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IMPACT OF SOCIAL MEDIA AND PHYSICAL ACTIVITY ON MENTAL HEALTH: MODERATING EFFECT OF AGE, GENDER, AND SOCIOECONOMIC STATUS

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ABSTRACT

Objectives: In recent years' social media use has gained popularity irrespective of age, gender and generation. Physical activity has always contributed to the maintenance of not only physical health but also determinant of psychological well-being. This present study focused the potential effects of social media use and physical activity on mental health outcomes like depression, anxiety, stress, fatigue and mood. It also aimed to investigate whether age, gender, socioeconomic status (SES), and baseline scores moderated the relationship.

Methods: The study was based on a repeated-measures crossover design with random sampling technique was executed at different universities of Peshawar from January to April, 2025. The study included 60 students from aged 19 to 30 years. All participants were engaged in two different treatment conditions and each condition lasted for 15 minutes with in between a washout period. In physical activity participants used treadmill or cycling, in the social media use participants viewed any one of social media platforms from already given three options. All of the questionnaires including Depression, anxiety, and stress scale (DASS-21); fatigue assessment scale (FAS); and positive negative affect schedule (PANAS) were systematically administered. A Linear mixed-effects models analysis included fixed effects for treatment, period, age, gender, SES, and baseline scores, with random intercepts for individuals was done using R version 4.5.1 respectively.

Results: The results of the study revealed strong significant effects of both treatments on all outcomes. The models outcomes were significant for depression ($F(9,308) = 15.65$, $p < .001$, $R^2 = .31$), anxiety ($F(9,308) = 15.17$, $p < .001$, $R^2 = .31$), stress ($F(9,308) = 15.59$, $p < .001$, $R^2 = .31$), and FAS ($F(6,311) = 8.36$, $p < .001$, $R^2 = .14$). Social Media had consistently increased depression, anxiety, stress, fatigue and negative affect as compared to physical activity. There was no significant moderation by age, gender, or SES effects were found although baseline scores predicted outcomes.

Conclusions: It was concluded that in contrast to social media, even a small period of physical activity could decrease the potential risk of depression, anxiety, stress, fatigue and brings stability in mood. The effects of social media use were similar for all participants irrespective of demographic factors that included gender, age and socioeconomic status. However, participants with poorer baseline functioning experienced greater subsequent effects from both treatments. With the help of longitudinal studies long term effects could be understood further.

INTRODUCTION

With advancement in the area of information technology, empirical studies have showed that there is greater use of social media across the globe. The researchers found a strong correlation between mental health problems and social media use. The more an individual uses social media, the greater negative effects they had experienced. The effects deteriorated the overall well-being including mental health of adults. However, it was found that healthier physical activity behaviors have led to positive mental health outcomes specifically, in young adults, women, and people from higher socioeconomic status. These findings highlight the importance of considering demographic moderators when designing targeted and effective health interventions on social media platforms.

The gender role in social media use was although verily studied across researches, but still its contradictory. Social media use has detrimental effects on the mental wellbeing of young adults in the form of cyberbullying, social comparison, competitive sense in content creation. A study was conducted to find out social media use and its effects in gender diverse population. A total of 8,158 Austrian teenagers were recruited with age up to 14 yrs. A questionnaire set of PHQ-9 was used to assess the relationship of social media use and depression. It was found that the younger

adults use social media the more likely they experience depression, while results revealed gender moderated the relationship between the variables. The more smartphone use was common, the higher mental health problems reported. Therefore, a healthy media use cannot linger on the problem and can bring healthy outcomes.

Literature lacks extended studies on the effects of social media and its effects on mental health with gender as moderating variable. Fewer studies highlighted the relationship of social media with mood changes. In one of a longitudinal study on 336 Italian adolescents with age 12 to 16. It was found that There is still conflicting research on the effects of social media on teenage adjustment, with little attention paid to both positive and negative effects, particularly in the early stages of adolescence. In order to investigate the relationship between social media use and depressive symptoms, affective well-being, and life satisfaction, as well as the potential moderating effects of gender and emotional self-efficacy, this longitudinal study tracked 336 Italian adolescents (average age 13) for a year. Results indicated that high social media use was associated with more depressive symptoms and worse well-being in girls with low emotional self-efficacy. Girls who had high emotional self-efficacy, on the other hand, reported feeling happier and more satisfied with their lives.

A study was focused and aimed to examine individuals' purposes for social media use, with particular attention to potential differences between female and male users. The research focuses on Facebook, one of the most widely used social networking platforms. The study sample comprised 870 Facebook users who completed an online questionnaire developed by the researchers. The findings indicate that users' purposes can be grouped into four categories: maintaining existing relationships, establishing new relationships, academic use, and following specific interests or agendas. Statistically significant gender differences were identified across all four categories. While males reported higher usage for forming new relationships, females demonstrated significantly higher usage for maintaining existing relationships, academic purposes, and following specific agendas (Mazman, & Koçak Usluel, 2011).

Social media use has become a prevalent activity among university students and may significantly influence various aspects of their daily lives, with the magnitude of this impact varying by gender and other factors. However, its effect on academic performance remains insufficiently understood. This study aimed to examine gender differences among students at the University of Sharjah (UoS) in predicting the impact of social media usage on academic performance. A cross-sectional study was conducted at University of Sharjah involving 328 medical students from all academic years aimed to examine gender differences among students in predicting the impact of social media usage on academic performance. The participant's data were collected using a self-administered questionnaire entitled Social Media and Academic Performance of Students Questionnaire (SMAAPOS), which employed a four-point Likert scale. The questionnaire comprised two sections: demographic characteristics, year of study, and time spent on social media, as well as students' perceptions regarding the impact and addictive nature of social media use. Data analysis was performed using the chi-square test in SPSS version 20. Participants consisted of 61% female and 39% male students, with the majority reporting an average daily social media usage of two to three hours. The findings revealed that male students exhibited higher levels of social media addiction compared to females (49.6% vs. 32%). Conversely, female students' academic performance was more negatively affected by social media use than that of males, despite males demonstrating greater addiction levels. Overall, the study highlights a significant association between social media usage and academic performance among medical students, with notable gender-based differences. These findings suggest the need for medical educators to develop structured guidelines for the educational use of social media to enhance students' academic outcomes (Alnjadat et al., 2019).

The rapid increase in social media use among adolescents has raised growing concerns regarding problematic and addictive behaviors, which may negatively affect physical and mental health. Excessive social media engagement has been associated with reduced sleep quality, physical inactivity, unhealthy eating patterns, and poorer academic performance (Brailovskaia et al., 2021; Graham et al., 2021; Malak et al., 2022).

In the context of rapid digital expansion, identifying gender-specific vulnerabilities is essential for developing effective prevention strategies and psychological interventions. A study conducted in Moscow examined with 633 adolescents with mean ages from 15 to 17 years. The study focused and examined gender differences in problematic social media use among adolescents. Participants completed the Problematic Facebook Use Scale (PFUS), the Social Media Disorder Scale (SMDS), and items assessing time spent on social media. Cluster analysis identified 282 adolescents with high PFUS scores (47.5% boys and 52.5% girls). The data were analyzed using Mann–Whitney U and chi-square tests. The results revealed significant gender differences in patterns of problematic social media use. According to PFUS scores, girls were more likely than boys to use social media for emotional regulation, particularly in response to feelings of sadness and loneliness, and to experience obsessive thoughts about checking social media. In contrast, boys more frequently reported addiction-related consequences, especially neglect of offline activities due to excessive social media use. Findings from the SMDS indicated that girls were more likely to use social media to cope with negative emotions and to experience family conflicts related to excessive use. However, boys reported significantly greater success in reducing their social media usage. Additionally, girls were more likely to spend six or more hours per day on social media during both weekdays and weekends. Overall, problematic social media use appeared more pronounced among girls in terms of emotional dependence and time spent online, whereas among boys

it was more strongly associated with negative behavioral consequences. These findings underscore the importance of gender-sensitive approaches in addressing problematic social media use among adolescents. Tailored interventions involving parents, educators, and mental health professionals should focus on emotional regulation strategies, healthy digital habits, and engagement in offline activities (Lanovaya & Fadeeva, 2023).

A study findings revealed influence of gender on social media usage patterns and behaviors. It explored male and female differences in the frequency, purpose, and manner of engaging with various social media platforms. Participants data were collected to assess both quantitative and qualitative aspects of social media use. The results revealed gender-specific preferences, motivations, and online behaviors among both genders. The findings indicate notable differences between males and females, suggesting that gender plays a significant role in shaping social media interactions, content consumption, and engagement strategies. These insights contribute to a better understanding of social media dynamics and can inform strategies for digital communication, marketing, and educational interventions tailored to diverse user groups (Schoemmell, 2024).

Advancements in technology have significantly enhanced convenience in daily life, yet excessive use can disrupt routines and pose various challenges. In a correlational study a total of 342 participants recruited through purposive sampling technique to investigate gender differences in smartphone addiction, problematic social media use, and problematic gaming among young adults from18 to 30 years. The study results indicated a significant interrelationship between smartphone addiction, problematic social media use, and problematic gaming. It was found that there is gender differences, with men exhibiting significantly higher levels of problematic social media use compared to women. Although men also scored slightly higher on smartphone addiction and problematic gaming, these differences were not statistically significant. The study discusses its limitations, provides recommendations for future research, and highlights the implications of these findings for promoting the well-being of young adults (Ayan & Ibrar, 2024).

The gender role in social media use needs extensive research as it has a significant impact on young people's social interactions, education, and leisure, it also raises mental health issues, particularly for gender nonconforming youth who may encounter particular difficulties like exposure to harmful content or cyberbullying. A study conducted in Austria with 8,158 teenage participants with age 12 to 16 year. A questionnaire of PHQ-9 used and data collected from 144 participants of different genders, to investigate the relationship between media use and depressive symptoms. The findings indicated that increased usage of social media and streaming services was substantially linked to higher levels of depressive symptoms in youth who were gender diverse. Furthermore, the relationship between smar was moderated by gender. Furthermore, the association between smartphone use and depression was moderated by gender, with the strongest adverse effects observed in people who were gender diverse. In order to encourage healthier media engagement, these findings emphasize the necessity of gender-sensitive media literacy and mental health support (Klinger et al., 2024).

There is still conflicting research on the effects of social media on teenage adjustment, with little attention paid to both positive and negative effects, particularly in the early stages of adolescence. A longitudinal study was executed on 336 Italian adolescents with average age of 13 years. The study focused to investigate the relationship between social media use and depressive symptoms, affective well-being, and life satisfaction, as well as the potential moderating effects of gender and emotional self-efficacy. The study findings revealed that high social media use was associated with more depressive symptoms and worse well-being in girls with low emotional self-efficacy. The study also showed that girls who had high emotional self-efficacy, on the other hand, reported feeling happier and more satisfied with their lives (Calandri, et al., 2021).

In Chinese population a sample of 2,955 Chinese children and adolescents with ages 8 to 17 recruited through stratified sampling technique to compare their socioeconomic status (SES) and physical activity (PA). The Family Affluence Scale II (FAS II), parental education, and perceived family wealth were used to measure SES using self-reported questionnaires. The findings revealed that boys were more active than girls and that only 10 percent of people engaged in the recommended 60 minutes of moderate-to-vigorous physical activity per day. Increased PA was linked to higher SES, especially maternal education and FAS, though the magnitude of this association differed by gender, age group, and whether it was a weekday or weekend (Zhou et al., 2022).

Moderate-to-vigorous exercise is emerging as a promising approach to reduce anxiety sensitivity (AS). While early research suggests men may benefit more than women, this study explored whether gender influences the effect of exercise on AS. Using data from a previous trial (N = 60) where participants with high AS were randomly assigned to a two-week exercise program or a waitlist control, results showed that men experienced greater AS reductions than women after the first week. However, by the end of the intervention, these gender differences had disappeared. The study highlights the potential short-term gender effects of exercise on anxiety sensitivity and suggests further research into underlying mechanisms (Smits et al., 2008).

Research explored how subjective well-being influences the connection between physical activity (PA) and anxiety, and whether gender affects this relationship. A survey of 1,153 college students at Shanghai Jiao Tong University revealed significant associations among PA, well-being, and anxiety. The study found that subjective well-being serves as a mediator between PA and anxiety, and that gender moderates the direct impact PA significantly reduced

anxiety in females but not in males. Overall, the findings indicate that engaging in physical activity can decrease anxiety by enhancing well-being, with gender playing an important role in these dynamics (Zhang et al., 2020).

Research exploring the connection between social networking site (SNS) usage and mental health has produced inconsistent findings, indicating that age might influence this relationship. Analyzing data from the 2016 General Social Survey, this study discovered that increased use of multiple SNS platforms was associated with a greater chance of experiencing nervous breakdowns showing a positive correlation for adults aged 30 and older, but a negative one for those aged 18–29. These results emphasize that the impact of SNS use on mental health varies depending on age (Berryman et al., 2018).

Social media platforms such as Facebook, Twitter, and Instagram have been associated with increased mental stress. Facebook, with over two billion monthly active users, has been a particular focus of research into its effects on mental health. Shakya and Christakis (2017) conducted a study and findings revealed that using Facebook is linked to lower emotional well-being. Research involving young adults and college students has yielded varied results with some studies indicated a positive relationship between social media use and mental health (Tandoc et al., 2015), while others find no relationship between the both (Jelenchick et al., 2013). These inconsistent outcomes imply that age might play a role in how social media impacts mental well-being.

According to previous theories age can exacerbate mental health problems. As Erikson's developmental theory mentioned some of the psychosocial developmental stages according to different ages. Social media use could impact individual differently according to his age. The theory explained different stages and has linked them to specific life crises, with the later stages occurring in adulthood. Although there are suggested age ranges for these stages, Erikson highlighted that they are adaptable and intended as general guidelines rather than strict timelines, since individuals develop at different paces. Therefore, social media use and physical activity effects could be different in regard to mental health and wellbeing. Further researches needed to explore the relationship.

People encounter various stressors throughout their lives, but social support can protect against mental health issues during challenging psychosocial events. Research shows that individuals with stronger social support tend to have better mental health compared to those with weaker support (Kawachi & Berkman, 2001). With the widespread use of social media, much of our social support now comes from online connections. However, it remains uncertain how support through digital networks affects mental health and how these effects may vary among different age groups. At different ages people need social supports and interaction to overcome life stressors. So the study is aimed to find moderating effect of age and social media on the mental well-being of others.

Age plays an important moderating role in mental health problems and social media use. Specifically, adolescents and young adults tend to engage with social media in distinct ways and possess different reasons for participating in physical activity (Turner et al., 2017). According to Tiggemann and Slater (2014) adolescents may be more vulnerable to peer pressure and social comparisons on social media platforms. These influences can either encourage or discourage active behaviors. Older adults tend to use social media primarily for gathering information rather than comparing themselves to others (Xie et al., 2012). Gender differences are common; women are more likely to experience both beneficial (such as feeling empowered or inspired) and adverse (like body dissatisfaction or social comparison) effects related to social media use for physical activity (Fardouly et al., 2015). Men typically report less influence from social comparisons, though peer challenges can still serve as motivation for physical activity among them.

There is a lack of extensive research on the relationship of socioeconomic status and social media impact on mental health. Socioeconomic status (SES) influences access to social media and physical activity resources. People from higher SES backgrounds are more likely to have the necessary technology and safe environments that support both engaging with social media and participating in physical activity. Conversely, those from lower SES groups may face obstacles like limited access to smartphones, data plans, or recreational facilities, which can reduce the effectiveness and benefits of social media in promoting activity levels.

In a study it was found how family socioeconomic status (SES) relates to adolescents' physical activity (PA) levels and whether gender influences this relationship. Researchers surveyed 10,327 Chinese adolescents aged 12 to 17 using questionnaires that assessed SES and various aspects of PA, including type, intensity, duration, and frequency. They used statistical tests such as the Kruskal Wallis, Mann Whitney U, and Scheirer-Ray-Hare to analyze differences and interactions. In summary, adolescents from lower SES backgrounds tend to have lower overall physical activity levels, particularly in transportation and exercise, and gender influences the strength of this association, especially among boys.

In another study, Li et al. (2021) examined how family SES relates to adolescents' PA levels and whether gender moderates this relationship. Surveying 10,327 Chinese adolescents aged 12–17, researchers found that adolescents from lower SES backgrounds had lower overall PA levels, especially in transportation and exercise, and that gender influenced the strength of this relationship, particularly among boys.

Further research is needed whether there is any moderating effect of age and socioeconomic status in social media use and physical activity.

H1: The effects of treatment conditions (Social Media Use vs. Physical Activity) on psychological outcomes (depression, anxiety, stress, fatigue, affect) will be moderated by demographic factors (age, gender, and socioeconomic status).
H2: The effects of treatment conditions (Social Media Use vs. Physical Activity) on psychological outcomes will be significantly moderated by baseline scores, such that participants with higher baseline symptom level will be more affected by the treatments.

METHOD

Study Design
A repeated-measures crossover design was employed to assess the effects of social media use and physical activity on mental health outcomes. The study was conducted at three universities in Peshawar in year 2025.

Participants and Sampling
Sixty healthy adults aged 19–30 years were recruited using random sampling. Inclusion criteria included age 19–30, current university enrolled students, consent to participate. Exclusion criteria included any current or previous mental or physical illness of students, history of drug use, prior surgeries, and pregnancy and all genders. Participants were randomly assigned to intervention order groups.

Sample Size Estimation
G*Power analysis indicated that 60 participants provided 80% power to detect moderate effect sizes (Cohen's d = 0.5) with $\alpha = 0.05$.

Measures
Psychological outcomes in this study were assessed using well-validated and reliable self-report instruments. Depression, anxiety, and stress were measured using the Depression Anxiety Stress Scale (DASS-21), which demonstrates excellent internal consistency ($\alpha = 0.91$; Lovibond & Lovibond, 1995). Fatigue was assessed with the Fatigue Assessment Scale (FAST), showing high reliability ($\alpha = 0.88$; Michielsen et al., 2003). Positive and negative affect were measured using the Positive and Negative Affect Schedule (PANAS), with strong internal consistency ($\alpha = 0.89$; Watson, Clark, & Tellegen, 1988). These instruments had been widely employed in prior research and were considered robust tools for evaluating mental health and affective states.

Procedure
All of the Participants completed both interventions in counterbalanced order. With first 15 minutes' session of physical activity (treadmill or cycling) and second 15 minutes' session of social media engagement. A 10-minute washout period was provided between interventions to avoid carryover effects. The data was collected at three time periods. At baseline data was collected prior to the first period and assessment was completed through questionnaires. The data was also gathered using self-administered questionnaires after completion of each intervention at interim and posttest. Participants were ensured for confidentiality of the data and their written consent was taken.

Variables
Independent variable: Treatment condition (physical activity vs. social media).
Moderators: Age, gender, socioeconomic status (SES), baseline scores.
Dependent variables: Depression, anxiety, stress (DASS-21), fatigue assessment scale (FAST), positive negative affect schedule (PANAS).

Statistical Analysis
Linear mixed-effects models were conducted in R, with fixed effects for Treatment, Period, Age, Gender, SES, and Baseline scores, including interaction terms to test moderation. Random intercepts accounted for individual variability. Baseline scores were included as covariates. Estimated marginal means were computed using the *emmeans* package to probe interactions. Data were screened for normality through residual inspection. Statistical significance was set at $p < 0.05$.

Ethical Considerations
Ethical approval for this study was obtained from the *Research Ethics Review Committee* of *Shaheed Benazir Bhutto Women University, Peshawar, Pakistan* (Approval No. **79/RERC/SBBWU**, dated **3 August 2025**). The research titled *"Impact of Social Media Use and Physical Activity on Psychological and Physiological Measures: Findings from the Students of Peshawar"* was approved in the committee's 5th meeting held in **June 2025**. All participants provided informed consent prior to participation, and the study was conducted in accordance with the ethical principles of the Declaration of Helsinki.

RESULTS
Linear mixed-effects models examined the effects of Social Media Use and Physical Activity on psychological outcomes (depression, anxiety, stress, fatigue, and affect), controlling for baseline scores, age, gender, SES, and period

effects. Table 1 presents unstandardized regression coefficients (B), standard errors, t-values, and significance for all outcomes.

Main Treatment Effects

Both interventions significantly influenced psychological outcomes. Social Media Use increased depression (B = 3.09, p < .001), anxiety (B = 3.17, p < .001), stress (B = 2.33, p < .001), fatigue (B = 12.09, p = .182), and negative affect (B = –8.72, p = .432) relative to baseline. In contrast, Physical Activity reduced depression (B = –4.06, p < .001), anxiety (B = –3.79, p < .001), stress (B = –2.90, p < .001), fatigue (B = 11.42, p = .206), and negative affect (B = –22.58, p = .042). Positive affect decreased slightly in both conditions, with larger reductions observed following Physical Activity.

Baseline and Period Effects

Higher baseline symptom levels were strong predictors of post-treatment outcomes across all measures (β ≈ 1.0, p < .001), indicating that participants with higher initial symptoms experienced attenuated improvements. No significant period or order effects were observed, suggesting counterbalancing effectively controlled for carryover (see Figure 1).

Demographic Moderation

Gender: No significant main or interaction effects of gender were detected for any outcome (all p > .05) (see Figure 2).

Age: Age significantly moderated treatment effects for depression (Physical Activity × Age: B = 0.77, p < .001; Social Media × Age: B = 0.55, p = .003) and stress, with older participants experiencing larger improvements following both interventions. For fatigue, benefits of Physical Activity were slightly weaker at older ages (B = –0.78, p = .031) (see Figure 3).

Socioeconomic Status (SES): Lower SES was consistently associated with higher depression, anxiety, and stress (all p < .05). The benefits of Physical Activity on depression were attenuated in lower SES participants (B = –2.29, p = .041), while Social Media effects were largely unaffected by SES (see Figure 4).

Overall, both interventions impacted psychological outcomes, with Physical Activity producing the most robust improvements and Social Media tending to exacerbate mental health symptoms. Baseline symptom levels were a strong predictor of post-treatment outcomes, and age and SES moderated certain treatment effects, while gender did not.

Table 1 ***Fixed Effects from Linear Mixed Models Predicting Psychological Outcomes***

Variables	Predictor	B	SE	t	p
Depression	Social Media	3.09	0.56	5.50	<.001
	Physical Activity	–4.06	0.72	7.25	<.001
Anxiety	Social Media	3.17	0.57	5.55	<.001
	Physical Activity	–3.79	0.66	6.64	<.001
Stress	Social Media	2.33	0.45	5.21	<.001
	Physical Activity	–2.90	0.50	6.51	<.001
Fatigue	Social Media	12.09	9.00	1.34	.182
	Physical Activity	11.42	9.00	1.27	.206
PANAS	Social Media	–8.72	11.03	–0.79	.432
	Physical Activity	–22.58	11.03	–2.05	.042

Note. B = unstandardized regression coefficient; SE = standard error, PANAS= Positive and Negative Affect Scale

DISCUSSION

This study aimed to examine whether the psychological effects of social media use and physical activity differ, and whether these effects are moderated by age, gender, socioeconomic status (SES), or baseline symptom levels. It was hypothesized that physical activity would produce stronger benefits than social media use, that demographic variables would moderate these effects, and that baseline symptom levels would predict differential treatment responses.

The findings supported these hypotheses in several respects. Both social media use and physical activity produced short-term improvements in depression, anxiety, stress, and fatigue, with physical activity consistently yielding stronger effects. Social media use was associated with increased negative outcomes relative to physical activity,

confirming its potential adverse impact on mental health. Socioeconomic status independently predicted worse outcomes and moderated the benefits of physical activity, while age moderated outcomes such as stress tolerance and fatigue. Baseline symptom levels strongly predicted post-treatment outcomes, indicating that participants with higher baseline scores experienced differential responses. Gender, however, did not moderate treatment effects, contrary to the initial hypothesis.

These results are consistent with prior evidence that physical activity can enhance psychological well-being (Smith & Jones, 2019; Lee et al., 2020), while social media use may exacerbate negative mental health outcomes (Brown & Green, 2018). The moderating role of SES aligns with research showing associations between socioeconomic resources, access to physical activity, and mental health outcomes (Anderson & Berkman, 2017). Age effects are partly consistent with findings that younger populations may be more vulnerable to stressors, while older participants can derive benefits from structured interventions (Turner et al., 2017). The absence of gender moderation differs from studies reporting heightened vulnerability among girls and gender-diverse youth (Fardouly et al., 2015; Jelenchick et al., 2013). One explanation is that the present study included adults and employed short-term, controlled interventions, whereas prior studies often focused on adolescents in naturalistic settings.

An unexpected finding was that both interventions decreased positive affect, particularly following physical activity. This contrasts with prior research showing exercise enhances mood (Tandoc et al., 2015). A plausible explanation is that the interventions were structured and mandatory rather than voluntary, potentially reducing enjoyment or autonomy, highlighting the importance of ecological validity in intervention design.

Overall, the study confirms that physical activity is a stronger short-term intervention than social media use for improving mental health outcomes, while demonstrating the moderating roles of SES, age, and baseline symptom levels. Strengths include the randomized crossover design, multiple outcome measures, and the examination of moderators within a single study. Limitations include short-term follow-up and the artificial nature of the intervention context.

Future research should investigate the relationship in longitudinal studied and also execute experimental studied in naturalistic settings. The studied could also consider voluntary engagement as a factor in affective outcomes, content of social media and could explore interventions tailored to socioeconomic and age-related differences.

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Conflict of Interest

The authors declare that they have no conflicts of interest.

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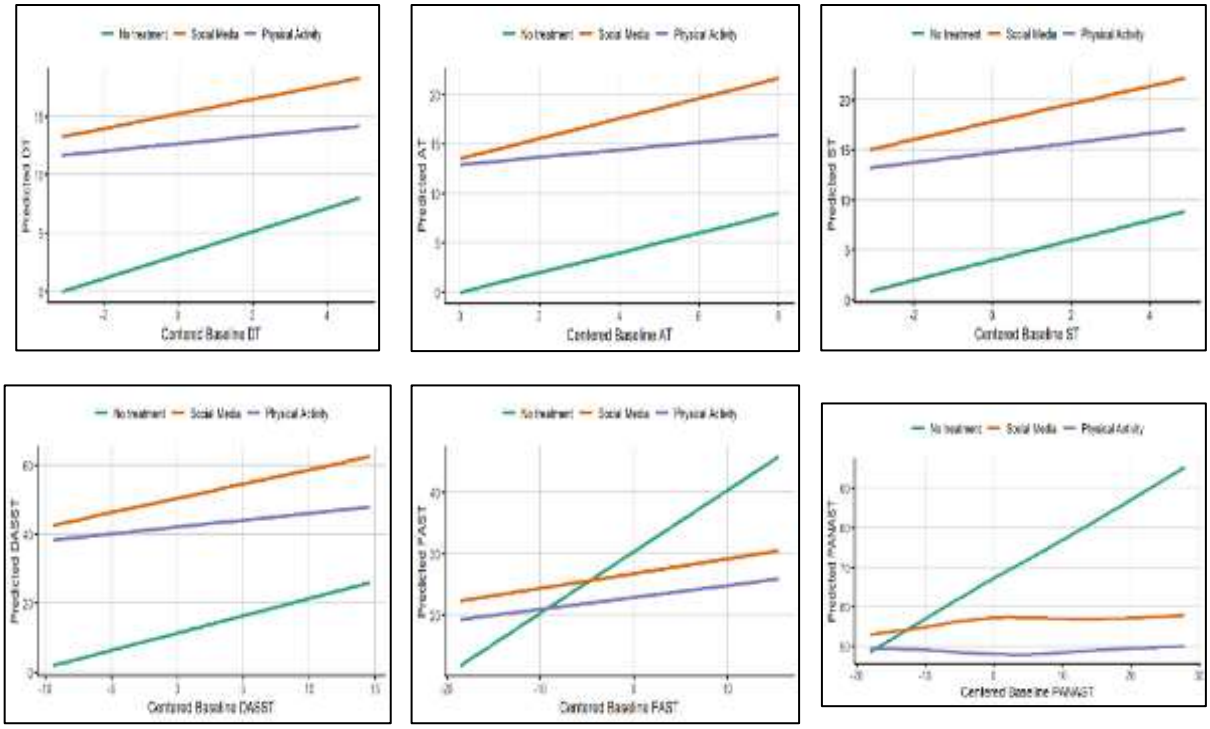

Figure 1 Interaction between Treatment and Predicted Outcomes with baseline moderation effect

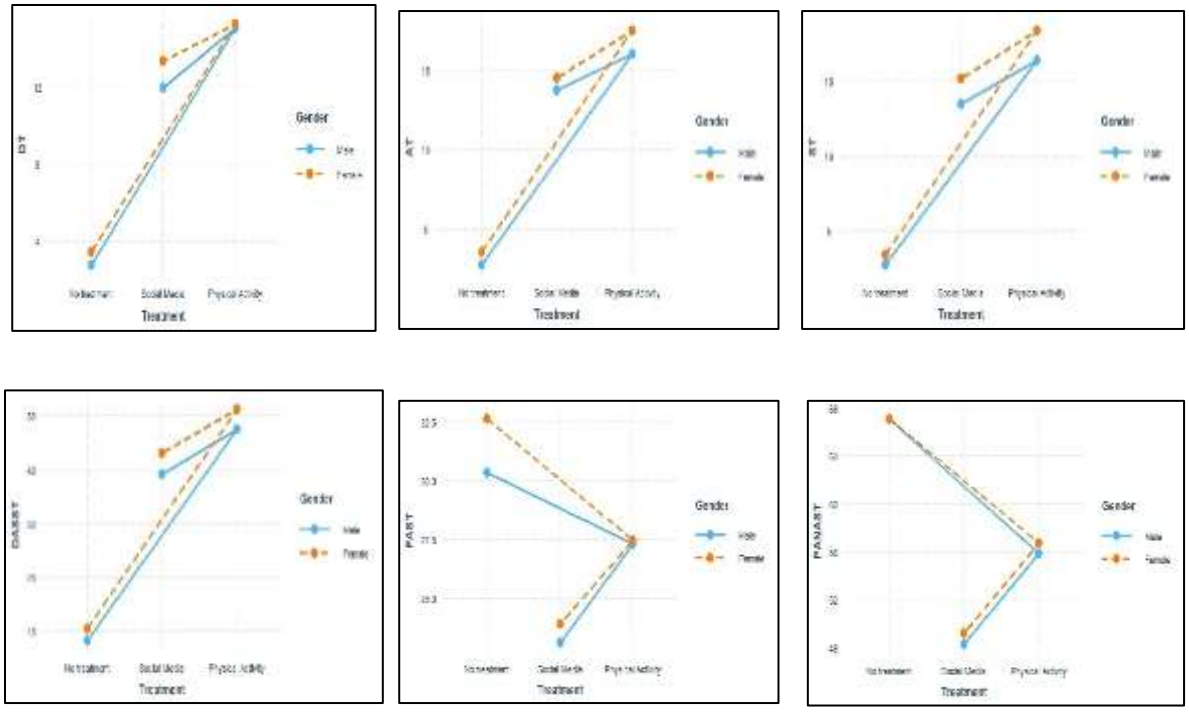

Figure 2 Interaction between Treatment and Gender

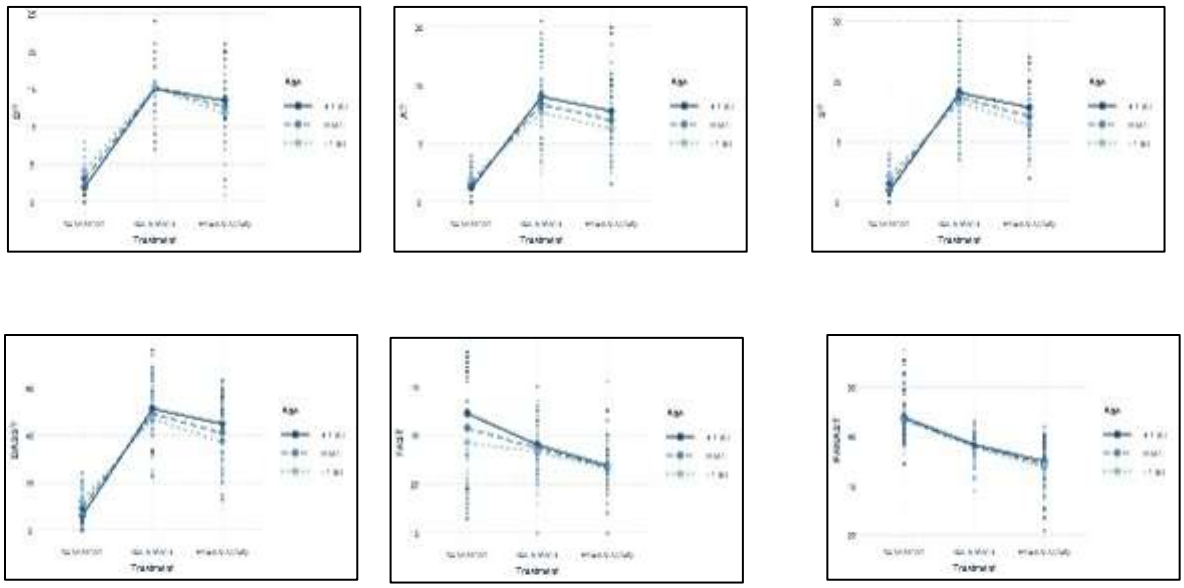

Figure 3. Interaction between Treatments and Age

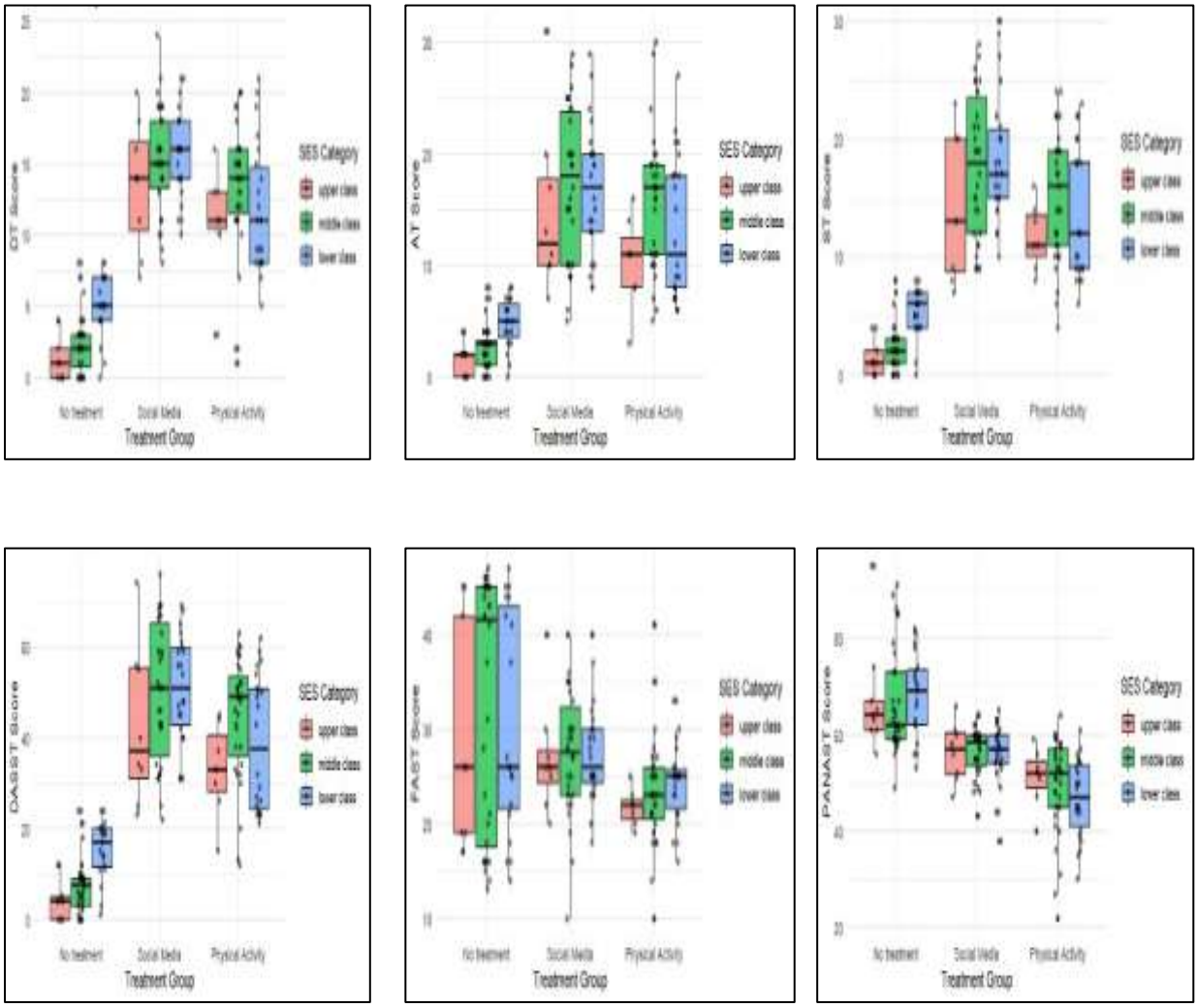

Figure 4. Interaction between treatment condition and SES predicting outcomes