Study of nutritional literacy and its associate factors among college students in Guangxi

Hongna Wei

A Thesis Submitted in Partial Fulfillment of Requirements for
degree of Master of Public Health in Public Health
March 2025

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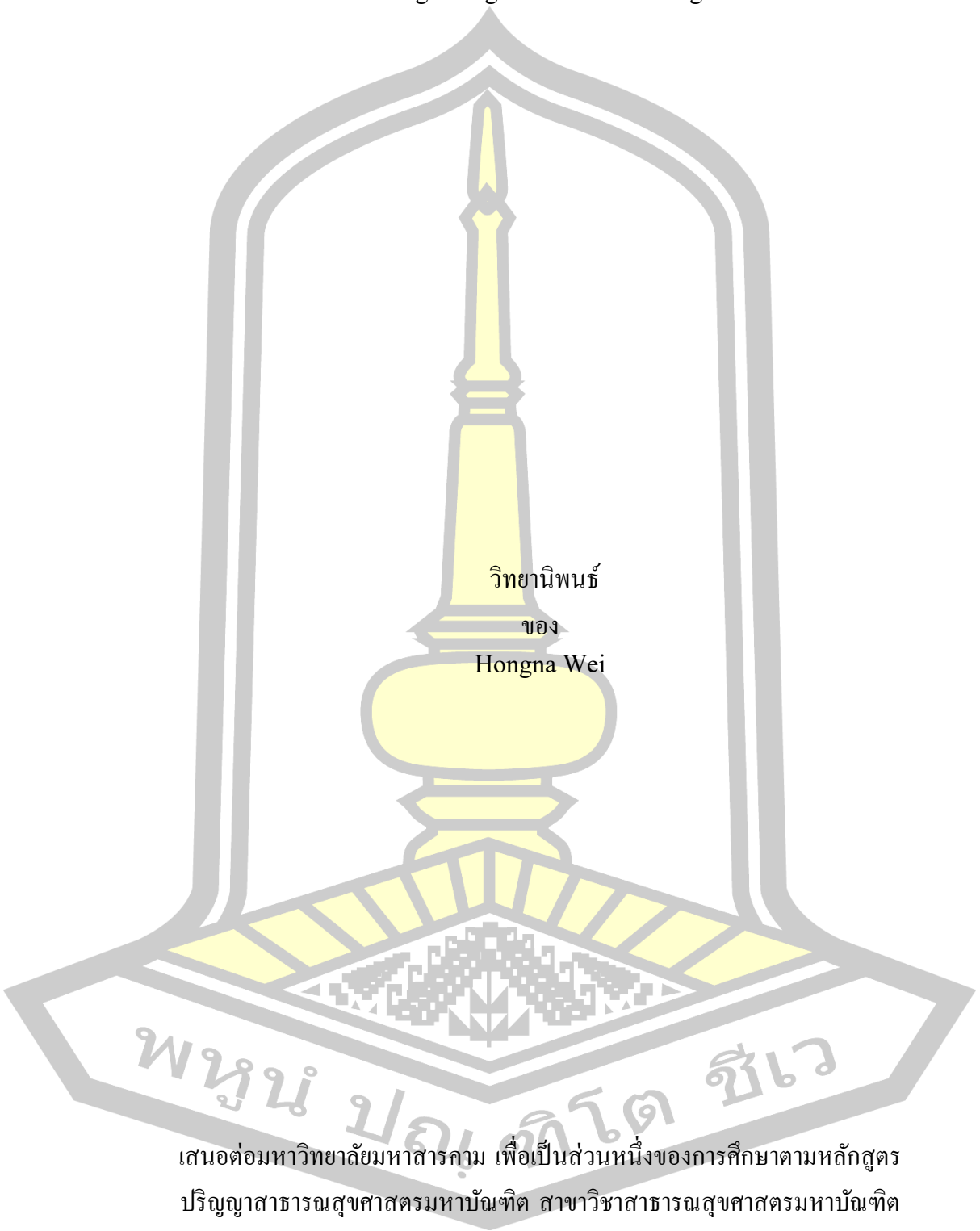

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Hongna Wei

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for Master of Public Health (Public Health)

March 2025

The examining committee has unanimously approved this Thesis, submitted by Ms. Hongna Wei , as a partial fulfillment of the requirements for the Master of Public Health Public Health at Mahasarakham University

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ABSTRACT

The aim of this study is to evaluate the nutritional literacy level of college students in Guangxi and explore the related factors affecting the nutritional literacy. This study was conducted from February to July 2024 in Guangxi Modern Vocational and Technical College, using a cross-sectional study design with integrating quantitative and qualitative research methods. Quantitative research using stratified sampling technique selected 1095 full-time students by using the way of questionnaire star to conduct online questionnaire survey collected 1095 full-time students in basic information, consumption habits and nutritional literacy level data. The research data statistical analysis, using multiple logic regression analysis to explore the related factors affecting nutritional literacy. In the qualitative study, 15 students were interviewed through focus groups to discuss the help of improving students' nutritional literacy and eating behavior. The findings of this study the nutritional literacy level of the higher vocational college students was high level. Exercise, BMI, nutrition education and nutrition knowledge were influencing factors for nutritional literacy level among vocational non-college students. Our evidence suggests that nutrition education should be provided to vocational college students, concentrating on freshmen students. A variety and appropriate nutrition education channels such as the internet, mobile devices, and social media should be used to improve information access for college students so that they can improve their nutritional literacy.

Keyword : nutrition literacy, health literacy, nutrition factors, college students

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Hongna Wei

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CHAPTER I
INTRODUCTION

1.1 Background

Dietary factors (e.g., high sodium intake, high carbohydrate and fat intake, etc.) caused by malnutrition have affected more than a third of the world's population, including overweight and obesity, with dietary-related chronic non-communicable disease (Global nutrition report, 2020). According to the Report on Nutrition and Chronic Diseases of Chinese Residents (2020), the overweight and obesity rate of Chinese adults aged 18 and above is 50.7 %, or more than half. Meanwhile, the rate of overweight and obesity in Chinese children aged 6-17 years old is 19%, and the rate of overweight and obesity in children under 6 years old is 10.4%(Report on Nutrition and Chronic Diseases of Chinese Residents, 2020). Previous studies reported that the causes of hypertension, diabetes, hypercholesterolemia, the prevalence chronic obstructive pulmonary disease, and the incidence of cancer are facing great challenges with regard to dietary behaviors. First, the energy supply ratio of dietary fat continues to rise. The daily amount of salt and oil used in household cooking is still much higher than the recommended value. At the same time, the proportion of residents eating out is rising, and the oil and salt in canteens, restaurants, and processed foods are generally higher than the recommended value. The problem of children and adolescents regularly drinking sugary drinks has become prominent. Second, the problem of overweight and obesity among residents is becoming increasingly prominent, and the incidence of chronic diseases is still on the rise. The rate of overweight and obesity among all age groups among urban and rural residents continued to rise, with more than half of adult residents being overweight or obese (The Report on Nutrition and Chronic Diseases of Chinese Residents, 2020). In China, unhealthy eating behaviors resulted in 30.2% of deaths and 21.3% of all disability-adjusted life years lost (Global Nutrition Report, 2021).

The nutrition and health status of the residents is an indirect indicator of the economic level, the quality of health care, and the health of the population in the

country or region (Hausebm et al., 2013). Nutritional literacy (NL) is an extension of health literacy, which refers to the ability of individuals to acquire, process, and understand basic nutritional knowledge and obtain appropriate dietary choices. It reflects the ability and way of individuals to acquire, understand, and process nutritional information and is a necessary condition for individuals to make reasonable dietary decisions (Nutbeam et al., 2008).

Health literacy is also defined as the ability of individuals to acquire, understand, and process basic health information and services and to make appropriate health decisions (Carbone et al., 2012). Nutrition literacy is regarded as a specific form of health literacy that is independent and complementary to each other (Krause et al., 2018); some researchers regard nutritional literacy as a subcategory of health literacy and food literacy (Truman et al., 2020). For the ability needed to obtain and understand nutritional information, the comprehensive conceptualization of nutritional literacy reflects the key elements of health literacy structure (Journal of Nutrition Education and Behavior, 2015). Nutritional literacy is an important determinant of dietary behavior (Escott-Stump,2011). Good nutritional literacy can enable individuals to follow dietary guidelines and make healthy dietary choices. Lack of nutritional literacy may reduce the ability to eat a healthy diet and lead to a reduction in diet quality (Itohy et al., 2009).

With the rapid development of the social economy, residents ' pursuit of life quality is getting higher and higher, and the level of health literacy has become one of the important indicators to measure the level of public health management and service and people's health status in China. In 2006, the Chinese Student Nutrition and Health Promotion Association continued to establish "nutrition and health schools" in the whole country. In 2011, the China Student Nutrition and Health Promotion Association and the China Working Committee for the next generation jointly promoted this work. In 2016, the National Health and Family Planning Commission issued the Standards for Health Promotion Schools (WS/T495-2016). In 2017, some primary and secondary schools in eight provinces (autonomous regions and

municipalities) of the Chinese Center for Disease Control and Prevention (nutrition and municipalities directly under the Central government) launched the pilot project of the "Nutrition Campuses" (Guidelines for nutrition and Health school construction,2021).

Additionally, the "Healthy China 2030" plan outline issued by the state in 2016 further clarified the need to improve China's health literacy and lifestyle monitoring system and improve the health literacy of the whole population. The nutritional literacy of residents has been included as one of the main indicators of the construction of a healthy China. Healthy China Action (2019-2030) is proposed for 2022 and 2030. The National Nutrition Improvement Plan (2017-2030) clearly states that nutrition should be integrated into all health policies. To continue to meet people's nutritional and health needs,by 2030, the nutritional literacy of residents will be further developed and improved, and the nutrition and health management of residents will be significantly improved at the same time.Thus, we should strengthen individualized weight management services, promote appropriate healthy weight management technologies with eating and movement balance, strengthen individualized guidance for overweight and obesity, and promote healthy weight throughout the whole life cycle through reasonable nutrition and adequate physical activity (The National Nutrition Improvement Program 2017-2030, 2017).

Nutrition is an important basis for human life maintenance and good health. In China, there is high attention paid to the nutritional literacy of infants and the elderly, but there are few researches on the nutritional literacy of college students. In China, the number of college students is about 91.79 million; about 57.66 million are in ordinary higher education, and the number of college students in higher vocational colleges in Guangxi is about 730,000 (Education statistics in 2021). Hechi city of Guangxi Zhuang Autonomous Region has 35,000 ordinary college students.,among which about 20,280 are full-time students. These college students are a special group of adults who are the main force in national construction. Nutrition knowledge level and positive nutrition attitude is necessary to change die behavior, while due to the

lack of nutrition knowledge, nutrition attitudes, etc, many college students form bad diet behaviors like skipping breakfast, eating at night and others. inadequate males which will lower. In addition, among teenagers, especially students who have just entered the university, it is easy to cause eating problems due to the current aesthetic trend of taking thinness as beauty. At the same time, the current college students' choices of food delivery and refined food also affect students' eating behavior, while dietary behavior directly influences nutrient intake.

Guangxi is an autonomous region inhabited by many ethnic groups. The number of ethnic minorities ranks first in China, accounting for 37.6% of the permanent population, among which the Zhuang nationality accounts for 31.4% of the permanent population of the region (the portal of the People's Government of Guangxi Zhuang Autonomous Region). In 2022, the health literacy level of Guangxi residents reached 23.15%, and that of Guangxi urban residents reached 25.00% and 21.27%. The health literacy level of Guangxi residents is 4.63% lower than that of national residents, and that of rural residents is lower than 6.51% (Guangxi Health Commission, 2022). In 2023,the health literacy level of Guangxi residents is low, only 25.10%, 4.60 percentage points lower than the national average (Guangxi Health Commission,2024).

The Zhuang groups provided more details about the results than the other 15 ethnic minority groups. Nutrients intake insufficiency, over consumption, and using blood testing to detect nutrient deficiency are three major topics for the results of nutrient intake/deficiency. (Yu et al., 2018; Huang et al., 2020), and sodium over-intake was reported most in nutrients over-intake (Jiang et al., 2013; Xie, 2015; Ka et al., 2018). Other diet-related behavior or practices are noted in the results of dietary habits, including high salt diet consumption, the consumption of pickled food, high-fat food, habits when buying foods, tea consumption, sweets consumption, breakfast consumption, meals per day, nutrition knowledge, causes for unbalanced diets, the influence of the Han main group or modernity, and more dietary habits. Guangxi

Modern Polytechnic College, located in the ethnic minority area of Hechi City, Guangxi, has a student population of about 13,500 of which approximately 78% are from rural areas (about 10,560 students), and about 9,720 Zhuang students, accounting for about 72% of the total number. The most students of this college is Zhuang minority group (Statistical Report of Guangxi Modern Institute of Technology in 2022).

Previous studies have shown that students with higher levels of nutrition literacy can develop healthy dietary habits and food purchasing behaviors, such as consuming more vegetables and fewer biscuits or candies (Liao et al., 2016), whereas low nutrition literacy has been shown to be associated with unhealthy diets (e.g., purchase and consumption of high-calorie food) (Santalo et al., 2019). Additionally, recent study reported that nutrition literacy along with good eating environment in college campuses improves college students' healthy eating behavior (Lai et al.,2021). Conversely, low nutrition literacy was found to be associated with diet-related disorders (Koca et al., 2020; Taylor et al., 2019). Individuals with lower nutrition literacy consume more high-salt, high-fat, or frying foods (Taylor et al., 2019). Improving nutrition literacy is regarded as a means of promoting health, particularly through enhancements in nutrition knowledge and practice (Koca et al., 2020). Moreover, the advanced nutrition literacy is characterized of the profound cognition of nutrition knowledge, optimized dietary behaviors, and highly developed skills to address nutrition and health barriers (Silk et al.,2008).

However, according to the questionnaire data collected in this study at Guangxi Modern Polytechnic College, a pilot study conducted by our research team revealed significant gaps in students' nutritional knowledge. For instance, 66% of respondents incorrectly believed that obesity and overweight during youth are unrelated to diabetes in later life. Additionally, unhealthy dietary habits were prevalent: only 31.25% of students maintained regular three-meal schedules, while 58.93% reported irregular meal times, 9.82% frequently skipped meals, and 38.39% consumed fried foods regularly.

Therefore, investigating nutritional literacy and its associated factors among

college students, especially among the higher vocational college students in ethnic minority areas, is important for a better understanding of nutrition literacy levels that can improve their nutrition knowledge and healthy eating behaviors. Also, it may provide a basis for formulating more targeted nutrition education strategies to improve the nutritional status of college students.

1.2 Research question

1.2.1 What Are the Levels of Nutritional Literacy Among College Students in Guangxi;

1.2.2 Factors Associated with Nutritional Literacy Among College Students in Guangxi.

1.3 Research objectives

1.3.1 To assess the nutritional literacy level of college students in Guangxi.

1.3.2 To determine factors related to the nutritional literacy of college students in Guangxi.

1.4 The importance of research

This study aims to evaluate the level of nutritional literacy and associated factors in the Guangxi Zhuang autonomous region. The summarized results of this study may provide nutrition literacy basic knowledge and skills so as to effectively improve the students' nutrition literacy level and promote their health and disease prevention.

1.5 Scope of research

1.5.1 Scope of population

In this study, we integrate both of quantitative and qualitative method in a study.

(1) In the quantitative method, we focus on the assessment of demographic characteristics, social factors, and nutritional literacy among vocational college students in ethnic minority areas, as well as the relevant factors affecting nutritional literacy. The population in this phase is Guangxi students aged 18–23 years

old from Guangxi Modern Polytechnic College.

(2) In the qualitative data collection, Based on the theoretical framework of the qualitative study on nutrition literacy, an interview outline was developed. The qualitative research involved 15 participants, with in-depth interviews conducted to qualitatively analyze the nutrition literacy of 15 university students from the Guangxi region. The analysis specifically explored their demographic characteristics in the qualitative data, nutritional knowledge, exploration skills, communication skills, evaluation skills, self-management skills, and decision-making skills.

1.5.2 Scope of contents

The study design in this research was mixed-methods design (quantitative and qualitative methods). In quantitative method as the cross-sectional study will be used to assess the nutritional literacy level and determine factors related to nutritional literacy in college students. Also, we used qualitative method to explore the problems and barriers conducive to improving nutritional literacy, diet behavior, and nutrition-related disease prevention by utilize the focus group technique.

1.5.3 Scope of research setting

This research Was conducted at Guangxi Modern Polytechnic College.

1.5.4 Scope of study period

The quantitative method phase Was run from October to December 2023. The qualitative method phase will run from January to February 2024.

1.6 Operational definition

1.6.1 Nutritional literacy refers to the degree to which an individual has the capacity to obtain, process, and understand nutrition information and services required for making appropriate nutrition decisions. According to Nutbeam's model of health literacy and Velardo's conceptualization of nutrition, that includes five dimensions: 1) exploration skills; 2) communication skills; 3) evaluation skills; 4) self-management skills; and 5) decision-making skills (Nutbeam, 2008; Velardo, 2015).

1.6.2 Exploration skills refers to accessing, selection, preparation, cooking and planning of daily food and nutrition.

1.6.3 Communication skills refers to informing, inquiring, asking for advice,

communicating, information exchanging, discussing food and nutrition with peers, family, academics, and convincing others to consume healthy food.

1.6.4 Evaluation skills refers to ability to evaluate and select information regarding food and nutrition label.

1.6.5 Self-management skills refer to a decision on food consumption according to food-based dietary guidelines, deal with food budgeting

1.6.6 Decision-making skills refers to apply information to make a comparison (including expense management) on food price when consuming healthy food.

1.6.7 Knowledge of dietary nutrients refers to the digestion and absorption of food, basic knowledge of nutrition, nutrition of various foods, dietary structure and dietary guidelines, the principle and function of dietary nutrition and nutrition of all groups of people, the preparation of recipes, the relationship between dietary nutrition and disease, food pollution and prevention, etc.

1.6.8 Cultural food consumption refers to food consumption experiences emphasizing the cultural traditions and heritages of Chinese people in Guangxi Zhuang Autonomous Region .

1.6.9 Meal planning refers to a process that involves choosing the meals that individuals eat over a set period of time.

1.6.10 College student refers to the students who study in the college aged 18–20 years old from ethnic minority areas in Guangxi Modern Polytechnic College in He Chi city.

CHAPTER II
LITERATURE REVIEW

This study investigated the nutritional literacy and related factors of college students in Guangxi, including college students in Hechi City, Guangxi Zhuang Autonomous Region, aiming to study the level of nutritional literacy and the factors affecting their nutritional literacy. By reviewing the existing literature, concepts, theories, and how to organize these key contents as a whole research topic, the theoretical framework is introduced, and the relevant studies are summarized as follows:

2.1 Nutrition status in China

2.2 Nutrition literacy

2.3 Status of nutritional literacy in China

2.4 Status of nutrition Literacy in College Students

2.5 Factor relate to nutrition literacy

2.6 Research method

2.7 Relevant studies

2.8 Conceptual framework of the study

2.1 Nutrition status in China

Data from the Report on Nutrition and Chronic Diseases of Chinese Residents (2020) show that unhealthy lifestyles among residents are still common. The energy supply ratio of dietary fat continues to rise, and the rural region has exceeded the 30% recommended upper limit for the first time. The daily amount of salt and oil used by family cooking is still much higher than the recommended value. At the same time, the proportion of residents eating out is rising, and the oil and salt in canteens, restaurants and processed food should be concerned. The problem of regularly drinking sugary drinks in children and adolescents has become prominent. The smoking rate of people over 15 years old and the drinking rate of adults in the first 30 days are more than a quarter, and the problem of physical inactivity is widespread. The problem of overweight and obesity among residents is increasingly prominent, and the disease / incidence of chronic diseases is still on the rise. The rate of overweight and obesity among all age groups in urban and rural residents continued to rise, with more than half of adult residents overweight or obese.The prevalence of

hypertension, diabetes, hypercholesterolemia, chronic obstructive pulmonary disease and cancer incidence have increased compared to 2015.

The prevalence of nutritional overweight and obesity, showed an obvious increasing trend in China.In China, the rate of overweight and obesity of adult residents exceeds 50%.Previous studies reported that the causes of hypertension, diabetes, hypercholesterolemia, the prevalence chronic obstructive pulmonary disease, and the incidence of cancer are facing great challenges with regard to dietary behaviors. First, the energy supply ratio of dietary fat continues to rise. The daily amount of salt and oil used in household cooking is still much higher than the recommended value. At the same time, the proportion of residents eating out is rising, and the oil and salt in canteens, restaurants, and processed foods are generally higher than the recommended value. The problem of children and adolescents regularly drinking sugary drinks has become prominent. Second, the problem of overweight and obesity among residents is becoming increasingly prominent, and the incidence of chronic diseases is still on the rise. The rate of overweight and obesity among all age groups among urban and rural residents continued to rise, with more than half of adult residents being overweight or obese (The Report on Nutrition and Chronic Diseases of Chinese Residents, 2020). In China, unhealthy eating behaviors resulted in 30.2% of deaths and 21.3% of all disability-adjusted life years lost (Global Nutrition Report, 2021).

The awareness rate of residents' health knowledge is low, so the disease problems are increasingly prominent.Deaths caused by cardiovascular and cerebrovascular diseases, cancer, chronic respiratory diseases and diabetes account for 88% of the total deaths, and the disease burden accounts for more than 70% of the total disease burden. unhealthy lifestyles such as smoking, excessive drinking, lack of exercise and unreasonable diet are common, The prevention and control of major infectious diseases such as hepatitis, tuberculosis and AIDS remains grim, and problems in mental health, occupational health and endemic diseases cannot be ignored(Healthy China Action Promotion Committee,2019).

In summary, there are still unhealthy lifestyles in Chinese residents, and the problem of overweight and obesity among residents is increasingly prominent. Hypertension, diabetes, hypercholesterolemia and other diseases are still serious, and there are many bad eating behavior and unreasonable dietary structure. China’s nutrition landscape is marked by a dual burden of malnutrition and chronic disease, driven by structural dietary shifts and insufficient public health literacy.

2.2 Nutritional Literacy (NL)

At present, the concept of nutritional literacy (nutrition literacy, NL) is not unified. The professional term "nutritional literacy" first appeared in the assessment of literacy in the context of cardiovascular nutrition education (TenHave TR et al., 1997), and later gradually developed into a hot topic in the field of nutrition education and health promotion. Nutrition literacy is similar to health literacy (Silk et al., 2008); Nutritional literacy is an extension of health literacy, refers to the ability of individuals to acquire, process and understand basic nutritional knowledge and obtain appropriate dietary choices, reflecting the ability and way of individuals to acquire, understand and process nutritional information, and is a necessary condition for individuals to make reasonable dietary decisions (Krause C, Silk and Nutbeam et al., 2008); _Believed that nutritional literacy is "the ability to acquire, understand and process / use basic nutritional information"（Krause C et al., 2018); according to the Nutbeam definition of health literacy, nutritional literacy is divided into functional nutritional literacy, critical nutritional literacy and interactive nutritional literacy (Krause C et al.,2018). Among which is functional nutritional literacy refers to the ability to correctly read, interpret and understand food labels, emphasizing basic literacy and arithmetic skills, including the ability to acquire and process nutritional information to improve nutritional decision-making（Krause C et al., 2018). The latter two nutritional qualities were described as cognitive and interpersonal communication skills, respectively（Krause C et al., 2018). In which critical nutrition literacy is interpreted as having critical assessment skills, while improving awareness and critical action to solve good nutrition problems, and can correctly assess the reliability of network nutrition information sources (Naigaga da et al, 2018). Interactive nutritional literacy reflects the ability to make the right dietary choices, such as knowing that excessive saturated fat intake is bad for health, and then identifying and choosing foods low in saturated fat (Velardo, 2015). Velardo apply to Nutbeam (2000) of health literacy research model, nutritional literacy is divided into functional, interactive, critical three aspects of nutritional literacy, namely to master the simple nutrition information and application of basic literacy, using communi-cation nutrition information ability to make a healthy diet choice, critically processing nutrition information and the ability to overcome obstacles. Guttersrud et al. (2014) introduced more skills into improved nutrition literacy research, increasing the ability to access and use nutritional information, as well as to explore and address nutritional disorders in more complex social environments.

The health literacy model extends broader dimensions of health literacy from a population health perspective based on the individual need to acquire knowledge and skills in health care activities in a public health perspective called functional health literacy, in addition to interactive health knowledge and key health literacy. The three levels of health literacy models represent different levels of knowledge and skills from top to bottom and give individuals more decision-making and autonomy. According to the author Nutbeam D(Nutbeam et al., 2008), the health literacy dimensions include:

(1) Acquiring skills: Access to health information and health services means using the ability to select dates and know how to find information, according to practice, from multiple sources until the date is reliable.

(2) Cognitive skills: refers to the correct knowledge and understanding of the practice guide.

(3) Communication skills: Communication skills refer to the ability to communicate through speech and writing, including the ability to communicate and persuade others. Understand and receive information about the practice.

(4) Self-management skills: the ability to develop goals, plans and implement plans, and the ability to review them simultaneously. Follow this goal to correct your behavior.

(5) Decision-making skills: refers to the ability to define the selection, reject / avoid, or select the operation methods by using logic. Or analyze benefits to reject / avoid and take the right action.

(6) Media literacy skills: refers to the date reliability verification ability provided by the media that can be quickly released. Compare how to choose media to avoid potential risks to oneself and others' health as well as assess information to guide the community and society.

Nutrition literacy is a specific form of health literacy, Silk institute adapted the definition of health literacy, replace "nutrition" with "health", that nutrition literacy refers to individual acquisition, analysis and grasp the basic nutrition (health) information or services, and through the information or services to make correct nutrition (health) decisions (Silk KJ et al., 2008).

Most researchers currently believe that nutritional literacy is the degree to which individuals are able to access, process, and understand the nutritional information and services needed to make appropriate nutritional decisions. According to the Nutbeam's health literacy model and nutritional conceptualization of Velardo, it includes five dimensions: (1) exploration skills; (2) communication skills; (3)

evaluation skills; (4) self-management skills; and (5) decision-making skills (Nutbeam, 2008; Velardo, 2015).

Although the definition of nutritional literacy has not been consistently concluded, it has in common. The main common features can be interpreted as the ability to acquire, analyze and master basic nutritional information or services, and make correct nutritional decisions (Zhang Yunqiu et al., 2022). The integrated conceptualization of nutritional literacy for the capacity required to acquire and understand nutritional information reflects the key element structure of health literacy.

2.3 Status of nutritional literacy in China

The nutritional and health status of a population serves as an indirect indicator of a nation's or region's economic development, healthcare quality, and overall public health outcomes (Marietta et al., 2013). Nutrition literacy, a critical component of health literacy, plays a pivotal role in enhancing population well-being, improving dietary practices, and mitigating nutrition-related chronic diseases. Since 1982, China has conducted decadal national nutrition surveys, with the 2002 survey outcomes forming the scientific foundation for governmental policy formulation. However, rapid economic growth has accelerated shifts in dietary behaviors and health patterns, rendering decadal surveys insufficient to capture dynamic trends in nutrition-related diseases or facilitate timely interventions, thereby risking missed opportunities for optimal public health action. Furthermore, the 10-year survey interval fails to align with China's five-year socioeconomic planning cycles, which demand more frequent data updates （Guo Qiya et al., 2016).

Therefore, a new round of chronic disease and nutrition monitoring for Chinese residents was launched in 2010- 2013 respectively, covering nearly 2019-and 2015 million people in 31 provinces 600(across (autonomous regions and municipalities the country, with more than 600,000 people and representative of national and According to the monitoring results, the Report on Nutrition and .provincial levels .was compiled (2020) Chronic Diseases of Chinese Residents According to the Report the rate of ,(2020) on Nutrition and Chronic Diseases of Chinese Residents and the imbalance between %overweight and obesity of Chinese adults exceeds 50 energy intake and energy expenditure is the direct cause of overweight and obesity in kg 6.The average weight of men and women aged 18 and above was 69 .individuals kg, respectively, compared with the results released in 7.kg and 1 4.and 59 kg, up 3 The rate of overweight and obesity among all age groups in urban and rural .2015 areas continued to rise, with the rate of overweight and obesity among residents aged

The data also showed that the .respectively ,%4.and 16 %3.and above reaching 34 18 the detection ,%9.prevalence of diabetes among residents aged 18 and above was 11 The prevalence of .%5.and hypertension was 27 ,%2.rate of prediabetes was 35 %8.37,%3.and 60 and above was 13 59-44,45-hypertension among residents aged 18 The prevalence of hypertension is generally increasing, and .respectively ,%2.and 59 Hypertension is one of .the number of adult hypertension is estimated at 245 million the main causes of cardiovascular diseases and death such as coronary heart disease million deaths in 54.caused 2 (SBP) In 2017, high systolic blood pressure .and stroke of which died from cardiovascular disease %7.China, 95(Report on Nutrition and Chronic Diseases of Chinese Residents ,2020).

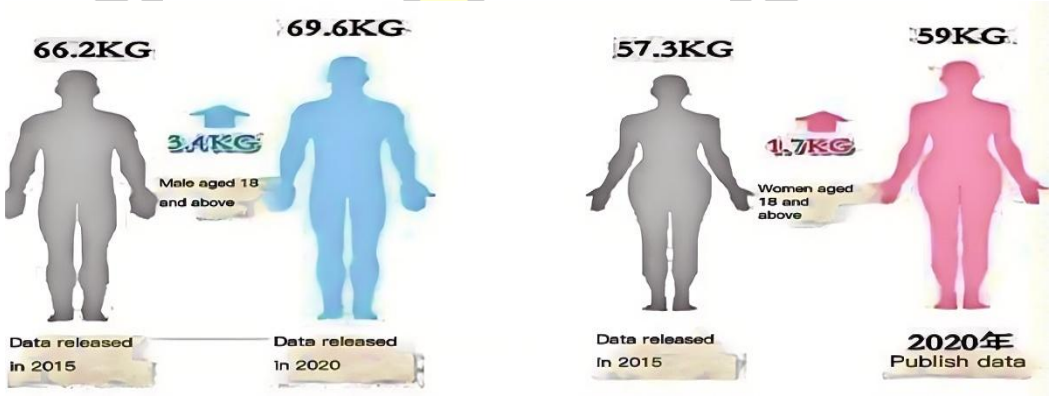


Figure 1 2015 Year-2020 adult different gender weight

In recent years, in order to improve the national nutrition and health level, the government has issued the Basic Knowledge and Skills of Health literacy, and .constantly improved the investigation, monitoring and intervention of health literacy In The State Council successively issued the Outline of the ,2016"Healthy China 2030" 2030-2017) Plan and the National Nutrition Plan)taking the improvement of , the national nutrition and health level as a part of the national strategic development, and taking" "significantly improving the nutrition and health literacy of the residents Reference Intake of dietary nutrients for .as one of the development goals Chinese.Part 1 :Residents is divided into five parts: macronutrients; Part 2: constant elements; Part 3: trace elements; Part 4: soluble vitamins; Part 5-fat: Water-soluble Dietary).vitamins, which provides a reference for dietary nutrient intake for residents reference intakes for Chinese residents,2018）

In 2021, the Scientific Research Report on Dietary Guidelines for Chinese Residents mentioned that from the trend of adult overweight and obesity from 2000 to the rate of obesity increased faster than the rate of overweight; and the rate of ,2018 .overweight and obesity in rural population was higher than in urban population

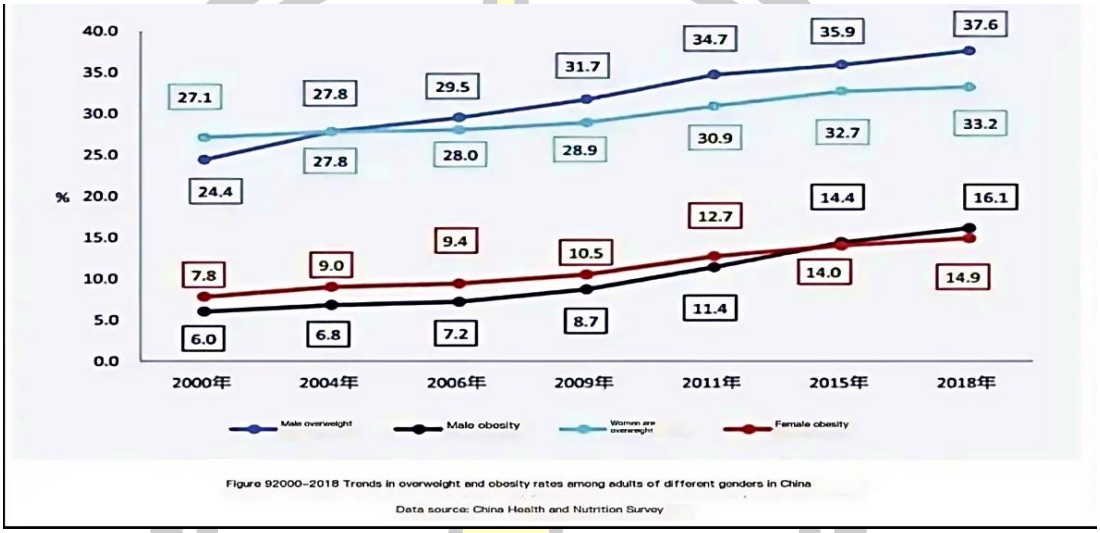


Figure 2 Changes in overweight and obesity in China from 2000 to 2018

Through the balanced diet pagoda of Chinese residents (2022) (Figure 3) and the balanced diet plate of Chinese residents (2022) (Figure 4), we explain the theme of the balanced diet and food composition structure, well highlight the Chinese cultural characteristics and balanced concept, and provide guidelines for residents' dietary .intake

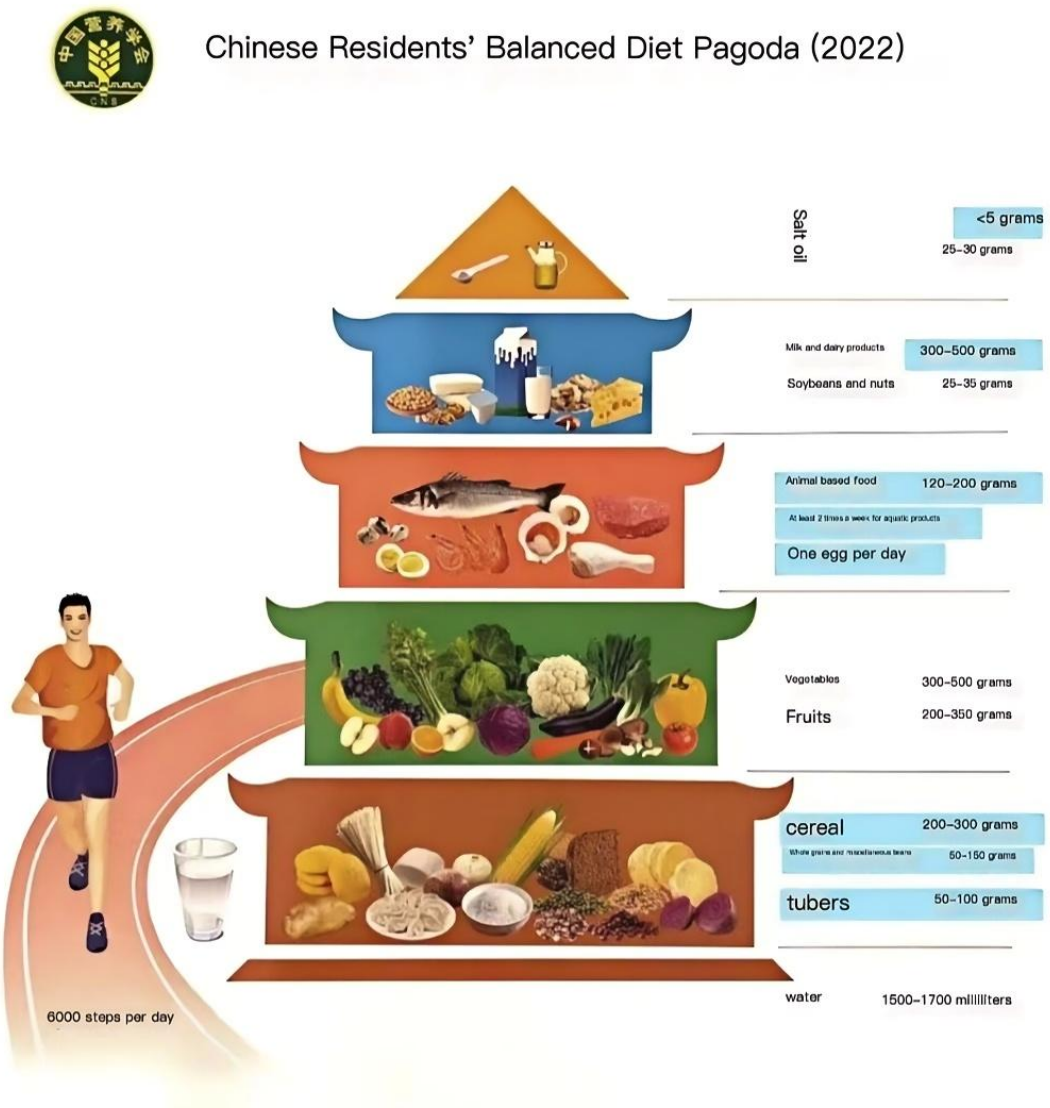


Figure 3 Chinese Residents' Balanced Diet Pagoda(2022)

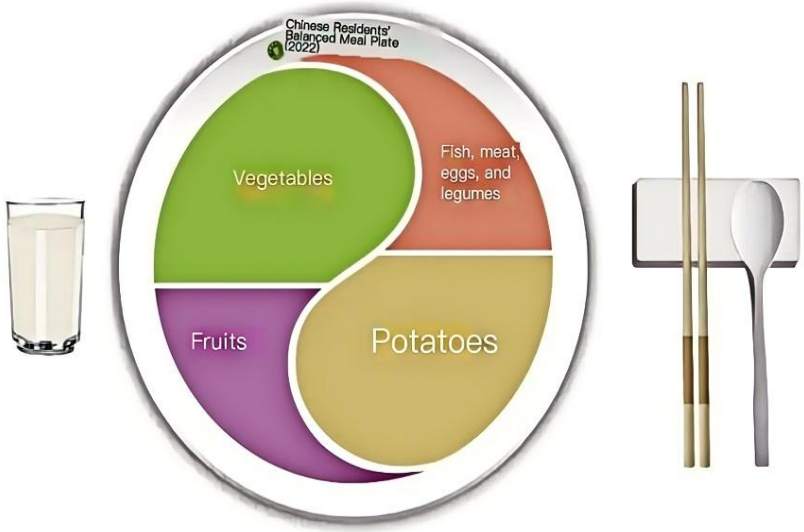


Figure 4 Balanced Diet Plate for Chinese Residents (2022)

The awareness rate of ,(2030-2019) According to the Healthy China Action nutrition and health will increase by 10 percent in 2022 and 10 percent in 2030 and by 2030, the awareness ,(2030-2017) According to the National Nutrition Plan .2022 rate of nutrition and health knowledge will increase by 10 percent compared with 2020.

Despite significant advancements in nutrition and health management for Chinese residents driven by policy initiatives and scientific monitoring, challenges such as overweight, obesity, and related chronic diseases among adults remain severe. Weak nutrition literacy education, insufficient daily physical activity, and persistent unhealthy dietary behaviors collectively contribute to a complex landscape where policy achievements coexist with unresolved public health risks.

2.4 Status of nutrition literacy in college students

There have been many domestic survey reports on the nutrition of college students, a large proportion of this involves conducting dietary surveys of college students, common 24-hour review or dietary diary method, these methods can only measure short-term dietary shots, does not represent the usual dietary habits; another part is the survey of nutrition knowledge, attitude and behavior of college students for

a certain nutrient , there are also surveys on nutritional knowledge and attitudes among college students (Liang Jie et al., 2008); recent years, the survey of nutrition knowledge-attitude-behavior (KAP) began in China, the KAP survey is a research method that began emerging in the medical field in the seventies, this approach yields a considerable time, total and universal information, so far, the KAP survey method has achieved very good results in the field of population disease awareness (Huang Xin et al., 2008), at the same time, the KAP method is also an ideal nutrition survey for college students. Summarize the nutrition KAP survey of college students in recent years, the results showed that: college students were generally lack of nutrition knowledge, college students in different majors, their nutritional knowledge scores were also different, among them, the nutrition knowledge score of the medical students is higher than that of the students of other subjects; boys scored significantly lower nutrition knowledge than girls (Yan Qu et al., 2008);the nutrition knowledge score of junior students is lower than that of senior students; the nutrition knowledge and behavior score of college students are lower than that of undergraduates; the scores of nutrition knowledge-attitude-behavior were lower than those of urban and county students (Shao Peilan, 2004). most college students have a correct nutrition attitude, think nutrition knowledge is important, they are willing to know more about nutrition knowledge, and say that they are willing to change bad eating habits if it is beneficial to their health. College students can not use the existing nutrition knowledge in daily behavior, some students have smoking, drinking habits, not enough attention to breakfast, in the choice of food, some students like to eat smoked, fried food, beans, animal viscera, grains to eat very little, the diet structure is unreasonable.

In 2017, the Development Course of Chinese Students' Physical Fitness Monitoring showed that the physical condition of Chinese college students showed a downward trend, and the obesity rate was increasing, increasing by 2%~3% every five years (Zhou Wei et al., 2017). In addition, college students' diet behavior also do not eat breakfast, often eat late at night snack, picky, irregular and a series of problems (Chang Yafen et al., 2014), cause these problems mainly because of the lack of nutrition knowledge, nutrition attitude, etc., and good nutrition knowledge level and positive nutrition attitude is necessary to change diet behavior (Liu Jia et al., 2020). Previous studies shown that the nutrition knowledge of college students is poor,

female nutrition knowledge level is higher than boys (Liu Taoran et al., 2019), nutrition related majors are higher than non-nutrition majors (Wang Shilong et al., 2017), and senior nutrition knowledge level is higher than that of lower grades (Wu songwen et al., 2006). According to the Report on Nutrition and Chronic Diseases of Chinese Residents (2020) (Disease Control and Prevention Bureau of the National Health Commission, 2022), the rate of overweight and obesity rate among residents aged 18 years and above were 3.3% and 16.4%, respectively. Overweight or obesity can lead to the occurrence of a variety of chronic non-communicable diseases, seriously affecting the quality of life and reduce residents' happiness. Due to the different living environments since childhood, urban and rural college students also have certain differences in their nutrition knowledge and eating habits (Zhu Mingyu et al., 2012)， According to the monitoring data released by the 2021 Nutrition Improvement Plan for Rural Students in Compulsory Education (2012-2022)(2021 Nutrition Improvement Plan for Rural Students in Compulsory Education 2012-2022,2012), according to the growth retardation rate in rural areas, the growth retardation rate of students aged 6-15 years in the monitored areas was 2.3%. In terms of waste rate, the waste rate was 9.8% for students aged 6 to 15 years in the monitored area. At the same time, the primary and middle school students in the monitoring area are also overweight and obese. In 2021, the rate of overweight and obesity among primary and middle school students in the monitored area was 18.7%. The anemia rate of the students in the monitored area was 12.0%. Anemia is a common nutrition-related disease in primary and middle school students in the economically underdeveloped areas of China. It will reduce the ability to resist infection, hinder the growth and development, and affect the ability of learning and exercise. The nutritional imbalance of students will affect their growth and cognitive ability, increase the risk of disease, and also lead to the loss of strength and intelligence in adulthood, bringing heavy economic burden to social development. The growth retardation rate of students is usually used as a main indicator of long-term dietary nutrient intake.

Researchers have carried out a series of relevant investigations and studies on college students through dietary survey, Food frequency questionnaire method(FFQ) survey, nutrition KAP survey (Goud LH et al., 2008) and other methods, and some results have been achieved. However, most of the domestic data are from student

surveys in Beijing, Shanghai, Guangzhou and Jinan (Yu Xiuju, 2015), which is not enough to fully reveal the problems. College students in Guangxi generally lack the understanding of nutrition knowledge, but the awareness rate of nutrition knowledge among urban students is higher than that of rural students, which may be related to the fact that urban students can have more access to nutrition knowledge in their daily study and life and have more opportunities to receive diet health education (Zhu Mingyu et al., 2012).Therefore, it is more urgent to investigate the nutritional status, nutrition knowledge and attitude behavior of college students in ethnic minority areas.

Guangxi Modern Polytechnic Collegeis located in Guangxi zhuang autonomous region, Hechi city ethnic minority areas, college students about 13500 people, including about 10560 rural college students, rural college students accounted for about 78%, nutritional literacy level is low, therefore, an urgent need to study the influence factors of college students 'nutritional literacy in this region, strengthen the knowledge popularization of nutrition literacy, improve college students' nutritional literacy skills, healthy diet behavior, etc., so as to improve the rural minority college students' nutritional literacy.

2.5 Factor relate to nutrition literacy

Knowledge of dietary nutrients is a core component of nutritional literacy, encompassing mechanisms of food digestion and absorption, fundamental knowledge of nutrition (e.g., functions of macronutrients, vitamins, and minerals), analysis of nutritional value across food categories (e.g., grains, meats, vegetables), dietary structures and guidelines (e.g., application of the Balanced Diet Pagoda), principles of dietary nutrition and population-specific requirements (e.g., adolescents and pregnant women), meal planning principles and nutritional pairing techniques, the relationship between dietary nutrition and chronic diseases (e.g., obesity, diabetes), as well as sources of food contamination and preventive measures. Studies indicate that college students’ mastery of this knowledge directly impacts their nutritional literacy. For instance, understanding the role of dietary fiber in gut health may encourage increased whole grain consumption (Liu, Jia et al., 2020), while a lack of awareness regarding sodium intake’s association with hypertension may lead to high-salt dietary habits (Disease Control and Prevention Bureau, 2022). Additionally, surveys reveal that medical students score significantly higher in nutrition knowledge than those in other

disciplines, senior students outperform junior students, and female students generally exhibit higher nutrition knowledge levels than males (Yan, Qu et al., 2008; Wu, Songwen et al., 2006). However, despite holding positive attitudes toward nutrition—recognizing its importance and expressing willingness to change unhealthy habits—many students still neglect breakfast, prefer high-fat and high-salt foods, and maintain unbalanced dietary structures in practice (Shao, Peilan, 2004). Therefore, systematic education on dietary nutrient knowledge (e.g., integrating dietary guidelines and digital platforms) is critical to enhancing college students' nutritional literacy. Bridging the gap between knowledge and behavior requires curriculum design, campus environment optimization, and targeted interventions (e.g., the rural "One Village, One Nutritionist" program) to address public health challenges posed by the rising prevalence of overweight, obesity, and chronic diseases.

2.6 Research method

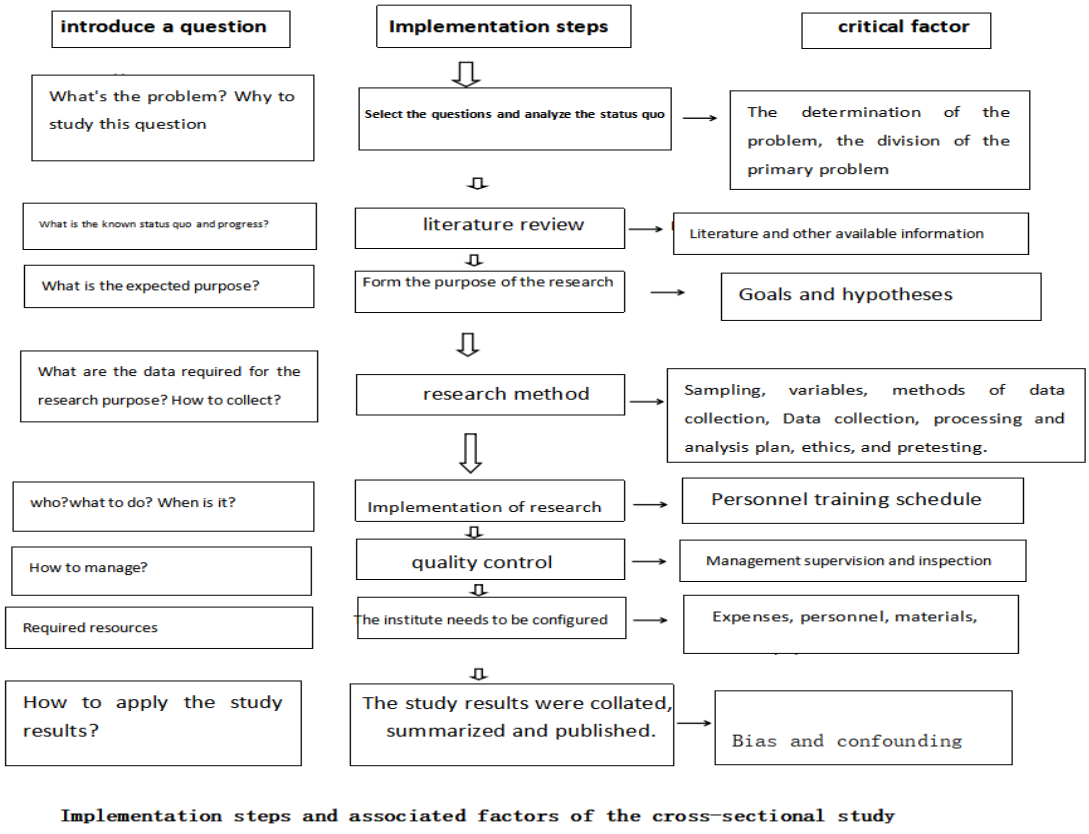
2.6.1 Cross-sectional study

The cross-sectional study method was used in this study Cross-sectional study (cross-sectional study), also known as current situation study or prevalence study, refers to the application of census (census) or sampling survey (sampling survey) in a specific population to collect relevant variables, disease or health data at a specific time to describe the distribution of current disease or health status and the association of a factor and disease. As a condition study at a particular time point or period, which only reflects the study time point or period is a descriptive study (Lin Guo et al., 2000).

Cross-sectional survey is often used in the prevalence survey, describe the population health status or characteristics (such as diet, nutrition, environment, etc.), immigration research (explore the relationship between genetic background and environmental factors and risk factors), understand the population behavior attitude and health way and views, health care measures and plan use and effect evaluation, put forward the disease etiology hypothesis, etc. Because the results of the cross-sectional study design have strong promotion significance and the natural control group from the same group, the results are comparable and can observe many factors and ethical safety. Therefore, many studies have adopted this design method (Wang Yi, 2008).

Attention should be paid to cross-sectional studies: (1) what is the purpose or hypothesis of the study? Is it of great significance for clinical application and

promotion?(2) What is the study population? Is there a clear diagnostic criteria? Is it a random sample? Is the sample size adequate?(3) What is the outcome of the study measurement (disease / exposure factors)? What measures are used to measure this measure (OR value / prevalence)?(4) Is the research method scientific? Is the detection method accurate? Are the objective observation indicators used?(5) Are the research results true and credible? Did you answer the original hypothesis? Is the statistical method appropriate? Are all the associated factors considered? What is the nonresponse rate?(6) Are the limitations and deficiencies of the study results discussed?(Lin Guo et al., 2000). The implementation steps of the cross-sectional study are shown in Fig.



Implementation steps and associated factors of the cross-sectional study

Figure 5 Implementation steps and associated factors of the cross-sectional study

There are two major categories of sampling methods(Xiaofeng Wang, et al.， 2020): (1) probability sampling methods, in which samples are chosen by using a method based on the theory of probability; and (2) nonprobability sampling methods, in which samples are selected based on subjective judgment. In general, probability sampling methods are preferred over nonprobability ones, as the former are

considered to be more accurate and rigorous. However, in applied clinical research, there are some circumstances in which it is not feasible or practical to perform random sampling. Nonprobability sampling is applied in those situations. Martínez-Mesa et al provided a useful discussion on the basic elements of selection of participants for a clinical study. Commonly used sampling methods are summarized in Table 1. Popular probability sampling techniques include simple random sampling, systematic sampling, stratified sampling, and cluster sampling. Nonprobability methods include convenience sampling, quota sampling, purposive sampling, and snowball sampling.

Table 1 Commonly Used Sampling Methods in Clinical Studies

Probability sampling methods	
Simple random sampling	Every member of the population has the same probability of being randomly selected into the sample
Systematic sampling	One selects every nth (ie, 10th) subject in the population to be in the sample
Stratified sampling	The population is divided into non-overlapping groups, or strata; a random sample of population members is then collected from within each stratum
Clustered sampling	The researcher divides the population into separate groups, called clusters. Then, a simple random sample of clusters is selected from the population. Note that the clusters are used as the sampling unit, rather than individuals
Nonprobability sampling methods	
Convenience sampling	Participants are selected based on availability and willingness to take part
Quota sampling	A tailored sample that is in proportion to some characteristic or trait of a population
Purposive sampling	Also known as judgmental or subjective sampling. It relies on the judgment of the researcher when choosing members of the population to participate in a study
	Existing study subjects recruit future subjects from among their

Snowball sampling	acquaintances

2.6.2 Quantitative studies

2.6.2.1 Quantitative research, also known as quantitative research, refers to the analysis and processing of data by mathematical methods, and reveals the nature and laws of things through the quantitative changes and characteristics of data. Quantitative research mainly adopts observation, investigation, measurement, experiment and other methods to collect the data of the research objects, through mathematical calculation and logical analysis, to obtain scientific, accurate and evidential rules from the data. The general process of the study is: （1） determine the research purpose and propose the hypothesis; （2）the selection of the experimental site, sample adoption and preparation (note the sample size and the randomness); （3）carry out the study (pay attention to the control of variables and dimensional analysis to achieve the objective and fair, systematic and normative process); （4） quantify the research data to obtain the research results and verify the hypothesis; and fifth, write the research report. This is a research process of "confirmation" or "falsification", and the requirements for each step are accurate and strict. The research process must advance in a straight line according to the plan stipulated in advance, and specific circumstances are not allowed to bias the research with objectivity and reliability (Zhang Xinhai et al., 2020).

Quantitative data analysis, such as descriptive statistics, can be used by the demographic characteristics of participants with frequency (such as numbers and percentage) and central trends (such as mean, pattern, and median), which may vary depending on the type of measurement scale; nominal, sequential, interval, and proportional scale (Duffy et al., 2001)

In this study, information was collected through quantitative research methods, questionnaire, experimental, existing data, observation, content analysis and other methods.

2.6.3 Qualitative study

Qualitative research, also known as qualitative research and qualitative research, is corresponding to quantitative research to explore the nature of things. It is a research method to determine the nature and laws of things by discovering problems and understanding the phenomena of things (Zhang Xinhai et al., 2020). Qualitative research obtained research data through historical review, empirical participation, interview method, and literature method. Compared with quantitative research, which

focuses on representative data analysis, qualitative research pays more attention to the typicality and deepness of things or phenomena, and summarizes the essential laws of things from individual things or phenomena to general and universal conclusions. The general process of research is: first, the research purpose is clear; second, the research schedule is formulated; third, the research object is the unit of analysis. The unit can be an independent individual or an organizational form, group or event; fourth, use qualitative research methods such as interviews and literature to conduct research; fifth, collect and analyze data. The main function of this step is to find the connection between the study data and the study purpose; sixth, test the reliability and validity of the study data, obtain the study results, and write the study report. Each step of the process is variable at any time, not a regular, step-by-step straight line route, but a cyclical process. If researchers trigger a new idea or problem when implementing a procedure, they can collect information again and make a plan (Zhang Xinhai et al., 2020).

Qualitative data analysis The analysis of qualitative data coincides with the collection of data using verbatim records. Transcription was performed as soon as possible after the interviews and focus groups and by the researchers. The main steps are based on a qualitative content analysis, in which open coding is used to develop relevant categories for the analysis. The choice of category or code is related to the area of this study. Therefore, the organization of the data, the selection of specific elements of the category data, and the exploration of the content of these categories reflect common practices in qualitative research ((Burns et al,, 2001).

2.7 Related studies

College students is the key to growth, growth of knowledge skills and individual health behavior reshape important stage, nutrition literacy ability helps students scientific food selection form a reasonable dietary structure, improve college students nutrition literacy, improve college students 'bad diet behavior and nutrition related disease prevention, so as to provide sufficient, proportion of appropriate energy and nutrients, is to meet the needs of college students' growth and development, maintain health. This is also indicated by a review of relevant domestic and international literature.

2.7.1 Importance of food and nourishing guidelines: standardized food and nourishing guidelines provide reference for all types of people, In 2023, the Chinese Health Commission published the Guidelines for Food and Raising for Adult Hypertension (2023 edition), Guidelines for Food and Raising for Adults with

Hyperlipidemia (2023), Guidelines for Adult Diabetes (2023), Guidelines for Food and Raising for Children and adolescents (2023 edition) and other guidelines for different groups, Food and feeding standardization for all types of people provides reference for the reasonable collocation of diet, It is to improve the cognitive level of college students' dietary nutrition supply and the daily implementation of dietary nutrition supply, Avoid the dietary knowledge blind area and the improper diet. Feng Chi, a Chinese researcher, believes that college students can learn the knowledge of dietary nutrition, and reasonably arrange the intake of heat energy and various nutrients at breakfast, lunch and dinner, and have regular meals (Feng Chi, 2021). Nutrition knowledge can promote college students to change food choice tendency, reduce the taste, price to choose food phenomenon, help college students pay more attention to nutrition in food selection, in terms of variety and quantity choose conducive to their healthy food, and reduce the choice of Fried food, so as to develop good eating habits (xin-xin zheng, 2021). Food and nourishing guide is an important part of nutrition knowledge, which is standardized, guiding and contemporary, and plays an important role in improving the nutritional literacy of college students.

2.7.2 Takeout food consumption: Take-out food consumption of college students is closely related to nutritional literacy. Sun Qing, a Chinese scholar, investigated the relationship between takeaway food consumption and nutritional literacy of college students. The survey found that 80.7% of college students had ordered takeout in the past month, among which the consumption frequency was 1~3 times / week (37.3%) and 4 times / week (23.9%), while only 19.3% of college students had not ordered takeout. The consumption of takeout food is more common, and the attention of nutritional factors is low. More than half will choose high salt / high oil / high sugar food, which is worrying. College students' nutritional literacy and takeaway food consumption frequency and high salt / high oil / high sugar food consumption are negative correlation, and focus on total energy intake and nutrition collocation positive correlation, mainly reflected in the application of skills, interactive and judging skills nutrition literacy, however, cognitive knowledge reserves, knowledge understanding nutrition literacy and takeaway food consumption frequency and high salt, high oil / high / high sugar takeaway food consumption has no significant correlation (sun qing, 2022). Chinese scholar Wang Su conducted a survey on the factors related to college students selling meals and the relationship with overweight and obesity. The results showed that after the control of gender, monthly living expenses, grade, major and permanent residence, the higher the frequency of selling meals among college students, the higher the rate of overweight and obesity. Students

with high monthly living expenses order takeout more frequently (Wang Su et al., 2021).

2. 7. 3 Adult Nutrition Literacy Assessment Scale: Adult Nutrition Literacy Assessment Scale can be used to measure the level of adult nutritional literacy. Zhang Yunqiu et al. found that through the reliability and validity of the nutritional literacy measurement scale for adults to evaluate the reliability and validity of the scale, it provided an effective evaluation tool for the development of nutrition health promotion actions and related decision-making and management. Select adult nutritional literacy assessment scale items and verify their credit validity to provide a measurement tool for evaluating the level of nutritional literacy in adults. This scale has good reliability and validity, and can be used for measurement (Zhang Yunqiu et al., 2021). Chinese scholars Yang yuan of American scholars Gibbs the development of nutritional literacy tools-NLt scale and its expansion version to explore the development and revision process, the scale for nutrition literacy assessment tool development provides a good example, but the sample size, sample representative, fill in time is still insufficient in the future scale development can strengthen the application of mathematical model to develop different age exclusive nutrition assessment tools (Yang Yuan, 2023). The adult nutritional literacy assessment scale can be used to measure the level of adult nutritional literacy, so as to know the factors related to nutritional literacy.

2.7.4 Relationship between nutritional literacy and demographic characteristics

(1) Age and Gender: A survey conducted by Chinese scholar Tang Ling et al. on college students in Xishuangbanna, China (Tang Ling et al., 2021), this survey found that the nutrition knowledge score of female students was higher than that of male students, and the nutrition knowledge score of older students was higher than that of younger students. Chinese scholars Wang Weixin (Wang Wei Xin, 2022) of Huanggang students in China, the boy nutrition knowledge score in good and above percentage are lower than girls, older students nutrition knowledge score is higher than the age of students nutrition knowledge, the two different papers, study 1 year, geographically apart is far away, but found enough, shows that college students nutrition knowledge has certain connection with gender, age.

(There are certain differences in nutrition :Professional and Grades (2 In a survey conducted .knowledge cognition of different majors and different grades on college students in Xishuangbanna, China .by Chinese scholar Tang Ling et al the survey found that the score of nutrition knowledge of ,(Tang Ling et al, 2021)

food students was higher than that of non-food students, and the score of nutrition knowledge of senior students was higher than that of nutrition knowledge of lower of Huanggang college (Wang Wei Xin, 2022) Chinese scholars Wang Weixin .grades students in China, found that the lower nutrition knowledge score lower, different professional nutrition knowledge score is different, the two different papers, research interval 1 year, geographically apart is far, but found enough consistent, shows that college students nutrition knowledge in different professional, different grade is .different

（3） Students from different urban and rural areas :Urban and rural areas In 2020, the .also know about nutrition knowledge and have certain nutrition (regions) Health literacy answers in 2020) %2.health literacy rate of Chinese residents was 23). Compared with the previous research results on the health literacy rate of college the highest health literacy of college students in ,(cities) students in Chinese provinces Answer yingjuan) %7.Shanghai is 66 et al .2015 ,) and the lowest rate is 5.Chen) %2 Guanfeng et al .2015 ,). In the literature collection, the survey of health literacy of college students in Jiangsu Province is the most analyzed, and the survey results are The highest health literacy of college students in Shanghai is .basically the same 66.The health literacy of .and the highest in the Yangtze River Delta region ,%7 college students in Wuhan was 33.Zou min) %0 et al .2019 ,) was higher than that of college students in Hubei Province by 13.Similarly, the .(Guo Yuting, 2019) %7 health literacy of college students in Zhengzhou was 24.higher than that of [29] %9 college students in Henan Province by 22.Yang xiao) %3 et al .2014 ,). To sum up, .the health literacy of college students in economically developed areas is higher Students 'region affects the level of health literacy, and the region, namely the source There are .of students, is also one of the factors affecting students' health literacy significant differences in students' health literacy between eastern and western China and remote areas, economically developed and underdeveloped areas, urban families The health literacy level of freshmen in Jiangsu University was .and rural families 18.9 ,%59.higher than that of the same age group, and the health literacy level of %39 JiYu) students from cities and cities was higher than that from rural areas et al., the survey found that the health literacy level of Chongqing residents was ;(2018 but the health literacy level of Tibet, Xinjiang and Gansu in western China ,%61.17 8 ,%17.was only 0.and 4 %9.Ren Jing) respectively %7 et al.2019 ,). It can be seen

With superior geographical .that the regional factors have a significant influence conditions, developed economy, high medical level, perfect medical facilities, attention and investment from the local government, and convenient access to Yu Changjun, a .information, students' health literacy level is correspondingly high Chinese scholar, conducted a survey of college students in Beijing in 2022, and found that the passing rate of urban students was significantly higher than that of rural Yu Changjun) .students et al.2022 ,). Xu Yifan's survey on nutritional literacy, the results also found that the level of nutritional literacy of rural students is still low, and there are lack of nutrition knowledge, difficulty in changing diet behavior, and 2019 ,.Xu Yifan et al) unreasonable diet structure). According to the two different papers, we can also see that there are some differences in the level of nutritional .literacy in urban and rural areas

（4）Education：Education is the most important way of personal growth and development, nutrition literacy knowledge level can gradually improve through the process of education, correct bad diet behavior, researchers from different countries nutrition literacy knowledge and education level related research, for example, Chinese researchers Zhu Wenli 2022) through the investigation, found that through education can improve different people due to diet culture environment, Chinese researcher Wang Wei also found that the level .physiology, cognitive ability Wang Wei) of education level also helped the improvement of nutritional literacy et al, 2018).

2.7.5 Relationship between nutritional literacy and disease prevention

tates that nutrition is an important (2030-2017) The National Nutrition Plan means to prevent and treat some chronic diseases, and vigorously promoting the nutritional prevention and treatment of chronic diseases can effectively improve the Notice of The General Office of the State Council on the) .disease outcome of patients 2017 ,(2030-2017) Issuance of the National Nutrition Plan). However, due to the lack of nutritional knowledge of patients, they cannot form the correct nutritional attitude The main reason is the lack of .and beliefs, and the nutrition compliance is poor 2021 ,.Monteirom et al) nutritional literacy). Nutritional literacy is the ability of individuals to acquire and understand nutritional information and to make correct 2009 ,.Zoellner J et al) nutritional decisions). In recent years, the nutritional literacy intervention has been widely used in patients with chronic diseases, and studies have

efficacy, -confirmed that it can improve the patient's nutritional compliance and self ,.Parekh N et al) reduce the incidence of complications, and reduce medical expenses Improving the nutritional literacy of patients with chronic diseases is a need to .(2018 2023 ,.Luo Peilin al) promote their healthy development). The above studies can find that the improvement of nutritional literacy is helpful to the prevention of some chronic diseases, and is an important factor in improving the nutritional status of .related chronic diseases-residents and the prevention and control of nutrition

2.7.6 Relationship between Nutrition Literacy and Health Literacy

The ability needed to obtain and understand nutrition information, the comprehensive conceptualization of nutritional literacy reflects the key elements of 2012 ,.et al .Velardo S) health literacy and food literacy structure). Health literacy is defined as an individual's ability to acquire, understand, and process basic health Carbone ET et) information and services, and to make appropriate health decisions 2012 ,.al). Health literacy is a better predictor of health status than age, income, 2012 ,.Carbone ET et al) employment, education, and ethnicity). Among them, nutrition literacy and food literacy are regarded as specific forms of health literacy, 2018 ,.Krause C et al) which are independent and complementary to each other)) ; some researchers regard nutrition literacy as a subcategory of health literacy and food 2020 ,.Truman Eet al) literacy). related skills, -Nutrition literacy emphasizes nutrition represents people's ability to choose a healthy diet in their daily life, and can be regarded as an integral part of the food nutrition education program, and is of great 2017 ,.Liao LL et al) significance for health promotion). The above studies can find that nutritional literacy and health literacy are closely related, and nutritional literacy .is an important part of health literacy

2.7.7 the relationship between nutrition literacy and nutrition education: nutrition education refers to the spread, education, intervention, the individual or group master food nutrition knowledge, establish health beliefs, thus change diet behavior, improve the nutrition and health of a series of activities and process (China council for the promotion of student nutrition and health, 2021). It can be seen that the goal and direct outcome index of nutrition education is to improve the level of nutrition literacy, and nutrition literacy is the core content of nutrition education. Guided by the main dietary behavior problems and nutrition and health problems, the core information of nutritional literacy of people with different cultural backgrounds and different ages is clearly defined, which actually solves the focus problem of "what to teach" in the implementation of nutrition education in this population. As the core

information of nutritional literacy includes not only the knowledge related to food nutrition, but also emphasizes the acquisition of skills within the whole food system (acquisition and planning, selecting, making and intake of food) (Zhu Wenli et al., 2022).

Food nutrition education is a complex proposition involving multiple fields, including medicine, food science, agronomy and anthropology. It is a highly professional work that requires the coordinated promotion of talents in different fields (Zheng Mo, et al., 2022). Chinese overall nutrition presents the phenomenon of "double peaks" (Bai Jun shuai, 2018), namely insufficient nutrition and excess nutrition exist at the same time (Zhao Hongmei, 2019), has brought serious challenges to residents health, but also exposed the national food nutrition knowledge, health literacy to improve and food nutrition education system needs to improve the real problems (XuXingli, 2020). The content of food nutrition education communication is comprehensive and multi-dimensional, mainly including three important aspects: knowledge, skills and attitude (Zheng Mo et al., 2022). According to relevant studies, college students are in higher education, but their nutrition knowledge is ignored. In the questionnaire survey of nutrition knowledge, the accuracy of the questions was more than 80% (Liu Die, et al., 2017). The rural population generally has a low educational level, and the opportunity for access to nutrition knowledge is very limited. Due to the lack of scientific nutrition knowledge, some villagers replace the highly nutritious local eggs with snacks such as puffed food (Yu Shujun, 2012).

According to the above studies, it can be found that nutrition education is helpful to the improvement of nutrition literacy level. Nutrition education can affect the audience to grasp the knowledge of food nutrition, and obtaining and planning, selecting, making, and making correct food intake decisions.

2.7.8 The relationship between Zhuang traditional food culture and nutrients: Zhuang people like to eat rice and rice porridge, like to make all kinds of rice dumplings, glutinous rice cakes and cakes with glutinous rice, and love to eat sour products. In the mountains to corn, millet, potato as the main food. Zhuang people like to eat pigs, chicken, duck, fish, some places like to eat fish, tofu and so on."The Zhuang area has a long history of wine making and drinking. The local residents have mastered the skills of brewing sweet wine and various fruit wines, which gives birth to the famous distillation and brewing. The ancient spicy wine brewed from Wei Zhongquan and the" old wine " brewed and sealed for several years (Lu Xuan et al., 2022). The food culture and customs of the Zhuang nationality have three characteristics: like eating glutinous rice food, like eating raw pickled sour and spicy

food, and rich and colorful food customs (Liu Pubing, 2007). The characteristics of zhuang food culture are mainly adapted to the natural ecological environment, with the characteristics of Lingnan regional food culture, such as certain original eating style, eating habits of "heavy wine and tea", and relatively loose eating rules; taking rice agriculture as the center, forming food culture with national characteristics, such as rice, supplemented by other crops, distinct rice agricultural characteristics of festival diet and dietary taboos related to rice agriculture; less exclusivity and deeper Chinese degree (Huang Anhui et al., 2005). Due to the mutual influence of the Zhuang and the Han people and the infiltration of the Han food culture, especially the "four qi and five tastes" and "medicinal food" theories of the Han people have a profound influence on the Zhuang food culture (Feng Qiuyu et al., 2009).

The Zhuang group provided more details about the findings than the other 15 ethnic minority groups. Insufficient nutrient intake, excess nutrient intake and use of blood tests to detect nutrient deficiency are three main themes of nutrient intake / deficiency outcomes.(Yu et al., 2018; Huang et al., 2020), excessive intake of sodium (Jiang et al., 2013; Xie, 2015; Ka et al., 2018). Other diet-related behaviors or practices form bad eating habits, such as high-salt diet consumption, consumption of pickles, high-fat food, habits of buying food, tea consumption, sweet food consumption, breakfast consumption, nutrition knowledge, and the causes of dietary imbalance.

According to the above study can be found, the zhuang diet culture has its unique characteristics, adapt to the natural ecological environment, with certain original diet style, like corn, millet, potato, like raw hot and spicy and diet etiquette, dietary diversification, but due to adapt to the natural ecological environment, with a certain original diet style, cause nutrient imbalance, nutritional literacy will be affected.

2.7.9 The Relationship between nutritional literacy and the Internet: Internet + " is a tool and means of nutrition work in the information age. Through the introduction of Internet thinking, the efficiency of information exchange between all links of nutrition work can be increased, and the improvement of traditional nutrition work can be promoted."Internet + nutrition" is not a new field of nutrition work, it is the expansion and extension of traditional nutrition work. The idea of " Internet + nutrition" is to take the service object as the core, take cloud computing as the basis, take information as the link, and implement the whole process management of nutrition in the whole life cycle by improving the efficiency, depth and breadth of information exchange, so as to achieve the fundamental purpose of improving the

health of residents. Specifically, " Internet + nutrition" can bring advantages to nutrition work in the three dimensions of life cycle, management process and service object. Research scholar Chen Ji'an and others proposed that many new, high-speed and convenient network communication platforms relying on the development of the Internet have brought unprecedented opportunities for health education and promotion (Fang Meiyan et al., 2018). Using "Internet +" technology for health education has many advantages: easy to carry and spread; good form, wide content; many contacts, good interaction; long-term, sustainable, personalized, and effective; high efficiency and low cost of organization and implementation (Chen Ji'an et al., 2020). Research scholars xu based on nutrition weight loss clinic, supported by " Internet + " technology, establish "offline regular visit + online with type management and regular follow-up evaluation" the combination of closed-loop nutrition weight loss management mode, observe weight loss effect, aims to help patients effective weight loss and body quality maintenance intervention ((Xu Ruixue et al., 2022)). The use of online small program realizes the whole process of knowledge guidance and answer questions. Online punching management, nutritionist comments and interaction provide effective guidance and supervision, and timely professional guidance is an important factor in the success of weight loss (KimM et al., 2020). At the same time, the sharing of the weight reduction weekly report makes the weight loss effect intuitively displayed through data changes, forming self-motivation (Xu Ruixue et al., 2022). Under the background of "Internet +", a nutritious restaurant was established in Guiyang. Consumers rank all aspects of nutritious meals in order: nutrition collocation, fat reduction effect, catering taste, healthy food ingredients and price. Therefore, for the production and promotion of marketing meals, consumers actually do not pay special attention to the price (Li Chunhua et al., 2019).

The National Nutrition Plan (2017-2030) has been proposed to vigorously provide information services to benefit the people. Development of nutrition, sports and health information of wearable devices, mobile terminals (APP) , promote " Internet + " , big data frontier technology and nutrition health integration development, develop personalized, differentiated nutrition health electronic products, such as nutrition calculator, dietary nutrition, sports health guidance mobile applications, etc., provide convenient and health information technology products and services (national nutrition plan (2017-2030) notice, 2017).

According to the above research, it can be found that at present, nutrition is closely related to the Internet, and is the tool and means of nutrition work in the information age.

2.8 The conceptual framework of the study

Study of nutritional literacy and its associate factors among college students in Guangxi

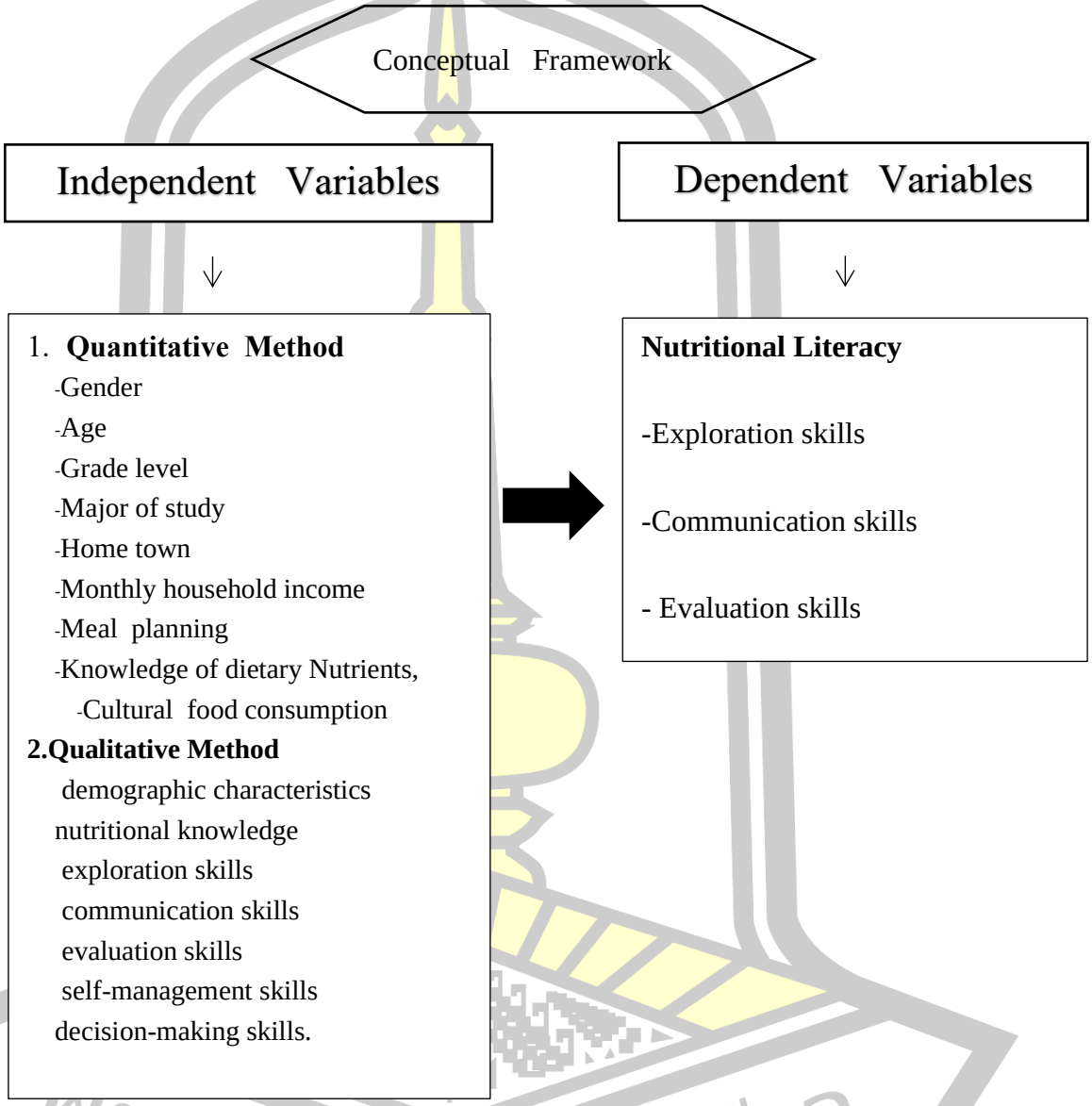


Figure 6 Conceptual Framework

CHAPTER III
METHODOLOGY

This Was were mixed-methods analytical study that integrates both quantitative and qualitative data collection. In the quantitative data collection, we focus on the explore of demographic characteristics, consumption factors, and nutritional literacy, as well as determining the associated factors. In the qualitative data collection, we focus on exploring the problems and barriers conducive to improving nutritional literacy, diet behavior, and nutrition-related disease prevention among college students. Around demographic characteristics, nutritional knowledge, exploration skills, communication skills, evaluation skills, self-management skills, decision-making skills content. The study procedure for this study is as follows:

3.1 The study design

The quantitative data collection, which the cross-sectional study will use to explore the nutritional literacy level and its associated factors among students in Guangxi Modern Polytechnic College. A questionnaire survey was conducted on 1095 full-time students aged 18-20 years old.

In terms of qualitative data collection, we Focus on demographic characteristics, nutritional knowledge, exploration skills, communication skills, evaluation skills, self-management skills, and decision-making skills by utilize the focus group technique among college students,exploring the problems and barriers conducive to improving nutritional literacy, diet behavior, and nutrition-related disease prevention.

3.2 Study populations and samples

3.2.1 The quantitative data collection

In this stage, the study populations are full-time students in Guangxi Modern Polytechnic College, China.

3.2.2 Sample size

The sample size was estimated using the Daniel'S formula (Daniel, 1999) as follows:

$$n = \frac{NZ^2P(1-P)}{d^2(N-1)+Z^2P(1-P)}$$

Where:

n= sample number

N= Population number (N = 13,500)

Z= confidence interval (set to 95%CI, Z=1.96)

P= the proportion of college students from medical school for nutritional literacy level (P=53.2%) (Gao et al., 2023)

D = Maximum allowable error =0.03

When

n = $\frac{13500*1.96^2*(0.532)(0.468)}{0.03^2(13500-1)+1.96^2*(0.532)(0.468)} = \frac{12912.2937216}{12.1491+0.9564662016}$

n = 985

Given that there will be a 10% actual dropout rate, more subjects should join the study, and the adjusted sample size can be calculated by the following formula:

Where:

N1=n/(1-d)

N1= adjusted sample size

d= dropout rate (d=0.1）

n= Sample size (n=985)

When:

N1= n/(1-d)

= 985/(1-0.1)

n= 1095

Therefore, the total sample size of the students was 1095 students

3.2.3 Inclusion criteria

(1) The students who were freshman, sophomores, or juniors and were aged 18–20 years old

(2) Ability to read and understand Mandarin independently

(3) Willing to participate

(4) Respect and guarantee the autonomy of the volunteers to participate in the study and allow the volunteers to revoke their consent to participate in the study at any stage of the study.

3.2.4 Exclusion criteria

(1) Students who refuse to answer the questionnaire;

(2) Students who provide incomplete answers.

3.2.5 Sampling method

In this study, the investigators were selected samples from each college as proportional as shown in Table 1. In each college, eligible students were selected by a stratified sampling method. First, the investigator were divided the subjects into subgroups by college years (strata) including of freshmen, sophomores, and juniors. The second, the investigator were maked the sampling frame of each stratum, which includes a list of all students who can be sampled. Third, the investigator will select samples from each stratum, and the data collection were conducted uninterrupted until the number of samples required for each college.

Table 2 The proportion to size of sample in each college

College	Number of students	Sample size of each college	Faculty	Number of students	sample size
Guangxi Modern Polytechnic College	13,500	1095	Faculty of Teacher Education	3,775	306
			Faculty of Mechanical and Electrical Engineering	2,560	207
			Faculty of civil engineering	1,985	161
			Faculty of Information Engineering	1,980	161
			Faculty of business	1,870	152
			Faculty of Intelligent	540	44

College	Number of students	Sample size of each college	Faculty	Number of students	sample size
			Metallurgy		
			Faculty of Sports and Arts	540	44
			Faculty of national defense	250	20
Total	13500	1095		13500	1095

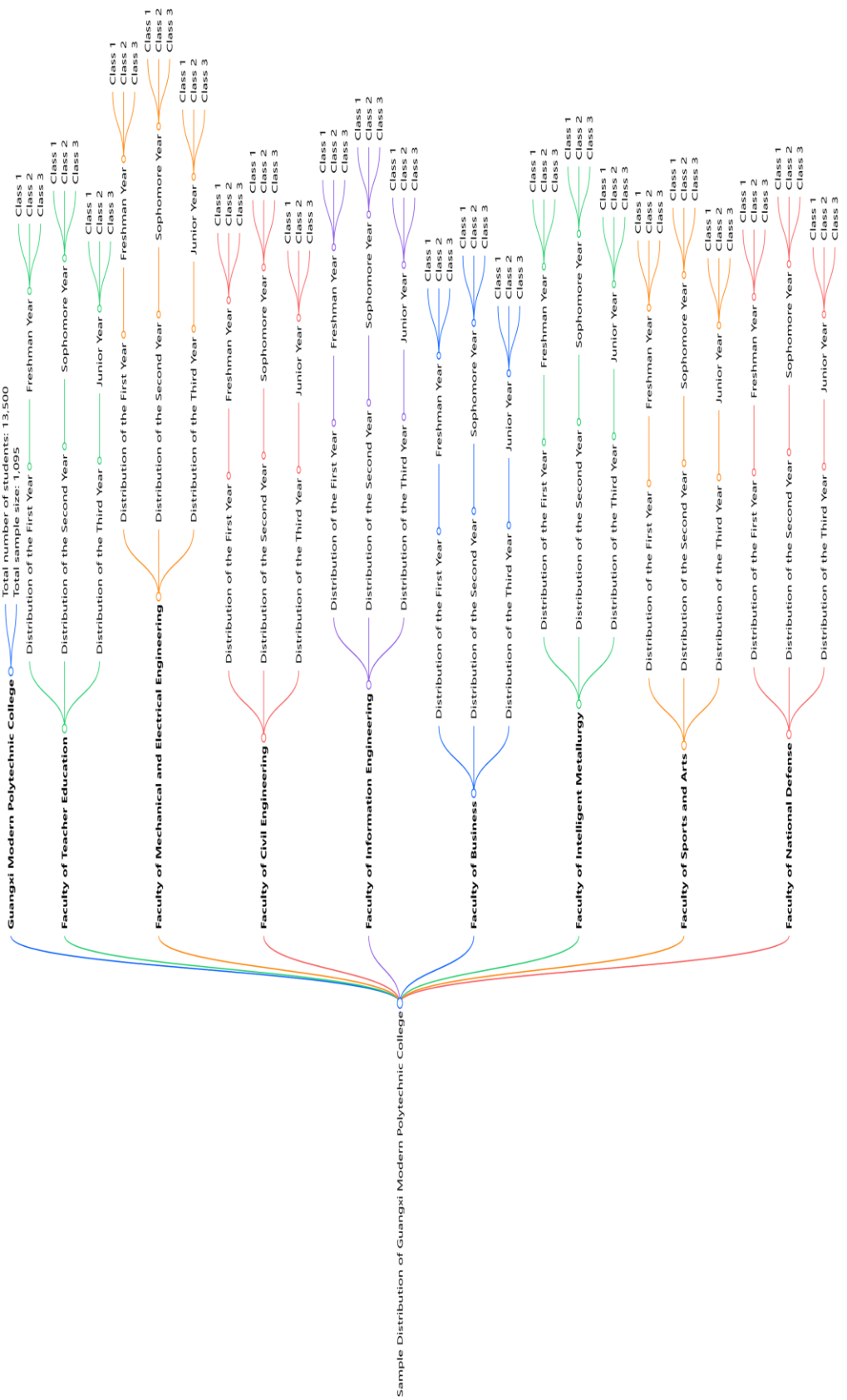


Figure 7 Sampling method

3.2.6 The qualitative data collection

The target group includes the key informants who can give information about the problems and barriers conducive to improving nutritional literacy, diet behavior, and nutrition-related disease prevention. Including demographic characteristics, nutritional knowledge, exploration skills, communication skills, evaluation skills, self-management skills, and decision-making skills content, The key informants or stakeholders include representative college students (n=15).

(1) The students who were freshman, sophomores, or juniors and were aged 18–23 years old

(2) Ability to read and understand Mandarin independently

(3) Willing to participate

3.2.7 Exclusion criteria

(1) Students who provide incomplete answers;

(2) Participants who are required to cancel their participation during the study;

(3) Participants in a sudden illness.

3.3 Research instruments and the evaluation of research instruments quality

3.3.1 Quantitative instruments

The self-administered questionnaire was developed on the basis of literature review that consists of two parts:

Part I: demographic characteristics and consumption factors

This part consists of demographic characteristics variables, including Demographic characteristic、Lifestyle、 Family medical history、 Basic knowledge in nutrition、 Nutrition literacy skills、 Levels of nutrition literacy and influencing factors。

Three exposure variables were considered: demographic characteristics, exercise, and nutrition knowledge. Demographic characteristics included age, gender, grade, ethnicity, residence, expense, family income, nutrition status (as body mass index; BMI was categorized into underweight [BMI < 18.5 Kg/m^2], normal [18.5–22.9 Kg/m^2], overweight [23–24.9 Kg/m^2] or obese [> 25 Kg/m^2] by following the

international classification for BMI in Asia) (WHO, 2004), and nutrition education (Zeng et al., 2022; Xu et al., 2024). Exercise rates were ranked as high (more than 300 minutes a week of moderate activity), moderate (150-300 min/wk of moderate activity), or low (less than 150 min/wk of moderate activity) (United States Department of Health and Human Services, 2018). The participants' nutrition knowledge was tested with a 14-item questionnaire (Kuder-Richardson= 0.80). Scores ranged from 0 to 14: scores of 9 or less were regarded as low, 10–11 as moderate, and 12 or more as high.

Part II: The Nutrition Literacy Scale

A self-reported NL questionnaire was developed based Nutbeam's model of health literacy and Velardo's conceptualization. This summated rating scale consists of 25 items measuring five component skills: 1) exploration skills; 2) communication skills; 3) evaluation skills; 4) self-management skills; and 5) decision-making . A participant's total NL score is the sum of the scores for all items (ranging from 5–125) with scores of 66 or more taken as adequate (high level), and those under 66 as inadequate (low level),Cronbach's $\alpha = 0.97$.

3.3.2 Qualitative instruments

The researcher has prepared the guidelines for questions that have been used in the In-depth Interview technique to explore the problems and barriers conducive to improving nutritional literacy, diet behavior, and nutrition-related disease prevention. Demographic characteristics in the qualitative data have been included, along with nutritional knowledge, exploration skills, communication skills, evaluation skills, self-management skills, and decision-making skills. Basic knowledge and concepts of nutritional literacy have been addressed, while the intention of knowledge seeking and barriers to the improvement of nutritional literacy levels have also been discussed.

3.4 Data collection

The research team consists of five members, and the tool used for data collection was Questionnaire Star, powerful software that designs questionnaires, professional network questionnaire survey platform can issue questionnaires through multiple channels, and the background can monitor and fill in and collect data in real

time, and performs simple data statistics. The implementation method is as follows: first, pour the items of the collected scale or questionnaire into the questionnaire star; then, edit the items to form an available questionnaire; finally, the completed questionnaire has a QR code or link to the subject and the subject will fill it in. Data collection was performed in two steps.

Step 1: Before distributing the questionnaires, five members were trained, informed consent, precautions, and handling unexpected situations before the questionnaires were filled out and distributed.

Step 2: For the collected questionnaires, four members were asked to check the completeness of the questionnaires, and if any questionable questionnaires were found, one person was asked to come together for consultation and finalization.

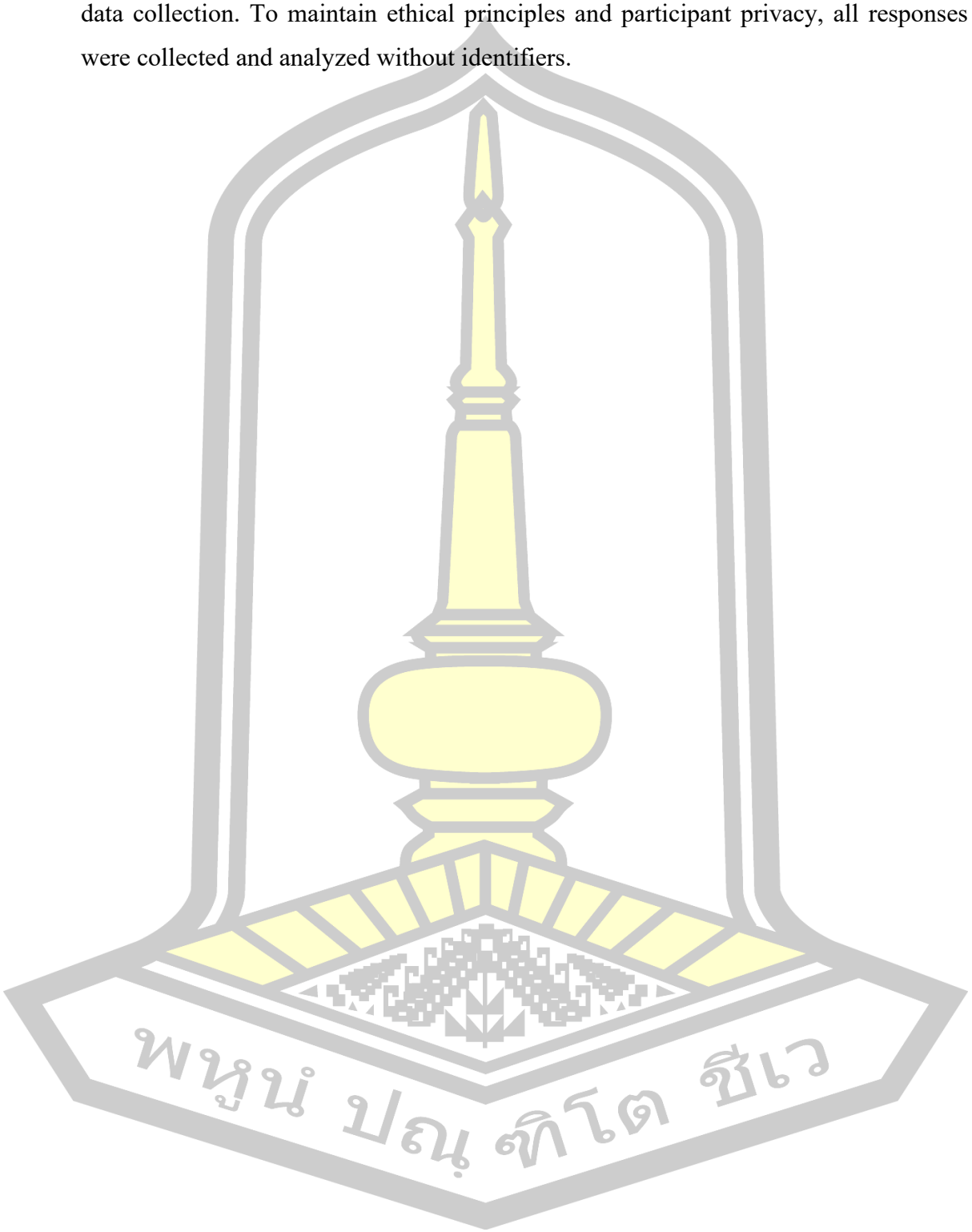
3.5 Data analysis

In the quantitative data analysis, the IBM SPSS version 25 was utilized to analyze all data. Descriptive statistics were performed to describe the demographic characteristics. The means and standard deviations of the descriptive statistics were used to describe quantitative variables such as age, monthly household income, knowledge of dietary nutrients score, and nutritional literacy score. The numbers of cases and percentages were employed to describe categorical variables, including gender, grade level, major of study, home town, meal planning, and cultural food consumption. Multivariate logistic regression analysis was conducted to determine correlations between demographic characteristics and factors influencing nutritional literacy, with odds ratios for each independent variable in the model interpreted for associations. The statistically significant level was set at $p < 0.05$. For qualitative data analysis, content analysis was applied.

3.6 Ethical approval

This study was submitted for ethical approval by the Research Ethics Boards of Mahasarakham University, Thailand. The students were provided with information about the research objectives and procedures of the study. Their participation was voluntary, and participants were informed about their right to refuse to participate or withdraw at any time with impunity. Written informed consent was then obtained

from the participants, and a self-reported questionnaire was administered to them for data collection. To maintain ethical principles and participant privacy, all responses were collected and analyzed without identifiers.



CHAPTER IV

RESULTS

This Was were mixed-methods analytical study that integrates both quantitative and qualitative data collection.This study conducted a cross-sectional analysis survey on the nutritional literacy and its related factors among college students in He chi City, Guang xi Zhuang Autonomous Region. The researchers employed both quantitative and qualitative methods to evaluate the nutritional literacy level of college students in Guangxi and explore the factors influencing their nutritional literacy. The research findings are presented as follows:

4.1 Quantitative Results

4.1.1 Basic Information of Survey Participants

4.1.1.1 Demographic characteristic

4.1.1.2 Lifestyle

4.1.1.3 Family medical history

4.1.1.4 Basic knowledge in nutrition

4.1.1.5 Nutrition literacy skills

4.1.1.6 Levels of nutrition literacy and influencing factors

4.2 Qualitative Results

4.2.1 Demographic characteristics for qualitative data

4.2.2 In-depth interview on nutritional literacy

4.1 Quantitative Results

4.1.1 Basic Information of Survey Participants

4.1.1.1 Demographic characteristic

The total number of respondents was 1095, the majority were male (56.8%). The largest age group was 20 years (35.0%). The Zhuang ethnic group was the most represented (42.6%), followed closely by the Han ethnic group (41.9%). The respondents were predominantly Sophomore students (51.7%). there were the largest proportion of normal body weight (46.8, while 29.5% were either overweight or obese. The vast majority of respondents (98.3%) resided in dormitories, and 91.5%

originated from rural areas. 96.4% of respondents were raised by their parents. The majority of respondents' families had a monthly income ranging between 1,000-3,000 yuan (55.7%). Respondents came from various secondary colleges, with the largest number from the Teacher Education College (n=306, 27.96%), followed by the Mechanical and Electrical Engineering College (n=207, 18.90%), the School of Civil Engineering and Architecture (n=161, 14.70%), the School of Information Engineering (n=161, 14.70%), the Business School (n=152 , 13.88%), the School of Intelligent Metallurgy (n=44, 4.0%), the School of Sports and Arts (n=44 , 4.0%), and the National Defense College (n=20 , 1.86%).For further details, please refer to Table 3.

Table 3 Demographic characteristic （n=1095)

Variables	**Number**	**%**
Gender		
Male	623	56.8
Female	472	43.2
Age		
18	152	13.7
19	354	32.3
20	384	35
21	147	13.4
22	42	3.8
23	16	1.4

Variables	Number	%
Ethnicity		
Han	459	41.9
Variable	**Number**	**%**
Zhuang	466	42.6
Other	170	16.4
Grade		
Freshmen	518	47.3
Sophomore	566	51.7
Junior	11	1
Study major		
Non-medical class	1095	100
BMI		
Underweight	260	23.7
Normal	512	46.8
Overweight-obesity	323	29.5
Living at school		
Yes	1077	98.3

Variables	Number	%
No	18	1.6
Residence		
Urban	92	8.4
Rural	1003	91.5
Principal caregiver		
Parents	1056	96.4
Grandparents	12	1
Other	27	2.4
Faculty / Department		
School of Teacher Education	306	27.96
School of Mechanical and Electrical Engineering	207	18.9
Institute of civil engineering	161	14.7
School of Information Engineering	161	14.7
business college	152	13.88
College of Intelligent Metallurgy	44	4
School of Sports and Arts	44	4
Institute of national defense	20	1.86

Variables	Number	%
Variable	**Number**	**%**
Family income		
<1,000 yuan	180	16.4
1000~3000 yuan	611	55.7
3,000 ~ 5,000 yuan	227	20.7
5,000 ~ 7,000 yuan	54	4.9
7,000 ~ 10,000 yuan	15	1.3
1,0000 yuan or above	11	1
Expense		
＜1000	604	55.1
1000～1500	462	42.1
1500～2000	22	2.2
≥2000	7	0.6

4.1.1.2 Lifestyle

The majority of students exhibited good non-smoking habits (n=886, 79.0%). In terms of alcohol consumption, over 60% had never consumed alcohol (n=681, 62.1%). Regarding physical activity, nearly half maintained a daily exercise routine (n=515, 47.0%), while a small number exercised infrequently (n=68, 6.2%). Concerning dietary habits, 83.01% reported eating high-fat and high-sugar foods occasionally (n=912, 83.01%), with a minority eating them frequently (n=65, 5.9%).

In terms of sleep quality, 24% rarely or never had good sleep (n=263, 24.0%). Nutritional knowledge was high, with over 90% recognizing the importance of a balanced diet (n=1027, 93.7%), though awareness of specific guidelines, like the "Dietary Guidelines for Chinese Residents," was lower (n=631, 57.6%). Lastly, 68.9% had received nutrition education (n=754, 68.9%), while 31.1% had not (n=341, 31.1%). See Table 4 for more details.

Table 4 Lifestyle (n=1095)

Variable	Number	%
Smoking status		
Never smoked	886	79
Ex-smoker	193	17.6
Current Smoker	36	3.2
Alcohol consumption		
Never drinker	681	62.1
Ex- drinker	403	36.8
Current drinker	11	1
Exercise		
Daily	515	47
Several times a week	475	43.4

Variable	Number	%
Once a month	68	6.2
Never	37	3.4
received nutrition education		
yes	754	68.9
no	341	31.1

4.1.1.3 Family Medical History

Table 5 primarily examines familial medical history. The majority of participants (80.91%, n=886) reported "Other" conditions. Diabetes had the highest specific prevalence, with 10.68% (n=117). Cancer was reported in 2.1% (n=24) of cases, and high blood pressure was identified in 2.7% (n=30) of cases. Heart attack and stroke were less prevalent, reported in 0.11% (n=13) and 0.05% (n=6) of cases, respectively refer to Table 5.

Table 5 Family Medical History (n=1095)

Disease Categories	Yes Number (%)	Relationship
Heart attack	13 (0.11)	[parents] (5, 0.1%); [grandparents] (7,); [uncle] (1,);
Stroke	6 (0.05)	[father] (3,); [Mother] (2,); [grandparents] (1,);
Cancer	24 (2.1)	[grandparents] (8,); [parents] (8); other (8,)

Diabetes	117 (10.68)	Grandparents、parents etc
High blood pressure	30 (2.7)	Grandparents、parents etc
Other (Other patients without any disease)	886 (80.91)	Other patients without any disease

4.1.1.4 Basic knowledge in nutrition

Table 6 mainly evaluates college students' knowledge of basic nutrition knowledge. Most of the students strongly know that a balanced meal plan is a plan in which appropriate amounts of each food group is used, boiling is one of the more healthy cooking methods, and follow with excessive consumption of sugar, sweets, and chocolate is harmful for health. Almost half of the students don't know that obesity and being overweight during young age is not associated with diabetes in older ages, and osteoporosis occurs as people grow older and cannot be prevented.

Table 6 Basic knowledge in nutrition （n=1095）

No	Content	Correct	
		Number	%
1	Obesity and being overweight during young age is not associated with diabetes in older ages.	682	62.2
2	Legumes are not the good sources of proteins.	775	70.77
3	Osteoporosis occurs as people age and is incapable of being prevented.	692	63.2
4	Daily eating breakfast helps me to learn more.	991	83.1
5	A balanced meal plan is a plan in which appropriate amounts of each food group is used.	1027	93.7
6	Easily understand the nutrition facts (e.g. amount of energy, sugar, protein, etc.) on food packages.	910	83.1

No	Content	Correct	
		Number	%
7	Boiling is one of the more healthy cooking methods.	1021	93.2
8	Engaging in daily physical activity for 30 to 40 minutes can prevent obesity.	1005	91.8
9	Consumption of salty snacks (e.g. chips, corn puffs, etc.) is harmful for health	889	80.9
10	Excessive consumption of sugar, sweets, and chocolate is harmful for health	1017	92.9
11	Reading of production and expiration date on food package is important for health	1056	96.4
12	Unhealthy food packing without standard sign and health license not to be used.	1036	94.6
13	Know the contents of the Dietary Guidelines for Chinese Residents	631	57.6
14	Know the Dietary Tower for Chinese Residents	736	67

4.1.1.5 Nutrition literacy skills

4.1.1.5.1 Exploration skills

Table 7 mainly explores students' exploration skills. The highest percentage of students selected occasionally eating a variety of vegetables daily (n=457, 41.7%). When it comes to promoting nutrition knowledge to friends, the majority did so occasionally (n=505, 46.1%). Similarly, most students occasionally selected reading nutrition and diet information through new media like WeChat and Weibo, or watching nutrition and health care programs (n=556, 50.8%). In terms of knowing where to find information on healthy eating, the highest proportion of students occasionally did so (n=490, 44.7%). Lastly, when facing nutritional problems, most students occasionally sought advice from friends, family, or other sources (n=484, 44.2%).

Table 7 Exploration skills（n=1095）

No	Content	Options						
		Never	Occasionally	Sometimes	Usually	Always	X	S.D
		n(%)	n(%)	n(%)	n(%)	n(%)		
1	I eat a variety of vegetables (e.g., lettuce, cabbage, tomatoes, carrots, etc.), every day.	49 (4.5)	457 (41.7)	190 (17.4)	205 (18.72)	194 (17.71)		
2	You often promote nutrition knowledge to your friends.	234 (21.4)	505 (46.1)	221 (20.2)	90 (8.21)	45 (4.11)		
3	I read nutrition and diet information spread by new media such as WeChat and Weibo, or watch nutrition and health care programs.	157 (14.3)	556 (50.8)	236 (21.6)	106 (9.68)	40 (3.65)		
4	I know where to find information on healthy eating.	118 (10.8)	490 (44.7)	273 (24.9)	120 (10.96)	94 (8.58)		
5	When I have nutritional problems, I can get information from friends, family, etc And suggest.	94 (8.5)	484 (44.2)	257 (23.6)	114 (10.41)	146 (13.3)		
6	Total						13.06	3.5

4.1.1.5.2 Communication skills

Table 8 mainly explores students' communication skills. The highest percentage of students selected occasionally sharing various nutrition information with their family or friends (n=479, 43.7%). When discussing healthy

eating with family or friends, the majority also did so occasionally (n=487, 44.4%). Regarding encouraging family or friends who are overweight and prefer high-fat foods to change their eating habits, the highest proportion selected sometimes (n=288, 26.3%). When living in an environment 10 minutes' walk from fresh food, the highest percentage of students selected occasionally managing to keep buying fresh items (n=426, 38.9%). Lastly, in an environment with high salt, sugar, fat, frying, and barbecue, the highest proportion of students selected occasionally resisting the temptation and choosing a healthy diet (n=429, 39.2%).

Table 8 Communication skills (n=1095)

No	Content	Options					X	S.D
		Never	Occasionally	Sometimes	Usually	Always		
		n(%)	n(%)	n(%)	n(%)	n(%)		
1	I often share various nutrition information with my family or friends.	145 (13.2)	479 (43.7)	271 (24.7)	119 (10.8)	81 (7.3)		
2	I often discuss healthy eating with my family or friends.	133 (12.1)	487 (44.4)	268 (24.4)	123 (11.2)	84 (7.6)		
3	If family or friends are overweight and like high-fat foods, I will encourage him They change their eating habits.	109 (10)	410 (37.4)	288 (26.3)	176 (16.1)	112 10.2)		

No	Content	Options					X	S.D
		Never	Occasionally	Sometimes	Usually	Always		
		n(%)	n(%)	n(%)	n(%)	n(%)		
4	Living in an environment 10 minutes walk without fresh food, I Can overcome difficulties and keep buying new things.	103 (9.4)	426 (38.9)	267 (24.4)	177 (16.2)	122 (11.1)		
5	Living in high salt, high sugar, high fat, frying, barbecue and other unhealthy drinks In the eating environment , I can resist the temptation to choose a healthy diet.	82 (7.5)	429 (39.2)	252 (23.0)	213 (19.5)	119 (10.9)		
6	Total						≈13.60	≈10.90

4.1.1.5.3 Evaluation skills

Table 9 mainly explores students' evaluation skills. The highest percentage of students selected "occasionally" when assessing whether their personal daily diet is scientific and reasonable (n=428, 39.1%). Similarly, the majority chose "occasionally" when evaluating the scientific accuracy of nutrition information from new media (n=437, 39.9%). In determining whether they maintain a balance between diet and exercise, the largest proportion of students selected "sometimes" (n=297, 27.1%). For evaluating the amount of diet needed for a healthy weight, the highest

percentage again chose "occasionally" (n=435, 39.7%). Finally, when judging their health status based on the nutritional value of various foods, most students also selected "occasionally" (n=415, 37.9%).

Table 9 Evaluation skills (n=1095)

No	Content	Options					X	S.D
		Never	Occasionally	Sometimes	Usually	Always		
		n(%)	n(%)	n(%)	n(%)	n(%)		
1	I can easily judge whether my personal daily diet is scientific and reasonable.	92 (8.4)	428 (39.1)	266 (24.3)	195 (17.8)	114 (10.4)		
2	I can easily judge whether the nutrition information spread by new media is scientific and reasonable.	99 (9.0)	437 (39.9)	289 (26.4)	174 (15.9)	96 (8.8)		
3	I can easily tell if I have a balance between diet and exercise.	99 (9.0)	426 (38.9)	297 (27.1)	176 (16.1)	97 (8.9)		
4	I can make a reasonable assessment of the amount of diet needed for a healthy weight.	100 (9.1)	435 (39.7)	277 (25.3)	165 (15.1)	118 (10.8)		

No	Content	Options					X	S.D
		Never	Occasionally	Sometimes	Usually	Always		
		n(%)	n(%)	n(%)	n(%)	n(%)		
5	In the face of a wide variety of food, I can according to its nutritional value and the human body Make the right judgment about your health status.	89 (8.1)	415 (37.9)	296 (27.0)	181 (16.5)	114 (10.4)		
6	Total						≈13.97	≈11.31

4.1.1.5.4 Self-management skills

Table 10 Mainly explores students' self-management skills. The highest percentage of students selected "occasionally" when using nutrition knowledge to guide their daily diet (n=413, 37.7%). When it comes to following a low-salt, low-fat diet, most students also selected "occasionally" (n=467, 42.6%). In terms of rarely eating high-salt foods, the highest proportion selected "occasionally" (n=455, 41.6%). Regarding purchasing healthy foods based on nutrition labels, the majority chose "occasionally" (n=408, 37.3%). Finally, when eating out, most students selected "occasionally" considering nutritional factors for their food choices (n=422, 38.5%).

Table 10 Self-management skills (n=1095)

No	Content	Options					X	S.D
		Never	Occasionally	Sometimes	Usually	Always		
		n(%)	n(%)	n(%)	n(%)	n(%)		
1	You use nutrition knowledge to guide your daily diet.	117 (10.7)	413 (37.7)	284 (25.9)	174 (15.9)	107 (9.8)		
2	You usually go on a low-salt, low-fat diet.	90 (8.2)	467 (42.6)	323 (29.5)	141 (12.9)	74 (6.8)		
3	You rarely eat high-salt foods, such as pickles, fermented tofu, salted duck eggs, large sauces, yellow sauces, etc	106 (9.7)	455 (41.6)	261 (23.8)	170 (15.5)	103 (9.4)		
4	I often buy healthy foods based on nutrition labels.	103 (9.4)	408 (37.3)	289 (26.4)	183 (16.7)	112 (10.2)		
5	When eating out, I will consider the nutritional factors for food choices.	118 (10.8)	422 (38.5)	293 (26.8)	167 (15.3)	95 (8.7)		

No	Content	Options					X	S.D
		Never	Occasionally	Sometimes	Usually	Always		
		n(%)	n(%)	n(%)	n(%)	n(%)		
6	Total						≈13.71	≈11.10

4.1.1.5.5 Decision-making skills

Table 11 mainly explores students' decision-making skills. The highest percentage of students selected "occasionally" when eating a variety of vegetables daily (n=433, 39.5%). When dining out with friends who choose unhealthy foods, the majority also selected "occasionally" being able to choose healthy foods (n=437, 39.9%). In terms of buying healthy food from the school cafeteria based on pocket money, most students selected "occasionally" (n=406, 37.1%). Regarding the ability to say "no" to unhealthy eating suggestions from friends, the highest proportion chose "occasionally" (n=431, 39.4%). Finally, when shopping with parents, the majority selected "occasionally" buying foods with standardized labeling (n=395, 36.1%).

Table 11 Decision-making skills (n=1095)

No	Content	Options					X	S.D
		Never	Occasionally	Sometimes	Usually	Always		
		n(%)	n(%)	n(%)	n(%)	n(%)		
1	I eat a variety of vegetables (e.g., lettuce, cabbage, tomatoes, carrots, etc.), every day.	155 (14.2)	433 (39.5)	275 (25.1)	142 (13.0)	90 (8.2)		

No	Content	Options					X	S.D
		Never	Occasionally	Sometimes	Usually	Always		
		n(%)	n(%)	n(%)	n(%)	n(%)		
2	I go to a restaurant or to a fast food restaurant with my friends, they will all choose unhealthy foods (such as pizza, French fries, carbonated drinks, etc.), and I can choose healthy foods.	100 (9.1)	437 (39.9)	317 (28.9)	154 (14.1)	87 (7.9)		
3	I can buy healthy food from the school cafeteria, depending on my pocket money.	94 (8.6)	406 (37.1)	288 (26.3)	201 (18.4)	106 (9.7)		
4	I can easily say “no” to any unhealthy eating suggestions from my friends.	95 (8.7)	431 (39.4)	311 (28.4)	162 (14.8)	96 (8.8)		
5	When I go shopping with my mother or father, I buy foods with standardized	71 (6.5)	395 (36.1)	258 (23.6)	214 (19.5)	157 (14.3)		

No	Content	Options					X	S.D
		Never	Occasionally	Sometimes	Usually	Always		
		n(%)	n(%)	n(%)	n(%)	n(%)		
	labelling.							
6	Total						13.92	11.51

4.1.1.6 Levels of Nutrition literacy and Influencing Factors

Table 12 More of the vocational college students (50.59%) had a low level of NL than a high level. Differences in total nutrition literacy level were observed across demographic groups including those based on gender, exercise, BMI, nutrition education, and nutrition knowledge ($p < 0.05$). Across the levels of nutrition literacy , males who exercised had the highest levels of nutrition literacy . Additionally, students who exercised and had nutrition education also had higher total nutrition literacy scores.

Table 12 Variables with distribution of NL level (n=1095)

Variable	**Total (n =1095)**	**NL**		**p-value**
	(n =1095)	**Low (n=554)**	**High (n=541)**	
Age				0.275
<20	505(46.10)	265(47.82)	240(44.33)	
≥20	590(53.90)	289(52.18)	301(55.67)	
Gender				0.009
Male	623(56.81)	337 (60.72)	286(52.90)	
Female	472(43.19)	217(39.28)	255(47.10)	
Grade				0.091
		Low (n=554)	High (n=541)	
Freshmen	518(47.30)	244(44.00)	274(50.60)	
Sophomore	566(51.70)	304(54.90)	262(48.40)	

Variable	Total (n =1095)	NL		p-value
Junior	11(1.00)	6(1.10)	5(0.90)	
Ethnicity				0.088
Han	459(41.90)	219(39.50)	247(45.70)	
Zhuang	466(42.60)	249(44.90)	210(38.80)	
Other	170(16.40)	86(15.50)	84(15.50)	
Residence				0.656
Urban	92 (8.49)	44(7.94)	48(8.87)	
Rural	1003(91.51)	510(92.06)	493(91.13)	
Expense				0.940
<1500 yuan	609(55.61)	307(55.41)	302(55.82)	
≥1500 yuan	486(44.39)	247(44.59)	239(44.18)	
Family income				0.709
<3000 yuan	799(72.96)	401(72.38)	398(73.57)	
≥3000 yuan	296(27.03)	153(27.62)	143(26.43)	
Exercise				0.015
Active	515(47.03)	240(43.32)	275(50.83)	
Low	195(37.87)	99(41.25)	51(18.55)	
Moderate	170(33.00)	70(29.17)	102(37.09)	
High	150(29.13)	71(29.58)	122(44.36)	
Inactive	580(52.97)	314(56.68)	266(49.17)	
BMI				<0.001
Underweight	260(23.74)	140(25.27)	120(22.18)	
Normal	512(46.76)	222(40.07)	290(53.60)	
Overweight - obesity	323(29.50)	192(34.66)	131(24.22)	
		Low (n=554)	High (n=541)	
Nutrition education				<0.001
Yes	754(68.86)	341(61.55)	413(76.34)	
No	341(31.14)	213(38.45)	128(23.66)	

Variable	Total (n =1095)	NL		p-value
Nutrition knowledge				<0.001
Low	343(31.33)	220(39.71)	123(22.74)	
Medium	427(38.99)	175(31.59)	252(46.58)	
High	325(29.68)	159(28.70)	166(30.68)	

Table 13 Multiple Logistic regression was applied to measure the factors influencing total NL by considering five sub-dimensions. The students in the following categories were found to be less likely to have high levels of total NL: inactive students (OR = 1.32, 95% CI = 1.02 – 1.70), overweight or obese students (OR = 0.55, 95% CI = 0.41 – 0.74), underweight students (OR = 0.64, 95% CI = 0.47 – 0.89), those who had not received nutrition education (OR = 1.72, 95% CI = 1.30 – 2.28), and those with medium (OR = 1.60, 95% CI = 1.15 – 2.23) or low (OR = 2.31, 95% CI = 1.71 – 3.14) levels of nutrition knowledge. This can be compared with greater likelihood of high total NL among those who actively exercised, had normal BMI, had received nutrition education, and had a high level of nutrition knowledge.

Table 13 Multiple logistic regression for the NL level of participants (n=1095)

Independent variable	Total NL		
	OR_{adj}	95%CI	p-value
Exercise (Inactive)	Ref.		
Active	1.32	1.02-1.70	0.036*
BMI (Normal)	Ref.		
Overweight-obesity	0.55	0.41-0.74	<0.001**
Underweight	0.64	0.47-0.89	<0.001**
Nutrition education (No)	Ref.		
Yes	1.72	1.30-2.28	<0.001**
Nutrition knowledge (Low)	Ref.		

Independent variable	Total NL		
	OR_{adj}	95%CI	p-value
Medium	1.60	1.15-2.23	0.005*
High	2.31	1.71-3.14	<0.001**

4.2 Qualitative Results

Based on the theoretical framework of the qualitative study on nutrition literacy, an interview outline was developed. The qualitative research involved 15 participants, with in-depth interviews conducted to qualitatively analyze the nutrition literacy of 15 university students from the Guangxi region. The analysis specifically explored their demographic characteristics in the qualitative data, nutritional knowledge, exploration skills, communication skills, evaluation skills, self-management skills, and decision-making skills.

4.2.1 Demographic Characteristics for Qualitative Data

This study selected 15 university students from different grades and majors at Guangxi Modern Polytechnic College as interview subjects, covering a diverse range of fields including Analytical Testing Technology, Primary Education, Mold Design and Manufacturing, Automotive Inspection and Maintenance Technology, New Energy Vehicle Technology, Industrial Robotics, Music Education, and Automotive Repair and Inspection. The sample is considered to be representative and diverse. The age of the participants mainly ranged from 18 to 20 years old, with the highest proportion being 19-20 years old, accounting for 43.75%. The proportions of participants aged 18-19 years and 20-21 years were 31.25% and 25%, respectively. The number of first-year students was 7, accounting for 46.67%, while the number of 20-year students was 8, accounting for 53.33%. Third-year students were not included in the interview as they were engaged in off-campus internships. For more details, see Table 14

Table 14 Demographic characteristic for qualitative data（n=15)

Variable	All
	N (%)
Age	
<20	12（80.0）
>20	3（20.0）
Gender	
Male	11（73.3）
Female	3（26.7）
Grade	
Freshmen	7（46.7）
Sophomore	8（53.3）
Ethnicity	
Han	6（40.0）
Zhaung	6（40.0）
Other	3（20.0）
Residence	
Urban	5（33.33）
Rural	10（66.7）
Expense	
<1500 yuan	10（67.7）
>1500 yuan	5（33.3）
Family income	
<3000 yuan	8（53.3）
>3000 yuan	7（46.7）
Exercise	

Variable	All
	N (%)
Active	2 (13.3)
Low	5 (33.3)
Moderate	3 (20.0)
High	3 (20.0)
Inactive	2 (13.3)
BMI	
Underweight	4 (16.7)
Normal	7 (46.7)
Overweight - obesity	4 (16.6)
Nutrition education	
Yes	10 (66.7)
No	5 (33.3)
Nutrition knowledge	
Low	4 (26.7)
Medium	6 (40.0)
High	5 (33.3)

4.2.2 In-depth interviews on nutritional literacy

4.2.2.1 interview data

The interviews generated a wealth of data, encompassing participants' experiences and strategies in acquiring nutritional knowledge, exploration skills, communication skills, evaluation skills, self-management skills, and decision-making skills within various health contexts. This data also identified barriers and facilitators that may influence individuals' practices related to nutrition literacy. Table 1 5

presents the six interrelated themes—nutritional knowledge, exploration skills, communication skills, evaluation skills, self-management skills, and decision-making skills—along with their descriptions. The findings are organized according to these six themes, along with the relevant sub-themes and questions posed.

Table 15 Themes and additional participant quotations (n=15)

Participant number p1,p2,p3....p15	**Gender M: Male F: Female**		
Theme	**Sub-theme**	**Question**	**Response**
1. Basic Nutrition Knowledge	Understanding Basic Nutrition Knowledge	Please talk about your understanding of basic nutrition knowledge.	I think that basic nutrition knowledge is very important. It includes nutrients needed by the human body, such as vitamins and minerals, which are widely present in various foods, including vegetables, fruits, meats, eggs, dairy, etc. It should also include the principles of healthy eating and their application in daily life (P9). I know the basic needs of the human body, but I'm not very clear about balanced diets (P1). I know some nutritional benefits, like calcium is good for bones (P15). I'm not clear about the basic knowledge of nutrition literacy (P8).
		Which basic nutrition knowledge do you think is the most important?	I think all of it is important because health is the foundation of everything (P6). I believe that basic nutrition is important, including the seven

Participant number p1,p2,p3....p15	**Gender M: Male F: Female**		
Theme	**Sub-theme**	**Question**	**Response**
			essential nutrients, which are the fundamental substances necessary for maintaining life (P13). I think balanced diets are the most important (P8). A diverse diet, a varied diet helps provide the body with the nutrients it needs, and I recommend consuming at least 12 different foods daily (P7). I think nutrition skills and knowledge are important (P15).
2. Nutrition Literacy Skills	2.1 Exploration Skills	When you need to find information related to nutrition, how do you usually do it?	I study on official websites and platforms, such as the National Institute for Nutrition and Health and the China Nutrition Society's food composition database. These websites provide authoritative nutritional information. Sometimes I follow professional interpretations of the latest nutrition research, such as brief explanations on diet and nutrition, which are usually published in news media or professional websites. There are also online courses and educational activities, such as the nutrition MOOC provided by Wuhan University, which usually systematically introduces basic knowledge and practical skills in nutrition,

Participant number p1,p2,p3....p15	**Gender M: Male F: Female**		
Theme	**Sub-theme**	**Question**	**Response**
			suitable for those who want to study nutrition in-depth (P13). I learn through official websites and school courses (P1). I learn through short videos, books, and newspapers (P6). I check Xiaohongshu to see how influencers share their daily meals, and I search for nutrition knowledge online (P10). I search online and in books (P12).
	2.1 Exploration Skills	When searching for nutrition information, have you encountered any difficulties?	There aren't specific categories; most of the information is generalized (P8). Internet information is inconsistent (P4). Some information is inaccurate or incomplete (P10). Some information is too mixed (P14). The difficulty is not knowing whether the information is useful (P15).

Participant number p1,p2,p3....p15	**Gender M: Male F: Female**		
Theme	**Sub-theme**	**Question**	**Response**
	2.2 Communication Skills	How do you share nutrition-related information and knowledge with others?	I share my understanding of vegetable nutrition with classmates or friends I run with (P12). I share through social media, official websites (P15). I usually share through WeChat, QQ, and Xiao hong shu (P10). I mostly participate in school health promotion activities (P8).
	2.2 Communication Skills	What do you think is the most effective way to communicate?	I usually communicate face-to-face (P5). I think school professional courses are the most effective means of communication, and I usually obtain information through school professional courses (P7). Personal experiences, diet examples (P8). I get information through school professional courses or some bloggers' daily sharing (P10).
	2.3 Evaluation Skills	How do you judge the reliability of the nutrition information you find?	I think government websites, official websites, and school professional courses are relatively reliable. I use these as criteria for judgment (P7). I compare two aspects: one is what

Participant number p1,p2,p3....p15	Gender M: Male F: Female		
Theme	**Sub-theme**	**Question**	**Response**
			others share, and the other is whether authoritative doctors have also discussed this knowledge (P10). I usually rely on Baidu; Baidu won't lie to me. What benefit would they get from lying? (P5). I compare the information on official websites with what bloggers share before making a judgment (P14).
	2.3 Evaluation Skills	Have you encountered unreliable nutrition information?	Yes, I have encountered it. After consuming the food, I found out that there was no label on it (P1). I discovered it through personal experience (P3). I have encountered inconsistent information online (P7). Yes, I found it on Baidu (P8). I noticed contradictions within information from the same source or with widely accepted nutritional principles. This might indicate unreliable information. Also, if the information is primarily to promote a product, especially if it claims miraculous effects, it's usually unreliable (P13).

Participant number p1,p2,p3....p15	**Gender M: Male F: Female**		
Theme	**Sub-theme**	**Question**	**Response**
	2.4 Self-management Skills	How do you apply nutrition knowledge to manage your health in daily life?	I manage my health by planning meals, actively participating in physical activities, and maintaining a balanced lifestyle (P7). I follow online advice from doctors on the nutrients required by the human body and daily food intake (P10). I first check food labels for nutrients that I may be lacking and choose foods based on that (P1).
	2.4 Self-management Skills	What challenges have you faced in managing your health?	I can't control my diet well (P8). When I'm in a bad mood, I tend to overeat (P5). None, except I can’t control my mouth (P10). The food outside is too tempting; I can’t resist (P14). I lack health knowledge and don't know how to manage my health (P15).
	2.5 Decision-making Skills	When you need to make dietary decisions, how do you use nutrition information to make decisions?	I make decisions based on health labels, food ingredients, and weight loss needs (P7). I make plans based on my personal health goals (P8). I go for exercise, such as working out

Participant number p1,p2,p3....p15	**Gender M: Male F: Female**		
Theme	**Sub-theme**	**Question**	**Response**
			(P12). I usually make decisions based on the guidance of nutritionists (P4). I often make decisions by randomly choosing what to eat (P8).
	2.5 Decision-making Skills	What factors do you primarily consider when making nutrition-related decisions?	I usually base my decisions on micronutrients (P1). I mainly consider foods that can boost immunity and those rich in protein (P8). I compare my body with others who have better physiques before deciding what I want to eat (P10). I choose based on low oil, low spice, and good appearance (P5).
3. Other Opinions		Do you have any other opinions or suggestions about nutrition literacy, dietary behavior, or the prevention of utrition-related diseases?	I suggest the school offer more professional courses (P1). Eat and drink as needed; don't overemphasize shaping a perfect body (P10). I suggest promoting it more on campus (P14). Learn more about nutrition literacy (P15).

CHAPTER V

CONCLUSION, DISCUSSION, AND RECOMMENDATION

This chapter presents aspects of the conclusions, discussion of the findings, and recommendations for practice and further research as follows:

5.1 Quantitative study results are discussed

5.1.1 Nutrition literacy level of students

This study found that: (1) College students who exercise regularly and have received nutrition education also have a higher level of nutritional literacy; (2) Regarding the BMI factors, Overweight / obese and underweight students had lower nutritional literacy than students with normal BMI, In particular, the risk ratio of overweight / obese students was significant at all nutritional literacy levels; (3) Receiving nutrition education, students who did not receive nutrition education had significantly lower nutrition literacy at all levels of nutrition literacy than those who had received nutrition education; (4) In terms of nutrition knowledge, participants with moderate levels of nutrition knowledge had lower nutritional literacy than those with high levels of nutritional knowledge, while participants with low nutrition knowledge had the lowest nutritional literacy at all nutritional literacy levels, and nutritional literacy 29.68% of the students with a higher level, by comparison, 31.33% of students had low nutritional knowledge.

According to the above research, the nutritional literacy level of college students in Hechi City, Guangxi Province.The low nutritional knowledge level of students accounts for a large proportion, and the nutritional literacy level still needs to be improved,This shows that in order to improve the evel of nutritional literacy in the future, we must start from all levels and not ignore one. Therefore, in the education of college students, we should not o nutritional literacy strengthen the publicity of nutrition knowledge and health behavior, carry out diversified nutrition education activities, but also pay attention to the cultivation of basic nutrition skills, enhance the ability of students to identify and use nutrition information, so as to comprehensively improve their nutritional literacy level.

5.1.2 Influencing factors of college students' nutritional literacy

This study found that exercise, BMI, nutrition education and nutrition knowledge all had effects on nutritional literacy.

5.1.2.1 Exercise

Results show that exercise is one of the factors affecting the nutritional literacy levels. Exercise was found to be an important factor affecting the nutritional literacy level of non-medical students. Students participating in regular exercise showed higher nutritional literacy levels compared to their less active peers. This is consistent with the findings of Xu et al. (2024), which reported a positive association between adolescent physical activity and nutritional literacy. The association between exercise and nutritional literacy may be due to its important role in promoting a healthy lifestyle, which is usually accompanied by enhanced cognition and application of nutrition knowledge. The nutritional literacy skills are essential to effectively accessing nutritional information and making informed dietary choices. The differences in nutritional literacy levels among non-medical college students by exercise and BMI correspond to the conclusions of previous studies in the adolescent group (Topan et al., 2023; Koca and Arkan, 2020). However, non-medical students have lower nutritional literacy levels than medical students, consistent with factors for health literacy [Yan et al., 2023; Yang et al., 2022; Xu et al., 2019], as medical or health science students have nutrition courses (Burkhart et al., 2020). The proportion of active students was lower than non-active students; this indicates that active students had better nutritional literacy. Similar to Xu et al. (2024), this study found that exercise in adolescents was positively associated with nutritional literacy. Nutritional literacy levels varied among non-middle school students. Given the strong association between exercise and nutritional literacy, it is necessary to incorporate physical activity in nutrition education programs to improve nutritional literacy levels among non-medical students.

5.1.2.2 Body mass index (BMI)

Body mass index (BMI) is also an important factor affecting the nutritional literacy. This study found that students with different BMI varied in nutritional literacy level, Previous studies have shown that high interaction skills are associated with better diet quality (Joulaei et al., 2018; Mungvongsa et al., 2023). However, our findings differ from the findings of some studies (e. g., Taleb and Itani, 2021), which did not find a significant association between BMI and certain nutritional literacy skills. The relationship between BMI and nutritional literacy in this study suggests that students with normal BMI generally have better interaction and communication skills, which are essential for assessing the credibility of

nutritional information and communicating the information effectively. This suggests that the impact of BMI should be considered when designing nutrition education interventions designed to improve nutritional literacy.

5.1.2.3 Nutrition education Nutrition education plays a key role in improving the nutritional literacy. Our study found that students with nutrition education had significantly higher nutritional literacy levels and subskills, particularly in acquisition, decision-making and communication skills. This is consistent with previous studies showing that nutrition education is critical for developing nutrition knowledge and promoting healthy eating behaviors (Liao and Lai, 2017). Moreover, students with nutrition education had greater ability to apply their knowledge in real situations, thus improving the overall nutritional literacy level. The effectiveness of nutrition education in enhancing nutritional literacy highlights the need for comprehensive and easily accessible nutrition education programs in non-medical institutions. These programs should be targeted to both freshmen and seniors, with a focus on enhancing their ability to acquire and apply nutrition information.

5.1.2.4 Nutrition knowledge Nutritional knowledge was identified as a fundamental factor influencing the nutritional literacy. Students with higher levels of nutritional knowledge showed better nutritional literacy, especially in application, interaction, and communication skills. This finding is consistent with previous studies showing that nutritional knowledge is a key factor in determining nutritional literacy and is critical for making informed dietary decisions (Koca and Arkan, 2020; Taleb and Itani, 2021). Moreover, students with higher levels of nutrition knowledge are more proficient in obtaining and utilizing nutrition information, which is essential for improving diet quality and preventing nutrition-related diseases. Therefore, nutrition education programs should give priority to improving students' nutrition knowledge levels, especially those with lower basal levels, to improve their overall nutritional literacy levels and promote healthier eating behaviors.

To the best of our knowledge, this study is the first cross-sectional analysis of nutritional literacy among non-medical students in higher vocational colleges in ethnic minority areas in Guangxi. The results showed that the overall nutritional literacy level of students in the region was relatively high compared to similar populations. Independent factors affecting nutritional literacy, exercise, BMI, nutrition education, and nutrition knowledge. It is noteworthy that this study found that grade was a protective factor for nutritional literacy subskill application skills.

These results highlight the importance of nutrition education strategies targeting freshmen. Future studies should explore the effectiveness of diverse and appropriate nutrition education channels (e. g., Internet, electronic devices, and social media) to improve the nutritional literacy level of non-medical students in higher vocational colleges.

5.2 Qualitative research

According to the study results, this study analyzed the understanding and practice of college students in Guangxi in nutritional literacy based on the interview data of 15 participants. Through thematic analysis, the following themes and sub-themes were identified: basic nutrition knowledge, nutritional literacy skills (including exploration skills, communication skills, evaluation skills, self-management skills and decision-making skills), and other comments and suggestions. In terms of basic nutritional knowledge, some students have an understanding of the essential nutrients in various foods, the principles of a healthy diet, and their daily applications. They are also aware of the basic human needs and some nutritional benefits. However, there are still some students who have a rather vague understanding of a balanced diet and basic nutritional literacy knowledge. Generally speaking, students believe that health is the foundation, and all aspects of basic nutrition are of great importance. The participants' responses demonstrated their level of knowledge, practice methods and challenges they encountered.

5.2.1 Basic nutrition knowledge

The understanding of the basic nutrition knowledge is not comprehensive. Most participants recognized the importance of basic nutrition knowledge, especially in the basic principles of a healthy diet. However, some participants still had significant deficiencies in their understanding of nutrition knowledge, especially in the importance of a balanced diet and major nutrients. The lack of basic nutritional knowledge among college students leads to the low overall nutritional literacy (Min Shuhui et al., 2022). Moreover, although many college students, aware of the importance of nutrition knowledge, still have a large knowledge gap in practical application, especially showing immature judgment in self-management and diet choices. This phenomenon is not o nutritional literacy reflected in domestic studies, but also has similar findings in international studies. A study from the United States showed that despite their general awareness of the importance of nutrition to health, many showed a shallow understanding in practice, especially in a balanced diet and

nutrient selection (Stephens et al., 2021). An Australian study suggested that although college students can identify the importance of a healthy diet, they still have difficulties in how to apply this knowledge to their daily diet, showing a lack of understanding of nutrients (Lucas et al., 2022). In addition, the British study also supports this finding that although many college students have the basic nutrition knowledge, they still show immature judgment and insufficient knowledge reserve in real life, especially in food selection (PHE, 2020).

These results indicate that although participants pay high attention to health and nutrition, the depth and accuracy of their knowledge still need to be further improved, especially in the understanding and application of basic nutrition knowledge.

5.2.2 Nutritional literacy skills

5.2.2.1 Exploration skills: In terms of information acquisition, participants used various resources including official websites, school courses and social media platforms to find nutritional information. However, they still face many challenges when obtaining nutrition information, such as unclear classification, information and information accuracy and reliability, (zhang hua, 2021), points out that with the popularity of the Internet, the public access to nutrition information channels increasingly diversified, but it also brings the information overload and reliability is difficult to judge. They stressed that while the content published by official websites and educational institutions is relatively authoritative, nutrition information on social media is often strictly unaudited and misleading. Therefore, it is essential to improve the public's information screening and evaluation capacity (Zhang Hua et al., 2021). In addition, information inconsistency and accuracy issues are one of the main barriers to the improvement of public nutritional literacy (Li Li, 2022). She analyzes the content of the multiple nutrition information platform, found that even for the same nutrition topic, different sources of information may be very different, even contradictory, which requires the public in obtaining information keep critical thinking, learn to verify the authenticity of the information from multiple angles (li li, 2022), it is related to the research results.

These issues affect their ability to acquire knowledge of effective nutrition. This suggests a need to improve guidance on how to evaluate and select reliable sources of nutritional information. Wang Qiang et al. (2020) focus on the role of technical solutions in improving nutritional information literacy. They believe that in addition to strengthening education and guidance, it is also necessary to develop intelligent

nutrition information screening tools, which can analyze the reliability of information sources, the scientificity and timeliness of content, and provide users with more accurate and personalized nutrition advice (Wang Qiang et al., 2020). In addition, the researcher Zhao Min is concerned about the impact of cultural differences on the acceptance of nutrition information. She pointed out that different countries and regions also have differences in the understanding and acceptance of nutrition information due to differences in dietary habits and cultural background. Therefore, these factors need to be fully considered when improving the nutritional literacy of the public and develop more targeted education and communication strategies (Zhao Min, 2021). These studies remind us of the need to adopt a more comprehensive and diverse perspective when addressing nutrition information access issues.

Recent research on exploratory skills in nutritional literacy skills not o nutritional literacy validated the challenges of information acquisition, but also proposed solutions from multiple perspectives, including strengthening information screening and evaluation capabilities, using technical tools to assist decision-making, and considering cultural differences. These studies provide a valuable reference for improving our deep understanding of nutritional information literacy problems and finding effective solutions.

5.2.2.2 Communication skills

Communication and sharing are not systematic enough. Although participants share nutrition knowledge through social media and face-to-face communication, they lack systematic and standardized communication channels, which may lead to inaccurate dissemination of information. The lack of standardized communication channels is one of the important reasons for the inaccurate dissemination of nutrition knowledge among college students. This problem is further exacerbated by the lack of information literacy training in higher education settings (Zhang & Li, 2021). In addition, although social media is the main way to obtain nutritional information, the reliability and scientificity of its content are uneven, which increases the risk of students obtaining misinformation (Li et al., 2022). These problems show that there is still significant room for improvement in nutritional literacy, and it is urgent to strengthen education and information literacy training to improve their relevant abilities.

5.2.2.3 Assessment skills

The assessment capacity is limited. In in-depth investigation of college students' nutritional literacy, we found that participants can preliminary information evaluation ability, through comparison from food labels, official website, school courses and social media information sources to evaluate the reliability of the information, the behavior shows they have certain information screening consciousness. However, from the overall dimension of critical thinking, the ability of the participants is still weak, and it is difficult to keep a clear mind in the flood of information and conduct a comprehensive and profound analysis. College students often struggle to think critically and independently when facing large amounts of information, which makes them more vulnerable to misinformation (Xu & Zhang (2021). What is particularly noteworthy is that some students have a blind trust in information sources and fail to fully realize the vital importance of the authenticity and reliability of information, which undoubtedly increases the risk of their being affected by misinformation and misinformation, and has a negative impact on the construction of nutrition cognition that cannot be ignored. Some students' blind trust in information sources further aggravates the risk of misdirection in the process of information screening, and affects their correct understanding of nutrition knowledge (Liu et al., 2022).

5.2.2.4 Self-management skills

Although participants generally had a clear understanding of the importance of health management, they encountered many challenges in the process of translating this perception into practical action. Some participants showed high enthusiasm and self-requirement when making diet plans, however, they were often difficult to persevere in the actual implementation process. This phenomenon of "knowing and doing differently" reveals their deficiencies in self-management skills, especially in the ability of diet management. The main problems faced by college students in diet management include insufficient adherence to diet plans and weak self-control ability, especially in front of the temptation of high-calorie foods (Li et al. (2021). To make matters more complicated, participants' eating behaviors are also often significantly influenced by mood fluctuations. Emotional eating, as a common phenomenon, has been fully reflected in the research. Some participants tend to seek comfort and relief through food when they are depressed or stressed up. This unhealthy response is not helpful to solve emotional problems, but may exacerbate nutritional imbalance and deterioration of physical health (Zhang & Wang (2022). These challenges suggest that future nutrition education and health promotion efforts

need to focus more on the self-management skills of college students, especially in diet management and emotion regulation.

5.2.2.5 Decision skills

Participants mai nutritional literacy considered personal health goals, nutrition labels, and external recommendations in their dietary decisions. However, some participants mentioned the arbitrariness and external influence in the decision-making process, which reflected the lack of systematic analysis and planning in the nutritional decision-making process of some students. College students' dietary decisions are limited by personal health goals and external recommendations, but the lack of systematic analysis and planning makes their decision-making processes often appear arbitrary (Jiang et al., 2021). This arbitrariness may lead to unreasonable dietary choices that can affect the achievement of health goals. Although nutrition labels and external recommendations affect decision-making to some extent, college students still lack effective analytical tools and methods in the decision-making process, making it difficult for them to make scientific and systematic nutrition decision-making (Chen & Liu 2023). This shows that in order to improve the decision-making skills of college students, the training of systematic analysis and planning should be strengthened to help them make more scientific and rational dietary decisions.

This study reveals the current situation and challenges of nutritional literacy among college students in Guangxi. Although participants had some awareness of the importance of nutrition knowledge, there are still significant knowledge gaps and practice barriers in practical application. In particular, the difficulty of accessing information, limited communication channels, inadequate ability to assess information, and challenges in self-management all indicate the need for targeted educational interventions to improve student level of nutritional literacy.

5.3 Proposals

This study is the first cross-sectional study on non-college students in higher vocational ethnic minority areas in Guangxi. One of the strengths of the current study is the sample size and precise effect estimates adjusted for potential confounders. However, this study has some limitations. Although tightly controlled, there may introduce some information bias during data collection. As far as our knowledge, the results of this study show that the total nutritional literacy level of vocational non-

college students in minority areas in Guangxi is higher. Exercise, BMI, nutrition education and nutrition knowledge were the factors influencing the total nutritional literacy level of occupational non-university students and their 5 subcomponent skills. Interestingly, this study revealed rank as a protective factor for nutritional literacy skills applied to nutritional literacy subcomponent skills. Specific subcomponent skill measures of the nutritional literacy that are needed to be applied in future strategies. We propose that enhanced nutrition education, Schools should develop targeted nutrition education programs, Especially in the practical application of a balanced diet and nutritional literacy, To make up for the gap of the knowledge of the students; Improving information literacy, Conduct information literacy training, Help students improve their ability to identify reliable information from numerous messages, Cultivate critical thinking; Supporting peer education, Encourage knowledge-sharing through peer education and social media, Using students' social networks to disseminate accurate nutrition information, Emotional challenges encountered in Kang's management; Promoting personalized nutrition planning, Guide students to develop personalized nutrition and health goals, Combining professional guidance and self-monitoring, Optimize their dietary decision-making process.

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APPENDIX

Questionnaire

In order to understand the present situation of college students' nutritional literacy, for college students have targeted to provide basis for nutrition education, carry out the questionnaire, you fill out will lay a solid foundation for this subject smoothly, but also contribute to healthy China, thank you for your active participation. The research team solemnly promises that we will keep your information strictly confidential.

Title: Study of nutritional literacy and its associate factors among college students in Guangxi
Date: .....

Part 1: Demographic data

1.Fundamental state
A1.Sex: male [ ] female [ ]
A2.Date of birth: .....
A3.Ethnic group [single choice]: Han[ ]..... Zhuang[ ].....Other[ ].....
A4.Year of college: 1 [ ] 2 [ ] 3 [ ]
A5.Study major: Medical class[ ] Non-medical class[ ]
A6.Weight:.....Kilograms
A7.Height:.....Centimetres
A8.Living at school: Yes [ ] No [ ]
A9.Registered residence: Urban [ ] Rural [ ]
A10.Principal caregiver: Parents [ ] Grandparents [ ] Other [ ]
A11.Name of your secondary college:
School of Teacher Education[ ]
School of Mechanical and Electrical Engineering[ ]
Institute of civil engineering[ ]
School of Information Engineering[ ]
business college[ ]
College of Intelligent Metallurgy[ ]
School of Sports and Arts[ ]
Institute of national defense[ ]
A12.Monthly income level (including work income, spouse or child support, government subsidies, etc.)
（1）<1,000 yuan[ ]
（2）1000~3000 yuan [ ]
（3）3,000 ~ 5,000 yuan [ ]
（4）5,000 ~ 7,000 yuan [ ]
（5）7,000 to 10,000 yuan[ ]
（6）1,000 yuan or above[ ]
A13.How much is your monthly living allowance?
1.＜1000[ ]；2.1000～1500[ ]；3.1500～2000[ ]；4.≥2000[ ]

2.Lifestyle
（1）.Smoking status
Never smoked: [ ] Ex-smoker: [ ] Current Smoker: [ ]
（2）Alcohol consumption
Never drinked : [ ] Ex- drinker: [ ] Current drinker: [ ]
（3）Physical activity

Daily : [ ] Several times a week: [ ] Once a month: [ ] Never: [ ]

（4）Do you often exercise for an hour a day in the past month?

<1 / week [ ] 1~2 / week [ ] 3~5 / week [ ] 6~7 / week [ ]

（5）How good are you eating fresh vegetables?

<3 times / week [ ] 3~6 times / week [ ] 1 times / day [ ] 2 times / day [ ] 3 times / day [ ]

（6）How good are you eating fresh fruit?

<3 times / week[ ] 3~6 times / week[ ] 1 times / day[ ] 2 times / day[ ] 3 times / day [ ]

（7）Do you like to eat foods high in fat and sugar?(Such as meat patties, burgers, potato chips, cakes, chocolate, etc.)

Very like[ ] Like[ ] General[ ]

（8）How well did you sleep well in the past week?

Little or no (<1 day)[ ] Not too much (1~2 days)[ ] Sometimes or half the time (3 to 4 days)[ ]
Most of the time (5 to 7 days)[ ]

3.Family Medical History

Has a member of your immediate family (father, mother, siblings, and grandparents) had or suffered from any of the following? If 'Yes', Please state relationship and condition.

		Relationship
Heart attack	Yes [ ] No [ ]	
Stroke	Yes [ ] No [ ]	
Cancer	Yes [ ] No [ ]	
Diabetes	Yes [ ] No [ ]	
High blood pressure	Yes [ ] No [ ]	
Other	Yes [ ] No [ ]	

4.Receiving nutritional literacy education

School nutrition education: Yes [ ] ;No [ ]

Part 2: Nutrition literacy

2.1 Basic knowledge in nutrition

No	Content	Answering Options	
		Yes	No
1	Obesity and being overweight during young age is not associated with diabetes in older ages.		
2	Legumes are not the good sources of proteins.		
3	Osteoporosis occurs as people grow older and cannot be prevented.		
4	Daily eating breakfast helps me to learn more.		
5	A balanced meal plan is a plan in which appropriate amounts of each food group is used.		
6	I can easily understand the nutrition facts (e.g. amount of energy, sugar, protein, etc.) on food packages		
7	Boiling is one of the more healthy cooking methods.		
8	Daily physical activity for 30–40 minutes prevents obesity.		
9	Consumption of salty snacks (e.g. chips, corn puffs, etc.) is harmful for health		
10	Excessive consumption of sugar, sweets, and chocolate is harmful for health		
11	Reading of production and expiration date on food package is important for health		
12	Unhealthy food packing without standard sign and health license not to be used.		
13	Do you know the contents of the Dietary Guidelines for Chinese Residents ?		
14	Do you know the Dietary Tower for Chinese Residents?		

2.2 Basic skills of nutritional literacy

2.2.1 Exploration skills

No	Content	Answering Options				
		Never (1)	Occasionally (2)	Sometimes (3)	Usually (4)	Always (5)
1	I eat a variety of vegetables (e.g., lettuce, cabbage, tomatoes, carrots, etc.), every day					
2	You often promote nutrition knowledge to your friends.					
3	I read nutrition and diet information spread by new media such as WeChat and Weibo, or watch nutrition and health care programs.					
4	I know where to find information on healthy eating.					
5	When I have nutritional problems, I can get information from friends, family, etc And suggest.					

2.2.2 Eommunication skills

No	Content	Answering Options				
		Never (1)	Occasionally (2)	Sometimes (3)	Usually (4)	Always (5)
1	I often share various nutrition information with my family or friends.					
2	I often discuss healthy eating with my family or friends.					
3	If family or friends are overweight and like high-fat foods, I will encourage him They change their eating habits.					
4	Living in an environment 10 minutes walk without fresh food, I Can overcome difficulties and keep buying new things.					
5	Living in high salt, high sugar, high fat, frying, barbecue and other unhealthy drinks In the eating environment, I can resist the temptation to choose a healthy diet.					

2.2.3 Evaluation skills

No	Content	Answering Options				
		Never (1)	Occasionally (2)	Sometimes (3)	Usually (4)	Always (5)
1	I can easily judge whether my personal daily diet is scientific and reasonable.					
2	I can easily judge whether the nutrition information spread by new media is scientific and reasonable.					
3	I can easily tell if I have a balance between diet and exercise.					
4	I can make a reasonable assessment of the amount of diet needed for a healthy weight.					
5	In the face of a wide variety of food, I can according to its nutritional value and the human body Make the right judgment about your health status.					

2.2.4 Self-management skills

No	Content	Answering Options				
		Never (1)	Occasionally (2)	Sometimes (3)	Usually (4)	Always (5)
1	You use nutrition knowledge to guide your daily diet.					
2	You usually go on a low-salt, low-fat diet.					

3	You rarely eat high-salt foods, such as pickles, fermented tofu, salted duck eggs, large sauces, yellow sauces, etc					
4	I often buy healthy foods based on nutrition labels.					
5	When eating out, I will consider the nutritional factors for food choices。					

2.2.5 Decision-making skills

No	Content	Answering Options				
		Never (1)	Occasionally (2)	Sometimes (3)	Usually (4)	Always (5)
1	I eat a variety of vegetables (e.g., lettuce, cabbage, tomatoes, carrots, etc.), every day					
2	I go to a restaurant or to a fast food restaurant with my friends, they will all choose unhealthy foods (such as pizza, French fries, carbonated drinks, etc.), and I can choose healthy foods.					
3	I can buy healthy food from the school cafeteria, depending on my pocket money.					
4	I can easily say "no" to any unhealthy eating suggestions from my friends.					
5	When I go shopping with my mother or father, I buy foods with standardized labelling.					

THE ETHICAL APPROVAL

MAHASARAKHAM UNIVERSITY ETHICS COMMITTEE FOR
RESEARCH INVOLVING HUMAN SUBJECTS

Certificate of Approval

Approval number: 048-570/2024

Title : Study of nutritional literacy and its associate factors among college students, in Guangxi.

Principal Investigator : Hongna Wei
Responsible Department : Faculty of Public Health
Research site : Guangxi Modern Polytechnic College

Review Method : Expedited Review

Date of Manufacture : 31 January 2024 **expire :** 30 January 2025

This research application has been reviewed and approved by the Ethics Committee for Research Involving Human Subjects, Mahasarakham University, Thailand. Approval is dependent on local ethical approval having been received. Any subsequent changes to the consent form must be re-submitted to the Committee.

.....

(Associate Professor Vorapoj Promasatayaprot)
Vice Chairman

Approval is granted subject to the following conditions: (see back of this Certificate)

570/66

ECMSU01-05.03 Update 2021

Research Subject Information Sheet for Questionnaire

(For Participants aged 18 years and older)

Dear, All Participants

My name is Ms. Hongna Wei, the master degree student of Public Health program, Faculty of Public Health, Mahasarakham University. I am conducting the research entitle: "Study of nutritional literacy and its associate factors among college students , in Guangxi". This study aims to evaluate the level of nutritional literacy and associated factors in the Guangxi Zhuang autonomous region. The summarized results of this study may provide nutrition literacy basic knowledge and skills so as to effectively improve the students' nutrition literacy level and promote their health and disease prevention. In the quantitative data collection, we focus on the assessment of demographic characteristics, consumption factors, and nutritional literacy among vocational college students in ethnic minority areas, as well as the relevant factors affecting nutritional literacy. The population in this phase is Guangxi students aged 18–20 years old from Guangxi Modern Polytechnic College. In the qualitative data collection, we focus on exploring the problems and barriers conducive to improving nutritional literacy, diet behavior, and nutrition-related disease prevention. The key informants or stakeholders include 10-15 representative college students. The following topics will be discussed: basic knowledge and concepts of nutritional literacy; intention of knowledge seeking; barriers to the improvement of nutritional literacy levels; how to popularize the prevention and treatment measures of nutrition and nutrition-related diseases; food safety and hygiene; and experience in traditional food .

The population in this phase is Guangxi students aged 18–20 years old from Guangxi Modern Polytechnic College.

Your participation in this study is voluntary. Whether to participate in this study is up to you. If you decide to participate in the first stage of this study, I would like you to answer the questionnaire. This self filled questionnaire consists of five parts, consisting of 36 items, and the response time is approximately 15-25 minutes. After you have answered all the questions, please send them back to the research team. Please take the time to carefully answer the questionnaire or ask the researchers if there are any unclear areas or if you have any questions. In addition, you have the right to withdraw at any time without prior notice.

If you feel uncomfortable or undesired with some questions, you have the right to refuse to answer questions. Also, you have the right to withdraw from this program at any time without prior notice. In additional, the refusal or withdrawal from this project will involve no affect your learning, now or in the future.

The data will be kept and not publicly disclosed on an individual person. All data will be identified only by a code, with personal details kept in a locked file or secure computer with access only by the immediate research team. The results will only present in terms of overall and these data will be destroyed at the end of the study. In this research, you do not receive compensation and will not be charged anything.

If you have any questions about the research, or if you would like more information, please contact Mr. Tu Hao, Faculty of Public Health, Mahasarakham University. Tel. (mobile phone): (+86) 18677896165, E-mail: 283681425@qq.com

If you are not treated as described or want to know your rights while participating in this research. You can contact the Review Ethics Broads of Mahasarakham University, Division of research facilitation and dissemination, Mahasarakham University. Tel. 043-754416 (internal number 1755)

Best Regards,

.....

( )

Researcher

Informed Consent Form

(For Participants aged 18 years and older)

Name-Surname Wei

(Mr./Mrs./Ms.)..... .....Age.....(years)

Address: .....Village No.....Sub-district.....

District.....Province.....

I read the research subject information sheet and obtain the description of this study by Ms. Hongna Wei about the voluntary of " Study of nutritional literacy and its associate factors among college students , in Guangxi". These information including the rational and purpose of the study and list all procedures that I have to act and be treated, list the benefits that I will receive from the research and risks that may occur from participating in the research, also the guidelines for prevention and correction in case of danger by reading/listening to the description of the message from research subject information sheet for questionnaire. Moreover, I have also received an explanation and response from the research project leader already.

As well as an assurance from the researcher that my data will be kept confidential, will not be anonymous, and the results will presented in an overview or summary to academic benefit.

"The participation in this study, I participate voluntarily" and I am free to withdraw at any time, without giving a reason and without cost, and no affect to my learning, now or in the future.

I have read and I understand the provided information from research subject information sheet and informed consent form. I voluntarily agree to take part in this study and give my signature already.

Sign..... Participant

(.....)

Date.....

Sign..... Witness (In case of reading the explanation to the volunteers)

(.....)

Date.....

Sign..... Investigator/ person taking the consent

(.....)

Date.....

PICTURE OF DATA

BIOGRAPHY

NAME	Ms.Hongna Wei
DATE OF BIRTH	04/12/1983
PLACE OF BIRTH	Hechi City, Guangxi-China
ADDRESS	PP Apartment Thakhonyang, Kantharawichai district, Mahasarakarm
POSITION	Teacher
PLACE OF WORK	Hechi City, Guangxi
EDUCATION	2010 Bachelor of Science in Physics, South-Central Minzu University 2025 Master of Public Health, Faculty of Public Health, Mahasarakham University
Research grants & awards	Presided over 1 municipal departmental level project, 1 university project and participated in 8 projects; chaired the research project of young and middle-aged teachers in Guangxi, "Study on Internal Governance System Optimization of Higher Vocational Colleges in Ethnic Areas under Vision" and "Practice and Exploration of Ideological and Political Education in Minority Vocational Colleges", etc.
Research output	In November 2019, he wrote the paper "An Analysis of the connection between Vocational Moral Education in Secondary Vocational Education and Higher Vocational Education in Ethnic Minority Areas" and won the second prize in the paper evaluation of the moral education seminar of regional vocational colleges.