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A Comparison of Aerobic Exercises versus Yoga on Sedentary Behaviour, Sleep Quality, and Physical Activity in Young Individuals

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Abstract

Background: Sedentary behaviour, poor sleep quality, and insufficient physical activity are important lifestyle concerns among young individuals. Aerobic exercise and yoga are potential interventions for improving these health-related outcomes.

Objective: To compare the effects of aerobic exercises versus yoga on sedentary behaviour, sleep quality, and physical activity in young individuals.

Methods: A total of 30 apparently healthy individuals aged 18–25 years participated in this comparative experimental study. Participants were divided into two groups: Group A (n=15), which received aerobic exercise, and Group B (n=15), which received yoga. Both interventions were conducted three times per week for 12 weeks. Outcomes were assessed using the Sedentary Behaviour Questionnaire (SBQ), Pittsburgh Sleep Quality Index (PSQI), and Global Physical Activity Questionnaire (GPAQ).

Results: Both groups demonstrated improvements in all three outcomes. The yoga group showed greater descriptive reductions in SBQ and PSQI scores, whereas the aerobic exercise group demonstrated a greater descriptive increase in GPAQ scores.

Conclusion: Both aerobic exercise and yoga were associated with improvements in sedentary behaviour, sleep quality, and physical activity among young individuals.

INTRODUCTION

Sedentary behaviour is increasingly recognized as a major public health issue, particularly among young individuals. It refers to activities performed in a sitting or reclining posture with minimal energy expenditure (≤1.5 METs). Due to technological advancements and academic demands, students spend a large portion of their time in screen-based activities such as online learning and digital device use, leading to reduced physical activity and increased health risks [1,2].

Prolonged sedentary behaviour results in several adverse physiological effects, including reduced muscle activity, impaired glucose metabolism, decreased insulin sensitivity, and altered lipid metabolism. These changes increase the risk of obesity, cardiovascular diseases, and metabolic disorders. Additionally, extended sitting contributes to poor posture, reduced joint mobility, and muscle imbalances, affecting overall functional ability [3,4].

Sleep is a vital component of health that supports physiological balance, cognitive function, and

emotional well-being. However, many young individuals experience poor sleep quality due to factors such as excessive screen exposure, irregular routines, and stress. Poor sleep is characterized by delayed sleep onset, reduced efficiency, and increased daytime fatigue [5,6].

Sleep disturbances lead to physiological alterations, including increased sympathetic activity, hormonal imbalance, and disruption of the hypothalamic–pituitary–adrenal axis. These changes negatively affect metabolism, immune function, cardiovascular health, and mental well-being [7,8].

A bidirectional relationship exists between sedentary behaviour and sleep quality. Increased sedentary time, especially in the evening, disrupts circadian rhythms, while poor sleep reduces motivation for physical activity, creating a cycle that negatively impacts overall health [9].

Regular physical activity helps break this cycle. Aerobic exercise improves cardiovascular efficiency, oxygen utilization, and metabolic function, while also enhancing sleep quality and psychological health. Yoga, as a mind-body practice, improves flexibility, strength, and autonomic balance, reduces stress, and promotes better sleep and lifestyle habits [10,11].

Standardized tools such as the Sedentary Behaviour Questionnaire (SBQ), Pittsburgh Sleep Quality Index (PSQI), and Global Physical Activity Questionnaire (GPAQ) are commonly used to assess these variables. Despite proven individual benefits of aerobic exercise and yoga, limited research compares their effectiveness on sedentary behaviour, sleep quality, and physical activity in young individuals .Therefore, comparative evaluation is necessary to guide effective intervention strategies.

SEDENTARY BEHAVIOUR

Sedentary behaviour refers to any waking activity performed in a sitting or reclining posture with very low energy expenditure (≤1.5 METs). It is different from physical inactivity, as individuals may achieve recommended exercise levels but still spend prolonged periods being sedentary. In modern lifestyles, especially among young individuals, increased use of digital devices and academic commitments has led to a significant rise in sedentary time [12].

Prolonged sedentary behaviour leads to several adverse physiological effects. Reduced muscle activity results in impaired glucose metabolism, decreased insulin sensitivity, and altered lipid regulation, increasing the risk of obesity, cardiovascular diseases, and metabolic disorders. It also negatively affects circulation and reduces cardiorespiratory fitness [13,14].

Musculoskeletal health is impacted by sustained sitting, which contributes to poor posture, muscle imbalances, reduced flexibility, and increased risk of back and neck pain. Additionally, sedentary behaviour is associated with psychological issues such as stress, anxiety, and reduced overall well-being [15,16].

Excessive sedentary time, particularly screen exposure in the evening, can disrupt circadian rhythms and impair sleep quality by delaying sleep onset and reducing sleep duration. This creates a cycle of fatigue and reduced physical activity, further reinforcing sedentary habits [17]

Therefore, reducing sedentary behaviour through regular physical activity, including aerobic exercise and yoga, is essential for improving overall physical, mental, and physiological health in young individuals [18].

SLEEP QUALITY AND ITS IMPORTANCE

Sleep quality refers to an individual's ability to initiate and maintain sleep, achieve adequate duration, and experience restorative rest that supports daytime functioning. Good sleep quality is characterized by

optimal sleep latency, minimal awakenings, sufficient duration (7–9 hours for young individuals), and high sleep efficiency [19].

Sleep plays a vital role in maintaining physiological and psychological health. It supports cognitive functions such as memory consolidation, learning, and attention, while also regulating mood and emotional stability. Physiologically, sleep is essential for hormonal balance, immune function, metabolic regulation, and tissue repair [20].

Poor sleep quality leads to significant physiological disturbances, including dysregulation of the hypothalamic–pituitary–adrenal axis, increased cortisol levels, reduced melatonin secretion, and altered appetite-regulating hormones such as leptin and ghrelin. These changes contribute to fatigue, impaired concentration, reduced physical performance, and increased risk of obesity, cardiovascular diseases, and mental health disorders [21].

In young individuals,factors such as excessive screen exposure, academic stress, irregular sleep schedules, and sedentary behaviour commonly impair sleep quality. Inadequate sleep negatively affects academic performance, daily functioning, and overall quality of life
[23].

Therefore, maintaining good sleep quality is essential for optimal physical health, cognitive efficiency, and emotional well-being. Interventions such as regular physical activity, including aerobic exercise and yoga, play a crucial role in improving sleep patterns and overall health outcomes [24].

PHYSICAL ACTIVITY IN YOUNG INDIVIDUALS

Physical activity refers to any bodily movement produced by skeletal muscles that results in energy expenditure. In young adults, regular physical activity is essential for maintaining optimal physical fitness, metabolic health, and psychological well-being. Current guidelines recommend at least 150–300 minutes of moderate-intensity or 75–150 minutes of vigorous-intensity physical activity per week for adults [25].

Adequate physical activity supports cardiovascular and respiratory efficiency, improves muscle strength, enhances flexibility, and promotes healthy body composition. It also plays a key role in regulating glucose metabolism, improving insulin sensitivity, and reducing the risk of non-communicable diseases such as obesity, diabetes, and cardiovascular disorders [26].

Despite its benefits, many young individuals fail to meet recommended activity levels due to academic demands, increased screen time, and sedentary lifestyles. Reduced physical activity is associated with decreased cardiorespiratory fitness, poor posture, reduced endurance, and increased fatigue [27].

Physical activity also has significant psychological benefits. It helps reduce stress, anxiety, and depressive symptoms while improving mood, cognitive performance, and overall quality of life. Additionally, regular physical activity positively influences sleep by improving sleep duration and efficiency [28].

Therefore, promoting physical activity in young individuals is crucial for preventing lifestyle-related disorders and enhancing overall health. Structured interventions such as aerobic exercise and yoga can effectively improve activity levels and reduce sedentary behaviour in this population [29].

PHYSIOLOGICAL CHANGES

1. Sleep Disturbance

Sleep disturbance leads to significant alterations in neuroendocrine and metabolic functions. It causes

dysregulation of the hypothalamic–pituitary–adrenal axis, resulting in increased cortisol levels and reduced melatonin secretion. Hormonal imbalance involving leptin and ghrelin affects appetite regulation and energy balance. Additionally, poor sleep increases sympathetic nervous system activity and reduces parasympathetic tone, contributing to cardiovascular strain. It also impairs glucose metabolism, immune function, cognitive performance, and physical recovery [30].

2. Sedentary Behaviour

Prolonged sedentary behaviour reduces skeletal muscle contractions, leading to decreased glucose uptake and impaired insulin sensitivity. It lowers lipoprotein lipase activity, resulting in altered lipid metabolism and increased fat accumulation. Reduced blood circulation and endothelial dysfunction negatively affect cardiovascular health. Furthermore, sustained sitting contributes to postural changes, muscle imbalances, reduced joint mobility, and decreased cardiorespiratory fitness [31].

3. Physical Inactivity

Physical inactivity leads to deconditioning of multiple body systems. It reduces cardiovascular efficiency, including decreased stroke volume and maximal oxygen uptake (VO_2 max). Muscle strength, endurance, and mitochondrial function decline, affecting overall functional capacity. Inactivity also contributes to increased adiposity, insulin resistance, and poor metabolic regulation. Additionally, reduced physical activity negatively impacts mental health by increasing stress, anxiety, and fatigue while lowering overall energy levels.

ROLE OF AEROBIC EXERCISE

Aerobic exercise involves continuous, rhythmic activities using large muscle groups, such as walking, jogging, cycling, or swimming. It plays a significant role in improving cardiovascular and respiratory efficiency by increasing maximal oxygen uptake (VO_2 max), stroke volume, and overall endurance. Regular aerobic activity enhances glucose metabolism, improves insulin sensitivity, and supports healthy body composition, thereby reducing the risk of metabolic and cardiovascular diseases [34].

Aerobic exercise also contributes to reducing sedentary behaviour by increasing daily energy expenditure and promoting an active lifestyle. Additionally, it has a positive effect on sleep quality by reducing sleep latency, increasing total sleep duration, and improving sleep efficiency. Psychological benefits include reduced stress, anxiety, and improved mood, which further support overall well-being in young individuals [35].

ROLE OF YOGA

Yoga is a holistic mind-body practice that combines physical postures (asanas), breathing techniques (pranayama), and relaxation or meditation. It improves flexibility, muscular strength, and postural alignment while enhancing body awareness. Physiologically, yoga promotes autonomic balance by reducing sympathetic activity and increasing parasympathetic dominance, leading to improved heart rate variability and relaxation .

Yoga plays an important role in improving sleep quality by reducing stress, calming the nervous system, and regulating breathing patterns. It also helps in decreasing sedentary behaviour by encouraging mindful movement and healthier lifestyle habits. Furthermore, yoga improves mental health by reducing anxiety, depression, and emotional stress, making it an effective intervention for overall physical and psychological well-being [36].

Outcome Measures

Selection of appropriate outcome measures is essential for objectively evaluating the effectiveness of any intervention. In the present study, three standardized and validated assessment tools will be used to assess sedentary behaviour, sleep quality, and physical activity among young individuals. These outcome measures are reliable, easy to administer, and widely used in both clinical practice and research [37].

Sedentary Behaviour Questionnaire (SBQ)

The Sedentary Behaviour Questionnaire (SBQ) is a self-reported instrument developed to assess the amount of time an individual spends performing various sedentary activities during weekdays and weekends. It includes activities such as watching television, computer use, studying, reading, travelling, and sitting during leisure time. The questionnaire provides an estimate of the average daily sedentary time and helps identify individuals with prolonged sitting behaviour. It is considered a reliable and valid tool for assessing sedentary behaviour in young individuals and has been widely used in epidemiological studies [39].

Pittsburgh Sleep Quality Index (PSQI)

The Pittsburgh Sleep Quality Index (PSQI) is one of the most widely accepted subjective instruments for assessing sleep quality over the previous month. It consists of seven components, namely subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. The global PSQI score ranges from 0 to 21, with higher scores indicating poorer sleep quality. A global score greater than five is generally considered indicative of poor sleep quality. The PSQI has demonstrated excellent reliability, validity, and sensitivity across various populations and is widely used in clinical and research settings [40].

Global Physical Activity Questionnaire (GPAQ)

The Global Physical Activity Questionnaire (GPAQ) was developed by the World Health Organization to assess physical activity across three domains: work-related activity, transport-related activity, and recreational activity. It also records sedentary time, allowing comprehensive evaluation of an individual's activity pattern. Physical activity is expressed in metabolic equivalent minutes (MET-minutes) per week, enabling classification of activity levels according to WHO recommendations. GPAQ is simple to administer, internationally standardized, and extensively validated for epidemiological research.[41]

Together, these three outcome measures provide a comprehensive assessment of lifestyle behaviours. SBQ quantifies sedentary behaviour, PSQI evaluates sleep quality, and GPAQ measures physical activity. Their combined use allows objective comparison of the effects of aerobic exercise and yoga on important lifestyle-related health outcomes among young individuals [42].

1.9 Research Gap

Although a considerable number of studies have investigated the individual effects of aerobic exercise or yoga on health-related outcomes, several important gaps remain in the existing literature. Most previous research has focused on a single intervention or a single outcome variable, such as sleep quality, physical activity, or stress reduction. Very few studies have simultaneously evaluated sedentary behaviour, sleep quality, and physical activity using standardized outcome measures [43].

Furthermore, available studies demonstrate considerable variation in intervention duration, exercise intensity, participant characteristics, and assessment methods, making direct comparison difficult. Many investigations have included middle-aged or elderly populations, whereas evidence involving healthy young adults remains limited. In addition, only a small number of studies have directly compared aerobic

exercise and yoga using validated tools such as the Sedentary Behaviour Questionnaire (SBQ), Pittsburgh Sleep Quality Index (PSQI), and Global Physical Activity Questionnaire (GPAQ).

Young adulthood represents a critical period for establishing lifelong healthy behaviours. Therefore, identifying the most effective lifestyle intervention during this stage has important implications for disease prevention and long-term health promotion. The lack of comparative evidence highlights the need for further research evaluating the relative effectiveness of aerobic exercise and yoga on sedentary behaviour, sleep quality, and physical activity among young individuals [44].

REVIEW OF LITERATURE

Dolezal BA, Neufeld EV, Boland DM, Martin JL, and Cooper CB (2017) conducted a systematic review titled adults aged 18–65 years, including healthy individuals and those with sleep disturbances. The intervention duration ranged from 4–24 weeks and included aerobic exercise, resistance training, yoga, and other mind-body exercises. Outcome measures included the Pittsburgh Sleep Quality Index (PSQI), sleep efficiency, sleep duration, sleep latency, polysomnography (PSG), and actigraphy. The review concluded that regular aerobic exercise and yoga significantly improve sleep quality, sleep duration, and sleep efficiency, making them effective non-pharmacological interventions for improving sleep health [50].

Memon AR et al. (2021) conducted a systematic review and meta-analysis titled *"Sleep and Physical Activity in University Students: A Systematic Review and Meta-analysis."* The review included 29 studies involving 141,000+ university students aged 18–30 years. The target population comprised healthy and sedentary university students. The studies evaluated moderate-to-vigorous physical activity over varying durations. Outcome measures included the Pittsburgh Sleep Quality Index (PSQI) and other validated sleep questionnaires. The review found that physically active students had better sleep quality and lower PSQI scores than sedentary students. The authors concluded that regular physical activity is associated with improved sleep quality and should be encouraged to promote overall health in young adults [51]

Author(s) (2024) conducted a network meta-analysis titled "Comparative Efficacy of Exercise Modalities on Sleep Quality in Populations with Sleep Disorders: A Systematic Review and Network Meta-analysis." The study included 17 randomized controlled trials involving adults (18–65 years) with sleep disorders, including insomnia. The intervention duration ranged from 4–24 weeks and compared mind-body exercises (yoga), moderate aerobic exercise, tai chi, and other exercise modalities. Outcome measures included the Pittsburgh Sleep Quality Index (PSQI), Sleep Efficiency, Sleep Latency, and Insomnia Severity Index (ISI). The analysis found that both yoga and aerobic exercise significantly improved sleep quality, with yoga showing greater improvements in sleep efficiency and insomnia symptoms, while aerobic exercise effectively enhanced overall sleep quality. The authors concluded that both yoga and aerobic exercise are effective non-pharmacological interventions for improving sleep quality in individuals with sleep disorders [52].

Comparative Efficacy of Exercise Modalities on Sleep Quality in Populations with Sleep Disorders (2024) conducted a systematic review and network meta-analysis titled

"Comparative Efficacy of Exercise Modalities on Sleep Quality in Populations with Sleep Disorders." The study included 17 randomized controlled trials involving adults aged 18–65 years diagnosed with sleep disorders, primarily insomnia. The intervention duration ranged from 4–24 weeks and included yoga, moderate aerobic exercise, tai chi, and other mind-body exercises. Outcome measures included the

Pittsburgh Sleep Quality Index (PSQI), Sleep Efficiency, Sleep Latency, and Insomnia Severity Index (ISI). The study found that both yoga and moderate aerobic exercise significantly improved sleep quality, with yoga producing greater improvements in sleep efficiency and insomnia symptoms, while aerobic exercise improved overall sleep quality. The authors concluded that both yoga and aerobic exercise are effective non-pharmacological interventions for managing sleep disorders, with yoga showing slightly superior benefits for sleep efficiency [53].

Effects of Exercise on Sleep Quality in the General Population (2024) conducted a systematic review and meta-analysis titled "Effects of Exercise on Sleep Quality in the General Population." The study included 81 randomized controlled trials involving 6,193 participants, primarily adults aged 18–65 years, including healthy individuals and those with poor sleep quality or sleep disorders. The intervention duration ranged from 4–24 weeks and included aerobic exercise, yoga, tai chi, resistance training, and other body–mind exercises. Outcome measures included the Pittsburgh Sleep Quality Index (PSQI), Sleep Efficiency, Sleep Duration, Sleep Latency, and Insomnia Severity Index (ISI). The meta-analysis found that exercise significantly improved subjective sleep quality and objective sleep efficiency, with yoga showing the greatest improvement in PSQI scores and aerobic exercise producing the greatest improvement in sleep efficiency. The authors concluded that both aerobic exercise and yoga are effective non-pharmacological interventions for improving sleep quality and should be recommended for individuals with poor sleep [54].

The Impact of Different Types of Exercise on Sleep in Sedentary Populations (2026) conducted a systematic review and network meta-analysis titled "The Impact of Different Types of Exercise on Sleep in Sedentary Populations." The study included sedentary adults aged 18–65 years with physically inactive or sedentary lifestyles. The intervention duration ranged from 4–24 weeks and included walking, aerobic exercise, cycling, yoga, and other exercise modalities. Outcome measures included sedentary behaviour, Pittsburgh Sleep Quality Index (PSQI), sleep efficiency, sleep duration, and physical activity levels. The review found that all exercise modalities significantly reduced sedentary behaviour and improved sleep quality, with yoga producing greater improvements in psychological relaxation and sleep quality, while aerobic exercise showed greater improvements in physical activity and cardiorespiratory fitness. The authors concluded that both aerobic exercise and yoga are effective interventions for reducing sedentary behaviour and improving sleep quality in sedentary individuals [55].

Dewi KA and Fuadi DF (2026) conducted a systematic review titled "Effects of Moderate-Intensity Walking Exercise on Sleep Quality and Cardiopulmonary Capacity in Sedentary Adolescents and Young Adults." The review included sedentary adolescents and young adults aged 12–30 years with physically inactive lifestyles. The included studies had intervention durations ranging from 4–12 weeks and evaluated moderate-intensity walking exercise as the primary intervention. Outcome measures included sleep quality, cardiopulmonary capacity (VO_2max/cardiorespiratory fitness), physical activity levels, and sedentary behaviour. The review found that regular moderate-intensity walking significantly improved sleep quality, cardiopulmonary fitness, and physical activity while reducing sedentary behaviour. The authors concluded that walking is a simple, safe, and effective aerobic exercise for improving sleep quality and overall health in sedentary adolescents and young adults [56].

Wang Y et al. (2022) conducted a systematic review and meta-analysis titled "Effects of Yoga on Sleep Quality and Insomnia in Adults." The review included 19 randomized controlled trials involving adults aged 18–65 years with poor sleep quality or insomnia. The intervention duration ranged from 6–24 weeks, and participants performed yoga sessions 2–5 times per week. Outcome measures included the

Pittsburgh Sleep Quality Index (PSQI), Insomnia Severity Index (ISI), sleep efficiency, and sleep latency. The review found that yoga significantly improved sleep quality, reduced insomnia symptoms, and enhanced sleep efficiency. The authors concluded that yoga is an effective non-pharmacological intervention for improving sleep quality in adults [57].

Kredlow MA et al. (2015) conducted a meta-analysis titled "The Effects of Physical Activity on Sleep." The study included 66 intervention studies involving healthy adults and individuals with sleep complaints aged 18–65 years. The intervention duration ranged from 1 day to 24 weeks and included aerobic exercise, resistance training, and combined exercise programs. Outcome measures included PSQI, polysomnography (PSG), sleep efficiency, sleep latency, and total sleep time. The analysis demonstrated that regular physical activity significantly improved sleep quality, increased sleep efficiency, and reduced sleep onset latency. The authors concluded that exercise is an effective strategy for improving sleep quality

across different popYang PY et al. (2012) conducted a systematic review and meta-analysis titled "Exercise Training Improves Sleep Quality in Middle-Aged and Older Adults." The review included 6 randomized controlled trials involving adults aged 40 years and above with sleep disturbances. The intervention duration ranged from 12–24 weeks and consisted mainly of moderate-intensity aerobic exercise. Outcome measures included the Pittsburgh Sleep Quality Index (PSQI), sleep duration, and sleep efficiency. The study reported that regular aerobic exercise significantly improved subjective sleep quality and reduced sleep disturbances. The authors concluded that moderate-intensity aerobic exercise is an effective intervention for improving sleep quality [58].

Kline CE (2014) conducted a systematic review titled "The Bidirectional Relationship Between Exercise and Sleep." The review included healthy adults and individuals with chronic sleep disturbances aged 18–65 years. The intervention duration varied from 4–24 weeks, and the studies evaluated aerobic exercise, walking, cycling, resistance exercise, and yoga. Outcome measures included the Pittsburgh Sleep Quality Index (PSQI), polysomnography, actigraphy, sleep efficiency, and sleep duration. The review found that regular exercise improved sleep quality, reduced daytime sleepiness, increased physical activity levels, and decreased sedentary behaviour. The author concluded that both aerobic exercise and yoga are effective non-pharmacological interventions for improving sleep quality and promoting an active lifestyle [59].

NEED OF THE STUDY

Sedentary behaviour, poor sleep quality, and insufficient physical activity have become increasingly common among young individuals due to prolonged screen time, academic workload, technological dependence, and unhealthy lifestyle habits. These behavioural changes have emerged as important public health concerns because they are associated with an increased risk of obesity, cardiovascular diseases, metabolic disorders, musculoskeletal dysfunction, psychological stress, anxiety, depression, and reduced quality of life. Early intervention during young adulthood is therefore essential to prevent the progression of these lifestyle-related health problems and to establish lifelong healthy behavioural patterns

[1–3].

Regular physical activity is one of the most effective non-pharmacological strategies for improving overall health. Among the various forms of physical activity, aerobic exercise enhances cardiorespiratory fitness, metabolic efficiency, and functional capacity, whereas yoga improves flexibility, autonomic

regulation, stress management, relaxation, and psychological well-being. Although both interventions have independently demonstrated positive effects on health, there is limited comparative evidence regarding their relative effectiveness in reducing sedentary behaviour, improving sleep quality, and increasing physical activity among healthy young individuals **[4–7]**.

Furthermore, many previous studies have focused on a single health outcome or a single intervention, with relatively few investigations simultaneously evaluating sedentary behaviour, sleep quality, and physical activity using standardized and validated assessment tools. Direct comparison of aerobic exercise and yoga employing the Sedentary Behaviour Questionnaire (SBQ), Pittsburgh Sleep Quality Index (PSQI), and Global Physical Activity Questionnaire (GPAQ) remains limited, particularly among healthy young individuals **[8–10]**.

Therefore, the present study is undertaken to compare the effectiveness of aerobic exercise and yoga on sedentary behaviour, sleep quality, and physical activity in young individuals using standardized outcome measures, namely the Sedentary Behaviour Questionnaire (SBQ), Pittsburgh Sleep Quality Index (PSQI), and Global Physical Activity Questionnaire (GPAQ). The findings of this study are expected to provide scientific evidence for selecting an appropriate lifestyle intervention and will contribute to evidence-based physiotherapy practice. The results may also assist physiotherapists, healthcare professionals, veducational institutions, and public health authorities in developing effective health promotion programmes aimed at encouraging active lifestyles, improving sleep quality, reducing sedentary behaviour, and enhancing the overall health and well-being of young individuals **[11,12]**.

AIM OF THE STUDY

A COMPARISON OF AEROBIC EXERCISES VERSUS YOGA ON SEDENTARY BEHAVIOUR, SLEEP QUALTY, AND PHYSICAL ACTIVITY IN YOUNG INDIVIDUALS

HYPOTHESIS

Null Hypothesis (H_0)

There is no difference between Aerobic Exercise and Yoga in improving sedentary behaviour, sleep quality, and physical activity among young individuals

Alternate Hypothesis (H_1)

There is a difference between Aerobic Exercise and Yoga in improving sedentary behaviour, sleep quality, and physical activity among young individuals

OBJECTIVES

- To assess the effect of aerobic exercises on sedentary behaviour using sedentary behaviour questionnaire - short form
- To assess the effect of yoga training on sedentary behaviour using sedentary behaviour questionnaire -short form
- To assess the effect of aerobic exercises on sleep quality using Pittsburg Sleep Quality Index (PSQI).
- To assess the effect of yoga training on sleep quality using Pittsburg Sleep Quality Index (PSQI).
- To assess the effect of aerobic exercises on physical activity using global physical activity questionnaire (GPAQ)

- To assess the effect of yoga on physical activity using Global physical activity questionnarie (GPAQ)

Materials

- Participant Information Sheet
- Informed Consent Form
- Demographic Assessment Form
- Stadiometer
- Digital Weighing Scale
- BMI Calculator
- Sedentary Behaviour Questionnaire (SBQ)
- Pittsburgh Sleep Quality Index (PSQI)
- Global Physical Activity Questionnaire (GPAQ)
- Yoga Mat
- Stopwatch
- Pulse Oximeter
- Attendance Register
- Exercise and Yoga Protocol Sheet



FIGURE 1 YOGA MAT



FIGURE 2 STOP WATCH



FIGURE 3 BMI CALCULATOR

METHODOLOGY

Study Design

- Randomized Comparative Experimental Study with a pre-test and post-test design. Study Setting
- College of Physiotherapy,
- Sri Venkateswara Institute of Medical Sciences (SVIMS), Tirupati, Andhra Pradesh.

Study Duration - 12 Months Intervention Duration

- 12 Weeks Study Population
- Apparently healthy young individuals aged 18–25 years. Sample Size
- 30 Participants
- Group A (Aerobic Exercise): 15 participants
- Group B (Yoga): 15 participants Sampling Technique
- Simple Random Sampling. Method of Group Allocation

Participants were randomly allocated into two groups using the Lottery Method.

- Group A: Aerobic Exercise
- Group B: Yoga

INCLUSION CRITERIA

Participants fulfilling all the following criteria will be included in the study:

1. Young individuals aged **18–25 years**.
2. Both male and female participants.
3. Apparently healthy individuals.
4. Individuals with **poor sleep quality**, defined as a **Pittsburgh Sleep Quality Index (PSQI) score >5**.
5. Individuals exhibiting **sedentary behaviour**, defined as sitting for **≥6 hours/day** or not meeting the recommended physical activity guidelines.
6. Participants willing to participate in a **12-week supervised Aerobic Exercise or Yoga programme**.
7. Participants able to understand and follow study instructions.
8. Participants willing to provide written informed consent.

EXCLUSION CRITERIA

1. Individuals diagnosed with cardiovascular diseases (e.g., coronary artery disease, heart failure, uncontrolled hypertension).
2. Individuals with respiratory disorders (e.g., chronic obstructive pulmonary disease, bronchial asthma requiring regular medication, pulmonary fibrosis).
3. Individuals with neurological disorders affecting mobility, balance, or coordination.
4. Individuals with musculoskeletal disorders, recent fractures, injuries, or conditions limiting participation in exercise or yoga.
5. Individuals who have undergone major surgery within the previous six months.
6. Individuals currently participating in a structured exercise programme, yoga programme, or competitive sports training.
7. Professional athletes or sportspersons.
8. Individuals taking sleeping medications, sedatives, or psychotropic drugs that may influence

sleep quality or physical activity.

9. Individuals diagnosed with psychiatric disorders or cognitive impairment that may interfere with study participation.
10. Individuals with acute illness, fever, or any medical condition contraindicating moderate-intensity exercise.
11. Individuals unwilling to provide written informed consent or unable to comply with the study protocol.

10. STUDY PROCEDURE

The present study was conducted after obtaining ethical clearance from the **Institutional Ethics Committee (IEC), Sri Venkateswara Institute of Medical Sciences (SVIMS), Tirupati (IEC Approval No. 1961)**, approved during the **153rd Institutional Ethics Committee meeting held on 24.01.2026**. Administrative permission to conduct the study was also be obtained from the Principal, College of Physiotherapy, SVIMS, Tirupati.

Participants was recruited from the College of Physiotherapy, Sri Venkateswara Institute of Medical Sciences (SVIMS), Tirupati, based on the predefined inclusion and exclusion criteria. The objectives, nature, benefits, and procedures of the study was explained to all eligible participants in their preferred language. Participants was informed that their participation is entirely voluntary and that they have the right to withdraw from the study at any stage without any consequences. Written informed consent was obtained from each participant before enrolment.

Following recruitment, demographic and anthropometric data including age, gender, height, weight, and Body Mass Index (BMI) will be recorded using a standardized assessment form. Baseline assessment will then be performed using the following validated outcome measures:

- Sedentary Behaviour Questionnaire (SBQ)
- Pittsburgh Sleep Quality Index (PSQI)
- Global Physical Activity Questionnaire (GPAQ)

After completion of the baseline assessment, participants was randomly allocated into two equal groups (n = 15 each) using the lottery method.

Group A – Aerobic Exercise Group (n = 15)

Participants allocated to Group A had undergone a supervised aerobic exercise programme for **12 weeks**, **three sessions per week**, with each session lasting **45–60 minutes**.

Each session consist of:

- Warm-up exercises (5–10 minutes)
- Moderate-intensity aerobic exercise (30–40 minutes)
- Cool-down and stretching exercises (5–10 minutes)

The exercise programme was prescribed according to the **FITT (Frequency, Intensity, Time, and Type) principle**. Exercise intensity was maintained at **50–70% of the age-predicted maximum heart rate (HRmax)**depending on the participant's tolerance. The intensity and duration of exercise will be progressively increased throughout the intervention period under the supervision of a physiotherapist while ensuring participant safety.

Group B – Yoga Group (n = 15)

Participants allocated to Group B underwent a supervised yoga programme for **12 weeks**, **three sessions per week**, with each session lasting **45–60 minutes**.

Each yoga session will include:

- Warm-up exercises
- SukshmaVyayama (loosening exercises)
- Selected Yoga Asanas
- Pranayama (breathing exercises)
- Shavasana (relaxation)
- Meditation

The yoga intervention was conducted under the supervision of a qualified yoga instructor. The programme was gradually progressed according to the participants' abilities while maintaining uniformity in the intervention protocol.

Attendance was recorded for every intervention session to monitor compliance. Participants in both groups was instructed to continue their routine daily activities throughout the study period and to refrain from participating in any additional structured exercise programmes, yoga classes, or other physical training that may influence the study outcomes. Any adverse events or discomfort experienced during the intervention period was documented and managed appropriately in accordance with Institutional Ethics Committee guidelines.

At the completion of the **12-week intervention**, all participants was undergo post-intervention assessment using the same outcome measures employed during baseline evaluation:

- Sedentary Behaviour Questionnaire (SBQ)
- Pittsburgh Sleep Quality Index (PSQI)
- Global Physical Activity Questionnaire (GPAQ)

The collected data was coded and entered into Microsoft Excel before being analysed using appropriate statistical software. Descriptive statistics was used to summarize participant characteristics. Within-group and between-group comparisons of pre- and post-intervention scores was performed using appropriate statistical tests. A **p-value of less than 0.05** was considered statistically significant. The findings was interpreted to determine and compare the effectiveness of aerobic exercise and yoga on sedentary behaviour, sleep quality, and physical activity among young individuals.

OUTCOME MEASURES

To evaluate the effectiveness of aerobic exercise versus yoga on sedentary behaviour, sleep quality, and physical activity among young individuals, standardized, valid, and reliable assessment tools were used. These instruments have been widely utilized in clinical practice and research because of their established psychometric properties. Baseline assessment were performed before the intervention, and the same outcome measures were reassessed after the completion of the 12-week intervention to determine the changes produced by the respective exercise programmes.

Sedentary Behaviour Questionnaire (SBQ)

The **Sedentary Behaviour Questionnaire (SBQ)** is a validated self-administered questionnaire to measure the amount of time an individual spends performing sedentary activities during a typical weekday and weekend day. Sedentary behaviour is defined as any waking behaviour characterized by an energy expenditure of $\leq$1.5 metabolic equivalents (METs) while sitting, reclining, or lying down.

The SBQ consists of questions related to a variety of sedentary activities commonly performed in daily life, including:

- Watching television
- Using a computer or laptop
- Playing video games
- Reading books or newspapers
- Talking on the telephone
- Sitting while travelling in a car, bus, or train
- Sitting during work or study
- Other leisure-time sitting activities

Participants are required to estimate the amount of time spent in each activity on both weekdays and weekends. The responses are converted into average hours per day, and the total sedentary time is calculated by summing the duration of all reported sedentary activities.

The SBQ provides a comprehensive estimate of an individual's sedentary lifestyle. Higher total sedentary time indicates a greater level of sedentary behaviour, which is associated with an increased risk of obesity, cardiovascular diseases, metabolic disorders, poor mental health, and reduced overall physical fitness.

Outcome

- Average sedentary time (hours/day)

Interpretation

- Lower duration = Better outcome
- Higher duration = Greater sedentary behaviour

Pittsburgh Sleep Quality Index (PSQI)

The **Pittsburgh Sleep Quality Index (PSQI)**is one of the most widely used standardized questionnaires for assessing subjective sleep quality over the previous one-month period. It is simple to administer, easy to interpret, and has been extensively validated in both healthy individuals and clinical populations.

The questionnaire consists of **19 self-rated questions**, which are grouped into seven components:

1. Subjective sleep quality
2. Sleep latency (time taken to fall asleep)
3. Sleep duration
4. Habitual sleep efficiency
5. Sleep disturbances
6. Use of sleeping medication
7. Daytime dysfunction

Each component is scored on a scale ranging from **0 to 3**, where:

- 0 = No difficulty
- 3 = Severe difficulty

The seven component scores are summed to obtain a **Global PSQI Score**, which ranges from **0 to 21**.

A lower global score represents better sleep quality, whereas a higher score indicates poorer sleep quality.

Interpretation

PSQI Score Interpretation

0–4Good sleep quality

≥5 Poor sleep quality

Poor sleep quality has been associated with decreased cognitive performance, increased fatigue, reduced academic productivity, mood disturbances, and an increased risk of chronic diseases. Therefore, the PSQI is considered an effective tool for evaluating changes in sleep quality following exercise and yoga interventions.

Outcome

- Global PSQI Score (0–21)

Global Physical Activity Questionnaire (GPAQ)

The **Global Physical Activity Questionnaire (GPAQ)** was developed by the **World Health Organization (WHO)** for surveillance of physical activity in adults across different countries. It is widely recommended for epidemiological studies because it measures physical activity across multiple domains of daily life.

The GPAQ evaluates physical activity performed in three major domains:

1. Work-related Physical Activity

Activities performed during occupational work, household work, farming, or other productive tasks.

2. Transport-related Physical Activity

Walking or cycling for transportation to and from places.

3. Recreational Physical Activity

Physical activities performed during leisure time, including sports, fitness exercises, jogging, walking, yoga, and other recreational activities.

In addition to physical activity, the GPAQ also measures the amount of time spent sitting during a typical day, providing additional information regarding sedentary behaviour.

The questionnaire records the frequency (days/week) and duration (minutes/day) of moderate-and vigorous-intensity physical activities. Based on these responses, total physical activity is calculated and expressed as **Metabolic Equivalent of Task (MET)-minutes per week**.

Interpretation

According to WHO guidelines, physical activity levels are classified into:

- **High Physical Activity**
- **Moderate Physical Activity**
- **Low Physical Activity**

Higher MET-minutes per week indicate greater participation in physical activity and better overall health status.

Outcome

- MET-minutes/week
- Physical activity classification (Low, Moderate, High)

STUDY ALGORITHM

A COMPARISON OF AEROBIC EXERCISES VERSUS YOGA ON SEDENTARY BEHAVIOUR, SLEEP QUALITY, AND PHYSICAL ACTIVITY IN YOUNG INDIVIDUALS

t

Young individuals with Sedentary Behaviour, Poor Sleep Quality, and Reduced Physical Activity

t

Screening According to Inclusion and Exclusion Criteria(n=30)

t

Written Informed Consent

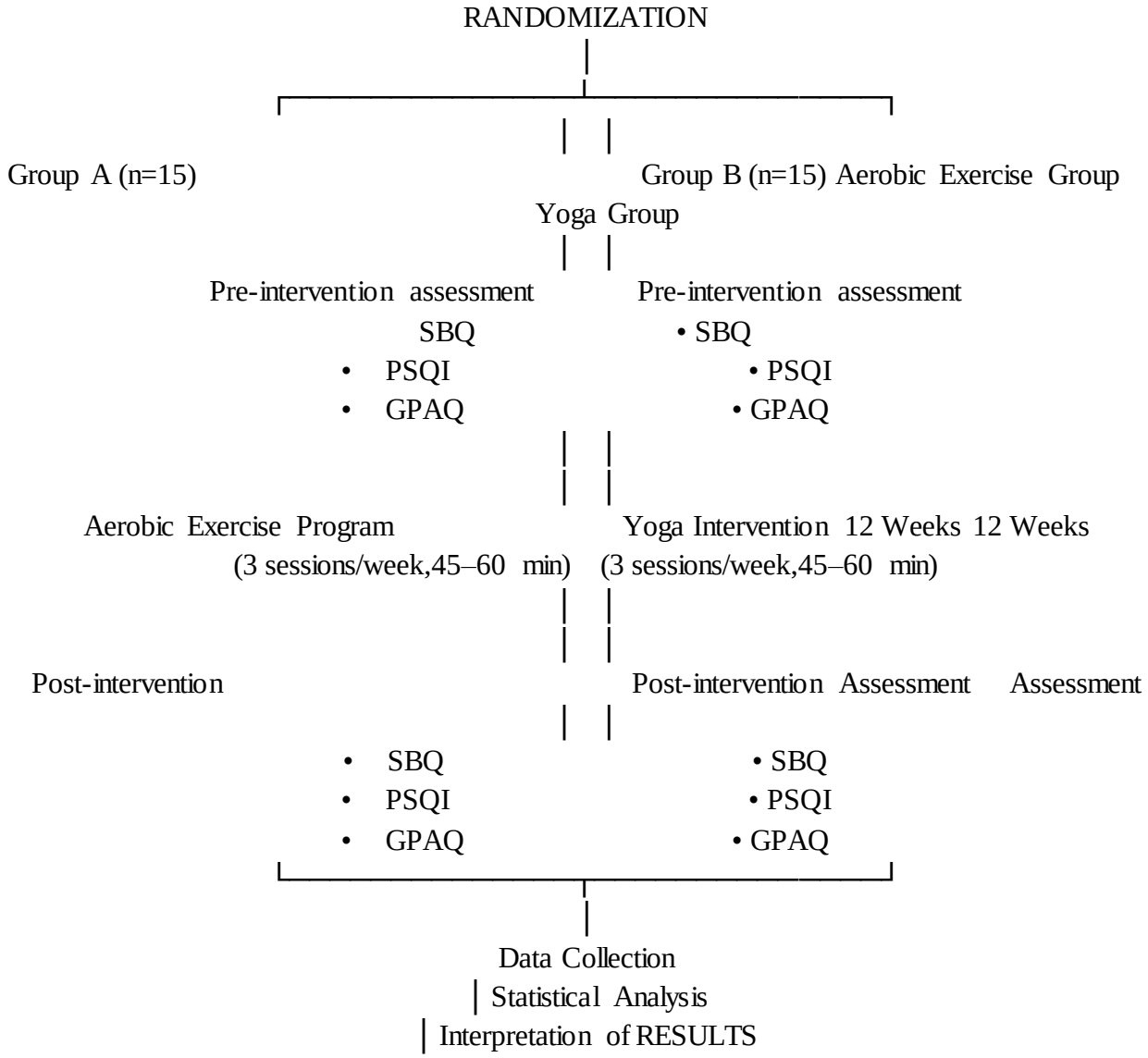
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Baseline Assessment

- Sedentary Behaviour Questionnaire (SBQ)
- Pittsburgh Sleep Quality Index (PSQI)
- Global Physical Activity Questionnaire (GPAQ)

t

Randomization (Lottery Method)



TREATMENT PROTOCOL

Group	Weeks	Sessions per Week	Duration per Session	Intensity	Type of Activity	Notes
Group 1			40	55–		10 minutes warm-up, 20 minutes

(Aerobic Exercise)	1–2 Weeks	3	Minutes	60% HRmax	Brisk walking, light jogging	main aerobic activity, 10 minutes cool-down and stretching
Group 2 (Yoga)	1–2 Weeks	3	45 Minutes	Mild Intensity	SukshmaVyayama, simple stretching asanas, deep breathing exercises	10 minutes SukshmaVyayama, 15 minutes simple stretching asanas, 20 minutes breathing practices

Group	**Weeks**	**Sessions per Week**	**Duration per Session**	**Intensity**	**Type of Activity**	**Notes**
Group 1 (Aerobic Exercise)	3–4 Weeks	3	45 Minutes	60–65% HRmax	Brisk walking, interval jogging, cycling	Gradually increase jogging intervals while maintaining moderate intensity
Group 2 (Yoga)	3–4 Weeks	3	60 Minutes	Moderate Intensity	Stretching asanas, moderate intensity asanas, pranayama, meditation	10 minutes stretching asanas, 20 minutes moderate intensity asanas, 20 minutes pranayama, 10 minutes meditation

Continuation of Treatment Protocol (Weeks 5–8)

Group	**Weeks**	**Sessions per Week**	**Duration per Session**	**Intensity**	**Type of Activity**	**Notes**
Group 1 (Aerobic Exercise)	5–8 Weeks	3	50 Minutes	65–70% HRmax	Brisk walking, jogging, cycling, stair climbing	10 minutes warm-up, 30 minutes aerobic exercise, 10 minutes cool-down and stretching
Group 2 (Yoga)	5–8 Weeks	3	60 Minutes	Moderate Intensity	Surya Namaskar, standing and sitting asanas, pranayama, meditation	10 minutes SukshmaVyayama, 25 minutes asanas, 15 minutes pranayama, 10 minutes meditation

Continuation of Treatment Protocol (Weeks 9–12)

Group	Weeks	Sessions per Week	Duration per Session	Intensity	Type of Activity	Notes
Group 1 (Aerobic Exercise)	9–12 Weeks	3	60 Minutes	70% HRmax (Moderate Intensity)	Brisk walking, jogging, cycling, aerobic dance (optional)	10 minutes warm-up, 40 minutes aerobic exercise, 10 minutes cool-down and stretching
Group 2 (Yoga)	9–12 Weeks	3	60 Minutes	Moderate Intensity	Complete yoga session including Surya Namaskar, standing, sitting, prone, supine asanas, pranayama, relaxation, meditation	10 minutes warm-up, 30 minutes asanas, 10 minutes pranayama, 5 minutes Shavasana, 5 minutes meditation







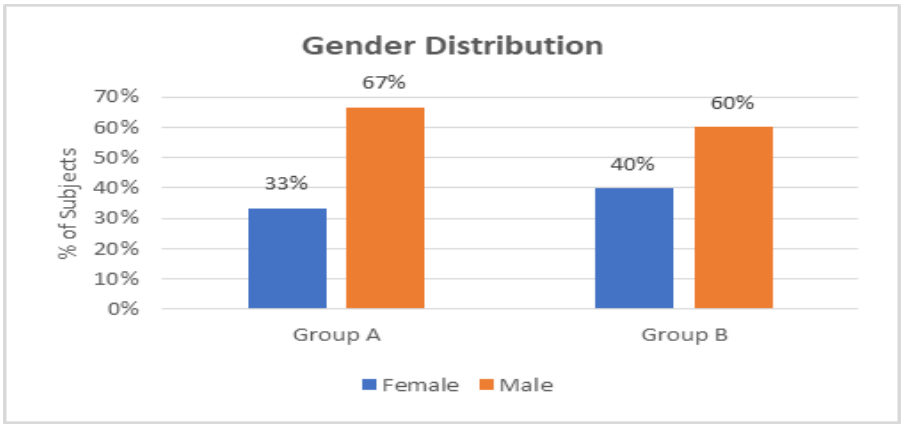
STATISTICAL ANALYSIS

The statistical analysis of the collected data was performed using IBM SPSS Statistics Version 20. Descriptive and inferential statistical analyses were carried out using SPSS, while the tables and graphical representations of the results were prepared using Microsoft Excel for clear presentation and interpretation of the findings

1. Descriptive Statistics

1.1 Gender Distribution of Participants in Group A and Group B

Gender	Group A	Group B
Female	5 (33%)	6 (40%)
Male	10 (67%)	9 (60%)
Total	**15 (100)**	**15 (100)**



The gender distribution of participants given above shows that in Group A, the majority of participants

were male (67%), while 33% were female. Similarly, in Group B, 60% of the participants were male and 40% were female. Overall, both groups showed a similar gender distribution with a higher proportion of male participants.

1.2 Baseline Demographic Characteristics and Outcome Measures of Participants in Group A and Group B

Descriptive Statistics				
	Group A		**Group B**	
Variable	**Mean**	**SD**	**Mean**	**SD**
Age	23.13	1.55	22.53	2.07
Height	167.60	8.12	167.20	7.95
Weight	55.93	3.45	55.47	3.31
BMI	20.01	1.95	19.89	1.89
SBQ_PRE	33.33	2.44	33.93	3.17
SBQ_MID	24.67	2.50	18.60	0.91
SBQ_POST	17.87	1.36	3.27	0.80
PSQI_PRE	13.00	1.00	13.00	1.00
PSQI_MID	7.93	0.70	4.87	0.99
PSQI_POST	5.80	0.56	2.33	0.72
GPAQ_PRE	1269.00	55.72	1154.67	77.65
GPAQ_MID	2092.60	107.09	1747.00	78.21
GPAQ_POST	3160.00	111.40	2437.00	133.40

The descriptive statistics of demographic characteristics and outcome measures for both groups given in the above table shows that the mean age was 23.13 (1.55) years in Group A and 22.53 (2.07) years in Group B. The mean height was 167.60 (8.12) cm and 167.20 (7.95) cm, while the mean weight was 55.93 (3.45) kg and 55.47 (3.31) kg in Groups A and B, respectively. The mean BMI was almost similar in both the groups, with 20.01 (1.95) kg/m² in Group A and 19.89 (1.89) kg/m² in Group B.

For the SBQ, the mean score decreased from 33.33 (2.44) at pre-test to 24.67 (2.50) at mid-test and 17.87 (1.36) at post-test in Group A, whereas Group B showed a reduction from
33.93 (3.17) to 18.60 (0.91) and 3.27 (0.80), respectively. Similarly, the PSQI scores decreased from 13.00 (1.00) at baseline to 7.93 (0.70) and 5.80 (0.56) in Group A, while Group B demonstrated a greater reduction from 13.00 (1.00) to 4.87 (0.99) and 2.33 (0.72). The GPAQ scores increased progressively from 1269.00 (55.72) to 2092.60 (107.09) and 3160.00 (111.40) in Group A, whereas Group B increased from 1154.67 (77.65) to 1747.00 (78.21) and 2437.00 (133.40), indicating improvements in physical activity levels over the study period in both groups.

NORMALITY TEST

Outcome Variable	Shapiro–Wilk (W)	p-value	Interpretation
SBQ	0.924	0.220	Normally distributed
PSQI	0.845	0.015	Not normally distributed
GPAQ	0.958	0.658	Normally distributed

Result

The normality of the outcome variables was assessed using the Shapiro–Wilk test. SBQ ($W = 0.924$, $p = 0.220$) and GPAQ ($W = 0.958$, $p = 0.658$) were normally distributed ($p > 0.05$), whereas PSQI ($W = 0.845$, $p = 0.015$) was not normally distributed ($p < 0.05$). Accordingly, appropriate statistical tests were selected based on the distribution of the data.

2. Inferential Statistics

2.1 Mixed Repeated Measures ANOVA for Comparison of SBQ Scores Between Group A and Group B Across Time

Descriptive Statistics				
Group		**N**	**Mean**	**SD**
SBQ_PRE	Group A	15	33.33	2.44
	Group B	15	33.93	3.17
	Total	30	33.63	2.80
SBQ_MID	Group A	15	24.67	2.50
	Group B	15	18.60	0.91
	Total	30	21.63	3.60
SBQ_POST	Group A	15	17.87	1.36
	Group B	15	3.27	0.80
	Total	30	10.57	7.50

Table of Mixed Repeated Measures ANOVA for SBQ Scores

Source	**df**	**F**	**p-value**	**Partial η^2**	**Interpretation**
Time (Greenhouse–Geisser)	1.36, 37.93	1815.52	<0.001	0.985	Significant change in SBQ scores **across the three assessment periods.**
Group	1, 28	120.09	<0.001	0.811	Significant overall difference in SBQ scores **between Group A and Group B.**
Time × Group (Greenhouse–Geisser)	1.36, 37.93	197.97	<0.001	0.876	The pattern of change in SBQ scores **over time** differed significantly **between the two groups.**

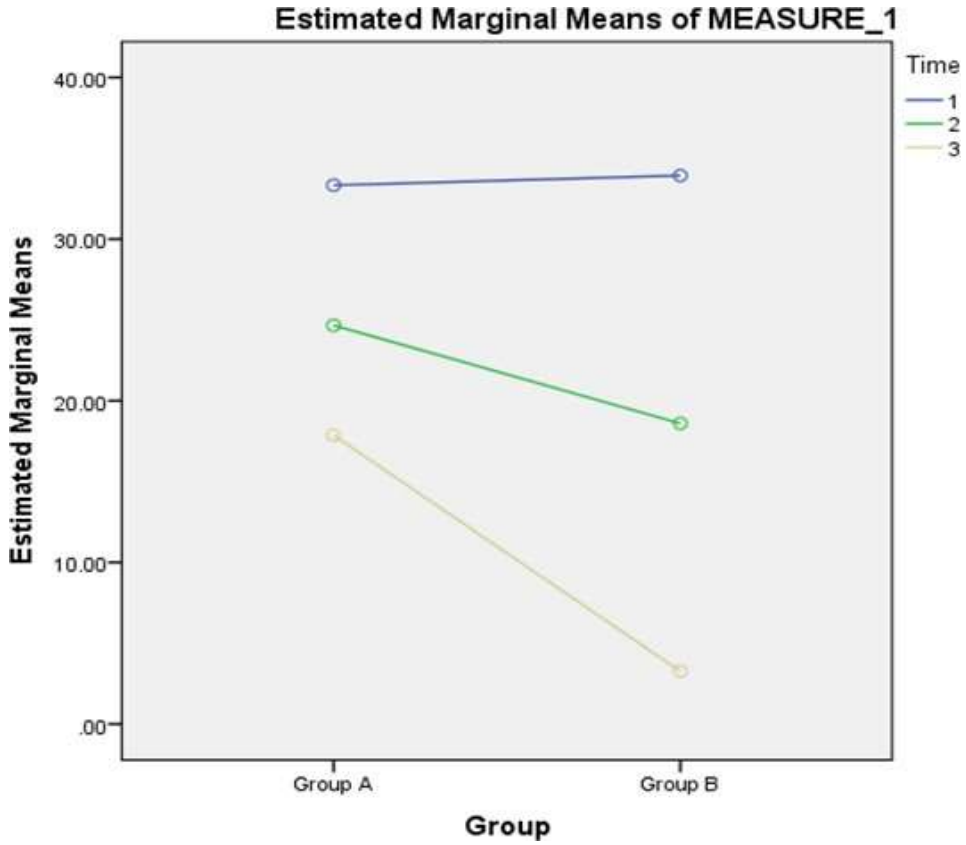
Mauchly's test of sphericity was significant ($W = 0.524$, $\chi^2(2) = 17.46$, $p < 0.001$), indicating that the assumption of sphericity was violated. Therefore, the Greenhouse–Geisser correction ($\varepsilon = 0.677$) was applied.

Table of Post Hoc Pairwise Comparisons (Bonferroni)

Comparison	**Mean Difference**	**p- value**	**Interpretation**
Pre vs Mid	12.00	<0.001	Significant reduction in SBQ scores from pre-

			test to mid-test.
Pre vs Post	23.07	<0.001	Significant reduction in SBQ scores from pre-test to post-test.
Mid vs Post	11.07	<0.001	Significant reduction in SBQ scores from mid-test to post-test.

Estimated Marginal Means



Interpertation of graph

- **X-axis:** Group A and Group B
- **Y-axis:** Estimated marginal mean scores
- **Blue line (Time 1):** Pre-test
- **Green line (Time 2):** Mid-test
- **Yellow line (Time 3):** Post-test

The Mixed Repeated Measures ANOVA revealed that Mauchly's test of sphericity was significant ($W = 0.524$, $\chi^2(2) = 17.46$, $p < 0.001$), indicating a violation of the sphericity assumption. Therefore, the Greenhouse–Geisser correction was applied to interpret the within-subject effects. A significant main effect of time was observed ($F(1.36, 37.93) = 1815.52$, $p < 0.001$, partial $\eta^2 = 0.985$), indicating that SBQ scores changed significantly across the pre-, mid-, and post-intervention assessments. In addition, there was a significant main effect of group ($F(1, 28) = 120.09$, $p < 0.001$, partial $\eta^2 = 0.811$), indicating that there was an overall difference in SBQ scores between Group A and Group B. Furthermore, a significant time × group interaction was observed ($F(1.36, 37.93) = 197.97$, $p < 0.001$, partial $\eta^2 = 0.876$), indicated that the pattern of improvement over time differed significantly between the two

groups.

Bonferroni-Adjusted Pairwise comparisons result showed that there were significant reductions observed in SBQ scores between pre-test and mid-test (mean difference = 12.00, p < 0.001), pre-test and post-test (mean difference = 23.07, p < 0.001), and mid-test and post-test (mean difference = 11.07, p < 0.001), indicating progressive improvement throughout the intervention period.

According to the estimated marginal means plot along with descriptive statistics, both Group A and Group B demonstrated reductions in SBQ scores over the intervention period. However, the significant time × group interaction, together with the descriptive statistics (Group A: 33.33 (2.44) → 24.67 (2.50) → 17.87 (1.36); Group B: 33.93 (3.17) → 18.60 (0.91) → 3.27 (0.80)),

indicates that **Group B experienced a substantially greater reduction in SBQ scores than Group A**, suggesting that the intervention applied to **Group B was more effective in improving SBQ outcomes.**

2.2 Mixed Repeated Measures ANOVA for Comparison of PSQI Scores Between Group A and Group B Across Time

Descriptive Statistics				
	Group	**Mean**	**SD**	**N**
PSQI_PRE	Group A	13.0000	1.00000	15
	Group B	13.0000	1.00000	15
	Total	13.0000	.98261	30
PSQI_MID	Group A	7.9333	.70373	15
	Group B	4.8667	.99043	15
	Total	6.4000	1.77337	30
PSQI_POST	Group A	5.8000	.56061	15
	Group B	2.3333	.72375	15
	Total	4.0667	1.87420	30

Table of Mixed Repeated Measures ANOVA for PSQI Scores

Source	**df**	**F**	**p-value**	**Partial η²**	**Interpretation**
Time	2, 56	1290.14	<0.001	0.979	Significant change in PSQI scores across the three assessment periods.
Group	1, 28	92.09	<0.001	0.767	Significant overall difference in PSQI scores between Group A and Group B.
Time × Group	2, 56	54.04	<0.001	0.659	The pattern of change in PSQI scores over time differed significantly between the two groups.

Mauchly's test of sphericity was not significant (W = 0.851, $\chi^2(2) = 4.356$, p = 0.113), indicating that the assumption of sphericity was met.

Therefore, the Sphericity Assumed results were used for interpretation.

Post Hoc Pairwise Comparisons (Bonferroni)

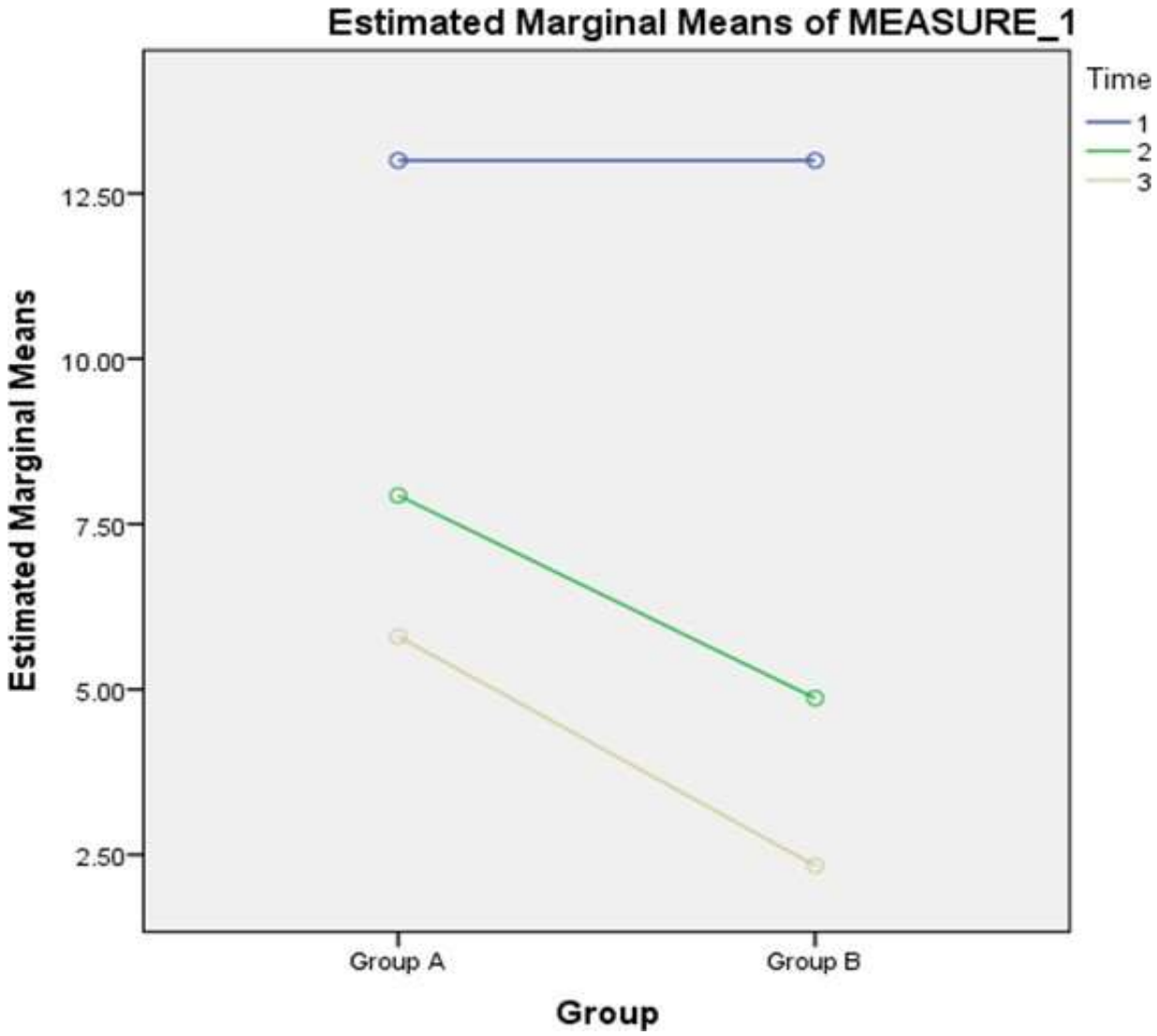
Comparison	Mean Difference	p-value	Interpretation
Pre vs Mid	6.60	<0.001	Significant reduction in PSQI scores from pre-test to mid-test.
Pre vs Post	8.93	<0.001	Significant reduction in PSQI scores from pre-test to post-test.
Mid vs Post	2.33	<0.001	Significant reduction in PSQI scores from mid-test to post-test.

Estimated Marginal Means

The mixed repeated measures ANOVA showed that Mauchly's test of sphericity was not significant ($W = 0.851$, $\chi^2(2) = 4.356$, $p = 0.113$), which indicates that the assumption of sphericity was satisfied. Therefore, the Sphericity Assumed results were considered. A significant main effect of time was observed ($F(2, 56) = 1290.14$, $p < 0.001$, partial $\eta^2 = 0.979$), indicating that PSQI scores significantly changed across the pre-, mid-, and post-intervention assessments. In addition, a significant main effect of group was also observed ($F(1, 28) = 92.09$, $p < 0.001$, partial $\eta^2 = 0.767$), indicating that there was an overall difference in PSQI scores between Group A and Group B. Furthermore, a significant time × group interaction ($F(2, 56) = 54.04$, $p < 0.001$, partial $\eta^2 = 0.659$) indicated that there was a significant difference in the pattern of change in PSQI scores across time between the two groups.

Bonferroni-Adjusted Pairwise Comparisons showed that there was a significant reduction in PSQI scores between pre-test and mid-test (mean difference = 6.60, $p < 0.001$), pre-test and post-test (mean difference = 8.93, $p < 0.001$), and mid-test and post-test (mean difference = 2.33, $p < 0.001$), indicating that there was a progressive improvement obtained throughout the intervention period.

Finally, the examination of the estimated marginal means showed that both groups experienced progressive reductions in PSQI scores from pre- to post-intervention. However, Group B demonstrated a greater reduction in P/SQI scores (13.00 at Pre-Test to 2.33 at Post-Test) compared with Group A (13.00 at Pre-Test to 5.80 at Post-Test), suggesting that the intervention received by **Group B was more effective** in improving sleep quality than the intervention received by Group A.



Interpertation of graph

- **X-axis:** Group A and Group B
- **Y-axis:** Estimated marginal mean scores
- **Blue line (Time 1):** Pre-test
- **Green line (Time 2):** Mid-test
- **Yellow line (Time 3):** Post-test

2.3 Mixed Repeated Measures ANOVA of GPAQ Scores at Pre-, Mid-, and Post-Intervention Between Group A and Group B

Table of Descriptive Statistics

Descriptive Statistics				
	Group	**N**	**Mean**	**SD**
GPAQ_PRE	Group A	15	1269.00	55.72
	Group B	15	1154.67	77.65
	Total	30	1211.83	88.26
GPAQ_MID	Group A	15	2092.60	107.09
	Group B	15	1747.00	78.21
	Total	30	1919.80	198.44

GPAQ_POST	Group A	15	3160.00	111.40
	Group B	15	2437.00	133.40
	Total	30	2798.50	387.00

Table of Mixed Repeated Measures ANOVA for GPAQ Scores

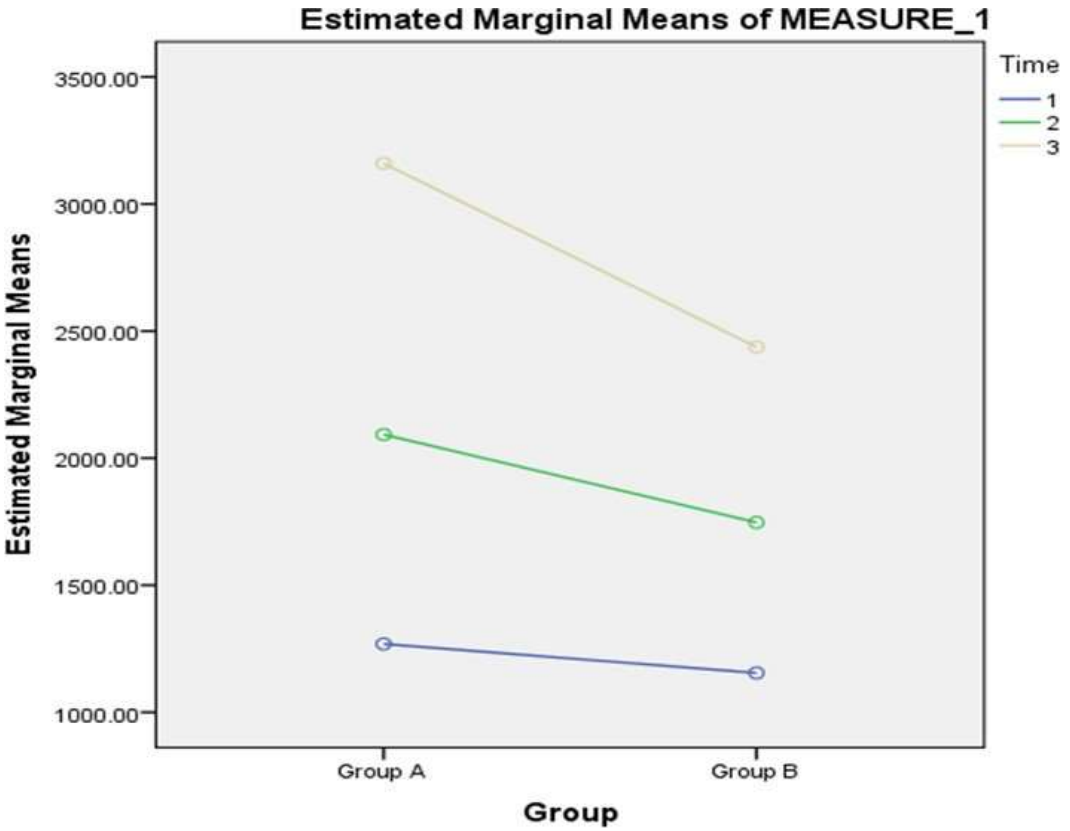
Source	df	F	p-value	Partial η^2	Interpretation
Time (Greenhouse–Geisser)	1.45, 40.46	5279.04	<0.001	0.995	Significant change in GPAQ scores across the three assessment periods.
Group	1, 28	164.38	<0.001	0.854	Significant overall difference in GPAQ scores between Group A and Group B.
Time × Group (Greenhouse–Geisser)	1.45, 40.46	197.19	<0.001	0.876	The pattern of change in GPAQ scores over time differed significantly between the two groups.

Mauchly's test of sphericity was found to be significant ($W = 0.616$, $\chi^2(2) = 13.09$, $p = 0.001 < 0.05$), indicating that the assumption of sphericity was violated. Therefore, the Greenhouse–Geisser correction ($\varepsilon = 0.722$) was considered when interpreting the within-subject effects.

Post Hoc Pairwise Comparisons (Bonferroni)

Comparison	Mean Difference	p-value	Interpretation
Pre vs Mid	-707.97	<0.001	GPAQ scores increased significantly from pre-test to mid-test.
Pre vs Post	-1586.67	<0.001	GPAQ scores increased significantly from pre-test to post-test.
Mid vs Post	-878.70	<0.001	GPAQ scores increased significantly from mid-test to post-test.

Here, the negative mean differences occur because we computed Pre − Mid, Pre − Post, and Mid – Post. Since GPAQ scores increased over time, these differences are coming as negative.



The Mixed Repeated Measures ANOVA indicated that Mauchly's test of sphericity was obtained as statistically significant ($W = 0.616$, $\chi^2(2) = 13.09$, $p = 0.001 < 0.05$), which demonstrated that the assumption of sphericity was violated. Therefore, the Greenhouse–Geisser correction was applied for interpreting the within-subject effects. In addition, the main effect of time was found to be significant ($F(1.45, 40.46) = 5279.04$, $p < 0.001$, partial $\eta^2 = 0.995$), indicating that GPAQ scores changed significantly across the pre-, mid-, and post-intervention assessments. A significant main effect of group was also found ($F(1, 28) = 164.38$, $p < 0.001$, partial $\eta^2 = 0.854$), indicating that the overall difference in GPAQ scores between Group A and Group B was statistically significant. Furthermore, the interaction between time and group (i.e., time × group interaction) was found to be significant ($F(1.45, 40.46) = 197.19$, $p < 0.001$, partial $\eta^2 = 0.876$), showed that the pattern of change in GPAQ scores over time differed significantly between the two groups.

Bonferroni-adjusted pairwise comparisons showed significant increases in GPAQ scores between pre-test and mid-test (mean difference = 707.97, $p < 0.001$), pre-test and post-test (mean difference = 1586.67, $p < 0.001$), and mid-test and post-test (mean difference = 878.70, $p < 0.001$). These findings clearly indicating gradual improvements in physical activity levels throughout the intervention period.

Finally, according to the estimated marginal means showed in means plot along with descriptive statistics, both groups experienced progressive increases in GPAQ scores from pre-to post-intervention. However, Group A demonstrated a greater improvement in physical activity levels (1269.00 at Pre-test to 3160.00 at Post-test) compared with Group B (1154.67 at Pre-test to 2437.00 at Post-test), suggesting that the **intervention given to Group A was more effective** in **improving physical activity** than the intervention provided to Group B.

3. Conclusion

According to the findings of the Mixed Repeated Measures ANOVA, we found that both interventions

produced significant improvements in sleep-related outcomes and physical activity over the intervention period. However, the pattern of change varied significantly between the two groups. In particular, greater improvements in sleep quality and sleep behaviour was found in Group B, whereas Group A showed greater improvement in physical activity levels.

Overall, the results indicate that both interventions were effective, with Group B being more effective for improving sleep-related outcomes and Group A being more effective for enhancing physical activity.

DISCUSSION

The present randomized comparative experimental study was undertaken to compare the effectiveness of aerobic exercise versus yoga on sedentary behaviour, sleep quality, and physical activity among apparently healthy young individuals aged 18–25 years. Modern lifestyles characterized by prolonged sitting, reduced physical activity, academic stress, and excessive screen exposure have contributed to increased sedentary behaviour and poor sleep quality among young individuals **[1–4]**. Both aerobic exercise and yoga have independently been reported to improve physical and psychological health; however, direct comparisons between these two interventions in young sedentary adults remain limited **[5–8]**.

Therefore, the present study sought to determine which intervention provides greater benefits across these important health outcomes.

Thirty participants fulfilling the inclusion criteria were randomly allocated into two equal groups. Group A underwent a supervised aerobic exercise programme, while Group B participated in a structured yoga programme for twelve weeks. Outcome measures included the Sedentary Behaviour Questionnaire (SBQ), Pittsburgh Sleep Quality Index (PSQI), and Global Physical Activity Questionnaire (GPAQ), all of which are internationally validated assessment tools **[9–11]**.

Baseline demographic characteristics demonstrated that both groups were comparable with respect to age, height, weight, and BMI, indicating successful randomization and minimizing the possibility of baseline confounding. Furthermore, the baseline SBQ, PSQI, and GPAQ scores were similar between groups, ensuring that the post-intervention differences could reasonably be attributed to the interventions rather than pre-existing differences.

The findings of the present study demonstrated a statistically significant reduction in sedentary behaviour in both intervention groups across the twelve-week programme. However, participants in the yoga group exhibited a substantially greater reduction in SBQ scores compared with those undergoing aerobic exercise. Mixed repeated measures ANOVA revealed significant effects of time, group, and time-by-group interaction ($p < 0.001$), indicating that although both interventions effectively reduced sedentary behaviour, yoga produced superior improvements.

The greater reduction in sedentary behaviour observed following yoga may be explained by its multidimensional influence on lifestyle behaviour. Unlike aerobic exercise, yoga combines physical postures, breathing exercises, mindfulness, and meditation, encouraging greater body awareness and behavioural self-regulation. These psychological effects may motivate participants to interrupt prolonged sitting, adopt healthier daily routines, and engage more frequently in purposeful movement beyond the supervised sessions. Yoga also reduces mental fatigue and perceived stress, both of which are known contributors to sedentary lifestyles among university students **[12–15]**.

These findings are consistent with previous literature. Prince et al. reported that behavioural physical

activity interventions effectively reduce sedentary behaviour in adults [16], while studies evaluating yoga have demonstrated improvements in lifestyle behaviours extending beyond exercise sessions [17,18]. Likewise, earlier randomized trials reported significant reductions in sedentary time following structured exercise programmes [19].

Sleep quality improved significantly in both intervention groups. Nevertheless, participants receiving yoga demonstrated markedly greater reductions in PSQI scores compared with the aerobic exercise group. Statistical analysis demonstrated highly significant improvements over time and significant differences between groups, indicating that yoga produced greater enhancement in subjective sleep quality.

The superiority of yoga in improving sleep quality may be attributed to several physiological and psychological mechanisms. Regular yoga practice stimulates parasympathetic nervous system activity, decreases sympathetic overactivity, lowers cortisol secretion, enhances vagal tone, and promotes emotional relaxation. Meditation and pranayama reduce anxiety and cognitive hyperarousal, thereby facilitating faster sleep onset, improved sleep continuity, and enhanced sleep efficiency [20–23].

The present findings closely agree with previous systematic reviews reporting that yoga significantly improves sleep quality, reduces insomnia severity, and enhances overall sleep efficiency [24,25]. Halpern et al. demonstrated significant reductions in stress and improvements in sleep following yoga practice [26], while more recent systematic reviews have similarly concluded that yoga provides greater benefits for sleep regulation than aerobic exercise due to its relaxation-based mechanisms [27].

Physical activity levels, assessed using GPAQ, increased significantly in both intervention groups after twelve weeks. However, unlike the findings for sedentary behaviour and sleep quality, aerobic exercise resulted in significantly greater improvements in GPAQ scores compared with yoga. Participants in the aerobic exercise group demonstrated substantially larger increases in MET-minutes per week, and repeated measures ANOVA confirmed significant effects of time, group, and interaction ($p < 0.001$).

The superior improvement in GPAQ scores following aerobic exercise is expected because aerobic training directly involves moderate-intensity continuous physical activity performed over extended durations. Activities such as brisk walking, jogging, cycling, and aerobic exercises substantially increase energy expenditure and cardiovascular workload, thereby contributing to greater weekly MET accumulation. Progressive increases in exercise intensity according to the FITT principle may also have enhanced participant endurance and encouraged continuation of physically active behaviours outside supervised sessions [28–30].

These findings support previous studies demonstrating that structured aerobic exercise significantly increases physical activity participation and cardiorespiratory fitness among sedentary young adults [31,32]. Systematic reviews have consistently shown that aerobic exercise remains one of the most effective interventions for increasing total physical activity levels and improving cardiovascular health [33,34].

Taken together, the findings indicate that both interventions provide substantial health benefits but influence different outcome domains. Yoga demonstrated superior effects on reducing sedentary behaviour and improving sleep quality, whereas aerobic exercise produced greater improvements in physical activity levels. These differences likely reflect their distinct physiological mechanisms [35–37].

The present study possesses several strengths. The randomized comparative design reduced selection bias, both interventions were supervised using standardized protocols, validated outcome measures were employed, and repeated assessments enabled evaluation of temporal changes, thereby improving the internal validity of the findings [38].

However, several limitations should be acknowledged. The sample size was relatively small, reducing statistical generalizability. Participants were recruited from a single institution, limiting external validity. Outcome measures were questionnaire-based and therefore subject to recall bias. The intervention duration was limited to twelve weeks, and long-term follow-up was not performed. Objective measures such as accelerometry, actigraphy, wearable sleep monitoring devices, or polysomnography were not included [39].

Future research should include larger multicentric randomized controlled trials with longer follow-up periods, objective assessment of sleep and physical activity, and inclusion of biochemical markers related to stress and inflammation. Studies evaluating combined aerobic exercise and yoga programmes may further clarify whether integrating both interventions provides additive or synergistic benefits [40].

Limitations of the Study

1. The study was conducted with a relatively small sample size (30 participants), which may limit the generalizability of the findings to the broader young adult population.
2. Participants were recruited from a single institution (College of Physiotherapy, SVIMS, Tirupati); therefore, the results may not be representative of individuals from other institutions or different geographical regions.
3. The intervention period was limited to 12 weeks, and no long-term follow-up was performed to determine whether the improvements in sedentary behaviour, sleep quality, and physical activity were sustained over time.
4. The study relied on self-reported outcome measures (SBQ, PSQI, and GPAQ), which are subject to recall bias and social desirability bias despite being validated assessment tools.
5. Objective assessment methods such as accelerometers, actigraphy, wearable activity trackers, or polysomnography were not used to objectively measure sedentary behaviour, physical activity, or sleep quality.

CONCLUSION

The present study compared the effectiveness of aerobic exercise versus yoga on sedentary behaviour, sleep quality, and physical activity among young individuals aged 18–25 years over a 12-week intervention period.

The findings demonstrated that both aerobic exercise and yoga produced statistically significant improvements in all three outcome measures, indicating that regular structured physical activity is effective in promoting a healthier lifestyle among sedentary young individuals.

Yoga was found to be significantly more effective than aerobic exercise in reducing sedentary behaviour and improving sleep quality, as evidenced by greater reductions in Sedentary Behaviour Questionnaire (SBQ) and Pittsburgh Sleep Quality Index (PSQI) scores.

These benefits may be attributed to the combined effects of physical postures, breathing exercises, relaxation techniques, and meditation, which enhance psychological well-being and promote better sleep. Conversely, aerobic exercise resulted in significantly greater improvements in physical activity levels, as

measured by the Global Physical Activity Questionnaire (GPAQ). The progressive moderate-intensity aerobic training effectively increased overall physical activity and energy expenditure, thereby improving participants' activity levels.

In conclusion, both aerobic exercise and yoga are safe, effective, and non-pharmacological interventions for improving sedentary behaviour, sleep quality, and physical activity among young adults. However, yoga may be the preferred intervention for individuals primarily seeking to improve sleep quality and reduce sedentary behaviour, whereas aerobic exercise may be more suitable for enhancing overall physical activity levels. Incorporating either or both interventions into the daily routine of young adults may contribute significantly to improving health, well-being, and quality of life.

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