

An Exploration of the Impact of Fitness Apps on Individual Exercise Behaviour

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Abstract

In the contemporary digital landscape, the proliferation of mobile applications (apps) dedicated to sports and fitness has attained unprecedented levels. This research endeavours to explore the nuanced interconnection between the adoption of fitness apps and user engagement in physical exercise, elucidating the underlying dynamics through the lens of exercise behaviour ecology. Employing a comprehensive questionnaire survey, encompassing 868 participants in China, the study delineates its investigative framework. Utilizing the SPSS PROCESS plugin, a moderated mediation model was scrutinized to analyse the data. The outcomes of this inquiry divulge a discernible positive correlation between the utilization of sports and fitness apps and users' engagement in exercise activities. This constructive influence is further expounded through the mediating function of exercise self-efficacy in the association between app usage and exercise behaviour. Additionally, the research underscores the pivotal moderating role of social support in shaping the relationship between exercise self-efficacy and exercise behaviour within the cohort of sports and fitness app users. Essentially, augmented perceived social support enhances the beneficial impact of exercise self-efficacy on exercise conduct. These research findings not only substantiate the affirmative link between sports and fitness apps and exercise behaviour but also furnish valuable insights into harnessing novel media technologies for the advancement of nationwide fitness and health promotion initiatives. The broad scope of the survey, encompassing diverse demographic profiles, underscores the widespread relevance and import of these findings within the domain of sports and fitness app development and utilization.

Keywords: Fitness Apps; Individual Exercise Behaviour; Exercise Self-Efficacy; Social Support.

Introduction

In the contemporary digital milieu, the proliferation of smartphones and smart wearable devices has heralded an unprecedented era in the development of mobile sports applications. While extant literature has alluded to the beneficial effects of fitness apps in fostering exercise routines and bolstering adherence among users, a notable research lacuna persists. This lacuna revolves around the intricate mechanisms by which exercise and fitness apps shape users' exercise behaviour, as well as the determinants influencing these mechanisms. The present study aims to bridge this critical gap in research by conducting a thorough investigation into the subject matter.

The Ecological Model of Physical Activity serves as the theoretical framework underpinning this inquiry. This model posits that individuals' exercise behaviour is contingent upon a dynamic interplay between personal and environmental factors (Sallis, Owen, & Fisher, 2015). Among these personal factors, exercise self-efficacy emerges as a pivotal psychological construct intricately intertwined with exercise behaviour. Prior research has indicated the potential for fitness and exercise apps to influence users' perceptions of their exercise capabilities

(Lee & Cho, 2017). Hence, the principal objective of this study is to meticulously examine the mediating role of exercise self-efficacy in elucidating the impact of fitness and exercise app usage on users' exercise behaviour. In the contemporary digital milieu, the proliferation of smartphones and smart wearable devices has heralded an unprecedented era in the development of mobile sports applications. While extant literature has alluded to the beneficial effects of fitness apps in fostering exercise routines and bolstering adherence among users, a notable research lacuna persists. This lacuna revolves around the intricate mechanisms by which exercise and fitness apps shape users' exercise behaviour, as well as the determinants influencing these mechanisms. The present study aims to bridge this critical gap in research by conducting a thorough investigation into the subject matter.

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potential for fitness and exercise apps to influence users' perceptions of their exercise capabilities (Lee & Cho, 2017). Hence, the principal objective of this study is to meticulously examine the mediating role of exercise self-efficacy in elucidating the impact of fitness and exercise app usage on users' exercise behaviour.

However, to achieve a comprehensive comprehension of individual exercise behaviour, it is imperative to scrutinize environmental factors as well. Social support, functioning as a vital external asset, harbours the potential to furnish invaluable aid when requisite, thereby fostering a conducive environment for individuals to perpetuate and replicate their exercise conduct. Operating frequently as a "regulator" amid individuals' psychological states and behaviours, social support emerges as a significant moderating factor in the intricate nexus between the utilization of fitness and exercise apps, users' psychological conditions, and exercise behaviour. Consequently, this investigation endeavours to delve into the moderating impact of social support within the realm of fitness and exercise app utilization on exercise behaviour.

This research bears dual significance within the contemporary societal landscape. It confronts the necessity of enhancing national health metrics amidst the proliferating sway of a mediated culture. Aligned with the theoretical underpinnings of the Ecological Model of Exercise Behaviour, this study endeavours to unveil the psychological pathways through which fitness and exercise app utilization influence exercise behaviour. Furthermore, it seeks to elucidate the contextual limitations of these pathways, thereby furnishing both theoretical groundwork and actionable insights to propel nationwide initiatives aimed at fostering fitness and health promotion.

In essence, this study undertakes an exhaustive examination of the intricate interplay among fitness and exercise app utilization, exercise self-efficacy, social support, and exercise behaviour. Through addressing the prevailing research void and elucidating these complex dynamics, this research endeavours to make a substantial contribution to our comprehension of the potential utilization of novel media technologies for fostering public engagement in fitness pursuits and, consequently, improving physical well-being. This introductory section sets the stage for the subsequent segments, which will delve further into the study's methodology, findings, and implications.

Literature Survey

In the contemporary digital milieu, the Internet has emerged as a potent instrument for health intervention,

owing to its accessibility, convenience, interactivity, and customization. With the advancement of mobile Internet technology, the widespread adoption of smartphones, and the proliferation of wearable devices, a diverse spectrum of fitness applications has emerged. Fitness applications, as denoted by the term, encompass third-party software on smartphones or wearable gadgets devised to aid users in tracking sports and fitness data, facilitating sports program acquisition, and advocating for healthy lifestyles.

Evidence suggests that the utilization of fitness applications fosters a positive disposition toward exercise among users, which, in turn, can lead to an elevated level of exercise intent (Kwan & Bryan, 2010). Furthermore, research has elucidated the beneficial impact of fitness applications' interactive interfaces, guided learning features, intuitive feedback mechanisms, and goal management functionalities in augmenting user persistence in exercise. It is noteworthy that exercise self-efficacy, a pivotal psychological construct within the domain of physical activity, assumes a central role in individuals' exercise behaviour.

Fitness applications employ diverse strategies aimed at motivating and engaging users in physical activity. These strategies encompass goal setting, progress tracking, rewards systems, social support, and gamification. Goal setting represents a fundamental feature of fitness apps, enabling users to establish specific objectives for their exercise regimens. Research indicates that the implementation of SMART (Specific, Measurable, Achievable, Relevant, Time-bound) goals within fitness apps correlates with heightened levels of motivation and dedication to exercise (Swann et al., 2023). Individuals with clearly defined goals demonstrate greater focus and perseverance in their workout routines.

Progress tracking serves as another potent aspect of fitness apps, enhancing motivation by visually presenting achievements such as steps taken, calories expended, or workout duration. This visual representation of progress fosters a sense of accomplishment, thereby bolstering motivation and encouraging users to sustain their exercise endeavours (Molina & Myrick, 2021). Rewards systems integrated into fitness apps offer incentives for attaining milestones or conquering challenges. These rewards may manifest as virtual badges, points, or tangible benefits like discounts on fitness merchandise or services. Studies indicate that rewards systems effectively incentivize users to participate in regular physical activity and strive for continuous improvement.

Social support functionalities within fitness apps enable users to engage with peers, join communities, and share their progress and accomplishments. Social interactions

within these platforms cultivate feelings of accountability, encouragement, and solidarity among users, ultimately fostering increased motivation and adherence to exercise routines (Kuru, 2023). Incorporating gamification elements such as challenges, leader boards, and achievements makes exercising more captivating and enjoyable. By transforming exercise into a game-like experience, fitness apps captivate users' attention and sustain their interest in physical activity. Gamification strategies also enhance intrinsic motivation by imbuing exercise tasks with greater meaning and reward. Thus, motivation and engagement strategies embedded within fitness apps play a pivotal role in driving individual exercise behaviour.

Behavioural Changes and Health Outcomes by Using Fitness App

The utilization of fitness applications has been associated with notable alterations in behaviour and favourable health consequences among users, encompassing multifaceted aspects of physical activity conduct, lifestyle patterns, and health metrics. Consistent engagement with fitness apps correlates with heightened levels of physical activity among individuals. Studies have indicated that participants utilizing a fitness app to monitor their activity levels engaged in a greater volume of moderate-to-vigorous physical activity compared to non-users (Laranjo et al., 2021). The capability to monitor and track activity fosters increased awareness of daily movement patterns and serves as a motivator for integrating more physical activity into routines.

Moreover, fitness apps facilitate the cultivation of healthier lifestyle habits. Functionalities such as workout reminders, nutrition tracking, and sleep monitoring promote holistic well-being and prompt users to adopt healthier behaviours beyond mere exercise. For instance, research has demonstrated that users employing a comprehensive fitness app witnessed enhancements in sleep quality and dietary choices, leading to overall lifestyle improvements (Zhao, Freeman, & Li, 2016). The influence of fitness apps on health outcomes transcends physical activity and lifestyle modifications. Studies have showcased enhancements in various health markers among app users. Notably, research by Church et al. revealed significant reductions in body weight, body fat percentage, and blood pressure among individuals consistently utilizing a fitness app over a six-month duration (Church et al., 2007). These findings underscore the potential of fitness apps in contributing to weight management and cardiovascular health.

Furthermore, the incorporation of personalized recommendations and adaptive algorithms within fitness apps augments the efficacy of behaviour change interventions. By analysing user data and preferences, these apps can tailor exercise regimens, nutritional

guidance, and wellness suggestions to individual requirements, thereby fostering sustainable behaviour modification and enduring health benefits (Rivera et al., 2018). It is noteworthy, however, that while fitness apps present promising avenues for enhancing health outcomes, their effectiveness may vary contingent upon user engagement, adherence, and the quality of app features. Addressing obstacles such as user retention, data accuracy, and usability can enhance the overall impact of fitness apps in promoting positive behavioural changes and facilitating meaningful health outcomes for users.

Exercise Behaviour

Exercise behaviour encompasses a spectrum of routines and customs pertaining to physical activity, encompassing factors such as intensity, duration, and frequency of engagement. A nuanced comprehension of these dimensions of exercise behaviour is imperative for fostering healthy lifestyles and maximizing fitness outcomes. A meta-analysis revealed a discernible dose-response relationship between exercise duration and reductions in cardiovascular risk factors, with prolonged durations yielding more pronounced improvements (Sattelmair et al., 2011). However, it is crucial to account for individual fitness levels and incrementally escalate duration to mitigate the risk of overexertion and injuries.

Moreover, research underscores the significance of consistent exercise frequency in facilitating adherence to exercise regimens and perpetuating long-term engagement in physical activity habits. Emphasizing regular exercise frequency is shown to be pivotal in staving off chronic diseases and advancing overall well-being. Exercise behaviour, inclusive of intensity, duration, and frequency, assumes a pivotal role in shaping the efficacy and outcomes of physical activity endeavours (Hu et al., 2023). Integrating a blend of moderate and vigorous-intensity exercise, maintaining appropriate durations, and ensuring consistent exercise frequency emerge as fundamental components of a balanced and sustainable exercise routine. Subsequent investigations should continue to explore optimal methodologies for fostering healthy exercise behaviour and surmounting obstacles to sustained participation in physical activity.

Exercise Self-Efficacy

Individuals with elevated exercise self-efficacy demonstrate a greater propensity to initiate and sustain regular physical activity, surmount barriers, and persevere amid challenges (Feltz, Short, & Sullivan, 2008). Albert Bandura's concept of self-efficacy, encompassing an individual's assessment and belief in their capacity to execute exercise-related tasks, comprises several

determinants influencing self-efficacy, including direct experience, vicarious experience (observational learning), verbal persuasion, and emotional arousal. Among these factors, direct experience emerges as the most influential determinant, with the accumulation of successful endeavours bolstering self-efficacy. Fitness applications, with their array of features such as visualization, data monitoring, and personalized customization, serve as invaluable aids in overcoming obstacles and accruing successful experiences. Compared to non-users, users of fitness apps often report a heightened sense of group pressure and collective motivation during exercise (Jeffrey et al., 2019). Thus, it is plausible to posit that fitness apps can positively impact users' exercise self-efficacy by affording both direct and vicarious experiences.

Exercise self-efficacy stands as a robust predictor of exercise behaviour, with empirical evidence consistently indicating that individuals with heightened levels of exercise self-efficacy demonstrate greater initiative, enthusiasm, and persistence in engaging in physical activity (Burić & Macuka, 2018). This underscores the profound influence of self-efficacy on shaping exercise behaviour.

Fitness applications contribute to the cultivation and enhancement of exercise self-efficacy through diverse mechanisms. These apps furnish users with personalized exercise regimens, tools for tracking progress, feedback on achievements, and networks of social support, all of which bolster confidence in one's ability to engage in regular exercise (Dute, Bemelmans, & Breda, 2016). Research by Huang et al. found that the use of fitness apps led to enhancements in exercise self-efficacy among sedentary individuals. Multiple studies have demonstrated the mediating role of exercise self-efficacy in the relationship between fitness app usage and exercise behaviour (Huang & Ren, 2020). For instance, research by Zhang et al. revealed that exercise self-efficacy partially mediated the association between engagement with a fitness app and increased physical activity levels (Zhang, 2022). Individuals reporting higher exercise self-efficacy were more inclined to adhere to their exercise routines and attain improved health outcomes. The mediating effect of exercise self-efficacy extends to behavioural modifications and health outcomes, with studies showing that individuals with elevated exercise self-efficacy are more likely to experience favourable changes in behaviour, such as increased exercise frequency, intensity, and duration (McAuley, Lox, & Duncan, 1993). Furthermore, exercise self-efficacy has been linked to enhanced health outcomes, encompassing weight management, cardiovascular fitness, and mental well-being.

Social Support

Fitness applications establish virtual communities wherein users can connect with individuals sharing similar interests, forge friendships, and construct support networks. These communities typically coalesce around specific fitness objectives, such as weight management, resistance training, marathon preparation, or overall health enhancement. Users have the opportunity to exchange updates on their progress, discuss challenges, share success narratives, and impart advice or insights, fostering a nurturing ambiance conducive to reciprocal encouragement and motivation. A salient advantage of fitness apps lies in the capacity to garner peer support and inspiration from fellow users (Anderson, Burford, & Emmerton, 2016). Through functionalities like comments, likes, shares, and direct messaging, users can extend words of encouragement, celebrate milestones, and offer guidance or recommendations to community members. This peer support engenders a sense of belonging and camaraderie, motivating individuals to maintain consistency in their exercise routines (Allen, Vella-Brodrick, & Waters, 2016). Moreover, many fitness apps integrate expert guidance and coaching services, enabling users to access tailored advice, workout plans, and feedback from fitness professionals, trainers, or coaches. This expert support enhances the quality of social interaction within the app, empowering users to seek professional insights on exercise techniques, goal setting, nutrition, injury prevention, and overall well-being. The presence of knowledgeable mentors further enriches the social support milieu and fosters informed decision-making regarding fitness aspirations (Barr et al., 2008).

Fitness apps facilitate sustained engagement and communication among users through notifications, updates, event reminders, and real-time activity tracking. These features ensure ongoing interaction within the community, prompt responses to inquiries or concerns, and foster a sense of engagement and involvement (Vaghefi & Tulu, 2019).

In the context of individual health behaviours, social support emerges as a pivotal determinant. Social support encompasses the provision of material assistance or emotional backing individuals receive from societal sources, their social circles, or familial and friendly connections (Bloom & Spiegel, 1984). Within the domain of individual health behaviours, social support plays a crucial role in sustaining and improving health outcomes by mitigating adverse impacts on physical and mental well-being through the regulation of various factors. It serves to ameliorate the adverse

effects of physical exercise discomfort on both physical and mental health while simultaneously augmenting the pleasure and satisfaction derived from engaging in physical activity (Koenig et al., 1997). This study posits that during the utilization of a fitness app, the influence of exercise self-efficacy on exercise behaviour may vary contingent upon the levels of social support. Existing literature underscores the substantial impact of familial, peer, and broader social connections on individuals' exercise behaviours (Nabors et al., 2022), further highlighting the intricate interplay between social support and exercise conduct.

In summary, fitness apps function as digital platforms that cultivate social support by establishing virtual communities, facilitating peer interactions, offering expert guidance, encouraging group challenges, and ensuring sustained engagement. The robust networks of social support within these apps significantly contribute to users' motivation, adherence, and overall success in attaining their fitness and wellness objectives.

Hypothesis

Drawing from the exhaustive analysis delineated previously, this study posits the following hypotheses.

H1: *The utilization of fitness applications exerts a substantial positive influence on user exercise behaviour.*

H2: *Exercise self-efficacy serves as a mediating factor in the association between the utilization of fitness applications and users' exercise behaviour.*

H3: *Social support positively moderates the mediating impact of exercise self-efficacy between the utilization of fitness applications and exercise behaviour in the latter segment of the pathway.*

Subject and Method

Between May 2023 and August 2023, a total of 902 users of fitness applications were anonymously selected as respondents through purposive sampling from various fitness groups, running clubs, and sports clubs. The questionnaire, based on a Likert scale, was distributed both online and offline. Out of the distributed questionnaires, 868 were returned, resulting in a response rate of 97.1%. The effective rate, indicating the completeness and validity of responses, stood at 98.6%. The majority of respondents fell within the age range of 14 to 45 years. Statistical analysis of the data was performed using SPSS 20.0, including testing Cronbach's alpha for each variable. To mitigate common method bias, preliminary hypothesis testing was conducted through correlation analysis. Subsequently, a moderated mediation model was examined using the PROCESS plugin.

Variables

Variables: Utilization of Fitness Applications

Drawing from prior research (Beldad & Hegner, 2018), participants were queried regarding the frequency of involvement in the subsequent activities: Recording exercise data utilizing a fitness application, Exploring exercise-related information on the fitness application, Developing workout plans via the fitness application, Engaging in discussions about fitness-related subjects on the fitness application, Showcasing their exercise data on social networks, Seeking exercise partners through the fitness application. Employing a 5-point scale, responses ranged from "Never" to "Always." The mean score across all items was computed to gauge the frequency of participants' utilization of fitness applications, with higher scores indicating more frequent usage.

Mediating Variable: Exercise Self-Efficacy

Utilizing the Exercise Self-Efficacy Scale (ESES), established by Kroll (Kroll et al., 2007), encompassing 10 items such as "I consistently manage to overcome challenges encountered during exercise when I exert my utmost effort." Employing a 4-point scale, responses ranged from "Strongly Disagree" to "Strongly Agree," with scores ranging from 1 to 4. The mean score across all items was calculated to evaluate participants' exercise self-efficacy.

Moderating Variable: Social Support

Employing the Perceived Social Support Scale (PSSS), devised by Zimet (Zimet et al., 1990), encapsulating three dimensions: familial support, peer support, and support from other sources (such as supervisors, colleagues, classmates, relatives, etc.). It comprised 12 items such as "My family can genuinely provide me with practical assistance." Utilizing a 5-point scale, responses ranged from "Strongly Disagree" to "Strongly Agree," with scores ranging from 1 to 5. The mean score across all items was computed to ascertain participants' perceived social support.

Dependent Variable: Exercise Behaviour

The sports activity level scale evaluates respondents' exercise patterns concerning intensity, duration, and frequency.

Control Variables: Consistent with preceding research, gender, age, educational attainment, and duration of utilizing a fitness application are considered control variables in this study. Gender is treated as a binary variable, with males coded as 1 and females as 0. Age is categorized into four groups: 1 = 18-25 years, 2 = 26-35 years, 3 = 36-45 years, 4 = 46 years and above. Educational level is gauged on a four-point scale: 1 = high school or below, 2 = associate degree, 3 = bachelor's degree, 4 = master's degree and above.

Cronbach's alpha is assessed to ascertain the internal consistency or reliability of a set of measurement items or

queries in a research instrument. Table 1 demonstrates their heightened reliability in assessing the construct of interest.

Table 1

Cronbach's alpha of Variable Item

Variable	Use of Fitness Apps	Exercise Self-Efficacy	Social Support	Exercise Behaviour
Cronbach's alpha	0.92	0.84	0.88	0.91

Results

Initially, this study performed descriptive statistics and correlation analyses on the principal research variables. Table 2 delineates Pearson correlation coefficients among the research variables. Notably, a substantial positive correlation exists between the utilization of fitness applications and user exercise behaviour ($r = 0.47, p < 0.05$).

Furthermore, engagement with exercise and fitness applications exhibits a significant positive correlation with exercise self-efficacy ($r = 0.330, p < 0.05$) and social support ($r = 0.28, p < 0.01$). Moreover, exercise self-efficacy demonstrates a significant positive correlation with exercise behaviour ($r = 0.33, p < 0.05$) and social support ($r = 0.17, p < 0.01$). Lastly, exercise behaviour displays a significant positive correlation with family support ($r = 0.31, p < 0.05$).

Table 2

Correlation Analysis of Each Variable

	Use of the Fitness App	Exercise Self-Efficacy	Social Support	Exercise Behaviour
Use of the Fitness App	1	0.33*	0.28**	0.47*
Exercise Self-Efficacy	-	1	0.17**	0.43*
Social Support	-	-	1	0.31*
Exercise Behaviour	-	-	-	1

Table 3

Mediating Effect Analysis of Exercise Self-Efficacy on the Relationship Between Fitness App Usage and User Exercise Behaviour

Variable	Exercise Behaviour		Exercise Self-Efficacy		Exercise Behaviour	
	B	SE	B	SE	B	SE
Gender	0.31**	0.09	0.14	0.08	0.33**	0.09
Age	-0.09**	0.06	-0.09	0.05	-0.13*	0.07
Education Level	0	0.05	0.07	0.06	0	0.03
Use of the Fitness App	0.22**	0.08	0.15**	0.04	0.19*	0.08
Exercise Self-Efficacy			0.23**	0.04	0.14**	0.07
R2	0.23		0.15		0.28	
F	26.54**		16.73**		32.67**	

Using the SPSS macro program PROCESS Model 4 and controlling for gender, age, and education level, we investigated the mediating role of exercise self-efficacy in the relationship between fitness app usage and user exercise behaviour. The outcomes (see Table 3) reveal that fitness app usage significantly predicts user exercise behaviour ($B = 0.23, p < 0.01$). Even upon introducing the mediating variable (exercise self-efficacy), the direct predictive effect of fitness app usage on user exercise behaviour remains noteworthy ($B = 0.15, p < 0.01$). Furthermore, fitness app usage exhibits a significant positive predictive impact on exercise self-efficacy ($B = 0.268, p < 0.001$), while exercise self-efficacy significantly predicts exercise behaviour ($B = 0.28, p < 0.01$).

Additionally, the 95% bootstrap confidence intervals for the direct effect of fitness app usage on exercise behaviour and the mediating effect of exercise self-efficacy, [0.07, 0.21] and [0.03, 0.10], respectively, exclude zero. This implies that fitness app usage not only directly influences exercise behaviour but also does so indirectly through exercise self-efficacy. The direct effect and the mediating effect account for 63% and 37%, respectively, of the total effect. Consequently, both Hypothesis 1 and Hypothesis 2 posited in this study find support.

In the framework of a moderated mediation model, the moderating influence of social support was examined using SPSS PROCESS Model 14, with gender, age, and education level as control variables. The outcomes (refer to

Table 4) reveal that upon incorporating social support into the model independently, its interaction with exercise self-efficacy significantly forecasts exercise behaviour. This finding suggests that social support has the capacity to moderate the predictive impact of exercise self-efficacy on exercise behaviour. Consequently, Hypothesis H3 garners empirical support.

Table 4

Moderated Mediation Analysis of Social Support

Variable	Exercise Behaviour	
	B	SE
Gender	0.34**	0.09
Age	-0.12**	0.06
Education Level	0.05	0.05
Use of the Fitness App	0.24**	0.08
Exercise Self-Efficacy	0.31	0.04
Social Support	0.06	0.03
Exercise Self-Efficacy*Social Support	0.08**	0.04
R2	0.26	
F	29.34**	

To elucidate the moderating role of friend support in the relationship between self-efficacy and exercise behaviour, following Aiken and West's approach (Aiken, West, & Reno, 1991), this study categorized mean social support scores into high and low groups based on one standard deviation. Simple slope tests were conducted, revealing that for App users with higher social support, exercise self-efficacy significantly and positively predicted their exercise behaviour. Conversely, for App users with lower social support, while exercise self-efficacy still positively predicted their exercise behaviour, the predictive effect was weaker. This implies that as social support increases, the predictive effect of exercise self-efficacy on user exercise behaviour gradually strengthens.

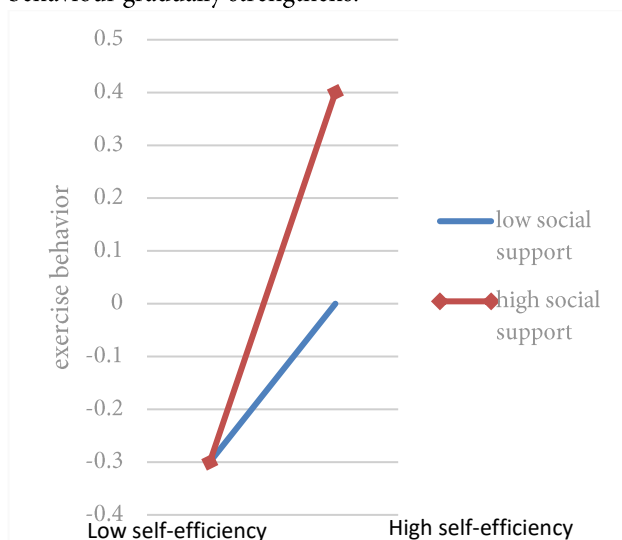


Figure 1. Mediating Effect Analysis of Exercise Behaviour.

Conclusion

In conclusion, our study offers vital insights into the intricate dynamics among fitness apps, exercise self-efficacy, social support, and exercise behaviour. It confirms and expands upon prior research, revealing the various ways in which fitness apps impact users' exercise habits. We unequivocally demonstrate that fitness app usage significantly enhances exercise behaviour by providing accessibility, convenience, interactivity, and personalization. These features empower users to engage in physical activity more consistently and enthusiastically, fostering tangible improvements in exercise routines. Moreover, our findings highlight the crucial role of exercise self-efficacy as a mediator between fitness app usage and exercise behaviour. Exercise self-efficacy serves as the link between the practical benefits of fitness apps and users' confidence in their ability to engage in physical activity regularly. Additionally, we explore the moderating effect of social support on the relationship between fitness app usage and exercise behaviour. Social support acts as a powerful factor that can amplify or diminish the influence of exercise self-efficacy on exercise behaviour among fitness app users, emphasizing the importance of fostering supportive environments to promote physical activity. Hence, our study underscores the significance of considering exercise self-efficacy and social support in designing fitness apps and interventions aimed at promoting physical activity and overall health.

Practical Implications

The pragmatic implications of our study are significant. For individuals endeavouring to enhance their exercise regimens, the incorporation of fitness apps provides a palpable avenue for augmenting physical activity levels. These applications serve not only as tracking instruments but also as reservoirs of motivation, direction, and encouragement. Health practitioners can utilize these insights to advocate for particular fitness apps customized to their patients' requirements and inclinations, thereby amplifying the efficacy of exercise interventions.

Limitations and Future Research

While our study significantly advances the comprehension of fitness apps and exercise behaviour, we acknowledge several limitations. Notably, potential biases such as self-reporting bias and selection bias among app users necessitate attention. Future research endeavours should focus on devising strategies to mitigate these biases and delve deeper into the intricacies of social support and exercise self-efficacy within fitness app ecosystems.

Prospective research avenues may involve exploring the enduring ramifications of fitness app usage on exercise behaviour, investigating cultural disparities in app utilization and efficacy, and scrutinizing the impact of app gamification

on bolstering exercise self-efficacy. Furthermore, assessing the influence of specific app features and interventions on exercise outcomes can furnish invaluable insights for both app developers and healthcare practitioners.

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