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RESEARCH ARTICLE

# The effect of the Fitify: Fitness, Home Workout app on sleep quality and health-related physical fitness among university students

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**ABSTRACT**

**Background:** Findings from previous studies indicate a growing trend in the use of smartphone apps in physical education. However, there remains a lack of research examining the impact of smartphone apps specifically "Fitify: Fitness Home Workout" on sleep quality and health-related physical fitness among college students prior to physical education classes. **Objectives:** The purpose of this study is to analyse the influence of the "Fitify: Fitness Home Workout" app prior to physical education classes on sleep quality and health-related physical fitness. **Methods:** We adopted a 11-week true experimental design as the method for this study. Fifty participants were assigned to the experimental group (EG: n = 25, age [years] = 19.8 ± 0.707; height [cm] = 163 ± 7.92; weight [kg] 54.0 ± 5.55) and the control group (CG: n = 25, age [years] = 19.4 ± 0.747; height [cm] = 164 ± 7.17; weight [kg] = 57.0 ± 5.60). Assessments of sleep quality and health-related physical fitness were conducted at the pretest and posttest. **Results:** Based on the results of the repeated measures ANOVA analysis, we observed that there was a significant effect of the time factor ($p < 0.001$) and the group factor ($p = 0.024$) on the interaction factor ($p < 0.001$) for the subjective sleep quality indicator. We also found significant effects of time ($p < 0.001$), group ($p = 0.004$), and interaction ($p < 0.001$) on the indicators of sleep quality and health-related physical fitness. **Conclusion:** We conclude and highlight that the use of "Fitify: Fitness Home Workout" prior to physical education classes can be an effective tool for improving sleep quality and health-related physical fitness among university students.

**Keywords**: Fitify; fitness application; sleep quality; health-related physical fitness; university students

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**Authors' Contributions**: a – Study Design; b – Data Collection; c – Statistical Analysis; d – Manuscript Preparation; e – Funding Acquisition

## INTRODUCTION

Technological advancements have made smartphones one of the most important devices of our time (Lundekvam Berge et al., 2026). With the ability to communicate, share, and access information, the world is literally at your fingertips. Internet-connected smartphones offer users the ability to communicate and access information almost instantly (He et al., 2024). Currently, smartphone technology has been integrated into physical education instruction at all levels, from elementary school through university (Gil-Espinosa et al., 2022). The literature reports that smartphone technology can assist in transferring knowledge and skills to students (Kliziene et al., 2021). Additionally, the abundance of smartphone apps can serve as a guide for students to learn independently without being constrained by fixed study schedules. Another reported benefit is that smartphone apps can be used anytime and anywhere, allowing students to acquire knowledge more quickly and easily. Several previous studies have demonstrated that implementing smartphone applications can serve as a powerful tool to enhance engagement and team sports performance among students (Rahayu et al., 2025). This indicates that smartphone applications, when used optimally, can assist instructors in achieving learning objectives (Dimyati et al., 2026; Johannsen et al., 2023; Pedraja-rejas et al., 2024). Another report reveals that smartphones, with their various features, can serve as an adequate learning strategy not only potentially improving the quality of physical education instruction but also effectively encouraging students to be more active in physical activities (Gil-Espinosa et al., 2022), and enhancing their health levels (Sousa Basto & Ferreira, 2025). However, we note that there are no previous studies on the effects of smartphone applications on sleep quality and physical fitness among college students, so this must be further explored through this research.

There is no doubt about the importance of sleep as the negative consequences of sleep deprivation including poor concentration, irritability, depression, loss of energy, and sleepiness should serve as a major warning (Kohyama, 2021). Many smartphone users, particularly adolescents and adults, tend to experience poor sleep quality due to extensive smartphone use before bedtime, as evidenced by studies (Izquierdo-Condoy et al., 2025). Current trends show that students spend most of their daily time using social media and watching streaming videos. While the duration of physical activity predicts physical well-being, sleep deprivation leads to decreased physical well-being, with subsequent effects including fatigue and drowsiness (Rahman et al., 2024). Furthermore, lack of quality sleep increases the risk of developing chronic and degenerative conditions such as hypertension, which, if not properly managed, can lead to complications (Kheirinejad et al., 2023).

Conceptually, physical fitness can be defined as a student's ability to engage in physical activities and sports during physical education classes on campus without experiencing excessive fatigue (Kljajević et al., 2022; Zhang & Su, 2026). This suggests that a high level of physical fitness can serve as a predictor of a student's ability to perform well in a particular sport (Špirtović et al., 2025). However, the downside is that a low level of physical fitness carries a high risk of developing chronic diseases, including heart disease, diabetes, and premature death (Geantă et al., 2025).

Thus, based on the previous explanation, we emphasise that previous research on smartphone apps has focused on improving various aspects of students' well-being; however, there are no studies that specifically evaluate the Fitify app in the context of university physical education. Fitify was chosen as the application used in this study to improve sleep quality and health-related physical fitness. It is easy to download from the Play Store and offers a variety of physical exercise features that students can do anywhere

and anytime. Furthermore, Fitify provides real-time feedback for students. The combination of physical exercise provided in Fitify and then implemented by students has the potential to encourage active movement or exercise, ultimately impacting sleep quality and health-related physical fitness

Therefore, in the context of this study, we aim to analyse the effects of using the "Fitify: Fitness Home Workout" app on sleep quality and physical fitness among college students.

## METHODS

### Design

We adopted a true pretest-posttest experimental design for an 11-week study. This design began with a pretest (sleep quality and physical fitness), followed by the implementation of a smartphone app programme to guide exercise activities in physical education classes. Meanwhile, the control group only engaged in activities without the smartphone app or underwent traditional learning. Our 11-week experimental research design is presented in **Figure 1**.

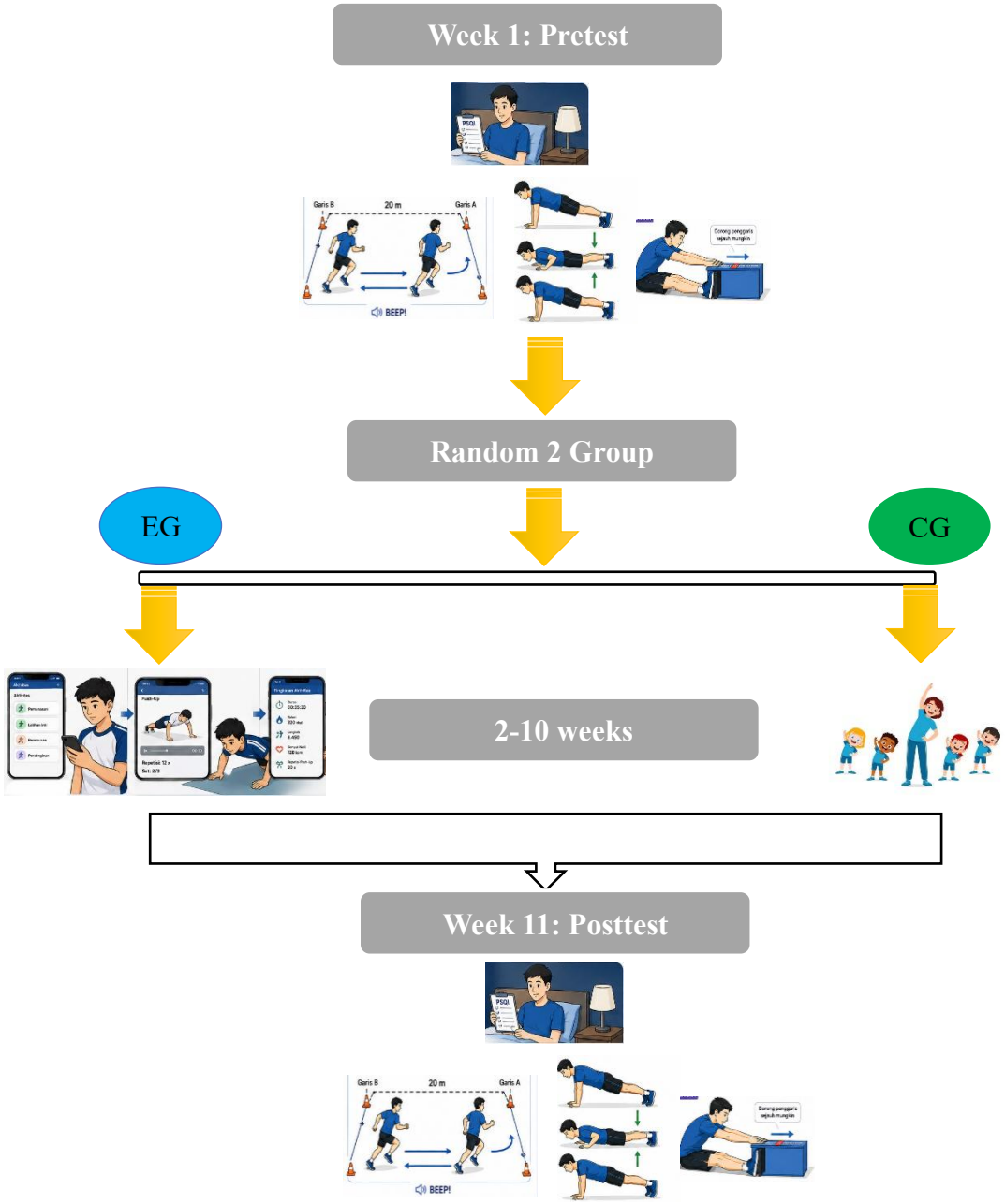


**Figure 1. 11-Week Research Design**

**Sample Size and Participants**

We first conducted a G-Power analysis, which served as the basis for determining the minimum sample size (number of participants) required for our current study. The formula used included: effect size f = 0.25, error probability α = 0.05, and power (1 – error probability β) = 0.90, resulting in a total sample size of 46 participants. Once the sample requirement was determined, the next step was to recruit participants for this study. We used inclusion criteria to select participants or students from the Universitas 17 Agustus 1945 Cirebon, ranging from first-year to fourth-year students. The inclusion criteria were: (i) active students not currently participating in national or international activities, (ii) 90% attendance, (iii) obtaining written consent to participate in this study, and (iv) not currently injured or suffering from chronic conditions that could hinder our research programme. Based on these criteria, 50 first-year students were selected; therefore, we divided these participants into an experimental group (EG) using the "Fitify: Fitness Home Workout" app (EG: n = 25, age [years] = 19.8 ± 0.707; height [cm] = 163 ± 7.92; weight [kg] 54.0±5.55) and a control group that only received traditional instruction (CG: n = 25, age [years] = 19.4±0.747; height [cm] = 164±7.17; weight [kg] = 57.0±5.60) using Research Randomizer software via online (https://www.randomizer.org/).

**Ethical Considerations**

This study was approved by the Ethics Committee of the Universitas 17 Agustus 1945 Cirebon (Reference No. 234/UNTAG/2026) and was conducted in accordance with the principles outlined in the 2024 Declaration of Helsinki.

**Instrument**

**Sleep Quality.** In the current study, we adopted the Pittsburgh Sleep Quality Index (PSQI) to assess sleep quality. Based on previous literature, this questionnaire consists of 19 items across seven components, including: (i) subjective sleep quality, (ii) sleep latency, (iii) sleep duration, (iv) sleep efficiency, (v) presence of sleep disturbances, (vi) use of sleep medication and (vii) daytime dysfunction. For the present study, only the global PSQI score was used, which ranges from 0 to 21 points, with higher scores indicating poorer sleep quality (Matos et al., 2025). In addition, we found that the validity (0.88) and reliability (0.78) values in the Indonesian version of the PSQI.

**Physical Fitness.** In this study, we assessed physical fitness components related to: (i) endurance through the Multistage 20-m Shuttle Run Test (Magee et al., 2021), in which participants stand at cone A or the starting line; upon hearing a "bleep" sound, they run as fast as possible to cone B and return to cone A after hearing another "bleep" sound. Participants repeated this activity continuously until they could no longer run or keep up with the "bleep" rhythm. The score recorded was the total number of round trips, which was later converted into $VO_2$ max. (ii) The strength component via the push-up test (Stojanović et al., 2023) where participants were instructed to perform push-ups for 30 second, and the number of push-ups completed was recorded. (iii) Flexibility component using the sit-and-reach test (Tsiakaras et al., 2025) participants were instructed to sit facing the sit-and-reach; upon hearing the "go" command, they reached as far as possible along the measurement line. The farthest reach indicates a high level of flexibility, measured in centimeters.

## Procedure

Our research was conducted at the campus of the Universitas 17 Agustus 1945Cirebon in February-March 2026. In addition, the implementation of the application "Fitify: Fitness Home Workout" and CG carried out the same program as EG but without the use of smartphone application guidance from 09.00-10.00 a.m. Both exercise groups followed a three-phase workout structure: (i) warm-up, (ii) main set, and (iii) cool-down (see **Table 1**).

**Table 1. The 11-Week Exercise Programme**

| Weeks | EG (Fitify: Fitness Home Workout App) | | |
|---|---|---|---|
| | Main activity | | |
| 1 | **Pretest** | | |
| 2-4 | Warm-up (5 min)<br>Explanation of the "Fitify: Fitness Home Workout" app (5 min) | Students exercise independently by following the guidelines in the "Fitify: Fitness Home Workout" app with the following physical activities:<br>Plank (5 min)<br>Crunches (5 min)<br>Tricep press (5 min)<br>Squats (5 min)<br>Butt kickers (5 min)<br>Rest between sets is 20 seconds. | Evaluation (5 min)<br>Cool-down (5 min) |
| 5-7 | Warm-up (5 min)<br>Explanation of the "Fitify: Fitness Home Workout" app (5 min) | Students exercise independently by following the guidelines in the "Fitify: Fitness Home Workout" app with the following physical activities:<br>Plank (5 min)<br>Crunches (5 min)<br>Tricep press (5 min)<br>Squats (5 min)<br>Butt kickers (5 min)<br>Rest between intervals for the " " is 20 seconds. | Assessment (5 min)<br>Cool-down (5 min) |
| 8-10 | Warm-up (5 min)<br>Explanation of the "Fitify: Fitness Home Workout" app (5 min) | Students exercise independently by following the guidelines in the "Fitify: Fitness Home Workout" app with the following physical activities:<br>Plank (5 min)<br>Crunches (5 min)<br>Tricep press (5 min)<br>Squats (5 min)<br>Butt kickers (5 min)<br>Rest between intervals is 20 seconds. | Assessment (5 min)<br>Cool-down (5 min) |
| 11 | **Posttest** | | |

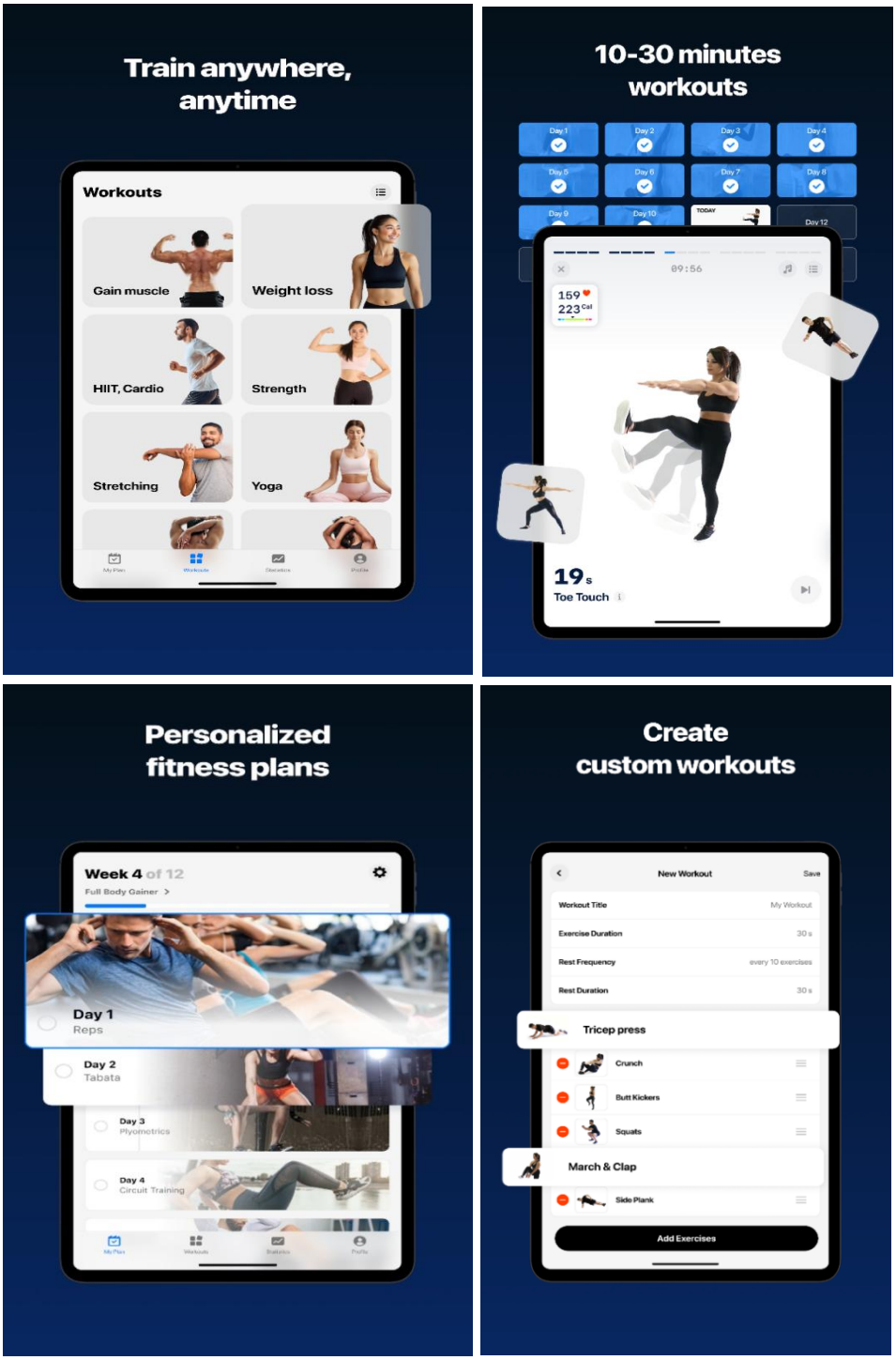


**Figure 2. "Fitify: Fitness Home Workout" Apps**

## Data Analysis

In this section, the researchers first analysed the descriptive statistics of the data, including: (i) the mean and (ii) the standard deviation. Second, we also presented the results of the normality test (Shapiro-Wilk test) and the homogeneity of variance test (Levene's test). A repeated-measures ANOVA was used to examine changes within groups over time and differences between groups. Effect sizes were calculated using partial eta-squared ($\eta^2p$) and categorized as small (< 0.06), moderate (0.06-0.13), or large (> 0.14). The significance level was set at 0.05, and all data were analysed using the Jamovi 2.3.28 software.

## RESULTS

As shown in **Table 2**, the normality test for the EG group ("Fitify: Fitness Home Workout" Apps) yielded values ranging from $p = 0.120$ to $p = 0.397$, while the CG group's values ranged from $p = 0.111$ to $p = 0.303$. Thus, these data confirm that both the EG and CG groups have normally distributed data. Additionally, we observed that the homogeneity test also confirmed homogeneous variance, with the EG yielding values ranging from $p = 0.123$ to $p = 0.447$ and the CG from 0.083 to 0.452 (see **Table 2**).

**Table 2. Normality Test and Homogeneity Test**

| Variable | Group | Normality test *p* | Homogeneity Test *p* |
|---|---|---|---|
| Subjective Sleep Quality | EG | 0.173 | 0.156 |
| (0-21 points) | CG | 0.146 | 0.112 |
| Sleep latency | EG | 0.181 | 0.123 |
| (0-21 points) | CG | 0.165 | 0.096 |
| Sleep duration | EG | 0.259 | 0.283 |
| (0-21 points) | CG | 0.213 | 0.134 |
| Sleep efficiency | EG | 0.155 | 0.401 |
| (0-21 points) | CG | 0.140 | 0.388 |
| Presence of sleep disturbances | EG | 0.258 | 0.438 |
| (0-21 points) | CG | 0.233 | 0.304 |
| Use of sleep medication | EG | 0.208 | 0.238 |
| (0-21 points) | CG | 0.111 | 0.432 |
| Daytime dysfunction | EG | 0.120 | 0.339 |
| (0-21 points) | CG | 0.171 | 0.452 |
| Bleep test | EG | 0.397 | 0.185 |
| (mL/kg/min) | CG | 0.266 | 0.083 |
| Push-up test | EG | 0.177 | 0.394 |
| (fre) | CG | 0.162 | 0.315 |
| Flexibility test | EG | 0.345 | 0.447 |
| (cm) | CG | 0.303 | 0.411 |

### The Effect of Two Teaching Styles on Sleep Quality Variables

Based on the results of the repeated-measures ANOVA analysis, we observed that there was a significant effect of the time factor ($p < .001$) and the group factor ($p = 0.024$) on the interaction factor ($p < 0.001$) for the subjective sleep quality indicator. We also found effects of time ($p < 0.001$), group ($p = 0.004$), and interaction ($p < 0.001$) on the sleep latency indicator. Additionally, we observed significant effects of time ($p < 0.001$), group ($p < 0.001$), and interaction ($p < 0.001$) on the sleep duration indicator. For the sleep efficiency indicator, significant effects of time ($p < 0.001$), group ($p = 0.039$), and interaction ($p < 0.001$) were found. Finally, similar findings were observed for the sleep disturbance, use of sleep medication until daytime dysfunction indicator, showing significant effects of time ($p < 0.001$), group ($p < 0.001$), and interaction ($p < 0.001$) (see **Table 3**). These data demonstrate that both the EG and CG experienced changes in sleep quality from the pretest to the posttest (see **Figure 3**).

**Table 3. Results of Repeated Measures ANOVA Analysis on the Sleep Quality Variable**

| Variable | Group | Time (F; p; $\eta^2$p) | Group (F; p; $\eta^2$p) | Interaction (F; p; $\eta^2$p) |
|---|---|---|---|---|
| Subjective Sleep Quality (0-21 points) | EG (n = 25) CG (n = 25) | F = 125.45 $p < 0.001$ $\eta^2p = 0.839$ | F = 5.79 p = 0.024 $\eta^2p = 0.194$ | F = 27.00 $p < 0.001$ $\eta^2p = 0.529$ |
| Sleep latency (0-21 points) | EG (n = 25) CG | F = 122.3 $p < 0.001$ $\eta^2p = 0.836$ | F = 10.3 $p = 0.004$ $\eta^2p = 0.301$ | F = 23.1 $p < 0.001$ $\eta^2p = 0.490$ |

| Variable | Group | Time (F; p; $\eta^2p$) | Group (F; p; $\eta^2p$) | Interaction (F; p; $\eta^2p$) |
|---|---|---|---|---|
| Sleep duration (0-21 points) | EG (n = 25) CG (n = 25) | F = 166.9 $p$ < 0.001 $\eta^2p$ = 0.874 | F = 15.9 $p$ < 0.001 $\eta^2p$ = 0.398 | F = 24.5 $p$ < 0.001 $\eta^2p$ = 0.505 |
| Sleep efficiency (0-21 points) | EG (n = 25) CG (n = 25) | F = 124.12 $p$ < 0.001 $\eta^2p$ = 0.838 | F = 4.77 $p$ = 0.039 $\eta^2p$ = 0.166 | F = 19.99 $p$ < 0.001 $\eta^2p$ = 0.454 |
| Presence of sleep disturbances (0-21 points) | EG (n = 25) CG (n = 25) | F = 157.4 $p$ < 0.001 $\eta^2p$ = 0.873 | F = 29.8 $p$ < 0.001 $\eta^2p$ = 0.564 | F = 15.5 $p$ < 0.001 $\eta^2p$ = 0.402 |
| Use of sleep medication (0-21 points) | EG (n = 25) CG (n = 25) | F = 167.8 $p$ < 0.001 $\eta^2p$ = 0.880 | F = 49.3 $p$ < 0.001 $\eta^2p$ = 0.570 | F = 17.12 $p$ < 0.001 $\eta^2p$ = 0.455 |
| Daytime dysfunction (0-21 points) | EG (n = 25) CG (n = 25) | F = 170.4 $p$ < 0.001 $\eta^2p$ = 0.870 | F = 16.7 $p$ < 0.001 $\eta^2p$ = 0.399 | F = 26.2 $p$ < 0.001 $\eta^2p$ = 0.511 |

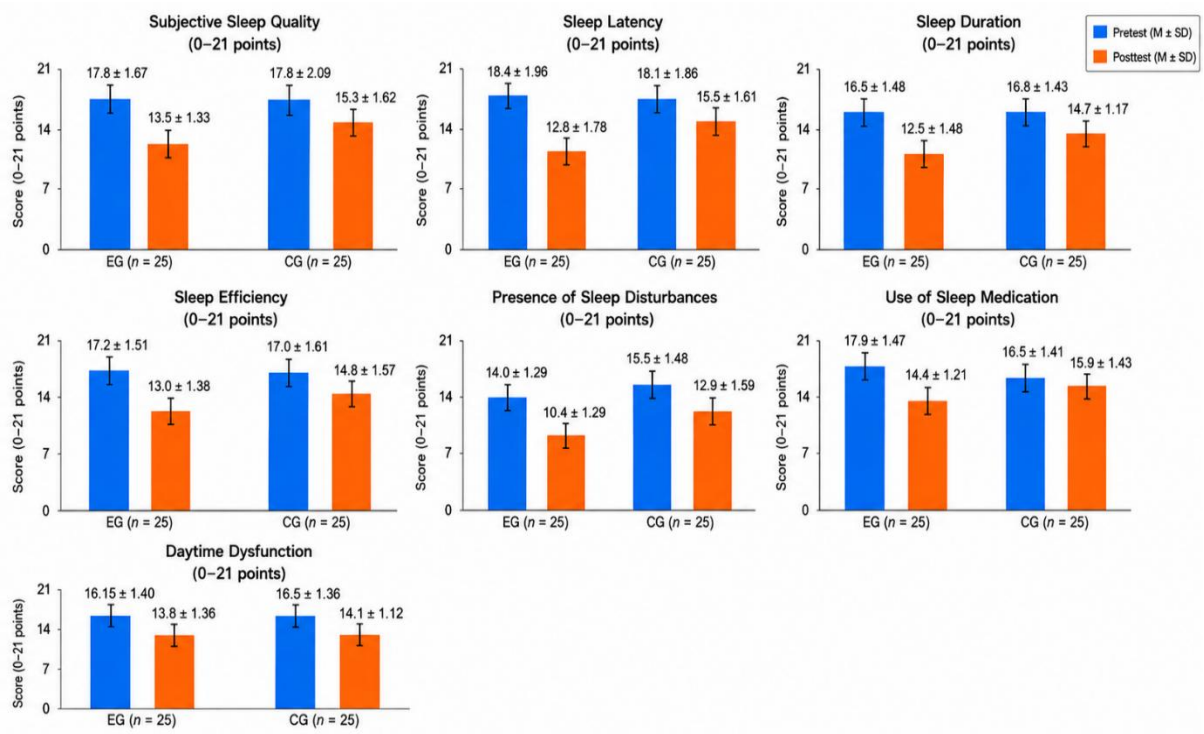


**Figure 3. The EG and CG Experienced Changes in Sleep Quality from the Pretest to the Posttest**

## The Effect of Two Teaching Methods on Physical Fitness Variables

Based on the results of the repeated-measures ANOVA analysis (**Table 4**), we observed that there was a significant effect of the time factor ($p$ < .001) and the group factor ($p$ = 0.004) on the interaction factor ($p$ < 0.001) for the bleep test indicator. We also found effects of time ($p$ < 0.001), group ($p$ = 0.032), and interaction ($p$ < 0.001) on the push-up test indicator. Additionally, we observed time ($p$ < 0.001), group ($p$ < 0.020), and interaction ($p$ = 0.005) effects on the flexibility test indicator. These data demonstrate that

both the EG and CG experienced changes in physical fitness from the pretest to the posttest (see **Figure 4**).

**Table 4. Results of Repeated Measures ANOVA Analysis on Physical Fitness Variables**

| Variable | Group | Time (F; p; $\eta^2$p) | Group (F; p; $\eta^2$p) | Interaction (F; p; $\eta^2$p) |
|---|---|---|---|---|
| Multistage 20-m Shuttle Run Test (mL/kg/min) | EG (n = 25) CG (n = 25) | F = 701.2 $p$ < 0.001 $\eta^2$p = .970 | F = 10.7 $p$ = 0.004 $\eta^2$p = 0.327 | F = 15.7 $p$ < 0.001 $\eta^2$p = 0.417 |
| Push-up test (fre) | EG (n = 25) CG (n = 25) | F = 313.48 $p$ < 0.001 $\eta^2$p = 0.929 | F = 5.20 $p$ = 0.032 $\eta^2$p = 0.178 | F = 17.80 $p$ < 0.001 $\eta^2$p = 0.426 |
| Sit-and-reach test (cm) | EG (n = 25) CG (n = 25) | F = 326.92 $p$ < 0.001 $\eta^2$p = 0.932 | F = 6.24 $p$ = 0.020 $\eta^2$p = 0.206 | F = 9.48 $p$ = 0.005 $\eta^2$p = 0.283 |

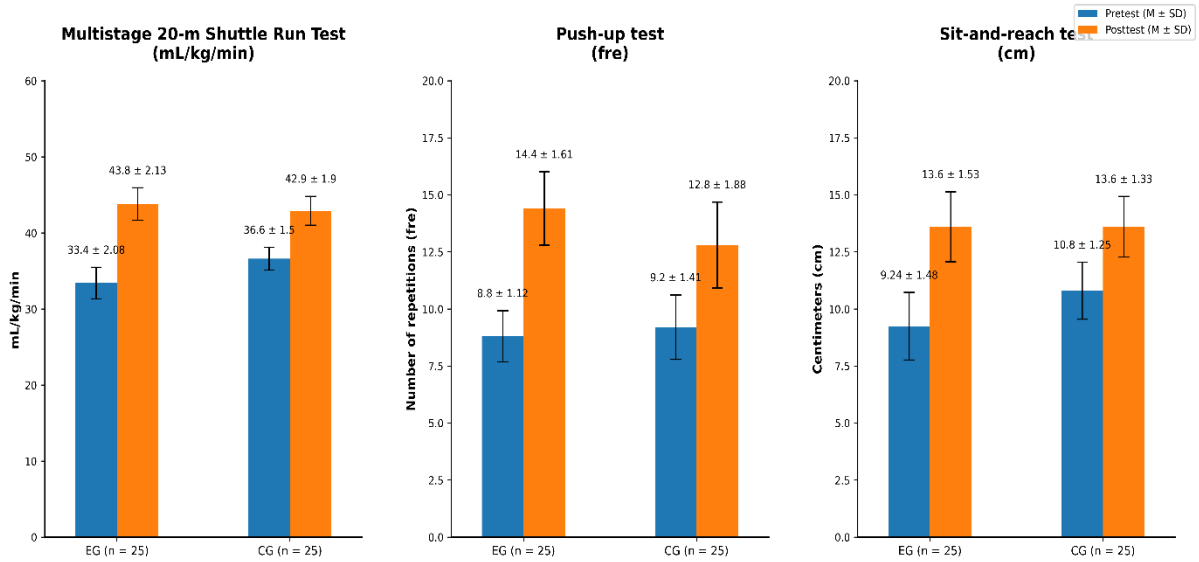


**Figure 4. The EG and CG Experienced Changes in Physical Fitness from the Pretest to the Posttest.**

## DISCUSSION

The aim of this study is to analyse the effects of using the "Fitify: Fitness Home Workout" app on sleep quality and physical fitness among college students. The first finding of this study indicates that the 11-week implementation of the "Fitify: Fitness Home Workout" app was effective in improving students' sleep quality and physical fitness. This can be explained by theories and findings from previous studies. Essentially, the use of modern and advanced technologies has become increasingly popular and a trend across various fields of research, including physical education. Several experts have acknowledged and clearly reported that the application of technologies such as virtual reality, augmented reality, YouTube, and smartphone apps can provide several benefits for students. In addition, our important findings show that the application of the Fitify application before physical exercise has a positive impact on sleep quality, basically Fitify is used as a guide or media to help the role of teachers in teaching physical exercise to students, combining smartphone applications (mobile health) with physical exercise creates a dual-behaviour intervention that is very effective in improving sleep quality. Simply put, physical exercise acts as a biological driver that prepares the body for restful

sleep, while smartphone apps serve as behavioural control systems that ensure that physical activity is performed consistently, measurably, and on time. Why use the Fitify app? Many people fail to reap the sleep benefits of exercise because they are inconsistent or mismanage their exercise intensity and timing. Based on Self-Regulation Theory, smartphone apps provide tools for goal setting, self-monitoring (tracking daily steps/calories), and feedback loops (visual graphs of success). These digital interventions trigger intrinsic motivation and increase exercise adherence, which directly stabilises the body's circadian rhythm. One study reported that a smartphone app-based intervention successfully increased users' physical activity by an average of 1,329 more steps per day and added 55 minutes of moderate-to-vigorous physical exercise (MVPA) per week. This app-driven increase in physical activity was directly correlated with a decrease in sedentary behavior (a lot of sitting) by 7 hours per week and a clinical improvement in participants' overall sleep quality (Rayward et al., 2018). Another study using a systematic review in line with our current findings showed that mHealth applications implemented effectively improve sleep quality (Arroyo & Zawadzki, 2022). Based on the findings of our study, which align with previous studies, this explains why using the "Fitify: Fitness Home Workout" app can positively impact sleep quality.

The second finding in our current study indicates that the use of the "Fitify: Fitness Home Workout" app prior to physical exercise has proven to be a key tool in improving levels of health-related physical fitness. This is also consistent with a previous study reporting that continuous physical activity interventions guided by a smartphone app can effectively improve certain aspects of physical and physiological health (Emberson et al., 2021). On the other hand, Silva et al. (2021) state that their findings align with ours, showing that interventions involving smartphone apps, when combined with a specific type of exercise, are superior to traditional interventions (without such combination). Our findings confirm that the smartphone app was used as a guide for the students, allowing them to closely follow the avatar demonstrating specific movements or exercise types. Based on this logical concept, our findings refute and disagree with previous findings claiming that the use of a smartphone app has a negative impact (Damaševičius et al., 2022) or has no significant effect on physical activity and psychological outcomes (He et al., 2024). The another finding was reported by Rahayu et al. (2025), which showed that integrating a smartphone app can serve as a very useful guide for students to actively engage in mastering soccer skills. On the other hand, another report contradicts our findings, indicating that smartphone apps have negative effects, such as disrupting resistance training, leading to a significant decrease in enjoyment (Rekstis et al., 2025). However, in our findings, when smartphone apps are used within time limits and as a guide for performing physical exercises or sports, they have a positive impact on improving sleep quality. The findings of our current study align with those of Sahin Koybulan et al. (2024), whose research indicates that smartphone app usage can be beneficial for sports professionals and is claimed to have positive health effects. In the field of sports psychology, it is noted that smartphones can alter and influence an individual's learning experience (DesClouds & Durand-Bush, 2021). As data found by Lee et al. (2021) indicates, the competitive performance of professional golfers is not related to the amount of time spent using smartphones but rather to the type of smartphone app used, in other words, a smartphone app with features that can serve as a guide has great potential to provide positive benefits for its users.

There are several limitations including: (i) single university, (ii) no follow-up (iii) no control for screen time, dieting, caffeine intake, sleep hygiene, physical activity outside

the programme. All of these factors can affect sleep quality. Thus, future research is expected to overcome all these limitations.

## CONCLUSION

Thus, our current study confirms that the use of the "Fitify: Fitness Home Workout" app over an 11-week period has a positive effect on sleep quality and health-related physical fitness levels. Consequently, this research can contribute to the development of physical education in university settings, including by improving sleep quality and health-related physical fitness levels among students.


## ACKNOWLEDGEMENTS

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## CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

## AI DISCLOSURE STATEMENT

The authors used QuillBot only for language and grammar editing. All scientific content, including its generation, analysis, interpretation, and presentation, was developed entirely by the authors without the use of generative AI.

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