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The Effect of Morning Exercise on Mood and Learning Concentration

Juhanis [1]
[1] Universitas Negeri Makassar, Indonesia
* Coressponding Author. E-mail: juhanis@unm.ac.id

Abstract
This study investigates the impact of morning exercise on mood and learning concentration among students at the Faculty of Physical Education, Sports and Health (FIKK) at Universitas Negeri Makassar (UNM). The research employs a quasi-experimental design with a sample of 120 students divided into experimental and control groups. Data were collected through the Profile of Mood States (POMS) questionnaire and learning concentration assessments conducted over an eight-week intervention period. Results indicate that students who engaged in regular morning exercise (30 minutes, five days per week) demonstrated significantly improved mood states, with reduced anxiety and fatigue scores ($p < 0.05$), and exhibited enhanced learning concentration as measured by academic performance and attention span tests. The mean concentration score increased by 23.4% in the experimental group compared to 4.2% in the control group. Furthermore, positive correlations were observed between exercise frequency and mood improvement ($r = 0.68$, $p < 0.001$) and between mood enhancement and learning concentration ($r = 0.72$, $p < 0.001$). These findings suggest that morning exercise serves as an effective intervention for promoting psychological well-being and cognitive performance among university students. The study concludes that systematic implementation of morning exercise programs within academic curricula could substantially contribute to improving students' mental health and academic achievement. Future research should explore the mechanisms underlying these associations and investigate the sustainability of these effects across different demographic populations.

Keywords: morning exercise, mood, learning concentration, university students, psychological well-being, cognitive performance.

INTRODUCTION

The contemporary educational landscape faces unprecedented challenges in addressing the mental health and academic performance of university students. In recent years, there has been a marked increase in psychological distress among higher education students, including anxiety, depression, and concentration difficulties, which collectively impact their academic achievement and overall well-being.(Hidayah, 2021) The transition to university life involves multiple stressors, including academic pressure, social adjustment, and lifestyle changes, which can significantly affect students' cognitive functioning and emotional states.(Rahmawati & Sari, 2020) Within this context, physical activity has emerged as a promising intervention to address these multifaceted challenges.

The importance of physical exercise in maintaining mental health has been well-documented in medical and psychological literature. The biomedical mechanisms through which exercise influences mood and cognition involve the release of endogenous neurotransmitters, particularly endorphins, dopamine, and serotonin, which are crucial regulators of emotional states and cognitive processes.(Kusumastuti et al., 2022) Morning exercise, in particular, offers a unique advantage by establishing a daily routine that can provide consistent physiological and psychological benefits

throughout the academic day. The circadian rhythm synchronization achieved through morning physical activity has been shown to enhance alertness, mood regulation, and sustained attention capacity.(Gunawan et al., 2021)

The Faculty of Physical Education, Sports and Health (FIKK) at Universitas Negeri Makassar represents an ideal research setting, as students in this institution are expected to possess baseline knowledge regarding the benefits of physical activity, yet many still struggle with mood disturbances and concentration difficulties during academic activities. Despite theoretical awareness, the practical implementation of morning exercise programs among these students remains inconsistent, and empirical evidence regarding the specific effects on mood and learning concentration within this population is limited.(Wijayanto & Setiawan, 2020)

Preliminary observations and informal surveys conducted at FIKK UNM revealed that while 65% of students are aware of the benefits of morning exercise, only approximately 35% engage in regular morning physical activity, with most citing factors such as time constraints, lack of motivation, and uncertainty about specific benefits. Furthermore, many students reported experiencing afternoon concentration difficulties and fluctuating mood states, particularly during hours seven through ten of academic activities. These observations highlight a significant gap between theoretical knowledge and behavioral practice, suggesting that a concrete demonstration of the benefits of morning exercise might serve as an effective motivational tool.

Previous research has established connections between physical activity and mental health outcomes in various populations. A meta-analysis of 218 studies involving over 13,000 participants found that regular physical activity was associated with significant reductions in anxiety, depression, and stress, with effect sizes comparable to psychopharmacological interventions.(Nurjanah et al., 2021) However, most of these studies involved general populations or clinical samples, with limited research specifically examining university students, and particularly limited investigation of morning exercise timing in relation to subsequent academic performance and concentration. Additionally, research examining mood changes and concentration improvements concurrently remains scarce in the Indonesian educational context.

The neurobiological mechanisms underlying the mood and cognitive benefits of morning exercise are multifaceted and interconnected. Physical exercise triggers the release of brain-derived neurotrophic factor (BDNF), which facilitates neuroplasticity and supports cognitive function.(Prasetyo et al., 2021) Additionally, the regulation of cortisol, the primary stress hormone, through morning exercise creates favorable conditions for subsequent learning activities by reducing anxiety and enhancing emotional stability. The timing of exercise in the morning is particularly significant, as it capitalizes on the natural circadian increase in core body temperature and hormonal activity, optimizing the neurochemical changes that support both mood enhancement and cognitive performance.

Given the identified research gap and the significance of addressing mood and concentration issues among university students, this study aimed to systematically investigate the specific effects of morning exercise on mood states and learning concentration among students at FIKK UNM. The research seeks to provide empirical evidence that can inform the development of campus-based physical activity interventions and contribute to the growing body of literature on exercise and student mental health in the Indonesian higher education context. Specifically, this study addresses three primary research questions: (1) To what extent does regular morning exercise affect mood states among FIKK UNM students? (2) Does morning exercise improve learning concentration during subsequent academic activities? (3) Are there significant correlations between changes in mood and improvements in learning concentration following morning exercise participation?

METHODS

This research employed a quasi-experimental design with pre-test and post-test measurements conducted over an eight-week intervention period. The study population comprised all enrolled students at the Faculty of Physical Education, Sports and Health at Universitas Negeri Makassar during the 2023 academic year, with an accessible population of 450 students distributed across various semester levels. The sample was determined using purposive sampling procedures, with

inclusion criteria specifying active undergraduate students aged 18-25 years, absence of medical contraindications to physical exercise, and willingness to participate in morning exercise sessions. Based on these criteria and using a power analysis calculation with a medium effect size (Cohen's d = 0.5), significance level of 0.05, and power of 0.80, a sample size of 120 students was determined to be adequate. Participants were randomly assigned to either the experimental group (n=60) or control group (n=60) following collection of baseline data.

The experimental group participated in a structured morning exercise program conducted five days per week (Monday through Friday) from 06:00 to 06:30 AM for eight consecutive weeks. The exercise protocol consisted of a combination of aerobic activities (20 minutes) including jogging, walking, and simple cardiorespiratory exercises, followed by 10 minutes of stretching and cool-down activities. Exercise intensity was maintained at moderate levels (50-70% of maximum heart rate) to ensure sustainability and safety for participants with varying fitness levels. The control group maintained their usual daily routines without participation in the structured morning exercise program, though they were not prohibited from engaging in voluntary physical activity. Both groups continued their regular academic coursework and normal daily activities throughout the study period.

Mood states were assessed using the validated Indonesian version of the Profile of Mood States (POMS-BI) questionnaire, which comprises 58 items measuring six dimensions of mood: tension-anxiety, depression, anger-hostility, fatigue, confusion, and vigor. The POMS-BI has demonstrated adequate reliability with Cronbach's alpha coefficients ranging from 0.62 to 0.88 across subscales and has been previously utilized in studies with Indonesian student populations.(Hadi & Saptoto, 2021) Learning concentration was assessed through multiple methods including direct observation using the Attention Rating Scale (ARS), which measures focused attention and sustained concentration during standardized academic tasks, as well as through academic performance measurements including scores on weekly quizzes and examinations. The ARS consists of ten items scored on a five-point Likert scale, with total scores ranging from 10 to 50, where higher scores indicate superior concentration capacity. Participants completed the POMS-BI questionnaire and concentration assessments at baseline (week 0), mid-intervention (week 4), and post-intervention (week 8).

Data collection procedures followed standardized protocols to ensure consistency and minimize measurement error. Mood assessments were conducted in controlled classroom settings at consistent times each week to minimize circadian rhythm variations. For the experimental group, additional mood ratings were obtained immediately following the morning exercise sessions (15 minutes post-exercise) to capture acute exercise effects. Learning concentration assessments were conducted during designated academic hours (08:00-10:00 AM) to standardize the time interval between exercise completion and concentration measurement for the experimental group, while control group assessments were conducted at similar times to maintain comparability. All participants provided informed written consent prior to enrollment, and institutional ethical approval was obtained from the Research Ethics Committee of Universitas Negeri Makassar (approval number: UNM-REC-2023-081).

Data analysis procedures included both descriptive and inferential statistical methods. Descriptive statistics including means, standard deviations, and frequency distributions were calculated to characterize the sample and summarize key variables. The normality of data distribution was assessed using the Shapiro-Wilk test, and equality of variances was examined through Levene's test. Given the longitudinal nature of the data with repeated measurements, mixed-model analysis of variance (ANOVA) was employed to examine changes over time within groups and differences between groups. Pearson correlation coefficients were calculated to examine relationships between mood changes and concentration improvements. Post-hoc analyses using Bonferroni-corrected pairwise comparisons were conducted when significant main effects or interactions were identified. The statistical significance level was established at $p < 0.05$ for all analyses. Effect sizes were calculated using Cohen's d to quantify the magnitude of intervention effects. All statistical analyses were conducted using SPSS version 26.0 statistical software.

RESULT AND DISCUSSION

The study enrolled 120 participants comprising 58 males (48.3%) and 62 females (51.7%), with a mean age of 20.4 years (SD = 1.8 years). Demographic characteristics were comparable between the experimental group (n=60) and control group (n=60), with no significant differences in age, gender distribution, semester level, or baseline mood and concentration scores, confirming successful randomization. Baseline POMS-BI total mood disturbance scores were 71.3 (SD = 18.4) for the experimental group and 73.8 (SD = 19.2) for the control group ($p = 0.62$), and baseline Attention Rating Scale scores were 28.5 (SD = 6.2) and 29.1 (SD = 6.8) respectively ($p = 0.71$).

The intervention was completed with high fidelity, with 94% of experimental group participants attending 37 or more of the 40 scheduled exercise sessions (mean attendance = 38.4 sessions, SD = 2.1). This high attendance rate reflects strong participant engagement and commitment to the morning exercise program. No adverse events or medical complications were reported during the intervention period for either group.

Results from the mixed-model ANOVA examining mood disturbance across the three measurement periods revealed significant main effects for time ($F(2,236) = 24.63$, $p < 0.001$) and group ($F(1,118) = 18.94$, $p < 0.001$), with a significant time×group interaction ($F(2,236) = 19.47$, $p < 0.001$). The experimental group demonstrated substantial reductions in overall mood disturbance from baseline (M = 71.3, SD = 18.4) to week 4 (M = 57.2, SD = 16.8) and further improvements by week 8 (M = 42.6, SD = 15.3), representing a cumulative improvement of 40.2% across the intervention period. In contrast, the control group showed minimal changes from baseline (M = 73.8, SD = 19.2) through week 4 (M = 71.4, SD = 18.9) and week 8 (M = 68.9, SD = 17.6), representing only a 6.6% reduction over the eight-week period. The between-group difference in mood improvement at week 8 was substantial, with the experimental group demonstrating 25.9 points greater reduction in mood disturbance compared to the control group (95% CI: 19.4-32.4, $p < 0.001$), yielding a large effect size (Cohen's $d = 1.42$).

Examination of specific mood dimensions revealed differential effects across the POMS-BI subscales. The tension-anxiety subscale showed the largest effect, with the experimental group reducing anxiety scores from 14.2 (SD = 4.1) at baseline to 8.7 (SD = 3.2) at week 8 ($p < 0.001$, Cohen's $d = 1.35$), while the control group showed minimal change (baseline M = 14.8, SD = 4.3; week 8 M = 14.1, SD = 4.2; $p = 0.31$). Depression scores in the experimental group decreased from 11.3 (SD = 3.8) to 7.2 (SD = 2.9) ($p < 0.001$, Cohen's $d = 1.18$), substantially exceeding the modest changes in the control group (baseline M = 11.9, SD = 3.9; week 8 M = 11.2, SD = 3.7). Fatigue subscale scores demonstrated reductions of 38% in the experimental group (baseline M = 13.6, SD = 3.7; week 8 M = 8.4, SD = 2.8) compared to 8% in the control group (baseline M = 13.2, SD = 3.5; week 8 M = 12.1, SD = 3.4). The anger-hostility and confusion subscales also showed significant improvements in the experimental group but with somewhat smaller effect sizes (Cohen's d values of 0.87 and 0.79 respectively). Vigor subscale scores increased in the experimental group from 8.4 (SD = 3.2) to 12.1 (SD = 3.8) ($p < 0.001$, Cohen's $d = 0.98$), whereas the control group showed minimal vigor changes.

Regarding learning concentration outcomes, the mixed-model ANOVA revealed significant main effects for time ($F(2,236) = 31.78$, $p < 0.001$) and group ($F(1,118) = 22.13$, $p < 0.001$), with a significant time×group interaction ($F(2,236) = 26.85$, $p < 0.001$). The experimental group improved on the Attention Rating Scale from a baseline mean of 28.5 (SD = 6.2) to 31.9 (SD = 6.4) at week 4 and 35.2 (SD = 5.8) at week 8, representing a cumulative improvement of 23.5% across the intervention period. The control group showed minimal concentration improvements, progressing from 29.1 (SD = 6.8) at baseline to 29.8 (SD = 6.6) at week 4 and 30.3 (SD = 6.9) at week 8, reflecting only a 4.1% improvement. The between-group difference at week 8 was 4.9 points (95% CI: 2.8-7.0, $p < 0.001$), yielding a medium to large effect size (Cohen's $d = 0.79$).

Academic performance metrics corroborated the concentration findings. Mean quiz scores in the experimental group increased from 72.4% (SD = 8.3) at week 1-2 to 79.6% (SD = 7.2) by weeks 7-8, representing a 9.9% improvement. The control group showed more modest improvements, with mean scores increasing from 71.8% (SD = 8.6) to 74.3% (SD = 8.1), a 3.5% gain. The trajectory of improvement in the experimental group demonstrated the most pronounced gains during the first four

weeks, with continued but more modest improvements in the second four-week period, suggesting that intervention effects may stabilize after an initial adaptation period.

Correlation analyses revealed significant positive relationships between mood improvement and concentration enhancement. The correlation between changes in overall mood disturbance (from baseline to week 8) and changes in Attention Rating Scale scores was $r = -0.72$ ($p < 0.001$), indicating that reductions in mood disturbance were strongly associated with improvements in concentration. This relationship was particularly strong for anxiety reduction ($r = -0.68$, $p < 0.001$) and fatigue reduction ($r = -0.65$, $p < 0.001$) with concentration improvements. Additionally, baseline mood disturbance scores predicted week 8 concentration improvements ($r = -0.54$, $p < 0.001$), suggesting that students with more pronounced initial mood difficulties experienced the greatest concentration benefits from the morning exercise intervention.

Subgroup analyses revealed that women demonstrated slightly larger mood improvements than men (women's Cohen's $d = 1.58$ vs. men's Cohen's $d = 1.28$), though this difference was not statistically significant ($p = 0.18$). However, concentration improvements were comparable between genders (women's Cohen's $d = 0.82$ vs. men's Cohen's $d = 0.76$, $p = 0.32$). Students from higher semester levels (fifth semester and above) showed comparable effects to those from lower semester levels ($p = 0.44$), indicating that the intervention benefits generalized across student cohorts with varying academic experience and responsibilities.

The results of this study provide compelling empirical evidence that regular morning exercise substantially improves both mood states and learning concentration among university students at FIKK UNM. The 40% reduction in overall mood disturbance in the experimental group compared to minimal changes in the control group represents a clinically meaningful improvement and demonstrates that the eight-week intervention duration was sufficient to produce substantial psychological benefits.(Rahmawati & Sari, 2020) These findings align with and extend previous research on exercise and mood, while adding important specificity regarding morning timing and concurrent improvements in cognitive performance.

The particular effectiveness of the morning exercise intervention can be understood through multiple interconnected physiological and psychological mechanisms. The acute effects of morning exercise—manifested as immediate improvements in mood following exercise sessions—are mediated by increased circulating levels of endorphins, dopamine, and serotonin, neurotransmitters critically involved in mood regulation and emotional well-being.(Kusumastuti et al., 2022) The chronic benefits observed across the eight-week intervention period reflect adaptations including sustained elevations in resting mood-regulating neurotransmitter systems, reduced reactivity of the hypothalamic-pituitary-adrenal (HPA) axis to subsequent stressors, and improved emotional regulation capacity. The morning timing of exercise appears particularly advantageous for establishing circadian rhythm synchronization, which optimizes numerous physiological processes throughout the day and enhances baseline emotional stability and cognitive readiness.

The differential effects across specific mood dimensions provide important insights into the mechanisms through which exercise influences psychological functioning. The particularly large reduction in anxiety and fatigue—the two mood dimensions most directly linked to academic performance deficits—suggests that the exercise intervention was particularly effective at addressing the specific psychological barriers to effective learning. This finding is consistent with theoretical models of anxiety and attention, which propose that heightened anxiety and fatigue consume cognitive resources that would otherwise be available for sustained attention and learning tasks.(Hidayah, 2021) By substantially reducing these mood disturbances, the morning exercise intervention appeared to liberate cognitive capacity for academic engagement.

The substantial improvements in learning concentration, with a 23.5% increase in Attention Rating Scale scores and concurrent 9.9% improvements in quiz performance, have important implications for academic achievement. These improvements align with emerging neuroscientific understanding of the cognitive benefits of physical activity, which operate through multiple pathways including enhanced cerebral blood flow, increased production of brain-derived neurotrophic factor (BDNF) that supports hippocampal neuroplasticity crucial for learning and memory, and improved

executive function capacity.(Gunawan et al., 2021) The timing of exercise in the morning ensured that these cognitive benefits were available precisely when students engaged in their most intensive academic work during morning classroom hours, potentially maximizing the translation of acute exercise effects into improved learning outcomes.

The strong correlation ($r = -0.72$) between mood improvement and concentration enhancement supports a mechanistic pathway in which exercise-induced mood improvements contribute to enhanced learning concentration. This finding suggests that the benefits of morning exercise on academic performance operate not solely through direct cognitive mechanisms but also through the affective pathway of improved emotional states creating more favorable conditions for sustained attention and cognitive engagement. The magnitude of this correlation indicates that mood and concentration improvements are substantially interrelated, supporting an integrated understanding of psychological well-being and cognitive performance in academic contexts.

The pattern of improvement in the experimental group, with the most pronounced gains during weeks 1-4 followed by more modest improvements in weeks 5-8, suggests initial rapid physiological adaptations to the exercise stimulus, followed by a plateau at higher functioning levels. This trajectory is consistent with established principles of exercise adaptation and suggests that the intervention effects reached a relatively stable plateau by week four, with substantial cognitive and affective benefits sustained through week eight.(Wijayanto & Setiawan, 2020) Longer-term follow-up studies would be valuable in determining whether these benefits sustain beyond the intervention period and whether further improvements occur with extended participation.

The high intervention completion rate (94% attending ≥37 of 40 sessions) is noteworthy and suggests several important factors. First, the morning timing and moderate exercise intensity appear sustainable for university students despite competing academic and social demands. Second, the early recognition of mood and cognitive benefits likely enhanced participant motivation to maintain engagement with the program. Third, the structured group format may have provided social support and accountability that facilitated adherence. These factors are important considerations for the practical implementation of campus-based physical activity interventions.

The minimal differences in intervention effects between genders and across semester levels suggest that the benefits of morning exercise generalize broadly across the student population, supporting recommendations for universal implementation rather than targeting specific subgroups. However, the finding that students with higher baseline mood disturbance experienced greater concentration benefits warrants attention, as it suggests that morning exercise interventions may be particularly valuable for students experiencing psychological difficulties, potentially functioning as an accessible, low-stigma intervention that addresses mental health needs while simultaneously enhancing academic performance.

The study findings must be considered within the context of several methodological considerations. The quasi-experimental design, while appropriate for this research question and practical setting, does not establish causation with the certainty of a fully randomized controlled trial design. However, the randomization of group assignment, control of potential confounding variables, and longitudinal measurement design with repeated assessments substantially strengthen causal inference. The measurement of mood and concentration through established, validated instruments enhances confidence in the validity of outcomes. The eight-week intervention duration represents an intermediate timeframe that captures meaningful changes while remaining practical for implementation in academic settings, though longer-term sustainability remains an important area for future investigation.

These findings contribute to the growing literature demonstrating the importance of physical activity for university student mental health and academic performance, with particular emphasis on the potential of structured morning exercise programs as feasible, evidence-supported interventions. The results suggest that FIKK UNM and similar institutions might beneficially incorporate morning exercise opportunities into their campus infrastructure and academic programming to support student well-being and achievement.

CONCLUSSION

This study demonstrates that regular morning exercise produces substantial improvements in both mood states and learning concentration among university students at FIKK UNM. Over an eight-week intervention period, students engaging in 30 minutes of moderate-intensity morning exercise five days weekly showed 40% reductions in overall mood disturbance, with particularly pronounced improvements in anxiety (38% reduction), depression (36% reduction), and fatigue (38% reduction). Concurrent with these mood improvements, students demonstrated 23.5% improvements in learning concentration as measured by standardized attention ratings and 9.9% improvements in academic quiz performance. The strong correlation between mood enhancement and concentration improvement ($r = 0.72$) suggests that these benefits operate through interconnected physiological and psychological pathways, with improved emotional states facilitating cognitive engagement and learning processes.

The findings provide compelling evidence for the inclusion of morning exercise programs within university health promotion and academic support initiatives. Several recommendations emerge from this research for various stakeholder groups. For institutional administrators at FIKK UNM and comparable higher education institutions, the results suggest that investment in campus facilities and programming to support early morning exercise activities would likely yield substantial returns in terms of student mental health and academic achievement. The development of structured, accessible morning exercise programs—potentially incorporating varied modalities such as aerobic exercise, yoga, tai chi, and other physical activities—would accommodate diverse student preferences while providing consistent benefits. Integration of morning exercise into academic curricula or credit-bearing wellness courses could enhance participation and normalize physical activity as a component of academic life.

For academic advisors and student support personnel, the research indicates that morning exercise should be promoted as a practical, evidence-supported strategy for students experiencing concentration difficulties or mood disturbances. Rather than relying solely on remedial academic interventions or mental health referrals, integration of exercise recommendations into comprehensive student support approaches would address underlying psychological barriers to learning. Student affairs professionals should consider developing targeted outreach to students experiencing academic difficulties, highlighting the potential of morning exercise to simultaneously improve mood and concentration.

For future researchers, several important investigations emerge from this work. Longitudinal follow-up studies examining the sustainability of mood and concentration improvements beyond the intervention period would clarify whether the effects persist through behavioral change and adaptation or require continued participation. Investigation of mechanisms through assessment of neurochemical markers, neuroimaging, and hormonal measures would elucidate the specific physiological pathways mediating the observed improvements. Examination of different exercise modalities, intensities, and timing regimens would clarify optimal intervention parameters for diverse student populations. Exploration of psychological mediators such as self-efficacy, social support, and exercise motivation would enhance understanding of factors promoting adherence and sustained benefit. Studies incorporating diverse institutional contexts, geographic locations, and cultural settings would determine generalizability of findings across varied university populations.

Additionally, research examining potential secondary benefits of morning exercise programs—including effects on sleep quality, social connection, and overall quality of life—would provide a more comprehensive understanding of intervention impact. Investigation of cost-effectiveness and return-on-investment for institutional implementation would support resource allocation decisions. Finally, qualitative research exploring student experiences, perceived benefits, and implementation barriers would complement quantitative findings and provide practical guidance for program development and refinement.

In conclusion, the evidence presented in this study supports a paradigm shift toward greater emphasis on physical activity as a cornerstone of university student health and academic success. Morning exercise represents an accessible, evidence-supported, and cost-effective intervention that addresses multiple dimensions of student well-being simultaneously. The substantial improvements in

mood and learning concentration observed in this study suggest that systematic implementation of morning exercise programs at FIKK UNM and comparable institutions could meaningfully enhance student mental health and academic achievement, ultimately contributing to the development of healthier, more successful university students prepared for successful professional and personal lives beyond the academic context.

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