

Overview of Mobile Fitness Applications on Physical and Mental Health of Chinese Obese College Students

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ABSTRACT

This research mainly conducts a comprehensive literature review on the specific impacts of mobile fitness applications on the physical and mental well-being of obese college students. Obesity, as a global epidemic, poses a significant threat to the health of college students, both physically and mentally. The research hopes to offer novel insights into addressing this issue by examining the potential of mobile fitness applications. It begins by outlining the prevalence of obesity and related psychological issues such as depression and anxiety, emphasizing the high obesity rate and low physical activity participation among college students. Following that, the article reviews the definition, functionality, and global popularity of mobile fitness applications, analyzing their potential in promoting healthy behavior change and enhancing physical activity engagement. Studies have shown that mobile fitness apps, through functions like tracking and analyzing fitness data, providing personalized guidance, and fostering online communities, can positively impact obese college students' physical and mental health. Nevertheless, current research on the effectiveness of mobile fitness apps remains insufficient, necessitating further studies to determine the most effective application features and develop personalized interventions tailored to diverse user needs. The article concludes by suggesting that future research should focus on optimizing app functionalities and fostering sustained user engagement to foster long-term improvements in the physical and mental health of obese college students.

Contribution/Originality: The paper's primary contribution lies in reviewing the potential impact of mobile fitness applications on the physical and mental health of obese college students and proposing further research to optimize app functionalities and facilitate personalized interventions, ultimately leading to long-term health improvements.

1. Introduction

Obesity is a global epidemic that poses a serious public health challenge (Wang et al., 2022). Common genetic obesity, secondary obesity, and simple obesity are three kinds. There are many reasons for obesity, each influenced by a unique combination of biological, psycho-social, environmental, and cultural influences (Sparling, 2007). Obesity can easily lead to several psychological issues. Depression, anxiety, happiness and satisfaction, interpersonal sensitivity, and other psychological problems are more prevalent in obese people (Avila et al., 2015). According to current estimates, one-third of university students worldwide suffer from mental health issues, the most frequent of which are depression and anxiety (Auerbach et al., 2018).

According to World Health Organization, in 2022, one in eight people globally suffer from obesity (WHO, 2024). With a sedentary lifestyle and a lack of physical exercise (Liu et al., 2023; Zengin & Kirkbir, 2021), people become vulnerable both physically, mentally and emotionally, particularly, the problem of insufficient physical activity among college students is especially serious, accounting for as high as 52.2%. Among them, 34.4% are at the potential risk of being overweight or obese (Al-Nawaiseh et al., 2022). College students who do not get enough exercise have a 1.25 times higher risk of obesity than those who do (Wang, 2019a). Physical inactivity participation in transition from adolescence to college students (Kwan et al., 2012). Early adulthood (aged 18-25 years) is considered a potential period for the onset of obesity (Banna et al., 2022). This high incidence of physical inactivity may negatively affect the physical and mental health of college students. These students ultimately constitute a public health risk because there is an ample evidence that young adults who are overweight in increasing student physical activity become obese adults and are at an increased risk of experiencing negative obesity-related health consequences and chronic diseases (Sarcona et al., 2017). From a public health perspective, the best solution remains to encourage positive behavior change related to physical activity. Therefore, strengthening the physical activity of college students may be the way to prevent obesity problems (Al-Nawaiseh et al., 2022).

Similarly, in China, obesity has emerged as a serious public health concern. According to the latest national prevalence estimates from 2015 to 2019, the obesity rate was 7.9% among children and adolescents aged 6 to 17, while it was 16.4% among adults (≥ 18 years) (Pan et al., 2021). Another study showed that release report of the eighth national survey on student physical fitness and health shows that reducing the rate of overweight and obesity of college students has become an urgent problem to be solved (Department of Physical Health and Arts Education Ministry of Education, 2021). It is the inescapable responsibility of sports workers to assist these students in overcoming physical fitness and related psychological problems.

According to the 51st statistical report on China's internet development, China's burgeoning mobile landscape, boasting 1.067 billion users averaging 26.7 weekly hours online, presents fertile ground for the rapid development and adoption of mobile fitness applications (CNNIC, 2023). The change in public production and lifestyle and the public fitness demand not only provide development opportunities for the development of fitness Apps but also put forward higher requirements for the development of fitness Apps (Xu, 2015). Mobile applications play an important role in their daily life, indicating their potential for health promotion strategies (Dute et al., 2016; Wei et al., 2021).

Fitness technology has the potential to support health behavior change and encourage obese individuals to be active, change their lifestyle, and stay motivated (Alturki, 2016). Interventions based on technology have emerged as a viable approach for increasing physical activity participation and improving mental health outcomes (Liu et al., 2023).

1.1. Research objectives

- i. The definition, functions, and classification of mobile fitness applications are analyzed.
- ii. The impact of mobile fitness apps on the physical activity levels of obese college students are assessed. Meanwhile, the improving effects of mobile fitness applications on the mental health of obese college students are developed.
- iii. The strategies for mobile fitness apps in health interventions for obese college students are proposed.

2. Research Methods

Relevant literature is mainly searched through the CNKI, Google Academic and Web of Science databases. Inclusion criteria for articles were Chinese and English language, peer-reviewed and published between 2012 and September 2023. Key words were used as "mobile fitness app", "fitness app", "smartphone fitness app", "sport app", "exercise fitness app", "fitness app development", "physical fitness", "mental health", "physical and mental health", and "obese college students", and summarized through the literature.

3. Results

3.1. Mobile fitness App Definition and Functions

An App is short for Application, which refers to applications, third-party applications that are designed and used on smartphones, tablets and other mobile devices. According to Gong (2014), the current mainstream smartphone systems are Android, Aliyun system and Apple IOS system. People download and use these apps to establish their social network, entertain, read news, get information of sports, fit and so on, which makes their lives very convenient. Popular sports fitness Apps among users mainly include Keep, Gudong Sports, Nike +, fit, daily yoga, etc. Most people use running fitness Apps, with a high penetration rate (Li, 2020).

Due to the development time of Chinese mobile fitness applications is relatively short, and scholars have no in-depth research, so clear and unified definition of mobile fitness application is lacked. It can seen from the existing research results that researchers have different explanations for the definition of a fitness App, among which the third-party application of smartphones or wearable devices, recording exercise data and giving fitness guidance are the three necessary conditions for fitness App. Both authors agree that fitness App does not include sports news, sports competitions, medical consultation, and other content (Wu & Wang, 2015; Ying, 2022). Explain in more detail, use the fragmented time to exercise, provide fitness information, participate in sports social networking, share online sports data, experience, urge, and develop healthy living habits of fitness (He, 2017; Ying, 2022). In short, fitness App mainly includes recording and analyzing fitness data, providing professional fitness guidance services, and building third-party applications that are online and interpersonal communities and installed on smartphones or mobile devices.

According to the function of fitness App classifications, most popular mobile fitness applications mainly focus on fitness fat shape (training guidance), daily monitoring, and fitness social contact (Xu, 2015; Ying, 2022). However, some authors suggest adding site reservation services (Shi, 2017; Yang et al., 2022; Ying, 2022). The sports teaching and healthy life App is put forward (Shi, 2017). App developers should pay more attention to the actual continuous use of users (Wei et al., 2021). Sports and fitness services on the Internet can be categorized by knowing the properties of various Sports-Apps: Sports-Apps for fitness monitoring, fitness guidance, and fitness and life services (Wang, 2021). The sharing function is one of the most popular functions of fitness enthusiasts (Wang, 2019b). While, Gowin et al. (2015) found that most participants intensely opposed linking their social media to apps.

Obviously, by connecting apps to a database, apps can allow users to set goals, enhance self-monitoring, and raise awareness, making smart applications to make exercise and physical activities more convenient to adopt (Dute et al., 2016). Its benefits, such as infinite time and space, customization courses, and detailed records of sports data, draw a significant number of customers. Additionally, the smartphones can be used anytime and anywhere, it can potentially reach many people and can provide good opportunities for health promotion and health protection.

Future app-based health interventions aimed at college students should focus more on the apps' functionality and incorporate expert guidance into the designs of the programs to assist users in reaching their objectives more successfully (Zhang et al., 2022a). There are also suggestions from the author, develop a fitness app designed just for obese users, suggest collaborating with manufacturers to enhance the effectiveness of fitness technology, establish thorough online evaluation standards, and research into bringing the advantages of fitness technology into the public health area to address obesity (Alturki, 2016).

Therefore, further research is needed to identify the most effective app features for promoting different aspects of physical fitness and achieving long-term health benefits. Developing personalized app-based interventions that cater to specific fitness goals and motivations could enhance effectiveness.

3.2. Mobile Fitness Apps and Physical Activities

The world's mobile fitness apps have been downloaded nearly 21 million times in January 2023. Up by 80% from 2022. According to October 2023 Fitness Apps-Worldwide Market Forecast, the fitness app market is expected to reach US\$5.00 billion by 2023, with user penetration of 10,848,712.93% and 13,080,603.45% by 2028 (Statista Market Insights, 2023). Mobile applications and the fitness market have prompted the rapid development of mobile fitness applications (Kandhro et al., 2022). Fitness apps have become a trend in the global fitness industry. Young people tend to use different apps on their mobile phones (Atta et al., 2021).

The rapid development of fitness apps in the commercial application market has attracted the attention of the academic community (Beldad & Hegner, 2018; Wang, 2018). Many studies have implemented empirical protocols to validate the results of users using fitness apps to improve physical activity levels (Schoeppe et al., 2017), to

make the sports resources of the fitness App fully utilized (Wang, 2018), and to help users increase physical activity and reduce sedentary time (Payne et al., 2015).

While research suggests that online media and physical exercise can be positive predictors of physical health improvement in obese individuals, with physical activity mediating the relationship between media and mental health (Wang et al., 2022), digital interventions for weight loss have shown mixed results. Godino et al. (2016) found limited long-term weight loss benefits from mobile apps, and other digital tools in young adults, despite short-term successes (Godino et al., 2016). Determining the effectiveness of these tools against other interventions remains challenging (Liu et al., 2022). However, digital fitness tools can still be effective in promoting physical activity and reducing sedentary behavior, even improving mental health (Liu et al., 2022). Fitness apps with social networking features, particularly, show promise for motivating and connecting women to exercise communities (Hollander et al., 2021).

While some studies haven't shown significant increases in physical activity through technology-based interventions, this which could be due to limitations like ceiling effects in active participants (Hollander et al., 2021). Rigorous research with larger sample sizes is crucial to properly assess the effectiveness of app-based health interventions (Payne et al., 2015).

Despite these challenges, smartphones offer vast potential for smarter physical activity promotion, though app developers haven't fully capitalized on it yet (Mollee et al., 2017). Advancements in mobile technology hold promise for tackling global health issues stemming from physical inactivity. Fitness apps present a potential strategy for individual-level activity promotion, and they may become increasingly important for positive lifestyle changes (Salzwedel et al., 2017). Nevertheless, from academic, this research field is still in its infancy.

3.3. Mobile Fitness App and Physical Fitness

Prior research defined physical fitness through the lens of mobility and its capacity for physical activity, highlighting its potential to reduce risks associated with sedentary lifestyles (Caspersen et al., 1985; Vancampfort et al., 2016). Corbin (2008) conceptualizes physical fitness as a state encompassing five health-related and six skill-related components, each contributing to overall quality of life. It's linked to effective work performance, leisure enjoyment, health maintenance, disease resistance, and emergency preparedness (Corbin, 2008). Studies reinforce this connection, indicating that high levels of fitness correlate with increased cardiorespiratory endurance, muscle strength and endurance, optimal body composition, and flexibility (Chen et al., 2016). Notably, a strong correlation exists between physical fitness and athletic ability (Jeng et al., 2015).

This study prioritizes health-related fitness aspects due to their significant impact on maximizing health benefits from physical activity (Bouchard et al., 1994). Achieving a certain level in these areas is deemed crucial for being considered "fit." Dedicated health-related fitness tests, commonly used by educators and researchers, serve to evaluate basic health within and beyond educational settings (Naughton et al., 2006). These tests target desirable health outcomes in areas with lasting impact across life stages, recognizing the influence of factors like age, gender, activity level, diet, and

medication. Consequently, this research undertakes a more in-depth exploration into the five pivotal constituents of health-related physical fitness.

The effectiveness of mobile apps for physical fitness and weight management remains mixed. While an App intervention has shown a promise in improving boys' physical function and slowing the decline in girls' (Guo, 2019), the impact on weight loss is less clear. Existing studies like those by Laing et al. (2014), Mateo et al. (2015), and Semper et al. (2016) present inconsistent results, highlighting the need for further research to determine the true potential of apps in addressing obesity and its associated socioeconomic costs (Laing et al., 2014; Mateo et al., 2015; Semper et al., 2016).

A study by Zhang et al. (2022b) found that using sports apps for physical exercise can effectively improve students' physical health. Students using the apps for 12 weeks showed significant improvements in objective and self-reported fitness compared to a control group, though body fat percentage remained unchanged (Zhang et al., 2022b). This highlights the potential of sports apps for promoting fitness, while also indicating a need for further research to identify the most effective app features for overall physical health improvement (Muntaner-Mas et al., 2021). Studies by Ha (2022) and Xing (2020) show significant reductions in weight, body mass index, percentage body fat, and waist circumference after using health apps for physical exercise programs. This improvement was particularly evident among overweight female college students (Ha, 2022; Xing, 2020).

While certain studies have demonstrated that comprehensive eight-week interventions enhance both the physical (Yue, 2018) and mental health of obese college students, with improvements in strength, speed, endurance, and flexibility (Wu & Zhang, 2023), other research such as that conducted by Guo (2019) indicates a relatively limited effect on speed, flexibility, and muscle endurance. Notably, a particularly insignificant impact was observed on the aerobic endurance of male students (Guo, 2019). Overall, evidence suggests potential for such interventions, but further research is needed to refine their effectiveness across specific fitness aspects.

Additionally, research by Chen et al. (2020) found that overweight and obese college students generally had lower physical fitness scores than normal-weight peers (Chen et al., 2020). Studies have indicated that mobile app-based interventions demonstrate potential and are gaining traction in facilitating weight loss and increasing physical activity. Nonetheless, further research is required to assess their sustained effectiveness over time within a more extensive population (Islam et al., 2020).

Mobile apps hold promise as a tool for improving physical fitness and managing weight, particularly for overweight individuals. Studies have shown significant improvements in objective and self-reported fitness, reductions in weight and body fat percentage, and positive impacts on overall health and well-being. However, the evidence remains mixed, with some studies showing less impact on specific aspects of fitness, like speed and flexibility. Most existing studies focus on short-term interventions. Long-term studies are crucial to assess the sustainability of app-based fitness interventions and their impact on chronic health conditions.

3.4. Mobile Fitness App and Mental Health

According to the report of [WHO \(2023\)](#), mental health plays an important role in people's health. It is reported that one in eight people globally are living with mental health conditions, which will affect many aspects of people's life, including their physical health, well-being, the way they interact with others and their livelihoods ([WHO, 2023](#)). At the same time, mental health is influencing a large number of adolescents and young men.

Mental health is a complex concept with various interpretations. [Liu \(2001\)](#) describes it as a continuous state of psychological well-being characterized by full vitality, positive inner experiences, and good social adaptation ([Liu, 2001](#)). This state allows individuals to fully utilize their physical and mental potential and contribute positively to society. While often defined as the absence of mental illness, [Knight and Lee \(2007\)](#) suggest it can also be viewed as a state of overall well-being or life satisfaction. Further emphasizing this multifaceted nature, the World Health Organization defines health as a state of mental well-being that enables people to cope with the stresses of life, realize their abilities, learn well and work well, and contribute to their community ([WHO, 2022](#)).

Mobile apps and text messaging have emerged as effective, usable, and feasible tools for delivering self-directed mobile health interventions across various health concerns, including weight management, smoking cessation, medication adherence, depression, anxiety, and stress ([Rathbone & Prescott, 2017](#)). Obese college students' psychological endurance and anti-frustration ability are weak ([Ha, 2022](#); [Ren, 2023](#)). Mobile Health interventions have the potential to actively address physical and mental health issues but lack regulatory and scientific validation of business-driven applications. However, the effectiveness depends on the specific health issues being addressed. Furthermore, longitudinal studies are needed to investigate recurrence rates, sustainability, and effectiveness.

Mental health is mainly manifested by the significant improvement in self-confidence and good improvement in interpersonal relationships, depression, anxiety, and other factors ([Yue, 2018](#)). The benefits of fitness apps on physical and mental health have been widely explored in previous studies ([Arteaga et al., 2010](#)). However, the research landscape on mobile apps for co-occurring overweight and obesity and depression and anxiety is sparse, with limited studies mainly from the US in recent years. Recognizing this gap, [Gómez-de-Regil et al. \(2020\)](#) call for future research to prioritize developing and testing comprehensive mobile app interventions targeting both conditions simultaneously. They emphasize the importance of cultural sensitivity and tailoring these interventions to the specific needs of diverse populations to maximize their effectiveness ([Gómez-de-Regil et al., 2020](#)).

Promoting physical exercise through the media can improve the mental health of obese people ([Wang et al., 2022](#)). Therefore, obese patients can incorporate physical exercise into their daily lives and use the media as a tool to motivate and support their exercise habits. However, the study did not make specific recommendations on which types of physical exercise or media use are the types or methods that are most effective in improving the health of obese people. Future research endeavors could conduct more in-depth investigations into these aspects.

4. Conclusions

Mobile fitness applications are leading a new trend in healthy lifestyles, catering to users' diverse health needs through their multifaceted functionalities. They have demonstrated significant potential, particularly in enhancing physical fitness and promoting mental health.

Regarding physical fitness, particularly in enhancing cardiorespiratory endurance, muscular strength and endurance, and improving body composition. While the long-term sustainability and efficacy of weight loss effects still require further validation, existing research has proven their ability to effectively increase physical activity levels, reduce sedentary time, and positively impact the health of obese individuals in the short term. As technology advances and research deepens, personalized and comprehensive mobile fitness apps will become the norm, better serving the fitness needs of diverse users and playing a more significant role in chronic disease management and health promotion.

In the domain of mental health, through facilitating physical exercise, these apps can effectively enhance users' self-confidence, ameliorate interpersonal relationships, and relieve psychological problems like depression and anxiety. Particularly for obese individuals, when these apps are integrated with physical exercise and mental health interventions, they offer a promising prospect for improving overall well-being. Future research should focus on developing scientifically validated and culturally sensitive comprehensive intervention measures to address mental and physical health issues more comprehensively.

Overall, the widespread adoption and significant growth of mobile fitness apps globally reflect their pivotal role in fostering healthy lifestyles. However, to fully unleash their potential, it is imperative to overcome existing challenges, such as validating long-term efficacy, ensuring sustained user engagement, and tapping into the full potential of technology. In the forthcoming period, the academic community and the industrial sector ought to engage in continuous cooperation, capitalizing on innovative research outcomes and technological progressions to drive the healthy evolution of mobile fitness applications, thereby rendering them conducive to the enhancement of comprehensive health and well-being.

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Conflict of Interest

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