeful walking are mainly influenced by built environment factors, with less influence from psychosocial factors. In contrast, recreational walking is more strongly influenced by psychosocial factors, with a weaker influence from the built environment. Third, the study found significant interaction effects between built environment and psychosocial factors on different walking behaviours, with consistent mechanisms across these behaviours. These findings suggest that in students with relatively negative psychosocial factors, a well-designed built environment more significantly promotes their walking behaviour. Finally, based on these findings, the study proposes relevant strategies to promote walking behaviour among university students. Overall, this research provides empirical evidence for campus planners and health promoters to design more effective interventions that encourage a healthy lifestyle among university students, laying a solid foundation for future policy-making.

CHAPTER 1

INTRODUCTION

1.1 Research Background

In contemporary society, public physical and mental health has become a critical concern in the fields of public health, transportation, and urban planning (Keyvanfar et al., 2018; Bornioli et al., 2019; Liao et al., 2022; Pereira et al., 2024). Under high-intensity and fast-paced lifestyles, the general public, especially university students, face health problems such as obesity and depression, which not only bring physical and psychological pain to individuals but also impose a serious burden on society (M. Liu et al., 2022; Wang Mohan, 2019; Mihailova & Kaminska, 2016). Research indicates that aside from diet and genetic factors, a lack of sufficient physical activities such as walking and prolonged sedentary behaviour are key contributors to these public health issues (Brandborg et al., 2022; Myers et al., 2021).

Furthermore, relevant studies indicate that lack of physical activity has posed a significant threat to public health and has become the fourth leading risk factor for mortality worldwide (Dhuli et al., 2022; Moxley et al., 2022; Ndupu et al., 2023). Research shows that insufficient physical activity significantly increases the risk of non-communicable diseases, including coronary heart disease, stroke, diabetes, and various cancers, which are the leading causes of premature death and disability (Sinha, 2020). A sedentary lifestyle further impairs metabolic health by reducing insulin sensitivity and cardiovascular function (Park et al., 2020). Furthermore, the recent studies indicate that the lack of physical activity can lead to a decline in individual concentration and cognitive abilities (Belcher et al., 2021; Haverkamp et al., 2020).

Walking, as the most primitive and fundamental mode of transportation for humans, and one of the most common physical activities, is an important way to

actively promote public health (World Health Organization, 2019). Since walking constitutes a significant portion of the physical activity of adults, it is more likely to confer related health benefits (Sawyer, 2018). For example, research has found a negative correlation between daily steps and mortality and incidence of cardiovascular disease, meaning that the more steps taken, the lower the mortality and cardiovascular disease risk, and this relationship is valid at different levels of sedentary time (Ahmadi et al., 2024).

Therefore, research on walking behaviour has become a core focus in multiple fields. The United Nations and the World Health Organization (WHO) emphasize in their Sustainable Development Goals (SDGs) and Universal Health Coverage (UHC) programs that creating pedestrian-friendly environments and promoting walking as a green travel mode are key measures to enhance community cohesion, improve residents' health benefits, and achieve sustainable development (Sacks et al., 2020; Siqueira et al., 2021; Wang Mohan, 2019). Additionally, the WHO has specifically adopted the “Global Recommendations on Physical Activity for Health,” which states that walking is an important means of promoting physical health (DiPietro et al., 2020). Meanwhile, countries worldwide have implemented various measures to build pedestrian-friendly cities. For example, the New York City Government launched the “Active Design Guidelines: Promoting Physical Activity and Health through Design,” which promotes residents' physical activity and health by optimizing the built environment (K. K. Lee, 2012). In China, Beijing and Shanghai promote green travel modes by building 15-minute living circles (R. Tan et al., 2024; C. Zheng, 2023). Singapore has encouraged walking and the use of public transportation by developing green corridors and pedestrian-friendly neighborhoods (Yuen et al., 2024).

Walking, as a low-cost and easy-to-maintain physical activity, is not only one of the most common modes of transportation for university students but also an important part of their daily physical activity. Multiple studies have shown that walking has significant benefits for their physical health and psychological well-being. First, regular walking activities not only help prevent obesity and alleviate chronic diseases such as cardiovascular diseases and diabetes (García-Hermoso et al., 2018; Pfisterer et al., 2022), but also significantly improve cardiorespiratory function and bone density (ZHOU, 2019). Second, walking plays an important role in alleviating students' mental stress, improving mood, enhancing life satisfaction, and reducing the pressures of study and life (Ghrouz et al., 2019; F. Wang & Boros, 2021). Additionally, walking can enhance university students' social skills by promoting communication and interaction among students, thereby increasing campus belonging and social capital (Bang et al., 2017; H. Kim & Yang, 2017). At the same time, these social interactions can foster interdisciplinary exchanges among students, sparking a large number of interdisciplinary innovative outcomes (Liao, Xu, et al., 2022).

As a green and low-carbon mode of transportation, walking also has other socio-economic benefits, such as reducing environmental pollution, alleviating traffic congestion, and creating green campuses, thus achieving sustainable development of the campus (Keat et al., 2016; Liao, Xu, et al., 2022; Mu & Lao, 2022; Ramakreshnan et al., 2020). Additionally, university students, as the future of social development, are at a critical period of personal growth. According to research, the lifestyle habits formed during university are likely to continue into adulthood (Hasbrouck, 2021; Joonyoung Lee & Tashman, 2019; Seo et al., 2024). Hence, it is crucial to guide university students in forming healthy and active lifestyles.

Therefore, considering the numerous benefits of walking, it is essential to create campus environments that promote walking behaviours among university students. As the generation responsible for the future development of society, university students benefit from such environments through improved physical health, reduced psychological stress, and enhanced social interactions, ultimately fostering a positive campus culture.

1.2 Problem Statement

University students, as an important group in society, are at a critical stage of rapid physical and mental development. They also carry the hope for future social development. Their health standards should not merely remain at the level of being disease-free; prevention before the onset of disease is very important for this group (Lederer & Oswalt, 2017). Although walking, as an important form of non-medical health intervention, has numerous benefits (Brandborg et al., 2022; Myers et al., 2021), research shows that there is generally a lack of physical activities such as walking among university students worldwide (Wang Mohan, 2019; Ndupu et al., 2023; Santana et al., 2023; Yu & Ye, 2023).

The rapid development of the transportation and logistics industries, along with the widespread use and high dependence on the internet, has led to a sedentary lifestyle among university students. A survey on the online life of Chinese university students shows that 73.15% of students spend 2-5 hours online daily, and 26.80% spend more than 5 hours. The average weekly online time for 56.69% of students is within 20 hours, while 14.26% spend more than 35 hours (Xiao, 2018). The leisure time outside of class for university students is relatively fixed, and an increase in online time inevitably reduces the time spent on physical activities like walking. This lifestyle not only

increases the rate of obesity but also raises the risk of cardiovascular diseases, diabetes, and mental illnesses (H. Yang et al., 2021). A 20-year survey on the prevalence of overweight and obesity among Chinese university students shows that the incidence of overweight and obesity has increased annually, and the physical fitness of university students has declined year by year (Wang Mohan, 2019). Recent studies have highlighted that the obesity prevalence among Chinese university students has reached approximately 15%, a rate that is moderately high on a global scale and particularly prominent in developing countries (Dengfeng, 2023; Tan Quandan et al., 2021). Globally, obesity rates among adolescents and university students in high-income nations stabilized around 2000, but in Asia, including countries like China and Malaysia, they have continued to rise rapidly, far exceeding the global average growth rate (Dong et al., 2023; Jiang et al., 2019; Pitil & Ghazali, 2022; Zhang et al., 2024). Given that China has the largest university student population in the world, this trend underscores the significant global impact of obesity among Chinese university students, highlighting the unique and pressing nature of this issue.

Additionally, multiple studies have pointed out that the mental health status of Chinese university students is concerning, with psychological issues such as anxiety and depression rising annually (Ji, 2022; Liu, 2022). In recent years, incidents of sudden death among university students due to participating in physical education classes, attending sports events, or being addicted to online games have been frequently reported, which is distressing and undoubtedly causes public concern.

Numerous studies have indicated that these health issues are closely related to insufficient physical activity (Yang et al., 2021; Zhang et al., 2024). The health issues faced by university students not only affect their quality of life but also impose a significant burden on society (Wang Mohan, 2019). By 2023, the number of university

students in China has reached an astonishing 47.63 million, the highest globally. This represents nearly a sixfold increase from 9.09 million in 2000 over the past 20 years. Simultaneously, the gross enrollment rate has also seen a similarly remarkable sixfold increase, reflecting the large-scale expansion and widespread accessibility of higher education in China (Figure 1.1). The health challenges faced by this vast student population cannot be overlooked and are highly complex. Given the numerous health benefits of walking, it is crucial for improving the health of university students and addressing this challenge(Liu et al., 2022; Pan et al., 2022; Ramakreshnan et al., 2020).

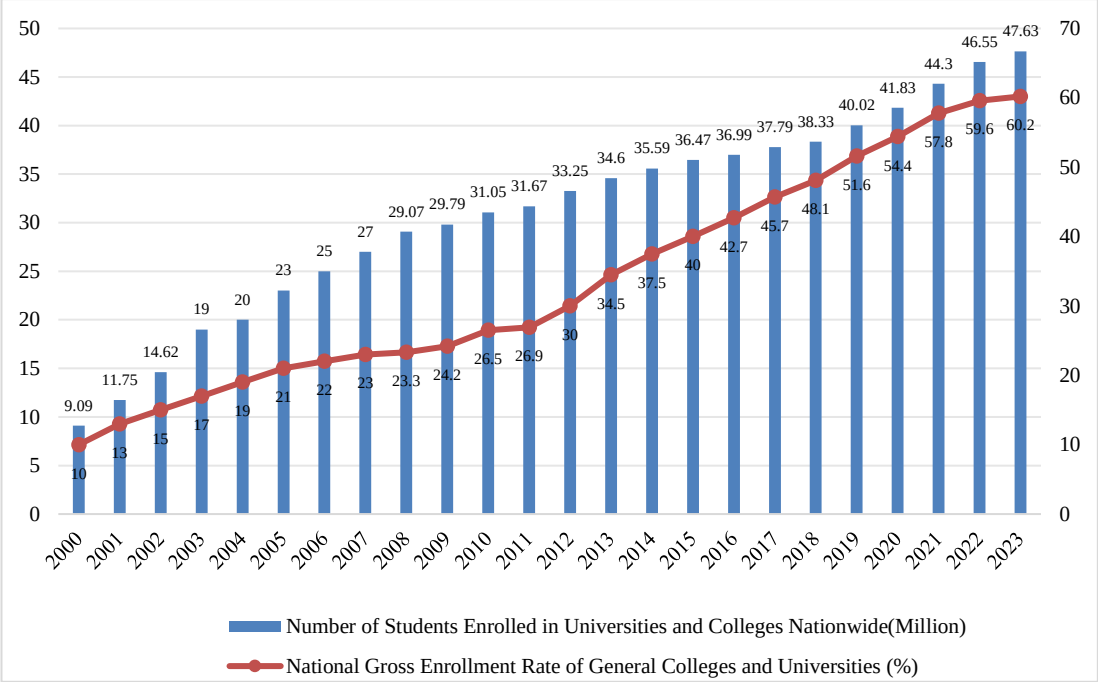

Figure 1.1 Student Enrollment Numbers and Gross Enrollment Rates in Higher Education in China (2020-2023), Source: Chinese National Education Development Statistics Bulletin 2000–2023

However, over the past 20 years, to cope with the sharp increase in the number of students, Chinese university campuses have undergone large-scale construction and expansion (Zhang et al., 2024). From 2000 to 2023, the number of higher education institutions increased from 1041 to 3074 (Figure 1.2). This rapid development often neglected the importance of the built environment, leading to issues such as insufficient walking facilities, poor accessibility, and inadequate landscaping (Zhang

et al., 2023), which severely affected students' walking experience, reducing their willingness and frequency to walk (Liao, Xu, et al., 2022; M. Liu et al., 2022). Additionally, there has been a relative lack of promotion and education regarding walking by schools, which has not effectively fostered and sustained healthy behaviours among university students (Ding peng, 2018).

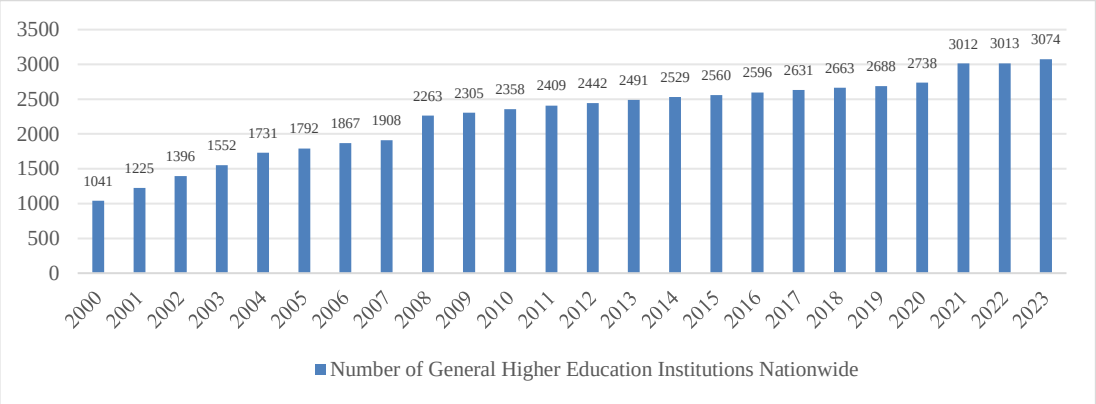

Figure 1.2 Number of General Higher Education Institutions Nationwide in China (2000-2023), Source: Chinese National Education Development Statistics Bulletin 2000–2023

Additionally, the campus is not only a composite space for education and residence but also the core place for students' daily activities. While walking behaviours in urban environments have been extensively studied (Gallardo-Peralta et al., 2023; Kang et al., 2023; Leung et al., 2021), the campus setting presents a unique and controlled context for research. Unlike urban areas with complex traffic systems and diverse population dynamics, Chinese university campuses are usually characterized by their closed boundary (Liao, Xu, et al., 2022), and on-campus housing is typically compulsory for students (Sun et al., 2018). Students' daily lives are largely confined within these campuses, where they frequently walk between various functional areas. In this environment, in addition to fulfilling commuting needs, walking has become a habit of life for students. Therefore, studying walking behavior within the campus context not only facilitates understanding of university students'

daily activity patterns but also provides valuable insights for designing targeted interventions to enhance their health and well-being.

Given the increasing severity of health issues among university students and the importance of the campus environment, the Chinese government has placed high importance on this matter and implemented a series of strategies to address it. The "Healthy China 2030" Plan, issued in 2016, proposed integrating the concept of healthy development into urban policies and advocating the construction of a "co-built, shared, and healthy for all" urban environment (Wu et al., 2017). The plan specifically emphasized that building healthy schools should be a key focus, with a healthy campus environment being a critical component. The goal is to establish a certain number of exemplary campus projects by 2030 (X. Tan et al., 2019; Wenrui, 2023). Additionally, the plan proposed promoting healthy lifestyles to encourage non-medical health interventions. Encouraging physical activities, such as walking, is identified as an important non-medical health intervention (Brandborg et al., 2022; Myers et al., 2021).

Following "Healthy China 2030," the "Healthy China Action (2019-2030)" released in 2019 further emphasized the development of environments that support activities such as walking and jogging (Zhao et al., 2023). It encourages achieving a daily physical activity goal of 6,000-10,000 steps and specifically includes the physical health levels of university students in the assessment criteria for higher education institutions (X. Dong et al., 2023). Against the backdrop of the national policies, in April 2022, the Ministry of Education of China issued the "National Healthy School Construction Plan," specifically mentioning the need to enhance schools' health promotion capabilities and create a school environment conducive to student health(Xin, 2022).

These policies highlight the national attention to the health issues of university students and indicate that the approach to these health issues has shifted from passive response to more proactive intervention. In particular, the policies encourage and advocate for improving health quality through physical activities like walking, making it one of the key means of proactive intervention. The campus environment, as the most frequently used space for university students' daily lives, plays a significant role in regulating physical activities such as walking. This not only helps achieve the goal of a healthy campus but also significantly enhances the health promotion capabilities of campus (Liao, Xu, et al., 2022; M. Liu et al., 2022).

Additionally, since the outbreak of the COVID-19 pandemic, the three-year lockdown implemented by Chinese universities has made walking the main mode of transportation and physical exercise for university students (M. Liu et al., 2022), further highlighting the importance of walking as a healthy travel mode. During the pandemic, students deeply realized the significant role of walking in promoting physical and mental health. In the post-pandemic era, students pay more attention to actively intervening in their health through walking and developing good lifestyle habits.

Therefore, given the urgency and importance of these issues, especially in campus environments like those in China, researching university students' walking behavior and its influencing factors is particularly critical. This can provide guidance for formulating effective intervention measures, improving the health status and quality of life of university students, and promoting the construction of healthy campuses.

1.3 Research Gap

Walking, as a crucial issue for promoting human health and sustainable development, has become a key research focus in public health and urban planning. Although joint efforts in these fields have deepened the understanding of walking behaviour and promoted interdisciplinary integration and exploration, significant research gaps still exist.

First, early studies in the field of public health focused on physical exercise or recreational physical activities with the aim of establishing health activity indicators for residents. Driven by behavioural science, the focus shifted to behavioural interventions for residents (J. Liu et al., 2023; Yuasa et al., 2022). However, research indicates that considering only individual-level factors such as beliefs, attitudes, and self-efficacy has a limited long-term impact on walking behaviour (Rhodes et al., 2018b). Therefore, public health research has gradually expanded to topics related to the external environment, showing the critical role of positive educational guidance and a good social environment in promoting walking(Rhodes et al., 2006a, 2020; Rhodes & Dickau, 2013). The field of urban planning leverages and integrates the strengths of other disciplines to further explore how the physical environment can actively respond to factors of concern in related fields, thereby becoming an embodiment and implementation of the research outcomes of these disciplines (Mirzaei et al., 2018; Saelens & Handy, 2008). Although these studies each reveal key factors influencing walking behaviour, they often remain limited to their independent research perspectives, neglecting the fact that walking is a complex behaviour influenced by multiple factors.

Secondly, research indicates that perceived built environment has a more direct and significant impact on pedestrians' walking experiences compared to objective built

environment attributes (Ewing et al., 2016). Due to the slow speed of walking, pedestrians can perceive built environment characteristics in detail, directly affecting their experience of area comfort, which is particularly crucial in research on health, planning, and design (Ewing & Cervero, 2010; Fonseca et al., 2021). However, evaluations of perceived environmental characteristics in campus environment studies are still relatively few (Zhang et al., 2024; Liao et al., 2022), indicating the need for further research on the perceived attributes of campus built environments and their impact on walking behaviour.

Next, given that walking behaviour is influenced by a wide range of factors, interdisciplinary and multidisciplinary research approaches have become mainstream trends. The application of the social-ecological model makes research on physical activities like walking more systematic, broadening the research perspective (Sallis et al., 2015; Wendel et al., 2015). This model integrates multidisciplinary perspectives and emphasizes the influence of multiple factors, including individual-level factors (e.g., self-efficacy, attitudes), social environmental factors (e.g., peer support), and physical environmental factors (e.g., land use diversity, accessibility, connectivity) (Sallis et al., 2015). It is considered a promising theoretical model for understanding walking behaviour (Rinne et al., 2022). Numerous studies employing the socio-ecological model have shown that the factors influencing walking behaviour are significantly affected by participants' identities, activity purposes, and environmental contexts(Feuillet et al., 2015; Sallis et al., 2015). Previous research has primarily focused on community and street levels, with subjects often being the elderly and children (Gallardo-Peralta et al., 2023; Zhou et al., 2021; Kang et al., 2023; Leung et al., 2021). However, the application of this model to walking behaviour among university students in campus environments remains limited (Zhang et al., 2022).

Furthermore, the fundamental assumption of the socio-ecological model is that an individual's behaviour results from the interaction of individual, social, and physical environmental factors within a specific behavioural context (Sallis et al., 2015). Although the core principle of this model emphasizes the interaction of factors at different levels, the specific mechanisms of these interaction effects remain unclear. The few existing studies show diverse results. For example, Carlson et al. (2012) found a stronger association between the built environment and recreational walking behaviour among older Americans with negative psychosocial characteristics; however, no significant interaction between these factors and walking was found among Belgian children (D'Haese et al., 2016). The inconsistency of these findings highlights the need for further research on how these factors interact in different populations and affect different types of walking behaviour. Currently, there is a lack of such research on university students.

Finally, although research on university campus environments and university students' walking behaviour is increasing internationally, these studies are mainly concentrated in Europe and America, with relatively limited research on Asia, especially China (Hajrasouliha, 2017; Soares et al., 2022). In China, although research on walking behaviour in university campuses is gaining attention, it mainly focuses on national key universities in major cities such as Beijing and Shanghai (Mu & Lao, 2022). According to the classification of university types in China, universities can be divided into three categories: national universities affiliated with the Ministry of Education, provincial universities with provincial governments, and municipal universities with municipal governments (Zou et al., 2022). Among these, municipal universities dominate in terms of number and student population. Due to their lower administrative level and lack of adequate funding, the walking environment quality on

such campuses is often substandard (Zhu et al., 2023; Zhou et al., 2011). Municipal universities in Anyang are a typical example of this category. These institutions receive limited attention (Zhu et al., 2023), and research on their walking environments remains notably insufficient.

Therefore, to fill the existing research gap, this study focuses on Chinese municipal university students, aiming to further enrich the academic discussion on campus built environment and student walking behaviour. By adopting the socio-ecological model, this study aligns with current academic trends and provides both a theoretical foundation and practical strategies for achieving long-term campus health promotion goals and addressing campus development needs.

1.4 Research Aim

This study aims to explore and investigate the psychosocial and environmental factors influencing university students' walking behaviour and their interactions, with the goal of providing scientific theoretical support and practical guidance for the development of effective campus walking promotion strategies.

1.5 Research Objectives

To achieve the research aim, the following specific objectives were formulated:

1. To investigate the characteristics of walking behaviours among university students.
2. To examine the impact of the campus built environment and psychosocial factors on walking behaviours among university students.
3. To investigate the interactive effects of the campus built environment and psychosocial factors on walking behaviours among university students.

4. To develop a socio-ecological model to promote walking behaviours among university students within campus environment.

1.6 Research Questions

This study specifically aims to answer the following research questions to achieve the research objectives:

Research Objective 1

i. What are the characteristics of walking behaviours among university students?

ii. How do walking behaviours among university students differ across demographic characteristics?

Research Objective 2

iii. How do campus built environment and psychosocial factors jointly influence walking behaviours among university students?

Research Objective 3

iv. How do the interactive effects of the campus built environment and psychosocial factors influence the walking behaviours among university students?

Research Objective 4

v. What socio-ecological model can be developed to promote walking behaviours among university students within campus environment?

1.7 Research Significance

Theoretical Significance: This study employed the socio-ecological model to investigate the complexity and multi-dimensionality of walking behaviour in campus environments. By systematically analyzing the psychosocial and built environment

factors influencing university students' walking behaviour and the interactions between these factors, this study aims to fill the theoretical gaps in current research, particularly in the context of campus environment. Additionally, the findings of this study deepen the understanding of the application of the socio-ecological model in the specific context of China, thereby providing a theoretical foundation and methodological guidance for future research on walking behaviour in similar environments.

Practical Significance: On a practical level, this study provides strategic recommendations for promoting university students' walking behaviour and optimizing campus environments. By clarifying how the campus environment interacts with students' psychosocial factors, this study helps policymakers and campus planners design more effective pedestrian-friendly campus environments, especially in resource-limited municipal universities. The findings of this study directly support the achievement of the United Nations' SDGs and the “Healthy China 2030” policy, particularly in promoting healthy lifestyles and creating healthy environments. These strategies not only enhance students' health but also foster a positive campus culture, achieving green and sustainable campus development. This is critically important for university students, who are responsible for driving the future development of society.

1.8 Research Scope

Based on the socio-ecological model, this study investigates the walking behaviours of students in Chinese campuses and their influencing factors. The study comprehensively investigates the purposeful walking, recreational walking, and total walking of university students to reveal the current level of walking behaviours on campuses and explore the differences in these types of walking behaviours across

demographic characteristics. In exploring the influencing factors, a comprehensive analysis of individual characteristics, psychosocial factors, and the campus built environment was conducted to explore how these factors affect walking behaviours.

Furthermore, based on the key principles of the socio-ecological model, this study examines how the interaction effects between psychosocial factors and the built campus environment influence different walking behaviours among university students. This study was conducted at two municipal universities in Anyang, Henan Province, China—Anyang Institute of Technology and Anyang Normal University. These universities were selected because they represented the general conditions of municipal universities (see Chapter 3 for details), thereby providing broadly applicable data. Additionally, the study employed a quantitative approach, targeting enrolled university students at these two universities to further deepen the understanding of walking behaviour among university students.

1.9 Operational Definitions

This section explains each operational definition individually to ensure a clear understanding of the key terms and concepts used in this study.

1.9.1 Walking Behaviour

In this study, based on the actual walking behaviours of university students on campus and the classification methods from previous literature, walking behaviours are mainly divided into purposeful walking and recreational walking (D'Haese et al., 2016; Ding et al., 2012). Purposeful walking refers to walking activities with a clear purpose, such as going to academic places for classes or experiments, or going to living places to meet personal needs. Recreational walking refers to walking with no specific

purpose, such as taking a stroll. Total walking is the sum of purposeful walking and recreational walking time.

1.9.2 Campus Built Environment

Campus built environment refers to the collection of teaching, residential, and recreational facilities within higher education institutions (Wang Mohan, 2019). These facilities not only support educational activities but also integrate social and cultural elements, forming the physical environment for students' daily activities. The specific characteristics include the following six aspects:

a) Land use diversity: It refers to the richness of different land use types within the campus, such as the distribution of academic buildings, dormitories, sports facilities, and recreational areas (Fonseca et al., 2022).

b) Accessibility: It refers to the ease with which one can walk from one place to another. In a campus environment, accessibility emphasizes students' ability to easily access various facilities on campus (Liu & Zhu, 2004; Wang et al., 2013).

c) Connectivity: It describes the continuity and network structure of streets and paths within the campus, measuring whether pedestrians can conveniently choose multiple paths to reach their destinations (Fonseca et al., 2022).

d) Infrastructure: It is the essential physical condition supporting walking and other physical activities, such as sidewalks, nighttime lighting, rest areas, and shelters (Fonseca et al., 2022; Rundle et al., 2011).

e) Aesthetics: It refers to the attractiveness and visual appeal of the campus. A visually pleasing environment can enhance the appeal of walking, such as good architectural styles and abundant greenery (Fonseca et al., 2022; Bang et al., 2017).

f) Safety: It primarily focuses on traffic and pedestrian safety within the campus, involving the risk levels of traffic accidents, vehicle speed control, pedestrian

pathways, and other pedestrian-friendly measures (Harun & Nashar, 2017; Harun et al., 2020).

1.9.3 Psychosocial Factors

The American Psychological Association defines "psychosocial" as reflecting an individual's internal psychological state, such as self-efficacy and attitude, alongside the external social environment, including subjective norms or social support, which collectively influence behaviour (K. Thomas et al., 2020). They shape behaviour through individuals' cognition, emotional capabilities, and their relationships with the social environment (Natvig et al., 2003). In the context of this study, psychosocial factors specifically focus on variables that significantly affect university students' walking behaviours. The psychosocial factors selected are based on behaviour-related theories and cover several core variables closely related to walking behaviours. These variables have been frequently studied and shown to have significant associations with walking behaviours in existing literature (Rhodes et al., 2018b; Trost et al., 2002). The specific variables are five:

a) Self-efficacy: It refers to the degree to which an individual believes they can complete a specific task. As described by Bandura, it directly affects the organization and execution of an individual's actions (Bandura, 1986).

b) Attitude: It refers to an individual's emotional perception of walking behaviour, which can significantly influence their choice and persistence in the behaviour (Ajzen, 1991).

c) Perceived benefits: They refer to the positive outcomes an individual believes may result from engaging in activities like walking, such as improved health, increased physical strength, or enhanced psychological well-being (D’Haese et al., 2016; Brown, 2005).

d) Perceived barriers: They include obstacles that affect an individual's participation in walking, such as time management difficulties, environmental constraints, lack of resources, and lack of personal motivation (D'Haese et al., 2016; Brown, 2005).

e) Subjective norm: It involve the social pressure or expectations perceived by an individual, particularly the support or opposition from significant others, influencing their decision to engage in a behaviour (Ajzen, 1991; Koh & Mackert, 2016).

1.9.4 Municipal University

Municipal universities are typically funded and constructed by prefecture-level city governments, with a primary focus on undergraduate education. In China's higher education system, universities are generally categorized into three types: national universities, provincial universities, and municipal universities (Zou et al., 2022). The national universities are overseen by the central government and usually lead in academic standards and research capabilities; provincial universities are managed by provincial governments and have significant academic influence within their regions; municipal universities, managed by municipal governments, typically emphasize applied education and constitute the largest proportion of universities in the national system (Zou et al., 2022). Despite this, municipal universities face significant disparities in size, facilities, and funding compared to centrally and provincially-administered universities (Zou & Liu, 2022). However, these institutions play a crucial role in providing higher education resources to local and surrounding areas, particularly in training talent needed for local economic development, which is of strategic importance. Additionally, due to their extensive coverage, municipal

universities have made significant contributions to raising the overall educational level of the population and promoting social equity (Zhu & Liao, 2023; Zhou et al., 2011).

1.9.5 University Student

University students to the social group receiving higher education but have not yet graduated, typically aged between 18 and 26 years (Ying, 2018). In China, students enrolled in municipal universities constitute the largest proportion of the total university student population nationwide. Since municipal universities primarily focus on undergraduate education, the academic pressure and social needs of their students differ from those of students in major cities and leading universities (Zou et al., 2022). In this study, university students specifically refer to undergraduates enrolled in these institutions, primarily aged between 18 and 22.

1.10 Organization of the Chapters

This section explains the organization of each chapter. This dissertation is divided into six chapters.

Chapter One discusses the research background, problem statement, and research gaps of the topic. Based on these foundations, it then introduces an overview of the research aim, research objectives, and research questions. This chapter also explains the scope and significance of the study. Finally, it provides operational definitions of the terms used in the research.

Chapter Two reviews the existing literature related to the topic. It begins by explaining the theoretical foundation of the study and the application of the socio-ecological model in walking behaviour research. Next, it introduces the classification of walking and its benefits to university students' physical health and provides literature on the main variables of this study: built environment, psychosocial factors,

and their interactions. Additionally, this chapter covers the demographic characteristics influencing university students' walking behaviours.

Chapter Three describes the research methodology of the study. First, this chapter discusses the research philosophy and research design adopted for the study, followed by the study area, population, sampling techniques, and sample size. Next, it explains the methods used for data collection in the quantitative study. Then, it presents the pilot study and the validity and reliability of the research instruments. Finally, this chapter describes the statistical methods used for data analysis.

Chapter Four presents the research findings. It provides the results of the three research objectives: 1) to investigate the characteristics of walking behaviours among university students and the demographic differences in these behaviours, 2) to examine the impact of the campus built environment and psychosocial factors on walking behaviours among university students, 3) to investigate the interaction effects between the campus built environment and psychosocial factors on walking behaviours among university students.

Chapter Five discusses the research findings according to the research objectives. It begins with a discussion of the results of university students' walking behaviours. It then discusses the combined influence of built environment and psychosocial factors on different walking behaviours. Finally, it discusses the interaction effects between the built environment and psychosocial factors on different types of walking behaviours and their differences.

Chapter Six provides the conclusions of the study. It summarizes the main findings of the entire research, discusses the theoretical and practical contributions of the study, and points out the limitations of the research. Finally, it offers prospects for future research directions.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter aims to review the literature and theoretical foundations related to this topic. The first section reviews fundamental theories such as theories of behaviour, environmental psychology, and the socio-ecological model, constructing the theoretical framework for this study. Next, the second section discusses the dependent variable of this study, university students' walking behaviours, introducing their classification and benefits, emphasizing their importance, and summarizing the measurement methods of walking behaviours, providing a comprehensive perspective for understanding university students' walking behaviours. The third section explores the main independent variables influencing walking behaviours: campus built environment, psychosocial factors, and sociodemographic characteristics, analyzing how these factors affect walking behaviours. The fourth section reviews the literature on how the interactions between independent variables influence walking behaviours. Finally, the fifth section completes the conceptual framework of this study based on the socio-ecological model and empirical research.

2.2 Underpinning Theories

In exploring university students' walking behaviours and their complex influencing factors, the theoretical foundation provides the necessary framework and perspective to systematically understand and analyze walking behaviours. This study integrates theories of behaviour, environmental psychology, and the socio-ecological model, forming a comprehensive theoretical foundation.

First, theories of behaviour explain how psychosocial factors influence behaviour. Next, environmental psychology reveals how environmental design influences individual behaviour. Finally, the socio-ecological model offers a multi-level analytical framework, considering the combined influence of individual, psychosocial, and environmental factors on behaviour. The following sections will provide a detailed explanation of these three components.

2.2.1 Theories of Behaviour

Research on walking initially focused on theories of behaviour, which primarily explore how individual cognition, perception, and social factors influence behaviour (Maddux, 1993; Norman & Conner, 2005). By deeply analyzing relevant theories of behaviour, researchers can better understand how psychosocial factors promote behaviour change, thereby achieving the goal of promoting healthy walking behaviours. Over the years, many theories of behaviour have been widely applied to research on various health behaviours. Some of the most popular theories include the Health Belief Model (HBM), Social Cognitive Theory (SCT), and Theory of Planned Behaviour (TPB) (Rhodes et al., 2009, 2018b; Rhodes & Dickau, 2013). These theories provide a solid theoretical foundation for understanding human behaviour and its changes.

2.2.1(a) Health Belief Model

The HBM is one of the earliest theoretical models applied to the promotion of individual health behaviours. Initially proposed by social psychologist Hochbaum in the 1950s, it was further developed by Rosenstock and Becker (Abraham & Sheeran, 2015; Steckler et al., 2010; Wendel et al., 2015). The application of this model has expanded from its initial focus on preventive health behaviours to various health behaviours, such as physical activity, smoking cessation, safe driving, and healthy eating (Abraham & Sheeran, 2015; Mozaffarian et al., 2012; Sallis et al., 2015; Wendel et al., 2015). In the

context of walking behaviour research, the model has been widely used globally to explore the psychosocial factors influencing walking and to implement health behaviour interventions (J. Liu et al., 2023; Omar et al., 2013; Sommers et al., 1995; Yuasa et al., 2022).

The model explains behaviour change based on individual perceptions, attitudes, and beliefs. Specifically, when individuals are concerned about an unhealthy condition, recognize its potential severe consequences, and understand that improving their behaviour can effectively promote health and prevent disease, they are more likely to take positive action (Abraham & Sheeran, 2015; Sallis et al., 2015). The HBM divides factors influencing health behaviour into demographic and psychosocial factors. Regarding psychosocial factors, the HBM primarily identifies four factors influencing behaviour change: perceived susceptibility, perceived severity, perceived benefits, and perceived barriers (Abraham & Sheeran, 2015). In the field of walking behaviour, perceived benefits and perceived barriers are considered significant influencing factors (J. Liu et al., 2023).

Moreover, as the theory developed, cues to action were added as a key factor. This factor refers to external prompts that encourage individuals to change their behaviour, such as media campaigns, expert advice, or social support (Champion & Skinner, 2008). For instance, a media campaign promoting healthy walking may motivate people to shift from a sedentary lifestyle to more walking. Subsequently, researchers introduced the concept of self-efficacy from social cognitive theory, further enhancing the explanatory power of the model by highlighting the importance of individuals' beliefs in their ability to control health behaviours in the process of behaviour change (Champion & Skinner, 2008; Skinner et al., 2015).