

**INVESTIGATING THE EFFECT OF BRAIN
BREAK EXERCISE VIDEOS ON MENTAL
STRESS, PERSONALITY, MENTAL HARDINESS,
SOCIAL SUPPORT AND PHYSICAL ACTIVITY
AMONG COLLEGE STUDENTS IN JIANGXI
PROVINCE, CHINA**

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PROVINCE, CHINA**

by

PAN MINGZHU

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LIST OF ABBREVIATIONS, SCRONYMS AND SYMBOLS

ACHA-NCHA	American college Health Association-National College Health Assessment
ACSM	American College of Sports Medicine
AG	Agreeable
APA	American Psychological Association
CBT	Cognitive behavioral intervention
CD-RISC	Connor-Davidson Resilience Scale
CFA	Confirmatory factor analysis
CFI	Comparative fit index
Chisq/df	Chi-square / degrees of freedom
CI	Confidence Interval
CO	Conscientiousness
COVID	Corona Virus Disease
CPC	Communist Party of China
CPS	Chinese Psychological Society
CR	Composite reliability
ECVI	Expected Cross-validation index
EX	Extraversion
GFI	Goodness of fit index
GPAQ	Global Physical Activity Questionnaire
HRV	Heart rate variability
ICC	Intraclass correlation coefficient
IN	Intellect
MH	Mental hardiness
MINI-IPIP	Mini International Personality Item Pool

MS	Mental stress
MS	Mental stress
MT	Music Therapy
MVPA	Moderate to vigorous physical activity
NE	Neuroticism
NNFI	Non-normed fit index
OP	Optimism
PA	Physical activity
PER	Personality
PNFI	Parsimony normed fit index
RCTs	Randomised controlled trials
RM ANOVA	Repeated measures analysis of variance
RM MANOVA	Repeated measures multivariate analysis of variance
RMSEA	Root Mean Square Error of Approximation
SEM	Structural equation modeling
SI	Skew index
SRMR	Standardized Root Mean Square Residual
SS	Social support
SSCS	Stress scales for college students
SSSUS	Social support scale for university students
ST	Strength
T2DM	Type 2 Diabetes Mellitus
TLI	Tucker-Lewis index
To	Toughness
WHO	World Health Organisation

**MENYELIDIK KESAN VIDEO SENAMAN BRAIN BREAKS TERHADAP
TEKANAN MENTAL, PERSONALITI, KETAHANAN MENTAL,
SOKONGAN SOSIAL DAN AKTIVITI FIZIKAL DALAM KALANGAN
PELAJAR KOLEJ DI WILAYAH JIANGXI, CHINA**

ABSTRAK

Pelajar kolej, sebagai satu kumpulan yang unik, sedang melalui peralihan antara kehidupan kampus dan kehidupan social, menghadapi tekanan seperti dinamik interpersonal, tuntutan akademik, kekangan kewangan, jangkaan pekerjaan, dan tekanan harian. Menguruskan kesejahteraan psikologi di universiti adalah isu yang mendesak. Penglibatan dalam aktiviti fizikal, seperti video senaman Brain Breaks, terbukti memberi kesan positif terhadap kesihatan mental dengan mengurangkan tahap tekanan. Kajian ini bertujuan untuk mengesahkan alat pengukuran tekanan uBioMacpa Pro di kalangan pelajar kolej Cina. Kajian menunjukkan bahawa ciri-ciri individu seperti personaliti, ketahanan mental, sokongan sosial, dan aktiviti fizikal mempengaruhi tahap tekanan mental secara signifikan. Oleh itu, objektif seterusnya adalah untuk meneroka hubungan antara faktor-faktor ini dan tekanan mental, dan untuk menilai kesan intervensi video senaman Brain-break ke atas pembolehubah kajian dalam kalangan pelajar kolej Cina di Bandar Shangrao, Wilayah Jiangxi. Kajian ini dijalankan dalam dua fasa, Fasa 1 melibatkan ujian kebolehpercayaan dan kesahan uBioMacpa Pro dan kajian keratan rentas, dengan 60 pelajar terlibat dalam ujian kebolehpercayaan, 200 dalam ujian kesahan, dan 890 dalam kajian keratan rentas. Selain itu, 80 pelajar dengan tekanan mental dari Fasa 1 menyertai Fasa 2, yang

merupakan percubaan terkawal rawak. Dalam fasa 2, 80 pelajar dibahagikan secara rawak kepada Kumpulan intervensi atau kawalan untuk eksperimen selama empat minggu. Kumpulan intervensi menerima video senaman Brain Breaks selama 20 minit (berintensiti sederhana hingga tinggi) dua kali seminggu. Indeks tekanan mental peserta dan pembolehubah lain diukur sebelum dan selepas intervensi menggunakan uBioMacpa Pro dan soal selidik yang dilaporkan sendiri. Data yang dikumpul dianalisis menggunakan SPSS 27.0 untuk deskriptif, analisis varians ukuran berulang, dan analisis multivariate ukuran berulang, serta Mplus 8.0 untuk pemodelan persamaan struktur. Keputusan fasa 1 menunjukkan bahawa uBioMacpa mempunyai kebolehpercayaan yang baik ($ICC > 0.75$) dan kesahan ($r = 0.246$, nilai $p < 0.01$), menjadikannya sesuai untuk memantau dan mengukur tekanan mental pelajar kolej Cina. Dalam kajian kedua Fasa 1, 40.8% pelajar dikategorikan dalam kumpulan tekanan utama, terkumpul, dan kronik, dengan skor purata 34.61 ($SD = 13.25$). Model skruktur akhir menunjukkan kesesuaian yang baik ($CFI = 0.976$, $TLI = 0.968$, $SRMR = 0.038$, $RMSEA$ p -value = 0.055), dan hubungan signifikan ditemui antara personaliti, ketahanan mental, sokongan sosial, jumlah aktiviti fizikal, dan tekanan mental. Ini mencadangkan bahawa strategi holistic diperlukan untuk mencegah masalah psikologi di kalangan pelajar kolej dengan mengintegrasikan faktor dalaman dan luaran. Dalam Fasa 2, peserta terdiri 39 pelajar perempuan dan 41 pelajar lelaki dengan purata umur 19 tahun ($SD = 1.41$ tahun). Kumpulan intervensi menunjukkan peningkatan yang signifikan berbanding kumpulan kawalan dalam ketahanan mental, tekanan mental, dan aktiviti fizikal, tetapi tidak dalam personaliti atau sokongan sosial. Intervensi

video senaman Brain Breaks terbukti bermanfaat untuk pelajar yang mengalami tekanan mental, menunjukkan kesan positif terhadap hasil kesihatan mental.

**INVESTIGATING THE EFFECT OF BRANIN BREAKS EXERCISE
VIDEOS ON MENTAL STRESS, PERSONALITY, MENTAL HARDINESS,
SOCIAL SUPPORT AND PHYSICAL ACTIVITY AMONG COLLEGE
STUDENTS IN JIANGXI, CHINA**

ABSTRACT

College students, as a distinct cohort, are navigating the transition between campus and social life, facing pressures such as interpersonal dynamics, academic demands, financial constraints, employment expectations, and daily stress. Managing psychological well-being in universities is a pressing concern. Engaging in physical activity, such as Brain Breaks exercise videos, has been shown to have a positive impact on mental health by reducing stress levels. This study primarily aims to validate the uBioMacpa Pro stress measurement tool among Chinese college students. Studies indicated that individual characteristics like personality traits, hardiness, social support, and physical activity profoundly influence mental stress levels. Thus, the subsequent objectives were to explore the relationships between these factors and mental stress, and to evaluate the effect of Brain-breaks exercise video intervention on the study variables among Chinese college students in Shangrao City, Jiangxi Province. The study was conducted in two phases, Phase 1 involved reliability and validity tests of the uBioMacpa Pro and a cross-sectional study, with 60 students involved in the reliability test, 200 in the validity test, and 890 in the cross-sectional study. Additionally, 80 students with mental stress from Phase 1 participated in Phase 2, which was a randomized controlled trial. In phase 2, 80 students were randomly

assigned to intervention or control groups with a four-week experiment. The intervention group received a 20-minute Brain Breaks exercise video (moderate to high intensity) twice a week. Participants' mental stress index and other variables were measured pre-and post-intervention using the uBioMacpa Pro and the self-reported questionnaires. The collected data were analyzed using SPSS 27.0 for descriptive statistics, repeated measures analysis of variance, and repeated measures multivariate analysis of variance, and Mplus 8.0 for structural equation modeling. Phase 1 results demonstrated that uBioMacpa has good reliability ($ICC > 0.75$) and validity ($r = 0.246$, $p\text{-value} < 0.01$), making it suitable for monitoring and measuring Chinese college students' mental stress. In the second study of Phase 1, 40.8% of students were categorized into primary, accumulated, and chronic stress groups, with a mean score of 34.61 ($SD = 13.25$). Moreover, the final structural model showed a good fit ($CFI = 0.976$, $TLI = 0.968$, $SRMR = 0.038$, $RMSEA\ p\text{-value} = 0.055$), and significant relationships were found between personality, mental hardiness, social support, amount of PA, and mental stress. Hence, it suggests holistic strategies are necessary to prevent psychological issues in college students by integrating internal and external factors. In Phase 2, participants included 39 female and 41 male students with a mean age of 19 years old ($SD = 1.41$ years). The intervention group showed significant improvements over the control group in mental hardiness, mental stress, and physical activity, but not in personality or social support. The Brain Breaks exercise video intervention proved beneficial for students with mental stress, indicating positive impacts on mental health outcomes.

CHAPTER 1

INTRODUCTION

1.1 Background

Mental health issues are a major public health challenge globally. Mental health is an integral part of general health and well-being. It exists with experiences ranging from an ideal state of well-being to debilitating states of great suffering and emotional pain on a complex continuum. People with mental health conditions are more likely to experience lower levels of mental well-being. The World Health Organization (WHO) defines health as a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity (WHO, 2018). Thus, mental health is also a measure of individual wellness.

There exists a robust connection between mental health and stress. Stress, an inevitable aspect of life, manifests as both a physiological and psychological reaction to external and internal challenges. Psychological stress could be positive, inspiring individuals to respond constructively to challenges, but it can also be negative, causing tension and anxiety. Prolonged exposure to chronic stress may precipitate a spectrum of mental health disorders, including anxiety and depression. Furthermore, maladaptive coping strategies, such as withdrawal, excessive anger, or substance abuse, could exacerbate these mental health issues. Mental stress significantly impacts physiological health, initiating a cascade of bodily responses such as elevated heart rate, increased muscle tension, and higher blood pressure. Prolonged chronic stress can

precipitate serious chronic conditions, including hypertension, diabetes, and cardiovascular diseases. According to Zhao et al. (2019), cardiovascular disease, which accounts for 40% of deaths in the Chinese population, is currently the main cause of death and premature death in China.

Chronic stress may also weaken the immune system, making people more susceptible to infections and illnesses. Prolonged periods of stress may have an impact on the immune system, which is highly activated for long periods, heightening the risk of common illnesses such as colds, influenza, etc. It has also been shown that prolonged chronic stress contributes to systemic inflammation, which is associated with a range of diseases, such like heart disease, cancer, and diabetes. Consequently, chronic stress may indirectly elevate the risk of these conditions. Additionally, stress significantly affects sleep quality (Prather et al., 2013). Anxiety and chronic stress are often precursors to sleep disturbances such as insomnia or non-restorative sleep (Blaxton et al., 2017). These sleep issues have been linked to several health problems, including obesity, cardiovascular diseases, and other diseases (Antza et al., 2022; Miller & Howarth, 2023; Peker et al., 2023; Stefani & Högl, 2020).

Until recently, mental health conditions have been highly prevalent in all countries. Several studies have shown that current university students are at the borderline of mental health problems (Berking & Wupperman 2012; Oswald et al., 2020; Pedrelli et al., 2015). At present, about one-third of college students have mental health problems of varying degrees, and a significant proportion of university students have psychological problems such as pessimism, anxiety, and depression (Prince,

2015). Every year, there are increasing numbers of withdrawals from universities due to mental illness and psychological disorders, and suicidal behavior cases are also on the rise (Ishii et al., 2018). As estimated by WHO, 54 million people in China suffer from depression, and about 41 million suffer from anxiety disorders (WHO, 2022). Meanwhile, it illustrated that depression and anxiety are the two most prevalent mental health disorders in China. The data from the China Mental Health Survey highlights a grave issue: annually, around 280,000 individuals in China commit suicide, with 40% suffering from depression. Notably, half of these depressed individuals are university students. Furthermore, the survey indicates that a significant 86% of these patients attribute emotional stress as the primary cause of their depression (Mental Health Branch of Chinese Association of Narcotic Drugs, 2023). Another study on the mental health of university students across China surveyed approximately 100,000 students in 43 cities and 23 universities nationwide, and it revealed that the average prevalence of psychological disorders among university students was 22.8% and that 73.2% of students experienced varying degrees of psychological stress (Li & Cao, 2022).

Furthermore, according to the WHO, the COVID-19 pandemic triggers 25% increase in the prevalence of anxiety and depression worldwide. At the same time, some studies have shown that contemporary college students have become psychologically vulnerable groups (Cooke et al., 2006). Qing and Chao (2023) noted that the COVID-19 pandemic has exacerbated economic downturns and job market stagnation, intensifying structural employment contradictions. Consequently, this has led to a reduced number of job opportunities for college graduates, rendering the

employment landscape for these students increasingly dire. The employment pressures resulting from the pandemic have heightened anxiety among college graduates, making psychological issues related to employment increasingly pronounced. Another study revealed that over 50% of college graduates experience varying degrees of psychological stress related to employment, commonly manifesting as negative emotions such as anxiety, confusion, low self-esteem, etc. (Peng et al., 2023). These negative emotions would accumulate, leading to varying degrees of psychological issues among some students.

College students, as a group with a higher cultural level and as the future reservoir of skilled talent, play a pivotal role in the future development of the country. Whereas, with the rapid development of society and the economy, college students face more stressful events in such a complex environment. According to Lazarus (2006), stress is produced when people experience stressful situations. Negative emotions may emerge when people are unsure of how to handle this sense of stress. Stress is a multifaceted construct that is affected by a large number of factors (Kuruvilla & Jacob 2007). The factors influencing psychological stress vary significantly across different populations. For university students, for example, freshmen would face the pressure of changing roles, sophomores would suffer the dilemma of how to actively engage with society, juniors would undergo the pressure of further studies, seniors may encounter the pressure of employment, and other scenarios will exert varying degrees of psychological pressure on university students (Ribeiro et al., 2018).

Concerning the influencing factors of mental health issues, the interaction

between individuals and their environments constitutes an ecological system. A common method of categorising these influencing factors is according to the source of psychological stress, which is divided into individual characteristics and social factors, which refer to an individual's mental processes and the external environment (Yu, 2024). Meanwhile, in the 'Stress and Coping' model developed by Lazarus and Folkman, mental stress is conceptualized not as a direct result of external stressors but rather as being determined by the individual's cognitive appraisal of those stressors (Lazarus, 1984). Two kinds of cognitive appraisals are identified in the model: primary appraisal and secondary appraisal (Biggs et al., 2017). In the primary appraisal process, individuals evaluate an encounter as irrelevant, benign-positive, or stressful. The secondary appraisal refers to whether the individual has sufficient resources to cope with the stressor. During the appraisal process, individuals are influenced by various factors (Surachman & Almeida, 2018); for instance, personality traits significantly shape the primary appraisal phase (Lazarus, 1984). Personality could influence an individual's behavior and can be considered as a broad set of attributes and characteristics that shape an individual's psychological makeup (Saucier & Srivastava, 2014). Different personality traits could influence how people perceive and deal with mental stress, affecting their mental health. Evidence shows that the interpretation of situations and the resulting emotional response are substantially influenced by individual personality traits. For instance, people with elevated emotional stability are inclined to perceive potentially stressful scenarios as challenges. Conversely, those with higher neuroticism levels may appraise these situations as threats, resulting in a

greater stress response (Afshar et al., 2015; Segerstrom & Smith, 2019). Through an analysis of the Big Five personality traits, Huang et al. also revealed that a person with negative personality traits had the highest chance of experiencing moderate or higher psychological distress (Huang et al., 2021). Meanwhile, some studies have suggested that different types of personnel would cope with stress in different ways (Grant & Langan-Fox, 2006; Lee-Baggley et al., 2005).

The secondary appraisal process primarily involves evaluating available resources, coping strategies, and support systems, such as mental hardiness and social support systems. Mental hardiness serves as a critical internal resource, enhancing an individual's capacity for tolerance and adaptability when confronted with stress-inducing situations (Bartone et al., 2018). Studies have demonstrated that hardiness has the potential to mitigate the possible negative effects of personality traits. Hardiness has been found to be negatively correlated with work stress in various settings and occupations, including hospital staff nurses, critical care nurses, and university staffers (Kunzler et al., 2020; Zahra et al., 2014). Therefore, for university students, the high competitiveness of the job market, and the academic pressure, it's necessary to explore how to improve their mental health by building their hardiness to relieve mental pressure. On the other hand, from the perspective of interpersonal, social support influences individuals' cognitive judgments, coping styles, and strategies when coping with stressful events and emotional distress (Mao et al., 2024). As for the study of how stress and social support interact among college students, most researchers agree that social support has a protective effect on people in stressful

circumstances and think it helps university students better manage stress (Alsubaie et al., 2019; Z. Green et al., 2024; Sabo et al., 2023). For instance, Mclean et al. revealed that students with higher levels of social support reported lower levels of stress, further supporting the negative correlation between social support and stress among university students (McLean et al., 2023). Similarly, Poots et al. concluded that college students who have good social support are more socially evolved, better able to adapt to society, better able to realize their potential, and have more positive experiences coping with social stress (Poots & Cassidy, 2020). University students who have a perception of insufficient social support are more likely to express life dissatisfaction and have suicidal thoughts (Arria et al., 2009). In the framework of Lazarus and Folkman Stress Coping Theory, social support is considered a personal coping resource that mitigates the negative effects of stress.

Additionally, physical activity constitutes a significant coping resource in the secondary appraisal process, contributing positively to stress management (Stults-Kolehmainen et al., 2014). Research evidence suggests that regular engagement in physical activity mitigates stress responses and bolsters psychological resilience through both physiological and psychological pathways. Specifically, physical activity has been associated with endorphin release, reduction in anxiety levels, and enhanced emotional regulation (Alizadeh Pahlavani, 2024; Kuan & Kueh, 2015; Wu et al., 2023; Yew et al., 2022). These effects collectively support the role of physical activity as an adaptive coping mechanism. Therefore, recognizing and promoting physical activity as a resource in coping strategies is crucial for advancing research on managing

psychological stress among college students. Personality, mental hardiness, social support, and physical activity all play distinct yet interconnected roles within the ‘Stress and Coping’ model, jointly influencing students’ cognitive appraisal and coping mechanisms in response to stress. While existing research has predominantly focused on the independent effects of these factors on psychological stress, there has been limited exploration of their interactive effects, particularly among Chinese college students. Consequently, this study aims to investigate the relationship between personality, mental hardiness, social support, physical activity, and mental stress in Chinese college students.

Presently, there is mounting research focused on the mental stress of college students. Therefore, some researchers have developed various techniques to evaluate mental stress states (Cai et al., 2022; Cushway et al., 1996; Limone et al., 2021; Whitney et al., 2022). The most popular method for assessing psychological stress levels is to adopt subjective methods. However, self-administered questionnaires inevitably suffer from biases, such as respondent bias, acquiescence bias and social desirability bias (Bowling, 2005). At present, some researchers or healthcare organizations have developed physiological measurement tools to measure mental stress (Katmah et al., 2021). uBioMacpa Pro was one such, developed by a Korean medical company. It evaluates accumulated stress by measuring heart rate variability (HRV) from pulse wave analysis of capillaries. HRV shows the variation in heart rate signal and evaluates the time interval between two adjacent R waves (Oh et al., 2021). uBioMacpa, the pulse detection, enables anyone to easily monitor stress and

cardiovascular health levels accumulated via bad lifestyle habits at home or work, maintaining a healthy state and preventing disease, which is the main purpose of the system. Thus, in this study, the research proposed to measure students' mental stress via uBioMacpa to obtain the psychological stress levels of university students objectively.

Moreover, physical activity (PA) intervention has been widely implemented to alleviate mental stress and improve individuals' mental health. Empirical studies have demonstrated that regular physical activity contributes not only to improved physical health but also to the reduction of symptoms associated with depression and anxiety, thereby enhancing mood and overall mental well-being (Creese et al., 2021; Singh et al., 2023; Wanjau et al., 2023). WHO underscores the significance of physical activity for mental health in various reports and guidelines. For instance, the Global Status Report on Physical Activity 2022 by WHO highlights that consistent physical activity can alleviate psychological stress and bolster mental health (WHO, 2022). Brain Breaks[®] are structured physical activity videos provided by HopSports, designed to promote physical and mental health among school-aged children. These videos typically last between 2-5 minutes and are intended to be used during the school day to provide students with short breaks that encourage physical movement and mental relaxation. The videos incorporate elements of sport, dance, and fitness, making them versatile and engaging for students of all ages. Research indicates that Brain Breaks can positively impact students' physical and mental health (Hidrus et al., 2020; Rizal et al., 2019; Zhou et al., 2021). Hence, the researcher proposed to adopt the Brain

Breaks exercise videos as an intervention to alleviate participants' mental stress and regulate their negative emotions, which is important for enhancing their physical and mental health.

1.2 Problem statement

Students in higher education are in the pre-adult phase, also known as late youth, which is characterised by two main traits: first, the developmental tasks at this stage are more demanding, difficult, and complex than those of youth; and second, the social roles they play have significantly changed (Almaiah et al., 2020). Due to these changes, society, educational institutions, and families now have new standards and expectations for college students. Therefore, after entering school, students have to adapt to new life, such as independent disposal of time and money, learning professional knowledge, dealing with more complex interpersonal relationships, participating in various activities for enriching social experience, acquiring various qualifications, etc. All of these changes may lead to physical and mental health problems among university students. On the physiological level, psychological stress can make the heart beat faster, blood pressure rise, and breathing faster, which can easily produce diseases such as hypertension and coronary heart disease (Lin et al., 2021). On the psychological level, psychological stress has a huge impact on mental health and can cause people to develop symptoms such as cognitive bias, anxiety, emotional agitation, irritability, and stereotypical actions, which can cause various neurological disorders such as neurasthenia, anxiety disorders, phobias, and depressive

neuroticism in mild cases, or serious mental illnesses and even personality disorders in severe cases (Hernández-Torrano et al., 2020).

However, from the existing research literature, it can be understood that most of the studies on psychological stress among university students have mainly used self-assessment questionnaires in their research design. For example, the college student stress scale (Feldt, 2008), the student stress scale, an adaptation of Holmes and Rahe's life events for college-age adults (Holmes & Rahe, 1967) , and other scales (Schneider et al., 2020; Taylor et al., 2020). All the self-assessment questionnaires are more subjective and to a certain extent affect the survey results. uBioMacpa Pro, as an objective measurement tool, can help to check blood circulation status and accumulated stress by measuring HRV through pulse wave analysis of capillary. It's an objective measurement instrument. At present, the majority of research and use of this device is concentrated in Korea (Jo, Park, & Yeon 2021; Jung & Jang 2016; Kim & Lee 2018; Ryu, Yun, & Choi 2020). However, there is a scarcity of research on the use of objective measurements of stress in China. Besides, there is currently no relevant study that has been conducted to examine the reliability and validity of uBioMacpa Pro for stress monitoring among Chinese college students. As a result, the first question to be answered in this study employing this equipment is whether it is appropriate for testing university students in China.

Studies have found that stress among university students is related to many factors, such as personality, hardiness, social support, physical activity, etc. Numerous studies have been conducted on both personality and stress, and most findings of these

research demonstrate that different aspects of the stress reaction are linked to various dimensions of personality traits (Xin et al., 2017). For instance, extroverted people displayed decreased cortisol activation in response to stress and a decrease in the emergence of negative emotions. According to research on the relationship between hardiness and stress, those with stronger hardiness tend to manage more favorably with stressful events (Green et al., 2007). There are also many studies on social support and stress, and the findings from this aspect of research indicate that social support has a significant direct effect on stress (Sullivan & Kashubeck-West, 2015; Ye et al., 2020). For PA, it has long been proven to be an effective strategy to promote individuals' physical and mental health (Elbe et al., 2019; Herbert, 2022b; Van Dyck et al., 2015), and how to better promote persons' psychological health through physical exercise has been a hot topic in the fields of sport and psychology. However, according to the currently available literature, there is less research on college students' personality, hardiness, social support, and physical activity in association with stress. Therefore, it's necessary and comprehensive to explore the study of personality, hardiness, social support, physical activity, and mental stress among university students and the mechanisms that contribute to it.

At present, there are very few studies on stress interventions for university students, the existing research in China shows that studies on stress among college students have mainly focused on exploring the relationship between stress and another variable and its mediating model. Currently, it is usual for Chinese universities to provide mental health education courses and to establish counseling services to help

students with psychological issues. These strategies have many limitations and are relatively inefficient. HOPSports developed a promising intervention, named Brain Breaks® physical activity solutions. It integrated different kinds of movement in 3-5-minute online exercise videos. For now, many studies have proven that Brain Breaks® has beneficial effects, such as improved internal feelings, improved self-confidence, improved cognitive and behavioral processing, and improved physical activity (Glapa et al., 2018; Popeska et al., 2018; Rizal et al., 2019). However, there are currently few studies in China that utilize Brain Breaks® as an intervention strategy, and there is a shortage of research that applies Brain Breaks® to interventions for psychological stress among Chinese university students. Therefore, this study uses the Brain Breaks® intervention to explore whether this intervention solution is effective in lowering the psychological stress of Chinese university students.

In general, this study attempts to explore the current level and status of psychological stress by using objective measures and instruments to measure psychological stress among Chinese university students. Furthermore, to address the issue of stress among university students, this study will adopt objective measurement to get the university students' stress status, combined with the exercise intervention, and to validate its effectiveness. Thus, this study hopes to provide new ideas and references for the construction of a mental health service system for college students and to assist them in managing their psychological stress and negative emotions to promote healthy physical and mental development.

1.3 Significance of study

Mental stress among university students has emerged as a critical issue, particularly within the Chinese context where academic pressure and social expectations are significant. Mental stress is a pervasive issue that poses significant risks to both mental and physical health. High levels of stress can lead to a range of adverse outcomes, including anxiety, depression, and burnout, which can severely influence academic performance and overall well-being (Hussain et al., 2013). Chronic stress can disrupt normal cognitive and emotional functioning, leading to difficulties in concentration, memory, and decision-making, further exacerbating academic challenges (Beiter et al., 2015). Addressing this issue is paramount for fostering a healthier, more resilient student population.

However, psychological stress is an indicator that is not easily monitored. To our knowledge, there are limited methods available today for measuring mental stress levels, and the usefulness of public pressure is restricted because of the cost, the difficulty of conveying and managing equipment, the environmental requirements needed for measurement, and the high level of skill needed for testing. In comparison to complicated psychiatric examinations and time-consuming psychometric questionnaires, the use of straightforward electronic devices for stress evaluation is more practical in research practice. Therefore, this study examined the reliability of the mental stress measuring meter (uBioMacpa Pro) among Chinese university students to provide a valid measurement tool and reference for stress research.

Moreover, this study could enrich and improve the connotation of stress theory

among university students. This study took college students' stress as the research object and intervened in the stress level, enhancing the theory's connotations and the technique for measuring the college students' stress level and status. Thus, it would provide new perspectives and theoretical references for the mental health care system of Chinese college students. Furthermore, this study, guided by the concept of health promotion, explored the current status, influencing factors, and interventions for college students' stress.

1.4 Operational Definition

1.4.1 Reliability and validity analysis

Reliability and validity analysis are fundamental aspects of research across various disciplines, ensuring the consistency and accuracy of measurements and assessments. Reliability refers to the consistency and stability of measurement over time, while validity pertains to the accuracy of the results obtained from the research (Kimberlin & Winterstein, 2008). In the context of measurement instruments, reliability ensures that the instrument produces consistent results when used repeatedly, while validity ensures that the instrument measures what it is intended to measure accurately (Heale & Twycross, 2015). Reliability and validity analysis are adopted to validate the uBiomacpa Pro among Chinese college students.

1.4.2 Confirmatory Factor Analysis (CFA)

Confirmatory factor analysis (CFA) is a special form of factor analysis, most applied in social science research (Tabri & Elliott, 2012). CFA tests whether the relationship between a factor and its corresponding measurement item conforms to the

theoretical relationship designed by the researcher. CFA is often tested through structural equation modeling. In practical research, the process of CFA is also the process of testing the measurement model. It provides a more precise understanding of the covariation among a number of indicators that is fewer than the number of measured variables (Hox, 2021) .

1.4.3 Structural Equation Modelling (SEM)

SEM has been described as a technique that combines factor analysis with linear regression models to validate hypotheses (Maddi et al., 2020). It is a powerful tool for evaluating relationships among variables and has been favored for testing mediation and moderation hypotheses (Sardeshmukh & Vandenberg, 2017). SEM is performed to explore the structural relationship between personality, mental hardiness, social support, amount of PA, and mental stress.

1.4.4 Personality

Personality is the unique set of behavioral tendencies, thoughts, and feelings that distinguish one individual from another and remain relatively consistent over time and across different situations (Saucier & Srivastava, 2014). It could influence an individual's behavior and can be considered as a broad set of attributes and characteristics that shape an individual's psychological makeup (Saucier & Srivastava, 2014). The present study used the five factors (Extraversion, Agreeableness, Conscientiousness, Neuroticism, and Intellect/Imagination) of MINI-IPIP developed by Donnellan et al. (2006).

1.4.5 Mental hardiness

Mental hardiness is a psychological construct that encompasses the ability to effectively cope with stress and adversity. Mental hardiness plays a significant role in improving individuals' ability to cope with environmental pressures and life stresses (Hajebi et al., 2016). For the present study, three factors (toughness, strength, and optimism) from the Connor-Davidson Resilience Scale (CD-RISC) (Connor & Davidson, 2003) were used to evaluate the hardiness trait of participants.

1.4.6 Social support

Social support is a multifaceted concept that encompasses various forms of assistance and plays a significant role in individuals' well-being and coping mechanisms. This support can be received from family, friends, community members, and organisations (Shumaker & Brownell, 1984). The present study adopted the Social Support Scale for University Students developed by Yue et al. (2008). It includes three factors, subjective support, objective support, and support utilisation. Subjective support, objective support, and support utilization are important concepts in the field of social support. Subjective support refers to the individual's perception of the support they receive from their social network, including emotional, informational, and instrumental support (Williams et al., 2004). On the other hand, objective support is the actual tangible support that an individual receives from their social network, such as financial assistance, practical help, or advice (Rubashkin et al., 2018). Support utilization, as defined in the literature, encompasses how individuals make use of the available social support, including seeking and accepting support from others (Colquitt

et al., 2014)

1.4.7 Amount of Physical Activity

Participants' physical activity level and exercise status. This study adopted the Global Physical Activity Questionnaire (GPAQ). GPAQ was designed to measure physical activity (PA) and sedentary time. Levels of total physical activity were classified into 3 levels: High, Moderate, and Low. Details of the GPAQ scoring protocol were discussed in Chapter 3, Section 3.8.6.

1.4.8 Mental stress

The concept of mental stress is closely related to the broader notion of mental health, as it can significantly influence an individual's ability to cope with adversity (Heaney, 2021). It can manifest in various forms, such as depression, anxiety, post-traumatic stress disorder (PTSD), and other mental health problems. For the present study, the mental stress of participants was measured by uBiomacpa Pro, which is an objective measuring tool. It was divided into five groups, good level, temporary stress, primary stress, accumulated stress, and chronic stress. Details of the uBioMacpa Pro instrument were discussed in Chapter 3, Section 3.8.1.

1.5 Research Objective, Research Questions, Research Hypothesis

The study's research objectives, questions, and hypothesis were separated into two phases (Phase 1 and Phase 2) based on the sequences of the research.

1.5.1 General Objective

The general objective of this research is to determine the relationship between personality, mental hardiness, social support, the amount of PA, and mental stress

among college students at Shangrao Normal University, Jiangxi, China, as well as the effect of the Brain Breaks video intervention on the variables among college students at Shangrao Normal University, Jiangxi, China.

1.5.2 Specific Objectives

1.5.2 (a) Phase 1

1. To validate the mental stress measuring by using, uBioMacpa Pro, among college students in Jiangxi, China.
2. To validate the translated Chinese version questionnaire Mini International Personality Item Pool (MINI-IPIP) and Connor-Davidson Resilience Scale (CD-RISC) scale among college students in China, using Confirmatory Factory Analysis (CFA).
3. To develop a structural equation model of personality, mental hardiness, social support, amount of PA, and mental stress among college students at Shangrao Normal University, Jiangxi, China.

1.5.2 (b) Phase 2

4. To examine the time effects (within groups) of the Brain-Breaks video exercise on personality, mental hardiness, social support, amount of PA, and mental stress among college students at Shangrao Normal University, Jiangxi, China.
5. To examine the group effects (between groups) of the Brain-Breaks video exercise on personality, mental hardiness, social support, amount of PA, and mental stress among college students at Shangrao Normal University, Jiangxi, China.

6. To examine the interaction effects (within-between groups) of the Brain-Breaks video exercise on personality, mental hardiness, social support, amount of PA, and mental stress among college students at Shangrao Normal University, Jiangxi, China.

1.5.3 Research Questions

1.5.3 (a) Phase 1

1. What is the validity and reliability of the uBioMacpa Pro among Chinese college students in Jiangxi, China?
2. Are the translated Chinese version questionnaires of the Mini International Personality Item Pool (MINI-IPIP) and Connor-Davidson Resilience Scale (CD-RISC) valid and reliable among college students in China based on confirmatory factor analysis (CFA)?
3. Are there any significant path relationships between personality, mental hardiness, social support, amount of PA, and mental stress among college students at Shangrao Normal University, Jiangxi, China?

1.5.3 (b) Phase 2

4. Is there any time effect of the Brain-Breaks video exercise intervention on personality, mental hardiness, social support, the amount of PA, and mental stress among college students at Shangrao Normal University, Jiangxi, China?

5. Is there any group effect of the Brain-Breaks video exercise intervention on personality, mental hardiness, social support, the amount of PA, and mental stress among college students at Shangrao Normal University, Jiangxi, China?
6. Is there any interaction effect of the Brain-Breaks video exercise intervention on personality, mental hardiness, social support, the amount of PA, and mental stress among college students at Shangrao Normal University, Jiangxi, China?

1.5.4 Research Hypothesis

1.5.4 (a) Phase 1

1. The mental stress measuring meter, uBioMacpa Pro, is valid and reliable among college students in Jiangxi, China.
2. The translated Chinese version questionnaires of the Mini International Personality Item Pool and Connor-Davidson Resilience Scale are valid among the college students in China based on confirmatory factor analysis.
3. There are significant path relationships between personality, mental hardiness, social support, amount of PA, and mental stress among college students at Shangrao Normal University, Jiangxi, China.

1.5.4 (b) Phase 2

4. There is a significant difference in time effect on personality, mental hardiness, social support, the amount of PA, and mental stress among college students at Shangrao Normal University, Jiangxi, China after being given the Brain-Breaks video exercise intervention.

5. There is a significant difference in group effect on personality, mental hardiness, social support, the amount of PA, and mental stress among college students at Shangrao Normal University, Jiangxi, China after being given the Brain-Breaks video exercise intervention.
6. There is a significant difference in interaction effect on personality, mental hardiness, social support, the amount of PA, and mental stress among college students at Shangrao Normal University, Jiangxi, China after being given the Brain-Breaks video exercise intervention.

1.6 Organisation of the thesis

The thesis is organised into 8 chapters. The chapter shows the study and the content of this thesis. This covers the research background, problem statement, research questions, and research objectives. Chapter 2 is the literature review which offers the status about related studies, mental stress of college students, prevalence, associated factors, intervention method, and previous studies about Brain Breaks exercise. Chapter 2 ends with the conceptual framework, illustrating the research design and relationship of the variables that adopted in the research.

Chapter 3 presents the methodology used in the phase 1 study. In phase 1, it consists of validating the mental stress measuring reliability in Chinese college students, validating the translated Chinese version questionnaire MINI-IPIP and CD-RISC using Confirmatory Factor Analysis (CFA), as well as exploring the relationship between personality, mental hardiness, social support, amount of PA, and mental stress. Two research methodologies are presented in Chapter 3.

Chapter 4 describes the results and findings of Phase 1. Chapter 5 shows the research method of Phase 2 study. Chapter 6 elaborates on the results for Phase 2. Chapters 3 & 5 mainly focus on illustrating the chosen approach and research procedures such as study design, sampling method, measurement tools, data analysis, etc., for each phase. The research results are described descriptively by displaying with tables or figures in Chapters 4 & 6. Chapter 7 presents the discussion about results and findings based on the specific research objectives for Phase 1 and 2 studies. Moreover, the strengths and limitations of this research are also presented in this chapter. The last chapter of this study is Chapter 8. The conclusions of this current study and recommendations for future study are shown in this chapter.

1.7 Summary

This chapter introduced important issues related to this current study. It started with an introduction about mental health, the background of the study, and the problem statement. The general and specific objectives are described in sub-points to provide a clear direction and paths for the study. In addition, the rationale of the study was provided to emphasize the significance of this research. To help with comprehension, useful explanations of the terminology used in the study are also provided. Next chapter, Chapter 2 shows a review of the relevant literature related to the study.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

To deepen the understanding of the research topic, the researcher conducted an exhaustive review of previously published studies that were pertinent. This chapter encapsulates a summary of the information gleaned from the literature review, providing the foundation understanding of the current study. It includes subchapters that comprehensively cover all the related variables and concepts relevant to the present study. All preceding research papers were sourced from reputable online databases that provide access to authentic journals publishing related articles. The primary databases utilized for gathering these studies included Google Scholar, ResearchGate, PubMed, CNKI, and Scopus. These platforms were instrumental for the researcher in amassing a comprehensive collection of relevant previous studies.

The literature search employed a range of keywords to thoroughly explore the research topic. These included: “mental stress”, “mental health status”, “college students’ mental stress”, “prevalence”, “management and treatment of mental stress”, “mental stress measuring tool”, “uBioMacpa Pro”, “personality”, “mental hardiness”,