

## **Response to Reviewer 1 Comments**

**Point 1:** The article is well structured. Statistical analysis is adequate. However, more information could be obtained by studying the dynamics of changes in the studied indicators.

**Response 1:** According to the suggestions for revision from the experts, our team studied and discussed carefully and have revised the article. We appreciate the pertinent comments from the experts, which benefited our team a lot.

## **Response to Reviewer 2 Comments**

**According to the revision opinions proposed by the expert, our team carefully studied and discussed, and revised the raised issues one by one. We appreciate the pertinent comments from expert, which benefited our team a lot.**

**Point 1:** The abstract started with the aims. A brief introduction can be optionally added. In the methodology of abstract,

**Response 1:** Thanks to the expert's suggestion, we have added a short introduction: Depression is a common mental disorder among college student population, with the main symptoms of persistent low mood, sad emotional experiences, lack of pleasure, listlessness, and impaired cognitive function, accompanied by the tendency to self-harm and suicide.

**Point 2:** the authors stated that the study design was cross-sectional. This is right, but the researchers ignored to calculate the prevalence of depression among the whole population,, please add it.

**Response 2:** Thanks to the expert's suggestion, we have added it in the abstract.

**Point 3:** The conclusion is not well supported. A cross-sectional study design can not lead to a casual relationship. It is better to rewrite the conclusion part.

**Response 3:** Thanks to the expert's suggestion, we have refined the conclusion section, striving for more accurate wording.

**Point 4:** No objectives were mentioned following the introduction, please add them in details.

**Response 4:** Thanks to the expert's suggestion, we have added the research hypothesis in the introduction section. It is unclear whether the behavioral activation system intervenes in the relationship between physical activity and depressive symptoms, much less what its pathways of action are, how it intervenes through the three sub-dimensions of the behavioral activation system including reward responsiveness, drive, and fun seeking, and whether the effects are consistent. To this end, this paper addressed the above questions through a cross-sectional research design with the aim of providing a theoretical basis for a deeper understanding of the relationship between human behavior, emotion, and the nervous system, and

providing a reference for researchers and college administrators. This paper proposed the following research hypotheses: 1. physical activity and behavioral activation system have specificity among college students with different depressive symptom scores; 2. physical activity, behavioral activation system and depressive symptoms are closely related; 3. behavioral activation system can mediate the relationship between physical activity and depressive symptoms, with different effects of sub-dimensions.

**Point 5:** Numbering of sections during constructing the article started with methodology section, but not with the introduction, please correct the numbering system you are following.

**Response 5:** Thanks to the expert's suggestion, we have revised in the article.

**Point 6:** In result section, language expressing the tables needs to be revised.

**Response 6:** Thanks to the expert's suggestion, we have revised in the article.

### **Response to Reviewer 3 Comments**

**According to the revision opinions proposed by the expert, our team carefully studied and discussed, and revised the raised issues one by one. We appreciate the pertinent comments from expert, which benefited our team a lot.**

**Point 1:** Introduction: The current study investigates mental disorders among college students, specifically focusing on depressive symptoms. It is suggested to replace the terms "mental illness" and "mental health problems" with "mental disorders" to align with clinical research terminology.

**Response 1:** Thanks to the expert's suggestion, we have revised the descriptions of "mental illness" and "mental health problems" to "mental disorders" throughout the article.

**Point 2:** Furthermore, it is recommended to include a clear statement on the study hypothesis(es) to provide a more focused direction for the research.

**Response 2:** Thanks to the expert's suggestion, we have added the research hypothesis in the third part of the introduction: 1. physical activity and behavioral activation system have specificity among college students with different depressive symptom scores; 2. physical activity, behavioral activation system and depressive symptoms are closely related; 3. behavioral activation system can mediate the relationship between physical activity and depressive symptoms, with different effects of sub-dimensions.

**Point 3:** The sentence, "based on which the pathways of the behavioral activation system mediating the effect of physical activity level on depressive symptoms in college students with depressive symptoms were clarified," should be rephrased to avoid misinterpretation and reflect the clinical nature of the study.

**Response 3:** Thanks to the expert's suggestion, we have revised to “behavioral activation system can mediate the relationship between physical activity and depressive symptoms, with different effects of sub-dimensions”.

**Point 4:** Methods: The study should clearly outline the inclusion and exclusion criteria for participants.

**Response 4:** Thanks to the expert's suggestion, we have supplemented the inclusion and exclusion criteria for the study subjects.

**Point 5:** Additionally, each statistical analysis should be directly linked to its purpose within the research design.

**Response 5:** Thanks to the expert's suggestion, we have revised in the article.

**Point 6:** Furthermore, further elaboration is needed regarding the division of the whole sample into subsamples, distinguishing between students with and without depression, or with different degrees of depressive symptoms.

**Response 6:** Thanks to the expert's suggestion, we have refined this part and added the following content to the section of research subjects in the article: Beck Depression Inventory-II was used to screen students and a score of  $\geq 14$  was considered as having depressive symptoms, 14-19 as mild depression, 20-28 as moderate depression, and 29-63 as severe depression.

**Point 7:** Results: The statement, "Post hoc multiple comparisons indicated significant differences in physical activity and reward responsiveness ( $P < 0.05$ ) for severe compared to moderate, and in physical activity, reward responsiveness and drive ( $P < 0.01$ ) for severe compared to mild," requires clarification. It is unclear whether "severe compared to moderate" refers to differences in depressive symptoms.

**Response 7:** Thanks to the expert's suggestion, we will be careful with the wording. "Severe compared to moderate" refers to "severe depressive symptoms compared to moderate depressive symptoms among college students", which has been revised and labeled in the article.

**Point 8:** The results should be presented more explicitly, and it would be useful to report the intermediate effect of drive, even if not statistically significant, in Table 3

**Response 8:** Thanks to the expert's suggestion, we have added and marked the results of drive.

**Point 9:** Discussion: The sentence, "The present study showed that only the dimension of reward responsiveness mediated the relationship between physical activity and depressive symptoms," requires further explanation and discussion in subsequent parts of the discussion section.

**Response 9:** Thanks to the expert's suggestion, we have discussed and analyzed it in the article. It is noteworthy that only the pathway of reward responsiveness can

mediate the relationship between physical activity and depressive symptoms. The possible reason is that reward responsiveness, as the initial evaluation of reward, measures early "reward interest", "goal-drive", and persistence, and its effect on depressive symptoms may precede the other two dimensions. The possible reasons why drive and fun seeking do not mediate the relationship between physical activity and depressive symptoms are: drive refers to the degree of willingness to exert effort to obtain a reward and measures late "reward responsiveness" and "impulsivity"; fun seeking is a continuous evaluation of the reward; drive and fun seeking are more significant for major depression which are better predictors of treatment effect for depression. The population included in this study had different conditions with relatively few severe depression symptoms, so it produced such results.

**Point 10:** Additionally, the study's limitations should be addressed to provide a comprehensive understanding of the research's scope and potential constraints.

**Response 10:** Thanks to the experts' suggestion, we added the limitations of the study, specified as: the data of the study were all from subjective reports, which may have some bias, and it is recommended that more objective indicators be used for measurement in the future; this study was conducted as a cross-sectional study, and longitudinal studies are still needed to further confirm the pathways of action.

**Point 11:** Conclusions: The concluding paragraph should be expanded to provide a more in-depth analysis of the study findings.

**Response 11:** Thanks to the experts' suggestion, we have revised and refined the conclusion section.

#### **Response to Reviewer 4 Comments**

According to the suggestions for revision from the experts, our team studied and discussed carefully and have revised the article. We appreciate the pertinent comments from the experts, which benefited our team a lot.

**Point 1:** Grammar: There are a lot of grammatical errors. This must be taken care of and addressed.

**Response 1:** Thanks to the experts' suggestion, we have asked experts in English to assist in revising the grammar of the article.