

The Relationship Between Exercise Types and the State of Mind of Rural Elderly Populations

Hongxia Tian^{1*}

Abstract

Examining the nexus between exercise modalities and the cognitive-emotional status of elderly populations residing in rural locales is imperative for enhancing initiatives aimed at mental health enhancement and policy formulation. Consequently, this investigation delved into the correlation between exercise modalities and the psychological well-being of senior citizens in rural settings, while also scrutinizing variations in this association across gender and educational strata. Employing a self-administered questionnaire encompassing demographic particulars and physical activity data alongside a truncated version of the Profile of Mood States (POMS) scale, the study was conducted across six conveniently selected villages, encompassing a total of 346 participants post the exclusion of incomplete or invalid responses. Statistical analyses were executed utilizing SPSS 21.0 and Stata 12.0 software, employing multiple linear regression techniques to scrutinize the interplay between exercise modalities and psychological states. Furthermore, gender and educational attainment were utilized as stratifying variables to discern disparities in this nexus, also via multiple linear regression modelling. The research unveiled that elderly individual engaging in intermittent exercise regimens exhibited diminished fatigue levels. Moreover, gender and educational attainment exhibited divergent impacts on this relationship, with female elderly participants partaking in intermittent exercise reporting reduced energy and anxiety levels, while heightened educational levels correlated with diminished depression and anxiety scores among those engaged in intermittent exercise, in comparison to counterparts adhering to continuous exercise routines. These findings bridge a lacuna in existing literature concerning exercise modalities, offering insights pivotal for policy development in this domain.

Keywords: Exercise Types; State of Mind; Mental Health; Older Adults; Rural Areas.

Introduction

The phenomenon of population aging stands as a pivotal aspect of contemporary global demographic transitions, eliciting significant apprehension regarding the array of social issues it precipitates across nations (Bloom et al., 2011; Veras, 2009). With China transitioning into an aging society since the turn of the millennium, the demographic of elderly individuals has steadily burgeoned (Bai & Lei, 2020). The seventh national population census conducted in 2020 revealed that individuals aged 60 and above constituted 18.70% of the overall populace, with those aged 65 and above accounting for 13.50% (National Bureau of Statistics, 2011). This marks a notable uptick of 5.44 percentage points from the findings of the 2010 census (National Bureau of Statistics, 2012). The Research Report on the Development Trend Forecast of Population Aging in China (Office of the National Working Committee on Aging, 2014) underscores that the span from 2030 to 2050 portends the acutest phase of population aging in China, with pronounced demographic aging and accelerated seniority increasingly conspicuous. Consequently, population aging poses a formidable challenge to China's

ascendancy in the 21st century. Moreover, a substantial 73.3% of individuals aged 60 and above in China reside in rural areas characterized by limited healthcare resources, thus amplifying concerns among scholars regarding the quality of life, health, and overall well-being of elderly denizens in rural locales (Huang Jinglin et al., 2023; National Bureau of Statistics, 2011; Yang et al., 2017).

As China's economic prosperity and living standards continue to advance, the conception of health among its populace has transcended mere physical well-being and longevity, with a heightened emphasis on psychological and social adjustment (Johnson & Acabchuk, 2018; Yang et al., 2016). Research indicates that a substantial proportion, ranging from 50% to 80%, of ailments afflicting the elderly in China stem from psychological disorders (Gao & Wang, 2016). In response, both the National Fitness Plan (2016-2020) (State Council, 2016) and the "Healthy China 2030" Plan (CPC Central Committee & State Council, 2016) underscore the imperative of widespread dissemination of mental health science and enhancement of mental health literacy as pivotal strategies for fostering holistic health and realizing the vision of a healthy populace and nation. Consequently, the mental well-being of the elderly cohort

¹ School of Physical Education, Henan Institute of Technology, Xinxiang 45300, China. Email: tianhongxia@hist.edu.cn

*Correspondence: tianhongxia@hist.edu.cn

is increasingly assuming a prominent position in the collective consciousness of society at large.

A state of mind denotes a subdued, tranquil, and enduring emotional condition with a profound impact, constituting the fundamental backdrop of an individual's mental activity over a span of time (Mills, 1991). It serves as a reflection of an individual's emotional disposition, directly influencing their mental well-being (Breslin et al., 2018; Prothmann et al., 2006). This state can be categorized into positive and negative realms. In a positive state of mind, individuals can readily and joyfully immerse themselves in daily pursuits, engage in positive and proactive interactions with others, and bolster their resolve to surmount challenges, thereby facilitating successful task completion. Conversely, a negative state of mind engenders bitterness, demoralization, hindered communication, diminished confidence, and frequent experiences of tension and anxiety, ultimately impeding work efficiency. Hence, a favourable state of mind fosters proactive behaviour and nurtures mental health, whereas an unfavourable one tends to precipitate despondency and frustration, potentially culminating in various mental disorders (Alsaleh et al., 2015).

There exists a robust association between physical exercise and mental state (Berger & Motl, 2000; Legey et al., 2017; Michishita et al., 2017), whereby engaging in physical activity can ameliorate negative emotions such as tension, anger, and confusion among participants, thereby fostering the enhancement of their positive mental state (Driver & Ede, 2009; Fennell et al., 2022; Liu, 2015). Drawing upon the variability principle of practice, non-continuous exercise programs, as opposed to continuous ones, entail more intricate movement sequences necessitating heightened limb coordination, thus engendering greater cognitive benefits (Heilmann et al., 2022). For instance, research by Shi et al. (2022) and Tsai et al. (2017) has demonstrated that endeavours featuring both open environments and sequential movement attributes yield notable advantages in enhancing executive function benefits. Moreover, according to the findings of Shi et al. (2023), mental health exhibits a close association with cognitive performance, with exercise modalities offering participants more enjoyable experiences and positive emotions being more conducive to fostering enhancements in executive function. In essence, the impact of exercise on mental health outcomes may be contingent upon the type of exercise undertaken. Nonetheless, empirical investigations into the relationship between exercise type and mental health outcomes remain relatively scarce.

This study seeks to fill gaps in current research by examining how different types of exercise influence the mental well-being of elderly individuals in rural settings. It

also aims to determine if this relationship varies by gender and education level. By doing so, we aim to contribute theoretically to the understanding of physical activity and mental health in the elderly while addressing the lack of evidence on specific exercise types. On a practical level, we hope our findings will inform government strategies aimed at enhancing the quality of life for elderly individuals in rural areas.

Literature Review

Viewed through the lens of the social ecological model, physical exercise emerges as a crucial determinant of mental health or the state of mind (Reupert, 2017). For instance, Michishita et al. (2017) demonstrated the enhancement of emotional states among workers through physical exercise, while Fennell et al. (2022) evaluated the impact of physical activity on mental states during the COVID-19 lockdown, revealing its efficacy in ameliorating negative emotions induced by isolation. Moreover, Driver et al. (2009) investigated the influence of physical exercise on the mental state of traumatic brain injury patients through an experimental-control group setup, noting improvements in patient energy levels and reductions in negative moods such as tension, depression, anger, fatigue, and confusion. Similarly, studies by Liu (2015) and others have observed that sustained engagement in physical exercise among older adults correlates with significant enhancements in their mental state, manifesting in the alleviation of negative emotions like tension, anger, fatigue, depression, and panic, alongside the elevation of positive emotions such as energy and self-mood. Furthermore, Liu (2021) examination of middle-aged and elderly Dong and Miao groups yielded congruent findings, underscoring the notable potential of physical exercise in enhancing the mental well-being of ethnic minority populations in middle to later life stages.

There is a growing body of evidence illuminating the intricate interplay between physical exercise and mental health, with an emerging emphasis on exploring dose-response relationships in forthcoming research endeavours. This trend holds paramount importance in crafting nuanced strategies for mental health promotion grounded in exercise interventions. For instance, Yao et al. (2021) conducted a comprehensive systematic review and meta-analysis of randomized controlled trials investigating the impact of physical exercise interventions on mental health outcomes among the elderly demographic. Their findings underscored the beneficial effects of physical exercise on mental health in individuals aged 60 and above, irrespective of factors such as age,

gender, and intervention duration. Notably, the study revealed that low-frequency, long-term, and consistent exercise regimens yielded more pronounced positive effects on mental health among the elderly. In a similar vein, [Morres et al. \(2019\)](#) employed quantitative effect testing methodologies to examine the efficacy of physical exercise interventions in ameliorating clinical depression among elderly cohorts. They observed significant antidepressant effects associated with moderate-intensity exercise sessions averaging 45 minutes, conducted three times weekly, over an average intervention duration of 9.2 weeks. Furthermore, researchers have begun exploring the potential moderating influence of exercise modality on the relationship between physical exercise and mental health outcomes. [Chen \(2022\)](#), for instance, highlighted the superior efficacy of traditional Chinese exercises like Tai Chi and Baduanjin in alleviating depression and anxiety compared to conventional physical exercise modalities. Parallel findings were echoed in [Kong et al. \(2019\)](#) investigation targeting college student populations, further underscoring the differential impact of exercise types on mental health outcomes.

The field of motor skill learning offers a fresh perspective for categorizing exercise types. According to [Zhang \(2012\)](#), motor skills are classified into continuous and non-continuous skills based on task organization. Continuous skills involve repetitive execution of a single movement without clear endpoints, such as running or swimming, while non-continuous skills comprise complex sequences of discrete movements, seen in activities like aerobics or martial arts routines. Recent research ([Shi et al., 2022](#)) has investigated the impact of physical exercise interventions on cognitive performance using this classification, revealing superior benefits from non-continuous skills over continuous ones. Furthermore, cognitive performance is intricately linked with emotions like anxiety and depression ([Shi et al., 2023](#)), suggesting potential disparities in the relationship between continuous and discrete skills and mental health. However, substantial empirical evidence supporting this notion is currently lacking.

Methods

Participants

This study employed a cross-sectional design, employing a combination of convenience and simple random sampling methods for participant selection. Initially, six villages in Xinxiang City, Henan Province, China, were chosen using convenience sampling. Subsequently, 70 participants were

randomly selected from each village using a random number table. A total of 420 participants completed the questionnaire survey. Ethical considerations were adhered to throughout the study. Firstly, all participants provided informed consent before completing the questionnaire. Secondly, the survey was conducted using anonymous questionnaires, with no collection of participants' identity information. Invalid questionnaires were excluded based on predefined criteria, such as incomplete information or irregular handwriting. After selection, a total of 346 participants were included in the final analysis.

Variables and Tools

The participant data in this study primarily encompassed demographic particulars, physical exercise details, and state of mind assessments. The questionnaire, containing specific items for each category, is provided as supplementary material.

Demographic Information

The demographic information collected comprises three variables: age, gender, and educational attainment. Gender is coded as "1" for male and "2" for female participants. Educational attainment is categorized as follows: "1" for illiterate, "2" for primary school, "3" for middle school, and "4" for high school.

Physical Exercise Information

The physical exercise information encompasses five variables: types of exercise, years of exercise, frequency of exercise per week, timing of exercise, and whether exercising with a partner. Participants' reported exercise modes were categorized into two groups: continuous programs (e.g., walking, running, swimming) coded as "1" and discontinuous programs (e.g., martial arts, square dancing, table tennis, badminton) coded as "2". Years of exercise were classified as follows: "1" for less than 3 years, "2" for 3 to 6 years, "3" for 7 to 10 years, and "4" for more than 10 years. Frequency of exercise per week was dichotomized as "1" for more than 3 times and "2" for less than 3 times. Timing of exercise was coded as "1" for morning exercise and "2" for evening exercise. Lastly, whether participants exercised with a partner was coded as "1" for yes and "2" for no.

State of Mind

This study utilized the short-form POMS scale, adapted by Prof. [Zhu \(1995\)](#) from East China Normal University, to assess the mental state of elderly participants. The scale, employing a Likert 5-point self-assessment, comprises 40 items grouped into 7 subscales: tension, anger, fatigue, depression, energy, panic, and self-esteem. Higher scores on tension, anger, fatigue, depression, and panic subscales

indicate greater mood disturbance, while higher scores on energy and self-esteem subscales suggest lower mood disturbance. Overall state of mind (TMD) was calculated by summing negative mood scores, subtracting positive mood scores, and adding a constant of 100, with higher scores indicating poorer mental state. The scale demonstrated satisfactory reliability, with a range of 0.62 to 0.82 and a mean of 0.71.

Procedures

Initially, this study engaged six individuals from the participants' social circles (relatives, classmates, and friends) to conduct face-to-face interviews using the household questionnaire method. These interviewers provided guidance to participants, especially those who were illiterate or had difficulty understanding the questions, by verbally paraphrasing the content. Questionnaire completion time varied, typically spanning from 15 to 30 minutes per participant. Additionally, to ensure the study's reliability, 100 participants were randomly selected for retesting, enabling an assessment of response consistency across two questionnaire administrations.

Mathematical Statistics

This study utilized SPSS 21.0 and Stata 12.0 software for data processing and statistical analysis, along with GraphPad Prism 8 software for result visualization. Descriptive statistics, including mean (M) and standard deviation (SD) for continuous variables and frequency/percentage for categorical variables, were employed. Test-retest reliability assessment was conducted using the consistency of responses and Pearson correlation coefficient. State of mind was treated as the dependent variable, with exercise type as the independent variable and demographic variables and basic physical exercise information as control variables. Additionally, the study investigated differences in the relationship between exercise types and the state of mind across gender and educational attainment, utilizing these variables as stratification factors. The significance level for all statistical tests was set at $\alpha=0.05$.

Results

Retest Reliability Test of the Questionnaire

The consistency between demographic and physical exercise information surpasses 85.0%, indicating robust test-retest reliability (see Table 1). Additionally, the correlation coefficient for mood state is $r=0.712$, with a significance level of $P<0.001$, signifying a moderate to high degree of correlation between the two tests.

Table 1

The Degree of Consistency in Responses to the Questionnaire on Demography and Physical Exercise Information

Items	Consistency Coefficient
Age	100.0%
Your gender is	100.0%
Your educational attainment is	98.0%
What kind of physical exercise do you usually do?	87.0%
The number of years you have been insisting on physical exercise is	93.0%
How many times do you participate in physical exercise per week?	94.0%
Is your usual exercise time in the morning or in the evening?	98.0%
Do you have a companion to accompany you when you participate in physical exercise?	95.0%

Basic Information about the Participants

The study comprised 346 participants aged between 60 and 95 years, with a mean age of (70.87 ± 12.94) years. Among them, 45.7% were male, and 54.3% were female. Regarding educational attainment, primary school accounted for the highest percentage (52.6%), followed by middle school (23.7%), illiteracy (18.5%), and high school (5.2%). In terms of exercise patterns, 75.1% of participants engaged in regular continuous programs, while 24.9% opted for discontinuous programs. Regarding the duration of exercise, 48.6% had been exercising for less than 3 years, 20.8% for 3 to 6 years, 6.9% for 7 to 10 years, and 23.7% for more than 10 years. Additionally, 59.8% exercised more than 3 times per week, and 40.2% exercised less than 3 times per week. The majority (62.1%) preferred morning exercise, while 37.9% preferred evening exercise. Furthermore, 53.2% preferred to exercise with a partner, while 46.8% did not.

Relationship Between Types of Exercise and State of Mind in Older Adults

After controlling for demographic and physical exercise variables, older adults engaging in discontinuous exercise programs exhibited significantly lower scores on the panic dimension compared to those in continuous programs ($\beta = -0.904$, 95% CI = -1.701 to -0.107). This suggests that older adults in discontinuous programs were significantly less prone to panic than their counterparts in continuous programs. Additionally, there were no statistically significant differences between the two groups in tension, anger, fatigue, depression, energy, self-esteem, or TMD ($P>0.05$). For further details, please refer to Figure 1, illustrating the results of the multiple linear regression analysis of exercise types and older adults' state of mind.

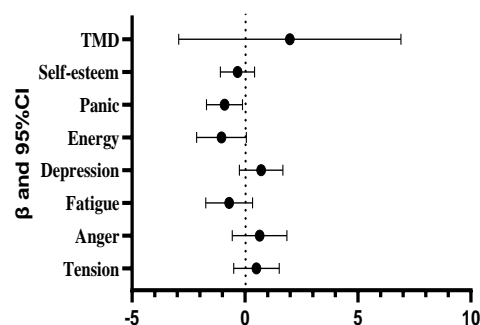


Figure 1: Results of Multiple Linear Regression Analysis of the Relationship Between Types of Exercise and State of Mind in Older Adults.

Gender Differences in the Relationship Between Types of Exercise and State of Mind in Older Adults

After adjusting for variables like educational attainment and physical exercise details, female older adults engaged in discontinuous exercise programs demonstrated significantly lower scores compared to their counterparts in continuous programs on the dimensions of energy ($\beta = -1.420$, 95% CI = -2.826 to -0.015) and panic ($\beta = -1.081$, 95% CI = -2.125 to -0.028). This indicates that older adults

participating in discontinuous programs exhibit notably lower levels of energy and panic than those in continuous programs. However, there were no statistically significant differences in the variability of TMD and its sub-dimension scores ($P > 0.05$) for both continuous and discontinuous exercise among older men. Hence, there exists gender variability in the relationship between exercise types and the state of mind in older adults. Detailed examinations of this relationship concerning gender are presented in [Figure 2](#).

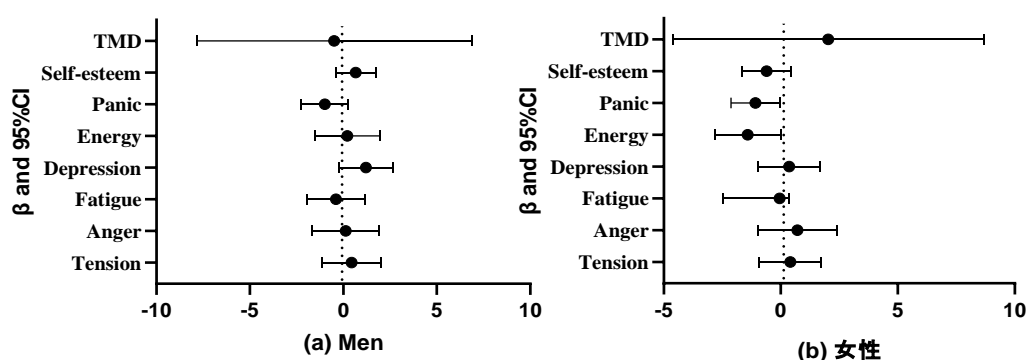


Figure 2: Gender Differences in the Relationship Between Types of Exercise and State of Mind in Older Adults.

Differences in the Relationship Between Types of Exercise and State of Mind in Older Adults by Educational Attainment

After adjusting for variables such as gender and physical exercise details, significant differences were observed in the relationship between types of exercise and state of mind across different educational attainment levels among older adults. For illiterate older adults, those engaging in discontinuous programs exhibited significantly lower scores on the energy ($\beta = -6.115$, 95% CI = -8.902 to -3.329) and self-esteem ($\beta = -2.499$, 95% CI = -4.594 to -0.404) dimensions compared to those in continuous programs.

Among older adults with a primary school education, individuals exercising in discontinuous programs had significantly lower scores on the panic dimension ($\beta = -1.365$, 95% CI = -2.400 to -0.329) than those in continuous programs.

For older adults with a high school education, participants engaging in discontinuous programs had significantly lower scores on the depression ($\beta = 2.829$, 95% CI = 0.663 to 4.496), energy ($\beta = 16.018$, 95% CI = 6.624 to 25.413), panic ($\beta = 5.954$, 95% CI = 4.238 to 7.760), and self-esteem ($\beta = 9.160$, 95% CI = 8.242 to 10.078) dimensions compared to those in continuous programs.

However, among older adults with a middle school education, differences in TMD and its sub-dimension scores between those in continuous and discontinuous programs were not statistically significant ($P>0.05$).

Thus, the relationship between types of exercise and the state of mind in older adults varies according to educational attainment. Detailed results of the differences in this relationship based on educational attainment are provided in Figure 3.

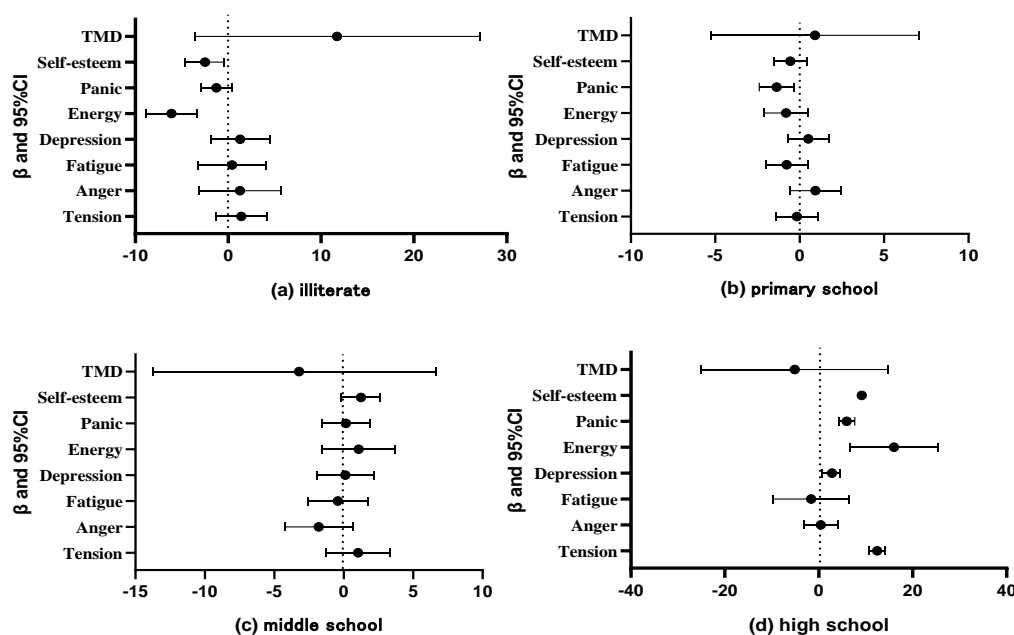


Figure 3: Differences in the Relationship Between Types of Exercise and State of Mind in Older Adults by Educational Attainment.

Discussion

Older Adults Who Exercised in Discontinuous Programs Had Lower Fatigue

The findings of this study indicate that older adults participating in discontinuous exercise programs experience lower levels of fatigue. These programs, such as martial arts, square dance, table tennis, and badminton, involve complex movement structures with changes in direction, requiring coordination of hands, eyes, body, and steps. Martial arts, for instance, additionally entail coordination of body and inner spirit, consciousness, and breathing, while square dance involves coordination with musical stimuli. Table tennis and badminton, with their confrontational nature, demand exercisers to make quick and effective decisions based on environmental cues. Numerous studies have corroborated that engaging in discontinuous exercise programs like martial arts, aerobics, and badminton can alleviate negative emotions and foster the release of positive emotions. These activities, which require coordination of all four limbs, serve to divert attention, enhance mood regulation, and facilitate interpersonal communication, thus fostering positive emotional experiences during exercise. Consequently, they

contribute to reducing both physical and mental fatigue among participants. Conversely, continuous exercise tends to concentrate exercisers' attention solely on the activity itself, limiting the effective transfer of mental resources and increasing susceptibility to fatigue.

Differences in the Relationship Between Exercise Types and The State of Mind with regard to Gender and Education Attainment

This study uncovers the nuanced relationship between exercise types and the state of mind in older adults, considering both gender and educational attainment. Among women, those in discontinuous exercise programs exhibited reduced levels of energy and panic compared to their male counterparts. However, the limited participation of women in discontinuous exercise might have influenced these results. Similarly, across different educational levels, older adults in discontinuous exercise programs showed lower scores for negative emotions like depression and panic compared to those in continuous programs. However, the uneven distribution of participants across educational levels may have impacted these findings. Further research with more balanced participant groups is needed to validate these results thoroughly.

The Implications of this Study for Practice and Policy

Drawing from the study's findings, practical and policy implications can be derived. Firstly, there is a need to promote and support physical exercise among elderly individuals residing in rural areas, with a particular emphasis on non-continuous exercise programs like martial arts, square dancing, table tennis, and badminton. These activities have been shown to mitigate fatigue and enhance mental well-being.

Secondly, when formulating and implementing physical exercise initiatives, it is imperative to consider gender and educational disparities, as these factors may influence the efficacy of exercise types on mental health outcomes. Lastly, it is recommended to establish robust monitoring and evaluation mechanisms to assess the impact of physical exercise on the mental state of the elderly population. Based on evaluation outcomes, policies and programs should be adapted and enhanced accordingly. Furthermore, fostering collaboration among health, sports, education, and social service sectors is crucial for addressing the holistic health needs of the elderly.

Conclusion

This study delved into the correlation between exercise types and the state of mind among older adults in rural areas, uncovering that those engaging in discontinuous exercise programs exhibited reduced fatigue. Moreover, noteworthy differences emerged when considering the

gender and education levels of the participants. Specifically, female older adults partaking in discontinuous programs experienced lower levels of energy and panic. Conversely, as education levels increased, older adults engaged in discontinuous programs demonstrated significantly diminished negative emotions like depression and panic compared to their counterparts in continuous programs. These findings contribute to the existing body of knowledge on physical exercise and mental well-being among the elderly, addressing a notable gap in evidence regarding exercise types and offering valuable insights for policy formulation in this domain.

However, several limitations are noteworthy in this study. Firstly, the use of a cross-sectional design only established a correlation between exercise types and mental states, failing to ascertain a causal relationship. Secondly, the relatively small sample size and uneven distribution across gender and educational levels may have compromised the accuracy of the results. Lastly, the potential moderating effect of other physical exercise variables on the relationship between exercise types and mental states remains unexplored due to the limited sample size. Addressing these limitations, future research could employ stratified sampling to ensure a more balanced representation across demographic factors like gender and education levels. Additionally, investigating the moderating role of demographic and exercise-related variables on this relationship is recommended. Longitudinal studies could also be employed to elucidate the causal dynamics between exercise types and mental states.

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