# Relationships between physical activity and social anxiety levels among college students in China

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# Abstract

### Background

Physical activity (PA) can effectively reduce social anxiety (SA), which is currently one of the most effective forms of psychological intervention. This study explored the relationship between exercise frequency, intensity, duration and social anxiety.

### Methods

This study was a college-based cross-sectional study. 844 college students from six universities in Qingdao, Shandong Province, China, were sampled for this study. The daily physical activity of the participants was assessed using the Physical Activity Rating Scale-3, While the social anxiety level was evaluated using the Liebowitz Social Anxiety Scale. A survey questionnaire was developed to investigate the essential characteristics of the participants. In addition, this study examined the relationship between physical activity components (frequency, duration, intensity) on motion features and social anxiety levels. Additional work was conducted to test if physical exercise played an alleviation role in mediating social anxiety levels in college students. Finally, moderation was analyzed using PROCESS macro for SPSS, and the relationship was evaluated by non-linear index fitting.

### Results

The results revealed that the exercise intensity(I) ($F = 24.35$, $p < 0.01$), exercise frequency(F) ($F = 16.31$, $p < 0.01$), and exercise duration (D) ($F = 9.8$, $p < 0.01$) were significant differences correlated with the score of social anxiety. This post hoc analysis showed that the SA level of Frequency 1(F1) was significantly higher than that of Frequency 3(F3) and Frequency 5(F5), and the SA level of Intensity 1(I1) was substantially higher than that of Intensity 3(I3) and Intensity 5(I5). In addition, the SA level of Duration 1(D1) was significantly higher than that of Duration 3(D3) and Duration 5(D5). In addition, the total score of SA was negatively correlated with the total score of physical activity ($p < 0.01$).

### Conclusions

Physical activity can alleviate social anxiety among university students. The most beneficial and optimized exercise plan: Moderate intensity, once or twice a week, and 21–30 minutes of exercise per session may reduce social anxiety.


# 1. Introduction

Recently, mental disorders among Chinese college students have become prominent increasingly [1] due to the pressure of society, family, employment, et al. Social Anxiety (SA) is one of the most common mental disorders among college students [2,3]. SA increases college students' drop-out risk, stifles employment opportunities, and rates of breakup [4,5]. SA refers to individuals' intense, persistent, irrational fear, nervousness, and worry of being exposed to social settings, such as fear of

embarrassment and negative evaluation by others, leading to inadequate self-awareness 6 . It has been found that SA is the third most common mental disorder after depressive disorder and alcohol dependence 7 . Therefore, exploring the ways to alleviate SA in college students is of great importance and interest.

It's well known that PA is currently one of the most effective forms of psychological intervention. PA may play an important role in reducing anxiety disorder in young adults during the COVID-19 pandemic [8,9]. PA is also one way to alleviate SA, and there have been many studies on the effect of physical activity on SA. For example, Hooria Jazaieri et al. found that mindfulness-based stress reduction (MBSR) and aerobic exercise could be reduced social anxiety and depression and increase subjective well-being 10 . Similarly, Philippe Goldin et al. showed that MBSR and aerobic exercise might enhance more adaptive social self-referential processes in patients with SAD 11 . Moreover, A recent study found that the Basketball and Baduanjin Exercise demonstrated significant effects on decreasing feelings of anxiety and meanwhile improving their related mental health among college students 12 . However, although the positive effects of physical activity on SA have been demonstrated, little attention has been paid to the relationship between three components of physical activity (intensity, duration, frequency) and SA.

This study aimed to explore further the relationship between physical activity and SA, and whether three components of physical activity can moderate their correlation. Therefore, we hope that the development of more effective and targeted exercise interventions to address this common psychological disorder in college students.

## 2. Materials And Methods

# 2.1. Research model

In this cross-sectional study, a Non-random snowball sampling strategy was employed. We posted a web-based questionnaire whereby participants were asked to forward the survey link to invite college students to participate in the study. To test whether the amount of exercise affected the social anxiety of university students, and was used to probe further which of the Relationships were affected by the specific factors. Most subjects have been scanned in the context of previous survey research [13]. Correlational model research involves the measurement of two or more variables that there is a change between to determine the degree of relationship 14 .

# 2.2. Study population and sample of research

The study population was all regular university students studying at different faculties of six universities in Qingdao. The survey was carried out in two rounds by releasing online questionnaires between April and May 2021. One thousand-five participants completed the investigation. Since Physical Activity Rating was a critical, independent variable and the levels of Social Anxiety were the dependent variable in the study, college students who had not answered the self-reported measures of PA and SA levels were

excluded from the study. Therefore, 844(83.98%) remained in this study. Among them, 45.3 per cent were women, and 54.7 per cent were men.

## 2.3. Data collection tools

In this study, the researchers designed the 'Personal Basic Information Form' to determine the individual characteristics of subjects; the 'Physical Activity Rating Scale-3 (PARS-3)' to determine physical activity types; Liebowitz Social Anxiety Scale (LSAS) was used to determine social anxiety levels. In addition, to assess if the other variables (e.g. gender, school grades, and whether the participant is an only child) could affect the relationships between physical activity and social anxiety.

### 2.3.1. Physical Activity Rating Scale-3 (PARS-3)

PARS-3 revised by Liang (1994), was adopted to investigate the physical activity of college students [15]. This scale mainly evaluates the physical activity participation during the previous month. Through this, it assesses the general level of physical activity, including three components (e.g., "exercise frequency," "exercise intensity," and "exercise duration"), and each component has five categories. The five-point Likert scale was used to score physical activity. Levels 1–5 of the exercise duration correspond to 0–4 marks (D1= "Less than 10 minutes", D2=" 11 to 20 minutes", D3= "21 to 30 minutes", D4= "31 to 59 minutes", and D5= "1 hour or more"). The exercise intensity (I1= "Light-intensity exercise," I2= "Low-intensity exercise," I3= "Moderate-intensity continuous exercise," I4= "High-intensity exercise," and I5= "High-intensity continuous exercise") and frequency (F1= "Less than once a month," F2= "2 to 3 times a month", F3= "1 or 2 times a week", F4= "3 to 5 times a week", and F5= "Once a day") are scored with 1–5 marks corresponding to 1–5. According to a previous study 16 , the total score of physical activity (i.e., the amount of exercise) is computed by the equation below: the amount of exercise = exercise intensity × exercise duration × exercise frequency, of which the score range is from 0 to 100. According to the evaluation standard the amount of exercise: a small amount of exercise is ≤ 19 marks, a moderate amount of exercise is 20 to 42 marks, and a large amount of exercise is ≥ 43 points. This scale has a good test-retest of 0.82, and its reliability and validity are good 17,18 .

### 2.3.2. Liebowitz Social Anxiety Scale (LSAS)

In this study, the severity of social anxiety symptoms among university students was used to measure and evaluate using the clinician-administered Liebowitz Social Anxiety Scale (LSAS) [19], a commonly self-rating version used scale to assess symptoms of social anxiety. The LSAS consists of 24 items, including four components (e.g., "social interaction," "public speech," being observed," and "eating and drinking in public") 20 . Among them, 'the fear or anxiety subscale' assesses the subjective experience of anxious affect, and 'the avoidance subscale' assesses the high sensitivity of the avoidance response. The total score on social anxiety is the sum of the items measuring fear or anxiety and avoidance symptoms, respectively. The range of the total score for social anxiety is 0-100, wherein the higher the score, the higher the anxiety. Based on the social anxiety scoring standard: a SAS ≤ 37 was classified as non-anxiety, a SAS score of 38–50 was classified as mild anxiety, 51–82 points were classified as moderate

anxiety, and a score ≥ 83 was classified as severe anxiety. We used the self-rating version of the LSAS, demonstrating good internal consistency: Cronbach's α = 0.77 and test-retest reliability: 0.82 [21,22].

## 2.4. Statistical analysis

All statistical analyses were performed using the SPSS software version 26.0. Continuous variables were presented as means ± standard deviation (SD), and categorical variables as frequencies(n) and percentages (%). At first, the independent sample t-tests were conducted to explore potential significant differences between groups on all included variables (e.g., "gender," "major," "only children or not," "residence," "grade," and" components of social anxiety and physical activity"). Secondly, Analysis of variance (ANOVA) was used to analyze the relationship between different exercise groups (according to PARS-3: low exercise group, moderate exercise group, and high interval exercise group) and scores on the four components of social anxiety. And then, social anxiety in different movement components was done by the Least Significant Difference (LSD) multiple-comparison test. Lastly, Pearson's correlation analysis was applied to explore further the relationship between the total social anxiety score and the amount of exercise and components. The non-linear fitting of the SA total score and PA total score in exponential form was carried out using Python software (version 3.1). Levels of significance included three layers are indicated as: *P < 0.05, **P < 0.01, ***P < 0.001.

# 3. Results

## 3.1. Descriptive statistics and comparative analysis

The demographic and exercise conditions variables for the whole sample are presented in Table 1. The percentage of no SA, mild SA, moderate SA, and severe SA was 27.84%(n = 235), 46.33%(n = 391), 19.31% (n = 163), and 6.52%(n = 55), respectively. Furthermore, this supports previous research, which suggests that social anxiety is highly prevalent (72.16%, n = 609) among university students.

The chi-square test showed that there were no statistically significant differences between residents. However, four groups were extremely statistically significant on gender ($^2$ = 19.425, P = 0.000), major ($^2$ = 13.717, P = 0.001) and activity level ($^2$ = 22.358, P = 0.000). In Addition, a significant difference was detected in grade ($^2$ = 14.026, P = 0.006) and a single child or not ($^2$ = 10.352, P = 0.010) among them. Overall, no matter demographic variables or physical activity level, the percentages, and frequency for mild SA were the highest, followed by no SA, moderate SA, and severe SA.

Furthermore, regarding the physical activity level, nearly 57% of participants reported that they often took part in low exercise, and the percentages for moderate and high interval exercise were 23.0% and 20.3%, respectively. While surprising, there was also a significant trend for lower social anxiety with increasing levels of physical activity and growth in grades. This suggests that there was also a relationship between the level of physical activity and social anxiety scores with some isokinetic parameters. It can further affect the level of social anxiety among university students.

Table 1
Comparisons of sociodemographic variables and physical activity levels between subjects among four groups of SA (N = 844).

| | Total (n = 844) | None SA(n = 235) | Mild SA(n = 391) | moderate SA(n = 163) | severe SA(n = 55) | $\chi^2$ |
|---|---|---|---|---|---|---|
| **Gender** | | | | | | |
| Male | 462(54.7%) | 155(33.5%) | 207(44.8%) | 74(16.0%) | 26(5.6%) | 19.425*** |
| Female | 382(45.3%) | 80(20.9%) | 184(48.2%) | 89(23.3%) | 29(7.6%) | |
| **Major** | | | | | | |
| Science | 563(66.7%) | 176(31.3%) | 259(46.0%) | 94(16.7%) | 34(6.0%) | 13.717** |
| Liberal Arts | 281(33.3%) | 59(21.0%) | 132(47.0%) | 69(24.6%) | 21(7.5%) | |
| **A single child or not** | | | | | | |
| *Only child* | 395(46.8%) | 130(32.9%) | 170(43.0%) | 74(18.7%) | 21(5.3%) | 10.352* |
| Non-*only child* | 449(53.2%) | 105(23.4%) | 221(49.2%) | 89(19.8%) | 34(7.6%) | |
| **Residence** | | | | | | |
| Urban | 354(41.9%) | 90(25.4%) | 165(46.6%) | 74(20.9%) | 25(7.1%) | 2.371 |
| Rural | 490(58.1%) | 145(29.6%) | 226(46.1%) | 89(18.2%) | 30(6.1%) | |
| **Grade** | | | | | | |
| Freshman | 248(29.4%) | 63(25.4%) | 112(45.2%) | 53(21.4%) | 20(8.1%) | 14.026** |
| Sophomore | 243(28.8%) | 60(24.7%) | 117(48.1%) | 52(21.4%) | 14(5.8%) | |
| Junior | 214(25.4%) | 59(27.6%) | 101(47.2%) | 42(19.6%) | 12(5.6%) | |
| Senior | 139(16.5%) | 53(38.1%) | 61(43.9%) | 16(11.5%) | 9(6.5%) | |
| **Activity level** | | | | | | |
| Low exercise | 479(56.8%) | 121(25.3%) | 218(45.5%) | 99(20.7%) | 41(8.6%) | 22.358*** |
| moderate exercise | 194(23.0%) | 49(25.3%) | 92(47.4%) | 44(22.7%) | 9(4.6%) | |
| High interval exercise | 171(20.3%) | 65(38.0%) | 81(47.4%) | 20(11.7%) | 5(2.9%) | |

Note: *P < 0.05, **P < 0.01, ***P < 0.001.

# 3.2. One-way analysis of variance

To further explore this interaction between physical activity and social anxiety, a subsidiary one-way ANOVA was employed to examine the score of social anxiety and its four components at different levels of physical activity, which is displayed in Table 2.

The results showed that the total social anxiety scores differed significantly at three activity levels ($F = 5.484$, $P < 0.05$, $\eta^2 = 0.951$). Likewise, apart from the eating and drinking in public, that was also existed in public speech ($F = 5.291$, $P < 0.05$, $\eta^2 = 0.991$), social interaction ($F = 4.115$, $P < 0.1$, $\eta^2 = 0.068$), and being observed ($F = 3.316$, $P < 0.1$, $\eta^2 = 0.053$), respectively. Remarkably, by this table, we found an obvious decrease in the score of SA and its four components with the advancing level of physical activity, especially from moderate to high interval exercise. However, that did not emerge from low exercise to moderate exercise.

Moreover, Post hoc analysis among groups were further evaluated that no matter in SA or its four components, the score of high interval exercise was considerably less than other exercises. As the number of exercises increases, the SA scores decrease further, and intergroup differences are very significant. In addition, the low exercise score was significantly higher than high interval exercise in SA, social interaction, and being observed. Overall, it was not difficult to find that there seems to be a dose-response relationship between social anxiety and physical activity and that high interval exercise levels might generate the most effective intervention effect for social anxiety.

Table 2
The score of SA and its four components at the different physical activity levels (N = 844).

| | social interaction | public speech | being observed | eating and drinking in public | The score of SA |
|---|---|---|---|---|---|
| **Activity level** | | | | | |
| Low exercise(n = 479) | 1.08 ± 0.66 | 1.22 ± 0.70 | 1.08 ± 0.66 | 0.73 ± 0.72 | 51.31 ± 27.72 |
| Moderate exercise(n = 194) | 0.83 ± 0.58 | 0.99 ± 0.61 | 0.85 ± 0.61 | 0.68 ± 0.67 | 40.10 ± 23.75 |
| High interval exercise(n = 171) | 0.83 ± 0.57 | 0.98 ± 0.57 | 0.86 ± 0.58 | 0.58 ± 0.65 | 39.92 ± 22.37 |
| F | 17.15** | 13.53** | 13.33** | 2.90 | 19.945** |
| Partial $\eta^2$ | 0.11 | 0.01 | 0.01 | 0.57 | 0.01 |
| Post hoc analysis | Low > Moderate** | Low > Moderate** | Low > Moderate** | Low > High* | Low > High* |
| | Low > High** | Low > High** | Low > High** | | Moderate > High* |
| | Low > Moderate = High | Low > Moderate = High | Low > High = Moderate | Low = Moderate > High | Low = Moderate > High |
| Note: *P < 0.05, **P < 0.01, ***P < 0.001. | | | | | |

To further confirm the above notion, we also conducted further analyses of the physical activity displayed in Table 3.

The results demonstrated that the exercise intensity (F = 24.35, P < 0.01), exercise frequency (F = 16.31, P < 0.01) and exercise duration (F = 9.8, P < 0.01) were significant differences correlated with the score of social anxiety. The results of Post hoc analysis showed that the SA level of F1 was significantly higher than that of F3 to F5 (P < 0.01), and the SA level of I1 was significantly higher than that of I3 to I5 (P < 0.05). In addition, the SA level of T1 was significantly higher than that of T3 and T5 (P < 0.01).

Table 3
The score of social anxiety and the interpretation of physical activity level (N = 844).

| Exercise amount | | $\bar{X} \pm S$ | F | P | Post hoc analysis |
|---|---|---|---|---|---|
| Frequency (F1-5) | F1: Less than once a month(n = 51) | 68.80 ± 32.30 | 16.31 | 0.01 | F1 > F3**<br>F1 > F4**<br>F1 > F5** |
| | F2: 2 to 3 times a month(n = 185) | 52.10 ± 28.16 | | | |
| | F3: 1 or 2 times a week(n = 342) | 41.32 ± 23.92 | | | |
| | F4: 3 to 5 times a week(n = 195) | 45.07 ± 22.88 | | | |
| | F5: Once a day(n = 71) | 41.70 ± 26.59 | | | |
| Intensity (I1-5) | I1: Light-intensity exercise(n = 188) | 60.94 ± 25.78 | 24.35 | 0.01 | I1 > I3**<br>I1 > I4*<br>I1 > I5** |
| | I2: Low-intensity exercise(n = 247) | 46.45 ± 25.76 | | | |
| | I3: Moderate-intensity continuous exercise(n = 159) | 37.46 ± 23.99 | | | |
| | I4: High-intensity exercise(n = 199) | 40.90 ± 24.66 | | | |
| | I5: High-intensity continuous exercise(n = 51) | 39.33 ± 23.09 | | | |
| Duration (T1-5) | D1: Less than 10 minutes(n = 67) | 59.52 ± 32.32 | 9.80 | 0.01 | T1 > T3**<br>T1 > T5** |
| | D2: 11 to 20 minutes(n = 172) | 50.84 ± 27.39 | | | |
| | D3: 21 to 30 minutes(n = 201) | 43.53 ± 25.67 | | | |
| | D4: 31 to 59 minutes(n = 160) | 48.14 ± 24.48 | | | |
| | D5: 1 hour or more(n = 244) | 40.07 ± 23.48 | | | |
| Note: *P < 0.05, **P < 0.01, ***P < 0.001. | | | | | |

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# 3.3. Correlation analysis

Figure 1 shows the exponential fitting of the correlation between the total score of social anxiety and the total score of physical activity. The results showed that the $R^2$ of exponential fitting was 0.54 ($P < 0.01$). The regression equation is: y = 85.912347*exp ( -0.026259*x).

# 4. Discussions

In recent years, the effects of physical activity (i.e., the amount of exercise) on SA have attracted significant attention, especially in mental and public health areas. Therefore, more empirical studies (e.g., surveys and experimental studies) are being devoted to the relationship between them. However, the underlying mechanisms behind the potential effects of physical activity on SA have remained largely unknown. Therefore, using a sample of Chinese undergraduate students, verifying the intrinsic correlation between physical activity and SA again, and testify which the amount of exercise has the most excellent effect in alleviating or intervening symptoms of social anxiety.

This research is to examine the relations between different amounts of exercise (and its three components) and social anxiety of university students and whether the amount of exercise could be adjustable to their correlation. The main findings from this study were as follows: Physical activity would be correlated negatively with social anxiety, which is consistent with recent findings from the Irish [23], in which the authors believe that physical activity is associated with lower odds of anxiety; the degree of social anxiety may be decreased with increased physical activity levels within a certain range, but this relationship is not linear. We also found that the preliminary efficacy of the low-moderate exercise volume group had better results in improving symptoms of social anxiety than the Moderate-High interval exercise volume group;The bidirectional association between physical activity and social anxiety would be correlated by the amount of exercise and its components. Through fitting, it is found that the social anxiety varied greatly with increases in exercise volume at the beginning and then continued increases in exercise volume were found to decrease SA efficiency.

# 4.1. The Role of Demographic Between Physical activity and Social Anxiety in College Students

The present study demonstrates that gender may be a viable and critical demographic indicator influencing social performance in predicting SA. Because the frequency and percentage of mild, moderate, and severe social anxiety for female university students were higher than for males, consistent with previous research [24,25]. In addition, according to our previous research work, the proportion of liberal arts students is significantly higher than that of science students; similarly, the proportion of non-only children is also significantly higher than that of only children 26 , which suggests that prominent and single child or not were solid predictive factors for SA. The leading cause for university students' differences in central and non-only children was the distinction between gender 27 . For example, Past studies have already suggested that female university students have relatively less receptive to Self-acceptance and Self-acknowledgment than male university students influenced by gender roles 28 , and

an egocentric lifestyle leads to a lack of interpersonal skills. Thus, studies showed that female students are more prone to social anxiety than the male gender on measures that assess social anxiety 29,30 .

*4.2. The Role of Exercise Intensity Between the Amount of Exercise and Social Anxiety in College Students*

The exercise intensity refers to how vigorous the physical activity is [31]. Exercise intensity s considered one of the most important indices of the amount of exercise. Since exercise intensity plays an essential moderating role in the entire physical activity-memory relationship 32 , thus, the optimal exercise intensity should be carefully determined, particularly in acute exercise protocols 33 . A previous study showed that only moderate-to high-intensity aerobic exercise had significantly changed self-reported anxiety symptoms 34 . The high-intensity aerobic exercise reduced negative moods such as anxiety 35 , and vigorous-intensity exercise has been associated with increased well-being 36 and further improvements in the quality of life 37 . This study found that the scores of social anxiety in the high-intensity and high-intensity continuous exercise groups were higher than in other groups. This study found that the scores of social anxiety in the high-intensity and high-intensity continuous exercise groups were higher than in other groups. The result further supports the view that “high-intensity to high-intensity continuous exercise has a more positive effect on the social anxiety of college students.”

*4.3. The Role of Exercise duration Between the Amount of Exercise and Social Anxiety in College Students*

Exercise duration is a significant amount of exercise design parameter [38], which refers to the time spent in a bout or the accumulated time spent for a day or a week 39 . Our previous findings suggest that extended exercise can strengthen the antidepressant effect of endurance exercise interventions 40 . Especially during long-term whole-body resistance exercises involving the more extended exercise of approximately 60 min 41 . Similarly, we found that One hour or more of exercise duration can promote social anxiety level decreased gradually and produce better health effects in college students from the present study.

*4.4. The Role of Exercise Frequency Between the Amount of Exercise and Social Anxiety in College Students*

The exercise frequency refers to how often a person is active [42]. Individuals who exercise for a long time are less likely to develop anxiety problems 43 . However, regular exercise reduces anxiety and improves self-esteem 44,45 .

Notably, this is also consistent with our results. With the intensity and duration increasing gradually over time, physical activity almost daily cannot significantly reduce total social anxiety. Instead, 1 or 2 times a week exercise may have reduced social anxiety in a practical sense. Therefore, the exercise frequency needs to reach the appropriate number of weekly exercise sessions with maximal exercise intensity and time loads. Exercise 1 or 2 times a week may be the best improvement frequency.

# 4.5. The Relationship Between Physical activity and Social Anxiety in College Students

These results suggest that the physical activity (i.e., the amount of exercise) was negatively associated with SA. Besides, the study further concludes that physical activity is negatively correlated with all components of the social anxiety of college students. The score SA showed a notably decreasing trend with increased physical activity levels. Thus, we postulated that there might be a dose-effect relationship. However, few positive effects were found from low exercise to moderate exercise. Besides, the correlation with each other was moderated by the amount of exercise. The higher the impact of the physical activity, the lower the degree of SA they would suffer. These findings may further imply that physical activity can be viewed as an effective means of intervention to cope with SA [46–48]. However, an essential prerequisite is that social anxiety can be improved as long as the threshold of exercise volumes is achieved.

## 4.6. Limitations and Relevance for Future Investigations

Despite its contributions, this study had several limitations. The first was its questionnaires, a cross-sectional study that may influence the findings and cannot explain the causal relationship more strictly. With that in mind, Future studies can utilize more sustained randomized clinical trials (RCTs) experimental to collect valid data that might better elucidate the relationship between physical activity and social anxiety. Secondly, we studied only college students, and may not be extrapolated to the other population segments (e.g., young children, elderly, clinical populations).

# 5. Conclusions

This cross-sectional study found that physical activity would be correlated negatively with social anxiety; the degree of social anxiety may be decreased with increased physical activity levels; the bidirectional association between physical activity and social anxiety would be correlated by the amount of exercise. The most beneficial and optimized exercise plan: Moderate intensity, once or twice a week, and 21–30 minutes of exercise per session may reduce social anxiety.

# Declarations

**Ethics approval and consent to participate** The study was conducted in accordance with the Declaration of Helsinki, and approved by the Ethics Committee of Ocean University of China (OUC-HM-2022-011, 05-11-2022). All the enrolled participants gave informed consent and participated voluntarily in the experiment.

**Consent for publication:** Not applicable.

**Availability of data and materials:** The data presented in this study are available on request from the corresponding author.

**Competing interests:** The authors declare that they have no competing interests

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**Authors' contributions:** Conceptualization, S.L. and W.Y.; methodology, B.L. and X.T.; software, L.G.; validation, M.J., K.L. and L.G.; formal analysis, W.Y.; investigation, K.L. and Q.J.; resources, L.G.; data curation, M.J.; writing—original draft preparation, M.J.; writing—review and editing, S.L.; visualization, W.Y.; supervision, W.Y.; project administration, L.G.; funding acquisition, L.G. All authors have read and agreed to the published version of the manuscript.

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**Authors' information (optional)**

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# Figures

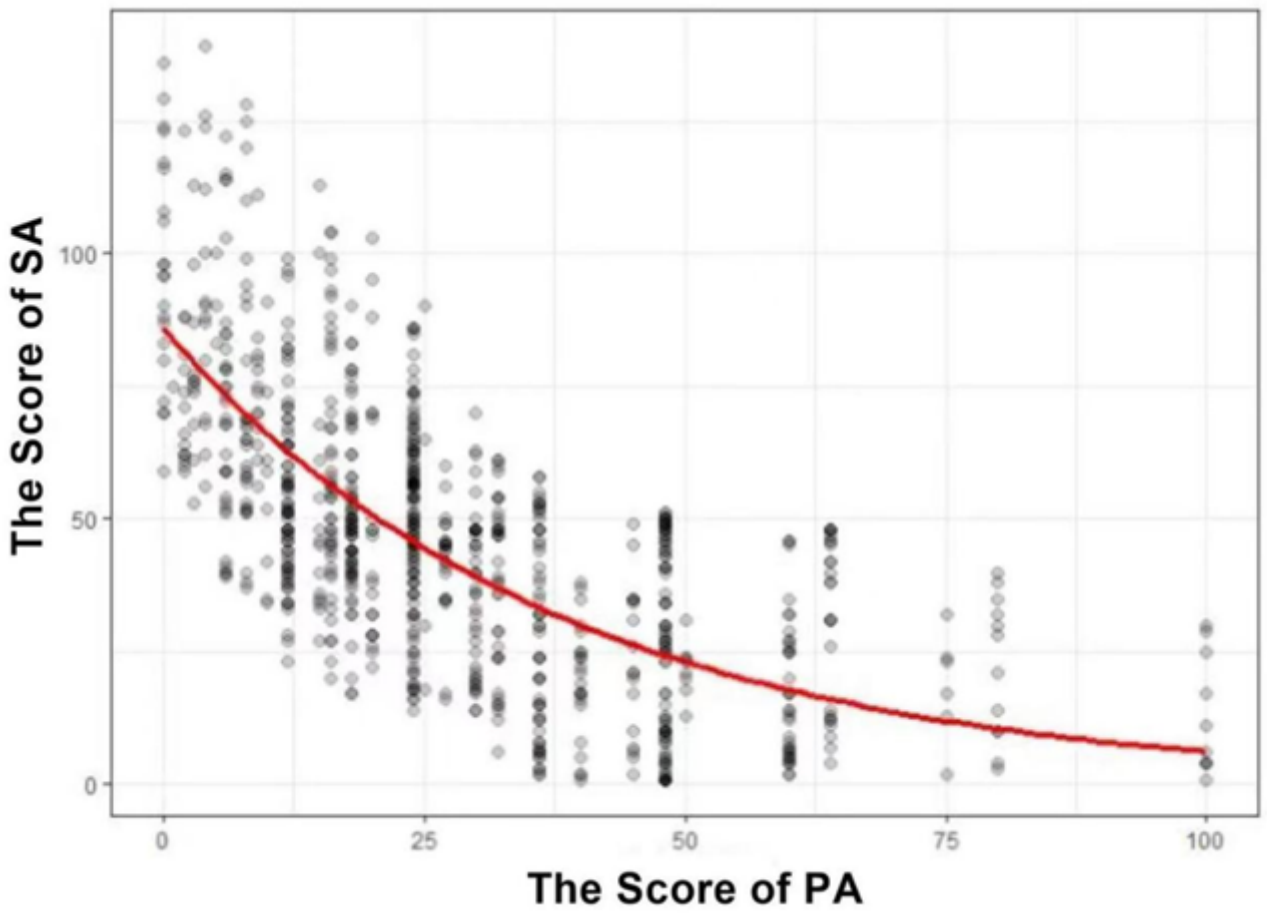


**Figure 1**

Correlation between the total score of physical activity and social anxiety. Note: SA = Social anxiety; PA = Physical Activity.

## Supplementary Files

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- Curvefittingdata.xlsx