The Relationship between Exercise Intention and Exercise Behavior among Chinese Junior High School Students: A Moderated Mediation Model

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Research Article

Keywords: exercise intention, exercise social support, action self-efficacy, exercise behavior, junior school students

Posted Date: September 16th, 2022

DOI: https://doi.org/10.21203/rs.3.rs-2052750/v1

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Abstract

**Purpose:** This study aims to investigate the relationship between exercise intention and exercise behavior, as well as the mechanism of exercise social support and action self-efficacy in the relationship between exercise intention and exercise behavior, so as to provide theoretical and empirical support for the promotion of physical exercise for junior high school students.

**Methods:** Totally 1312 junior middle school students were recruited to complete Behavioral Intention Scale, Exercise Social Support Scale, Action Self-efficacy Scale and Physical Activity Rating Scale-3. The correlation analysis and the mediation and moderation analysis were conducted.

**Results:** (1) There was a significant positive correlation between exercise intention and exercise behavior ($r=0.265, p<0.01$); (2) Exercise intention significantly positively predicted exercise social support ($\beta=0.231, t=8.457, p<0.01$), and exercise social support significantly positively predicted exercise behavior ($\beta=0.207, t=8.424, p<0.01$); (3) Exercise social support × action self-efficacy positively predicted exercise behavior of junior middle school students ($\beta=-0.058, t=-2.422, p<0.05$); (4) In the high action self-efficacy group, exercise social support had a significant positive prediction effect on exercise behavior ($\beta=0.19, t=5.93, p<0.01$); However, in the low action self-efficacy group, exercise social support had a stronger positive prediction effect on exercise behavior ($\beta=0.34, t=8.90, p<0.01$).

**Conclusion:** (1) Exercise intention can significantly positively predict junior middle school students' exercise behavior; (2) Exercise social support partially mediated the relationship between exercise intention and exercise behavior of junior high school students; (3) Action self-efficacy plays a moderating role in the latter half of the mediating process of exercise intention – exercise social support – exercise behavior. Action self-efficacy can enhance the prediction effect of social support on exercise behavior, especially for junior middle school students with low action self-efficacy, with the improvement of social support level of exercise, their physical exercise level shows a rapid upward trend.

Introduction

Lack of physical exercise will not only affect bone development, lead to overweight or obesity, but also affect the healthy personality development of adolescents (WHO,2020). The "Opinions on Strengthening School Physical Education to Promote Students' Physical and Mental Health and All-round Development" issued by the General Office of the State Council of China emphasizes that: to promote the coordinated development of youth cultural learning and physical exercise, to help students enjoy fun, enhance physical fitness, improve their personality, and temper their will in physical exercise, Cultivate socialist builders and successors with all-round development of moral, intellectual, physical, aesthetic and labor (General Office of the State Council, 2020). As the future hope of the country and the backbone of the implementation of the "Healthy China strategy", the health status of junior high school students has attracted much attention. However, the academic burden faced by junior high school students is crowding out most physical exercise time. What is more worrying is that even though junior high school students understand the necessity of physical exercise, in real life, individuals show inconsistent exercise intention
and exercise behavior. The existing studies have not yet provided a good theoretical explanation validity for this phenomenon. Therefore, discussing the relationship between exercise intention and exercise behavior and bridging the gap between intention and behavior is an important research topic in the field of exercise behavior promotion (Jiahui et al., 2021).

**Exercise Intention and Exercise Behavior**

According to planned behavior theory, behavior is mainly influenced by behavioral intention. Behavioral intention refers to an individual's subjective assessment of his willingness or possibility to engage in a certain behavior in the future, as well as the degree of effort he is willing to pay in the planned implementation behavior (Min, 2012). In the field of exercise, existing studies, guided by the theoretical model of planned behavior, have tested the applicability of the model in different groups (including children and adolescents, diabetics, and the elderly), and achieved relatively consistent results, namely, exercise intention can significantly predict exercise behavior (Jian et al., 2020; Ping, 2022). However, in recent years, studies have pointed out that there is a huge gap between the intention to exercise and the subsequent exercise behavior. "Inconsistency between words and deeds", "knowing but not doing" and other phenomena are very common. For example, Rhodes (2012) argues that the relationship between physical exercise intention and physical exercise behavior is weak and may be of no practical significance. Further meta-analysis showed that exercise intention predicted exercise behavior with a 46% difference (Rhodes, 2013). In a word, the relationship between exercise intention and exercise behavior has not reached a consistent conclusion. Moreover, there is still a lack of necessary empirical research on how exercise intention affects exercise behavior, that is, what is the mechanism of the two. Based on this, this study proposed hypothesis 1: there is a significant positive correlation between exercise intention and exercise behavior.

**Mediating Effect of Exercise Social Support**

Exercise social support is the material or spiritual help an individual receives from family members or relatives and friends (Leo et al., 2022). According to Health Action Process Approach (HAPA) model. The conduct of behavior consists of at least the motivation phase and a volition phase. Significantly, social support, environmental factors, and other influences play a role at all steps (Schwarzer and Luszczynska, 2008), Bandura (1997) claimed that perceived self-efficacy plays a crucial role at all stages along with other cognitions (Bandura, 1997). Studies have shown that exercise social support is an important predictor of exercise behavior (Baolin et al., 2021). Behavioral learning theory holds that adolescents at the stage of social adaptation tend to imitate the behaviors of authority (teachers) and form corresponding psychological characteristics and behavior patterns with peer support (Xin et al., 2020). Studies show that teacher support can provide a basis for teenagers to learn and imitate exercise behaviors, and help them form sports cognition, establish identity, establish rule awareness and avoid deviant behaviors (Lijun et al., 2017). Peer support can help maintain individual self-esteem, reduce loneliness and establish social relationships, thus forming a stable exercise pattern. Moreover, the more perceived peer support, the more likely it is to stimulate the awareness of active participation in exercise
and show the corresponding persistence (Hagger et al., 2003). After entering junior middle school, influenced by factors such as exam-oriented education, changes in lifestyle and adolescence, it is inevitable to have impacts on exercise behaviors, and students' exercise intentions will also have varying degrees of influence. However, if students' exercise intentions can be reasonably cultivated and improved at this stage, they tend to get more social support for exercise (Cheng et al., 2014). According to the theory of planned behavior, individual, social and cultural factors will affect exercise intention and exercise behavior. The stronger an individual's intention to exercise means that he or she is more inclined to exercise. When an individual is inclined to carry out certain activities, he or she will actively look for conditions conducive to his or her activities in his or her surrounding environment, which will also make it easier for an individual to feel the exercise social support provided by the surrounding environment. Therefore, exercise intention may positively promote exercise social support (Zheng et al., 2022). Studies have shown that exercise intention is significantly positively correlated with exercise social support (Alvaro et al., 2020). Individuals with a strong intention to exercise have a higher desire and initiative to participate in physical exercise, which may lead to the improvement of their physical exercise level, and at the same time increase the communication and communication between the individual and others on physical exercise, which in turn makes it easy to obtain exercise social support from family and peers (Kelei, 2019). Hui et al. (2022) found that social support given by parents, teachers and friends can positively predict teenagers' exercise behavior. Similarly, Li et al. (2021) found that feeling social support from others is also conducive to teenagers to invest more positive emotions in physical exercise. At the same time, the exercise intention model also believes that strong exercise intention will enable individuals to show themselves well in physical exercise, thus improving exercise social support (Kelei, 2019). Individuals who receive support from friends and peers are more likely to participate in physical exercise under the influence of peer effect (Huijun et al., 2010), which leads to the occurrence of exercise behavior. Therefore, exercise intention may influence exercise behavior through exercise social support. Therefore, hypothesis 2 is proposed: exercise social support plays a mediating role between exercise intention and exercise behavior.

**Moderating Effect of Action Self-efficacy**

Exercise intention affects the exercise behavior of junior high school students through exercise social support. This intermediary process may be different due to individual differences. Therefore, this study investigated whether this intermediary process could be influenced by other factors. Action self-efficacy affects individual exercise behavior (Yemin, 2010). Individuals with higher levels of action self-efficacy have sufficient self-confidence and can maintain an optimistic and positive emotional state when completing tasks (Xiaoxiao, 2018) and it is easy to produce dominant physical exercise behaviors, while individuals with lower action self-efficacy are too worried about their failures and lack confidence in themselves (Hongpeng, 2018) and will use negative ways to view and explain themselves and events in their daily life (Shenran et al., 2018). If individuals are hesitant to put physical exercise into practice, they tend to focus on a range of negative emotional experiences brought about by negative consequences, thus making it difficult for oneself to develop dominant exercise behaviors. For individuals who lack confidence in physical exercise, as the increase of exercise social support, the level of exercise behavior is
likely to be significantly enhanced (Kelei, 2019). Previous studies have shown that self-efficacy plays a regulatory role between exercise intention and exercise behavior. Students with high-level self-efficacy show a stronger relationship between planning and action (Hou et al., 2022). Then, can action self-efficacy regulate the relationship between exercise social support and exercise behavior? Accordingly, hypothesis 3: Action self-efficacy moderates the second half of the pathway of the mediating process of exercise intention-exercise social support-exercise behavior.

The Present Study

Based on the literature review above, this study intends to construct a model with moderated mediating variables (Fig. 1), aiming to study whether exercise social support plays a mediating role between exercise intention and exercise behavior of middle school students, and how action self-efficacy moderates the second half of this mediating process.

Materials And Methods

Participants and Procedure

A cross-sectional survey was conducted by using the convenience sampling method, 1 junior high school was selected from urban and rural areas in the three regions of southern, central and northern Shaanxi Province, and 2 classes were randomly selected from each junior high school and each grade from October to November 2021. Questionnaires will be issued during class and collected on the spot. A total of 1391 people from 36 classes were distributed questionnaires. After eliminating invalid questionnaires caused by lack of regular answering data and other reasons, 1312 valid questionnaires were collected. The average age of the participants was 14.00 ± 0.864, including 626 males and 686 females. There are 450 students in the first grade; 435 students in the second grade; and 427 students in the third grade. Participants understood the requirements of the survey through personal explanation, and all questionnaires were completed within 30 minutes. The study was in accordance with the Declaration of Helsinki, and was approved by the Institutional Review Board of the School of Physical Education and Health at Zhaoqing University of China, and all participants signed an informed consent form and were paid for their participation.

Measures and Instruments

Exercise Intention

The Chinese version of Exercise Intention Scale compiled by Ajzen (2006) and translated and revised by Yan (2008) has been adopted to measure the exercise intention of junior school students. The study confirms that the scale is suitable for measuring the exercise intention of Chinese junior school students (Min, 2012). The dimension of the scale is composed of three items, which aims to assess the willingness and possibility of teenagers to participate in exercise (e.g., “In the next two weeks, I plan to take physical exercise for more than 20 minutes at least three times a week”). The scale adopts Likert's 7-point score,
ranging from "1 = strongly disagree" to "7 = strongly agree". The higher the score, the stronger the intention to exercise. In this study, the three items of the Exercise Intention Scale converged well to one factor, with KMO value of 0.91 and chi square value of Bartlett ball test of 186253.88 ($p < 0.01$), explaining 71.32% of the total variance (Table 1). The fitting index of confirmatory factor analysis is $\chi^2/df = 2.79$, , $CFI = 0.93$, $NFI = 0.91$, $GFI = 0.917$, $NNFI = 0.925$, $RMESA = 0.093$. The goodness of fit is significantly better, indicating that the scale has good structural validity (Table 2). Cronbach's $\alpha$ is 0.73, indicating that the internal consistency of the scale is good.

**Exercise Social Support**

The Chinese version of Exercise Social Support Scale compiled by Stevenst al., (2000) and revised by Yemin (2010) has been used to measure the exercise social support of junior school students. Studies have proved that the scale is widely applicable to the measurement of exercise social support of Junior high school students in China (Junhua, 2014). The scale has 13 items (e.g., "My family or friends have been exercising with me for the past three months. "), and contains 2 dimensions: family support (e.g., "In the past three months, my family has proposed or expressed that they would take part in physical exercise with me. "), friend support (e.g., "In the past three months, my friend and I have been talking about exercise."). The scale adopts Likert's 5-point score, ranging from "1 = never" to "5 = always". The higher the score, the higher the social support for exercise. In this study, the three items of the Exercise Intention Scale converged well to one factor, with KMO value of 0.80 and chi square value of Bartlett ball test of 1173.02 ($p < 0.01$), explaining 69.33% of the total variance (Table 1). The fitting index of confirmatory factor analysis is $\chi^2/df = 1.73$, , $CFI = 0.95$, $NFI = 0.91$, $GFI = 0.901$, $NNFI = 0.941$, $RMESA = 0.072$. The goodness of fit is significantly better, indicating that the scale has good structural validity (Table 2). Cronbach's $\alpha$ is 0.81, indicating that the internal consistency of the scale is good.

**Action Self-efficacy**

The Chinese version of Action Self-efficacy Scale compiled by Britta et al., (2005) and revised by Mengying et al., (2011) has been used to measure the action self-efficacy of junior school students. Studies have proved that the scale is widely applicable to the measurement of Action self-efficacy of Junior high school students in China (Junhua, 2014). The scale has 4 items (e.g., "Even if I had to rethink my ideas about physical exercise. "), and contains 1 dimensions. The scale adopts Likert's 5-point score, ranging from "1 = not at all sure" to "5 = completely sure". The higher the score, the higher the individual action self-efficacy. In this study, the three items of the Exercise Intention Scale converged well to one factor, with KMO value of 0.90 and chi square value of Bartlett ball test of 2214.94 ($p < 0.01$), explaining 69.36% of the total variance (Table 1). The fitting index of confirmatory factor analysis is $\chi^2/df = 2.28$, , $CFI = 0.90$, $NFI = 0.90$, $GFI = 0.941$, $NNFI = 0.926$, $RMESA = 0.053$. The goodness of fit is significantly better, indicating that the scale has good structural validity (Table 2). Cronbach's $\alpha$ is 0.81, indicating that the internal consistency of the scale is good.

**Exercise Behavior**
Physical Activity Rating Scale (PARS-3) compiled by Liang (1994) has been adopted. The PARS-3 is a three-item self-reported scale, containing exercise time, exercise intensity and exercise frequency. Each item is rated from 1 to 5, and the total score of physical activity is computed by the following equation: intensity \times (time–1) \times frequency, with a range of 0 to 100. The higher the score, the higher the physical activity of the individual. A total score equal to or less than 19 is considered a small amount of exercise, 20 to 42 is considered a moderate amount of exercise, and a score equal to or greater than 43 is considered a large amount of exercise. According to previous experience (kelei et al., 2022), this study divided the small amount of physical exercise into two parts: no physical exercise and small amount of exercise. No physical exercise is equal to or less than 4 points, and a small amount of exercise is 5 to 19 points. Therefore, PE in this study is divided into four levels, from "1 = no physical exercise" to "4 = large amount of physical exercise". The internal consistency coefficient ($\alpha = 0.639$) and retest reliability ($r = 0.82$) of PARS-3 are quite reasonable. In addition, a previous study proved that the scale has good applicability in junior high school students (Penghui et al., 2021). In this study, the Cronbach's $\alpha$ coefficient of the scale is 0.622. In this study, the three items of the Exercise Intention Scale converged well to one factor, with KMO value of 0.90 and chi square value of Bartlett ball test of 274060.11 ($p < 0.01$), explaining 64.84% of the total variance (Table 1). The fitting index of confirmatory factor analysis is $\chi^2/df = 2.33, \text{CFI} = 0.98, \text{NFI} = 0.93, \text{GFI} = 0.906, \text{NNFI} = 0.981, \text{RMESA} = 0.037$. The goodness of fit is significantly better, indicating that the scale has good structural validity (Table 2). Cronbach's $\alpha$ is 0.72, indicating that the internal consistency of the scale is good.

<table>
<thead>
<tr>
<th>Factor naming</th>
<th>KMO</th>
<th>Bartlett chi square value (P value)</th>
<th>Cumulative variance interpretation rate</th>
<th>Cronbach' coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>exercise intention</td>
<td>0.91</td>
<td>186253.88 (p &lt; 0.01)</td>
<td>71.32%</td>
<td>0.73</td>
</tr>
<tr>
<td>friend support</td>
<td>0.80</td>
<td>1173.02 (p &lt; 0.01)</td>
<td>45.52%</td>
<td>0.89</td>
</tr>
<tr>
<td>family support</td>
<td></td>
<td></td>
<td>69.33%</td>
<td>0.85</td>
</tr>
<tr>
<td>action self-efficacy</td>
<td>0.90</td>
<td>2214.94 (p &lt; 0.01)</td>
<td>69.36%</td>
<td>0.81</td>
</tr>
<tr>
<td>exercise behavior</td>
<td>0.90</td>
<td>274060.11 (p &lt; 0.01)</td>
<td>64.84%</td>
<td>0.72</td>
</tr>
</tbody>
</table>
### Table 2
Results of confirmatory factor analysis

<table>
<thead>
<tr>
<th>Factor naming</th>
<th>χ²/df</th>
<th>CFI</th>
<th>NFI</th>
<th>GFI</th>
<th>NNFI</th>
<th>RMSEA</th>
</tr>
</thead>
<tbody>
<tr>
<td>exercise intention</td>
<td>2.792</td>
<td>0.932</td>
<td>0.911</td>
<td>0.917</td>
<td>0.925</td>
<td>0.093</td>
</tr>
<tr>
<td>exercise social support</td>
<td>1.734</td>
<td>0.954</td>
<td>0.938</td>
<td>0.901</td>
<td>0.941</td>
<td>0.072</td>
</tr>
<tr>
<td>action self-efficacy</td>
<td>2.289</td>
<td>0.901</td>
<td>0.907</td>
<td>0.941</td>
<td>0.926</td>
<td>0.053</td>
</tr>
<tr>
<td>exercise behavior</td>
<td>2.332</td>
<td>0.984</td>
<td>0.931</td>
<td>0.906</td>
<td>0.981</td>
<td>0.037</td>
</tr>
</tbody>
</table>

### Statistical Analyses

First, all statistical analyses were performed with IBM SPSS statistical software (version 21.0) and Mplus 8.0 for Windows (SPSS, Chicago, IL, United States). Second, IBM SPSS statistical software version 21.0 was used to test the data for Harman Common Method deviation, the relationship between exercise intention, exercise social support, action self-efficacy, and exercise behavior was calculated by Pearson’s correlation analysis. Continuous variables with normal distribution were presented as the mean ± standard deviation (SD). Third, in order to verify the mediating role of exercise social support in the relationship between exercise intention and exercise behavior, and whether this mediating process is regulated by action self-efficacy. According to the steps proposed by Yan et al., (2011) to test the moderated mediation model: (1) The direct effect was tested between exercise intention and exercise behavior; (2) Whether the direct effect was regulated by action self-efficacy was tested; and (3) MPLUS8.0 was used to conduct structural equation model analysis to test whether the mediating effect of exercise social support during exercise intention and exercise behavior was moderated by action self-efficacy. The estimate approaches for SEM is Bayesian-SEM. According to past experience, goodness of fit index χ²/DF less than 3 is acceptable, RMSEA less than 0.08, NNFI and CFI greater than 0.9, and SRMR less than 0.05 are considered acceptable, and in this study, r<0.1 is a small effect, 0.1 ≤ r ≤ 0.3 is a medium equivalent stress, and r > 0.5 is a large effect, the significance level was set at p < 0.05.

### Results

#### Common Method Deviation Test

First, Harman’s one-way test for common method bias was used (Podsakoff et al., 2003; Dandan et al., 2020), and the results showed that there are 7 factors whose characteristic roots are greater than 1 and the first factor explained 33.143%, which is less than the standard critical value of 40%, and this result indicated that the common method of this study is acceptable (Zhonglin et al., 2021). To ensure the accuracy of the results, a single common method factor control method was also used to test for common method bias, and a study showed (Hongxing et al., 2012) that the test results of this method were more accurate, and the results indicated that the model containing the common method factor could not fit the data. Therefore, the results of both tests indicate that there is no significant common method bias in the sample data.
Descriptive Statistics and Correlation Analysis

As shown in Table 3, exercise intention, exercise social support and action self-efficacy were significantly and positively related to exercise behavior; exercise intention was significantly and positively related to action self-efficacy; and exercise intention, action self-efficacy and exercise social support were significantly and positively related.

<table>
<thead>
<tr>
<th>Variables</th>
<th>M</th>
<th>SD</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. exercise social support</td>
<td>3.09</td>
<td>0.72</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. action self-efficacy</td>
<td>3.70</td>
<td>0.80</td>
<td>.172**</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. exercise behavior</td>
<td>2.90</td>
<td>0.78</td>
<td>.256**</td>
<td>.184**</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>4. exercise intention</td>
<td>5.93</td>
<td>1.22</td>
<td>.261**</td>
<td>.454**</td>
<td>.265**</td>
<td>1</td>
</tr>
</tbody>
</table>

N = 1312; * p < 0.05, ** p < 0.01.

Demographic Characteristics of the Study Sample

As shown in Table 4, of the total sample, 47.71% (626) were boys, and 52.29% (686) were girls. The exercise behavior of boys was significantly higher than that of girls, and there was no significant difference between boys and girls in exercise intention, exercise social support and action self-efficacy.

As shown in Table 5, of the total sample, 34.30% (450) were grade one students, 33.16% (435) were grade two students, and 32.55% (427) were grade three student. There are significant differences in exercise intention among different grades. Grade three is significantly lower than grade two and grade one, and grade two is significantly lower than grade one. There are significant differences in exercise behavior among grades. Grade three is significantly lower than grade one and grade two, and grade two is significantly lower than grade one. There was no significant difference among different grades in exercise social support and action self-efficacy.
Table 4
Differences in gender.

<table>
<thead>
<tr>
<th>Variable</th>
<th>gender</th>
<th>Number (%)</th>
<th>M</th>
<th>SD</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exercise intention</td>
<td>male</td>
<td>626 (47.71)</td>
<td>5.91</td>
<td>2.72</td>
<td>-1.367</td>
<td>0.168</td>
</tr>
<tr>
<td></td>
<td>female</td>
<td>686 (52.29)</td>
<td>5.96</td>
<td>2.67</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exercise social support</td>
<td>male</td>
<td>626 (47.71)</td>
<td>4.02</td>
<td>0.46</td>
<td>1.475</td>
<td>0.139</td>
</tr>
<tr>
<td></td>
<td>female</td>
<td>686 (52.29)</td>
<td>3.84</td>
<td>0.46</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Action self-efficacy</td>
<td>male</td>
<td>626 (47.71)</td>
<td>3.82</td>
<td>0.39</td>
<td>0.873</td>
<td>0.383</td>
</tr>
<tr>
<td></td>
<td>female</td>
<td>686 (52.29)</td>
<td>3.65</td>
<td>0.37</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exercise behavior</td>
<td>male</td>
<td>626 (47.71)</td>
<td>3.21</td>
<td>0.54</td>
<td>2.756</td>
<td>0.006</td>
</tr>
<tr>
<td></td>
<td>female</td>
<td>686 (52.29)</td>
<td>2.74</td>
<td>0.55</td>
<td></td>
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</tr>
</tbody>
</table>

Table 5
Differences in grade.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Grade</th>
<th>Number (%)</th>
<th>M</th>
<th>SD</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exercise intention</td>
<td>One</td>
<td>450 (34.30)</td>
<td>5.99</td>
<td>6.76</td>
<td>9.121</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>Two</td>
<td>435 (33.16)</td>
<td>5.92</td>
<td>7.67</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Three</td>
<td>427 (32.55)</td>
<td>5.87</td>
<td>7.69</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exercise social support</td>
<td>One</td>
<td>450 (34.30)</td>
<td>3.18</td>
<td>0.47</td>
<td>2.174</td>
<td>0.117</td>
</tr>
<tr>
<td></td>
<td>Two</td>
<td>435 (33.16)</td>
<td>3.14</td>
<td>0.46</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Three</td>
<td>427 (32.55)</td>
<td>3.06</td>
<td>0.45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Action self-efficacy</td>
<td>One</td>
<td>450 (34.30)</td>
<td>3.75</td>
<td>0.40</td>
<td>1.758</td>
<td>0.184</td>
</tr>
<tr>
<td></td>
<td>Two</td>
<td>435 (33.16)</td>
<td>3.82</td>
<td>0.37</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Three</td>
<td>427 (32.55)</td>
<td>3.68</td>
<td>0.38</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exercise behavior</td>
<td>One</td>
<td>450 (34.30)</td>
<td>3.14</td>
<td>0.49</td>
<td>38.203</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>Two</td>
<td>435 (33.16)</td>
<td>2.85</td>
<td>0.51</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Three</td>
<td>427 (32.55)</td>
<td>2.79</td>
<td>0.58</td>
<td></td>
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</tr>
</tbody>
</table>

Moderated Mediation Model Test

Structural equation model was used to test the relationship between exercise intention and exercise behavior of junior high school students. After controlling grade and gender variables, the single-
dimension scale was packaged according to the question packaging strategy provided by Yan et al., (2011). The tests are performed according to the moderated mediation test steps provided by Jie et al., (2021). The model fitting indexes are RMSEA = 0.001, CFI = 0.998, NNFI = 0.999, SRMR = 0.001, and the data fit the model well (see Fig. 2). The result shows, exercise intention significantly and positively predicted exercise social support ($\beta = 0.231$, $t = 8.457$, $p < 0.01$) and exercise social support significantly and positively predicted exercise behavior ($\beta = 0.207$, $t = 8.424$, $p < 0.01$), therefore, exercise social support was a mediating variable between exercise intention and exercise behavior of junior high school students, and hypothesis 2 was verified. After adding the mediating variable of exercise social support, intention to exercise still positively predicted exercise behavior significantly ($\beta = 0.174$, $t = 6.399$, $p < 0.01$), indicating that exercise social support plays an intermediary role in the relationship between exercise intention and exercise behavior of junior middle school students. The interaction term of exercise social support and action self-efficacy can significantly positively predicted junior middle school students’ exercise behavior ($\beta = 0.058$, $t = -2.422$, $p < 0.05$). Therefore, action self-efficacy moderates the second half of the mediated process of exercise intention→exercise social support→exercise behavior. That is, action self-efficacy has a moderating effect on junior middle school students' exercise behavior, and hypothesis 3 was tested. As can be seen from Table 6, action self-efficacy could not significantly regulate the relationship between exercise intention and exercise behavior ($\beta = -0.033$, $p > 0.05$), and action self-efficacy could not regulate the relationship between exercise social support and exercise behavior ($\beta = -0.031$, $p > 0.05$), so action self-efficacy only regulated the latter part of the mediating process of exercise intention→exercise social support→ exercise behavior half of the path.

In order to test how action self-efficacy moderates the effect of exercise social support on middle school students’ exercise behavior, the interaction was plotted by taking ± 1 of the action self-efficacy Z-score and as shown in Fig. 3. The simple slope test showed that for junior middle school students with higher action self-efficacy (e.g., Z = 1), exercise social support was also higher, and junior middle school students' exercise behavior showed an upward trend ($\beta = 0.19$, $t = 5.93$, $p < 0.01$). For each standard deviation increase in exercise social support, exercise behavior increased by 0.19 standard deviations. While for junior middle school students with low action self-efficacy (e.g., Z = -1), their exercise behavior showed a more significant upward trend as the degree of exercise social support increased ($\beta = 0.34$, $t = 8.90$, $p < 0.01$). For each standard deviation increase in exercise social support, exercise behavior increased by 0.34 standard deviations.
Table 6
Moderated Mediation Test and Tts Results.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Model 1</th>
<th></th>
<th></th>
<th>Model 2</th>
<th></th>
<th></th>
<th>Model 3</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>SE</td>
<td>p</td>
<td>B</td>
<td>SE</td>
<td>p</td>
<td>B</td>
<td>SE</td>
<td>p</td>
</tr>
<tr>
<td>Constant</td>
<td>0.015</td>
<td>0.021</td>
<td>0.481</td>
<td>0.014</td>
<td>0.019</td>
<td>0.471</td>
<td>0.012</td>
<td>0.019</td>
<td>0.549</td>
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<tr>
<td>exercise intention(X)</td>
<td>0.133</td>
<td>0.019</td>
<td>0.000**</td>
<td>0.123</td>
<td>0.017</td>
<td>0.000**</td>
<td>0.174</td>
<td>0.017</td>
<td>0.000**</td>
</tr>
<tr>
<td>action self-efficacy(U)</td>
<td>0.09</td>
<td>0.027</td>
<td>0.001**</td>
<td>0.071</td>
<td>0.025</td>
<td>0.005**</td>
<td>0.065</td>
<td>0.026</td>
<td>0.014*</td>
</tr>
<tr>
<td>U×X</td>
<td>-0.033</td>
<td>0.019</td>
<td>0.077</td>
<td>-0.031</td>
<td>0.017</td>
<td>0.071</td>
<td>-0.013</td>
<td>0.02</td>
<td>0.514</td>
</tr>
<tr>
<td>exercise social support(W)</td>
<td></td>
<td></td>
<td></td>
<td>0.207</td>
<td>0.027</td>
<td>0.000**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U×W</td>
<td></td>
<td></td>
<td></td>
<td>-0.058</td>
<td>0.028</td>
<td>0.013*</td>
<td></td>
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<tr>
<td>R²</td>
<td>0.077</td>
<td></td>
<td></td>
<td>0.074</td>
<td></td>
<td></td>
<td>0.115</td>
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<tr>
<td>ΔR²</td>
<td>0.075</td>
<td></td>
<td></td>
<td>0.072</td>
<td></td>
<td></td>
<td>0.111</td>
<td></td>
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</tr>
<tr>
<td>F Value</td>
<td>F (3,1569) = 43.768, p = 0.000</td>
<td></td>
<td></td>
<td>F (3,1569) = 41.562, p = 0.000</td>
<td></td>
<td></td>
<td>F (5,1567) = 40.643, p = 0.000</td>
<td></td>
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</tr>
</tbody>
</table>

N = 1312; * p < 0.05 ** p < 0.01.

Discussion

Exercise Intention and Exercise Behavior

Globally, more and more people lack physical activity, among which the adolescent population is particularly prominent, and human physical and mental health is suffering from increasing threats as a result (Yandong, 2014), and some studies have shown that insufficient physical activity is the most direct and deep-seated cause of physical decline, obesity, and myopia among adolescents (Jian, 2015; Huijun, 2010). It is of great practical and theoretical importance to investigate the influencing factors and mechanisms of physical exercise, which is the basis for promoting youth participation in physical exercise. In this study, a moderated mediation model was constructed to examine the factors and influencing mechanisms of exercise behavior among middle school students. Studies have shown that exercise intention can significantly positively predict junior middle school students' exercise behavior. That is, the stronger the exercise intention of middle school students, the more likely they are to participate in physical exercise, the finding that has also been widely confirmed in past studies (Kelei, 2019; Wenjuan et al., 2016; Lu et al., 2021). The theory of sport psychology believes that psychological
factors are the internal motivation and direct factors affecting physical exercise, and the main motivation for a person's willingness and persistence to participate in physical exercise comes from within. Humanistic learning theory believes that, in addition to external environmental factors, internal psychological factors such as personal intention, interest and motivation play a central role in learning, which provides an important theoretical support for promoting youth participation in physical activity through psychological factors.

The Mediating Role of Social Support

On the basis of verifying that exercise intention positively predicts the exercise behavior of junior high school students, this study further explores how exercise intention affects the exercise behavior of junior high school students. Studies have found that exercise intention has a significant positive predictive effect on exercise social support. The higher an individual's exercise intention level, the more encouragement and support they can get from friends and peers, it is consistent with previous studies (Kelei, 2019). Exercise social support can significantly positively predict junior high school students' exercise behavior, and high levels of exercise social support can lead to aggressive behavior in the process of physical exercise. It is helpful for individuals to establish good interpersonal relationships with others, and increase their likelihood of receiving exercise social support from family, friends, and peers, which in turn enhances their likelihood of participating in physical exercise, it is consistent with the existing findings (Xiaojuan et al., 2020). More importantly, this study found that exercise social support plays an intermediary role between exercise intention and junior middle school students' exercise behavior, which means that exercise intention can directly influence junior middle school students' exercise behavior on the one hand, and indirectly influence junior middle school students' exercise behavior through exercise social support on the other hand. This may be because individuals with high levels of exercise intention actively explore themselves as well as their external environment and wish to actively engage in physical activity. As a result, they also tend to receive higher exercise social support and often receive moral and action encouragement and support from family, friends and peers. At the same time, they can independently make more reasonable plans for their participation in physical exercise, and are confident in the physical exercise they will participate in, and can effectively overcome the obstacles and difficulties they encounter in the process of participating in physical exercise, which will effectively improve their participation in physical exercise. (Demetriou et al., 2015). However, students with a low level of exercise intention, who are used to passively adapting to their environment, usually behave passively, and in the process of participating in physical exercise, they lack a correct perception of the value of physical exercise and do not know how to participate in physical exercise and how to make a reasonable personal exercise plan. Therefore, they are unable to communicate with others and obtain corresponding support and encouragement. Meanwhile, individuals with low levels of exercise social support are usually accompanied by negative, shy, and nervous emotions during physical exercise (Baojuan et al., 2020), and these emotions can affect individuals' performance in physical exercise and reduce their level of participation in physical exercise. Therefore, when thinking about the relationship between exercise intention and exercise behavior of junior middle school students, it is important to pay attention to the important "bridging" role played by exercise social support.
Moderating role of action self-efficacy

Exploring the moderating variables of exercise intention-exercise behavior relationship is an important research direction (Liwei et al., 2019). Therefore, this study also examined the moderating role of the mediating process of "intention to exercise-exercise-social support-exercise behavior". In other words, whether action self-efficacy moderates this mediating process. The study showed that action self-efficacy moderated the relationship between exercise social support and exercise behavior of junior middle school students. Action self-efficacy is an important influence on exercise behavior (Wenbo, 2013) and refers to an individual's confidence in his or her ability to achieve the goals of physical exercise behavior.

The simple slope plot revealed that for junior high school students with high action self-efficacy, their physical exercise level did not show a significant upward trend with the increase in the level of exercise social support; while for junior high school students with low action self-efficacy, their physical exercise level showed a rapid upward trend with the increase in the level of exercise social support. That is to say, compared with the junior high school students with high level of action self-efficacy, the exercise social support of junior high school students with low action self-efficacy has more significant positive predictions of exercise behavior. The reason for this is that junior middle school students with high exercise social support in a low action self-efficacy situation are also able to significantly increase their physical exercise levels with encouragement and support from parents or peers (Susan et al., 2005). Some studies have shown that individuals are highly likely to participate in physical exercise if one of their parents or peers is often participate in physical activity (Huijun et al., 2010). Among the many factors influencing physical activity, peers and parents ranked in the top two (Fengmin, 2010), indicating that adolescent students who receive higher exercise social support are more likely to develop specific physical exercise behaviors. Therefore, under low action self-efficacy, exercise social support has a stronger predictive effect on exercise behavior. This suggests that for junior middle school students with low general self-efficacy, they should be involved in physical exercise first mainly by increasing exercise social support, and developing their interest and attitude to participate in physical exercise in the process of physical exercise, so as to develop physical exercise habits. On the contrary, junior middle school students with high levels of action self-efficacy have higher self-confidence when facing different environments or things, and believe that they are capable of overcoming various unfavorable situations. It is also usually easy to obtain higher exercise social support, and improving exercise social support can also improve their physical exercise level, but the magnitude of improvement is relatively small. This is the reason why the regression path coefficient of the interaction term between action self-efficacy and exercise social support on exercise behavior is negative. The negative number here does not mean that action self-efficacy × exercise social support negatively predicts exercise behavior of junior middle school students.

Improving the level of individual exercise social support would most benefit junior middle school students with low action self-efficacy, and improving action self-efficacy would most benefit junior high school students with low level of exercise social support. In short, in order to better improve the physical exercise level of junior high school students, we should take the following measures: (1) Stimulating the exercise
intention of junior high school students through multiple means. For example, the education authorities can improve the awareness of society as a whole of the important value of physical exercise through reforms in the education system (e.g., physical education scores in the total score of the college entrance examination), and allowing students time to participate in physical exercise by effectively reducing their academic burdens. The school department can enhance the endogenous motivation of physical education classes by choosing diverse teaching evaluations, diverse teaching contents, diverse teaching methods and means, and diverse teaching organization forms, etc. Schools actively organize extracurricular sports competitions and training, and establish sports clubs. This can provide students with convenient venues and equipment, and create an physical exercise atmosphere for students, and stimulate young people's willingness to participate in physical exercise. (2) Build a trinity social support system of community, family and school to improve the level of social support for middle school students' exercise. For example, students' parents or friends can pay close attention to their physical education learning situation and provide them with the material and spiritual support they need in a timely manner. They can experience encouragement and support from all sides and get the help they need when they need it, instead of being isolated, and then improve their physical activity level. Schools can recruit high-level athletes or discover and cultivate sports talents during physical exercises inside and outside of class, so as to give full play to the peer effect of the backbone of sports, thereby improving the level of physical exercise of junior high school students. (3) For junior high school students with low action self-efficacy, their action self-efficacy can be improved by persuading and encouraging, and improve their sports emotion regulation ability, so that they can experience more successful experiences, and change their wrong attribution methods to improving their action self-efficacy. Let them have enough self-confidence and initiative to overcome various difficulties and obstacles so as to improve their physical exercise level. While for junior high school students with high action self-efficacy, they can mainly improve their level of exercise social support by increasing their physical exercise intention, so as to prompt them to develop the habit of physical exercise as soon as possible.

Practical Significance

The theoretical significance of this paper is to expand the application of planned behavior theory in Chinese junior high school students, and to explore the application of the intermediary variable of exercise social support and the regulatory role of action self-efficacy in the process of Intention-Behavior transformation. This study investigated the relationship between exercise intention and exercise behavior, enriched the relevant research in the field of exercise intention and exercise behavior, and had important practical value for improving and intervening exercise behavior of junior high school students: Firstly, junior high school students, as a special group, are in the critical period of life development. Exercise behavior not only affects the physical health of junior high school students, but also has a very important impact on their academic performance and personality shaping, which is a big problem that cannot be ignored. Exercise intention is positively correlated with exercise behavior, which is an important variable to predict exercise behavior. Therefore, improving the exercise intention of junior high school students should become an important part of school education. Teachers, especially physical education teachers, should create conditions for students to do good physical education and extracurricular physical exercise
according to the characteristics of students' physical and mental development, which will be more direct help to the formation of junior middle school students' exercise intention. Secondly, exercise social support and action self-efficacy are important factors to predict junior middle school students' exercise behavior. In addition to improving the exercise intention of junior middle school students, providing them with more exercise social support (such as family support, friends support and teachers support, etc.) plays a very important role in improving their physical exercise level. Not only that, when improving and intervening in junior middle school students' exercise behavior, it is necessary to consider the individual's action self-efficacy level, and adopt different countermeasures for different levels of individuals. For junior middle school students with low action self-efficacy, improving their exercise social support level can promote their physical exercise level to rise rapidly.

Limitations And Prospectives

Of course, there are still some areas for improvement in this study: First, the study on the mechanism of exercise intention on exercise behavior is based on cross-sectional study. Although cross-sectional research can effectively answer many types of questions and the findings can explain complex models, it is difficult to obtain causal relationships between variables in this type of study. In the research, the longitudinal tracking design can be combined to be more effectively explain how exercise intention affects the exercise behavior of middle school students. Secondly, this study used the self-report method to conduct a questionnaire survey on middle school students and data can be collected later through a combination of multiple channels (such as evaluation by others, self-report) to reduce common method bias. Finally, the subject group in this study is middle school students, and the sampling range is small. Therefore, other age groups should remain attention when they are involved in the process of using the research results of the complex relationship between exercise intention, exercise social support, action self-efficacy, and exercise behavior. Therefore, future research should expand the scope of sampling to ensure the representativeness of the sample.

Conclusion

(1) Exercise intention can significantly positively predict exercise social support, action self-efficacy and exercise behavior, which means that exercise intention may promote the development level of exercise social support, action self-efficacy and exercise behavior of junior middle school students. (2) Exercise social support plays a partial mediating role between exercise intention and exercise behavior of junior high school students. (3) Action self-efficacy plays a moderating role in the latter half of the mediating process of exercise intention – exercise social support – exercise behavior. Action self-efficacy can enhance the prediction effect of social support on exercise behavior. For junior middle school students with high action self-efficacy, the increase trend of physical exercise level is not obvious with the improvement of social support level of exercise. For junior middle school students with low action self-efficacy, with the improvement of exercise social support level, their physical exercise level shows a rapid upward trend.
Declarations

Ethics approval and consent to participate

This study valued ethical precepts in research and was performed in agreement with the principles of the Declaration of Helsinki. Guilin University of Electronic Technology Academic Ethics Committee (cohort ethics code: 2022-0720-01) evaluated and approved the study. An informed consent was required from all participants.

Consent for publication

All authors have read and announced their consent for publication of this work.

Availability of data and materials

Data are available upon reasonable request. The interested researchers may contact Dr. Wenxia Liu (PI). The applications will be reviewed upon approval by the research council and the regional ethics committee of Guilin University Academic Ethics Committee. The study website is https://www.guet.edu.cn.

Competing interests

The authors declare that they have no competing interests.

Funding

Guangxi Higher Education Teaching Reform Project (Research and Practice of Wushu Teaching Reform in Colleges and Universities under the concept of "Curriculum Ideological and Political"), No.: 2021JGB191.

Author contributions


Acknowledgements

The authors would like to thank the participants in the study.

References


**Figures**
Figure 1

The Conceptual Model

Figure 2

Moderated mediation model.
Figure 3

The Moderating Effect of Action Self-efficacy on the Relationship between Exercise Social Support and Exercise Behavior.