

# Association of Cardiorespiratory Fitness and Stress, Depression, Anxiety and Sleep Disturbances in Obesity

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## ABSTRACT

**BACKGROUND AND AIM OF THE STUDY:** In recent years, "common mental ailments," such as adjustment disorder and tiredness due to stress, have surpassed musculoskeletal conditions as the major cause of extended sick leave. The most notable characteristics of these individuals include severe exhaustion—both mental and physical—caused by recognised external stress exposures that endure for longer than six months, sleep deprivation, decline in cognitive performance, and, frequently, psychiatric and somatic co-morbidity. Increased body weight and adiposity are linked to decreased sleep duration and quality. Insomnia, obstructive sleep apnoea, and restless legs syndrome are three of the most common sleep disorders that put people at risk for a variety of chronic illnesses. Recently, a link between poor cardiorespiratory fitness (CRF) and poor sleep quality has been proposed as a negative health outcome. However, there are few research examining the link between CRF and sleep quality measure.

**METHODS:** A total of 50 obese individuals were selected using convenient sampling technique from Saveetha Medical College and Hospital according to the inclusion and exclusion criteria after which a detailed study procedure was described to the individuals and informed written consent was obtained. Individuals were allocated into two groups using Depression, Anxiety, Stress Scale- DASS 21 and Sleep Quality Assessment PSQI. Obese Individuals with poor sleep quality and who fell under moderate and severe category for Depression, Anxiety, Stress were allocated in Group A and individuals who fell under only obese category were allocated in Group B. Both the groups were given 3 minutes' step test and their cardiorespiratory fitness was measured, and the results of the study were associated between the 2 groups.

**RESULT:** It was observed that, the cardiorespiratory fitness of Group A and Group B was found to be significantly different from one another.

**CONCLUSION:** From the result it has been concluded that Cardiorespiratory Fitness (CRF) is found to be less in obese individuals with sleep disturbances, stress, depression and anxiety when compared to obese individuals without sleep disturbances, stress, depression and anxiety.

**KEY WORDS:** Cardiorespiratory Fitness (CRF), sleep disturbances, stress, depression, anxiety, obesity.

## INTRODUCTION:

Depression and anxiety conditions are the top and sixth primary reasons for disability, respectively <sup>[1]</sup>. Sedentary behaviour is linked with risk of depression <sup>[2]</sup>. Cardiorespiratory fitness and the severity of depression symptoms are both significant predictors of mortality and disability. <sup>[3]</sup>. Anxiety and depression disorders is a term used to describe a set of prevalent debilitating mental health conditions, a negative impact on one's well-being and daily functioning. The risk of cardiovascular diseases is elevated in people with mental problems. <sup>[1]</sup>. Cardiorespiratory Fitness is the ability of the heart, lungs, and circulatory system to deliver oxygenated blood according to the metabolic needs imposed during

strong, dynamic activity by a wide group of muscles. Cardiorespiratory Fitness has been linked to improved cardiovascular health <sup>[4]</sup>.

Nearly one-third of all fatalities worldwide are caused by cardiovascular disorders. To decrease cardiovascular events, improving exercise capacity and cardiorespiratory fitness has been a major goal. <sup>[5]</sup> In this respect, compromised sleep quality has been proposed as an essential contributor to lower Cardiorespiratory Fitness. The risk of cardiovascular disease (CVD) is increased due to reduced Cardiorespiratory Fitness <sup>[2]</sup>. Cardiorespiratory fitness is a crucial part of overall physical fitness, which is largely defined by physical activity of moderate to intense level. In healthy men and women, cardiorespiratory fitness has previously been demonstrated to be a powerful independent determinant of mortality and cardiovascular disease <sup>[6]</sup>. Obesity and overweight are common risk factors for the majority of cardiovascular illnesses, such as coronary heart disease (CHD), heart failure (HF), and atrial fibrillation (AF) <sup>[7]</sup>. Obesity has a strong link with cardiovascular disease and stress related conditions. In the developing research relating Sleep Disorders and other chronic diseases, such as cardiovascular disease and diabetes mellitus, it is anticipated to be an important mediating factor within each age group. Researchers may be able to develop more efficient treatments for both obesity and sleep disorders if they understand this connection. <sup>[8]</sup>.

Higher levels of physical activity were associated with less declines in work quality and overall job performance; A higher level of cardiorespiratory fitness was associated with less effort being required to accomplish the work; Obesity was linked to having a harder time getting along with co-workers, and extreme obesity was linked to having a higher number of days off from work <sup>[9]</sup>. There are few studies that look into the link between Cardiorespiratory Fitness and sleep quality. Cardiorespiratory Fitness was not linked to sleep disruptions in women who had stress related fatigue disorder in a longitudinal study. Cardiorespiratory Fitness and sleep quality were linked in adolescent girls who appeared to be in good health. Another longitudinal study found that obese people have lower Cardiorespiratory Fitness because they have more sleep difficulties <sup>[2]</sup>. According to the literature presently available, increased sedentary behaviour is frequently linked to an increased risk of insomnia and sleep disturbance. <sup>[10]</sup> Restless legs syndrome (RLS) is a common type of sleep-related movement problem, with prevalence estimates ranging from 20 to 50 percent <sup>[2]</sup>. The length and quality of sleep is reduced in all of these illnesses, all of which have been linked to weight gain and obesity <sup>[4]</sup>.

Improved physical fitness and weight control strategies could lead to better sleep quality. <sup>[11]</sup> It should come as no surprise, then, that individuals who don't get enough sleep and don't exercise regularly have a much higher risk of chronic illness. Is it possible that these two habits have something in common? Since 2011, a considerable amount of study has been focused on understanding the physiology of sleep and how sleep and exercise interact <sup>[12]</sup>. It is argued that chronically high glucocorticoid hormone levels enhance Cardiorespiratory Fitness activity in the central nucleus of the amygdala, increase stimulus salience, and increase abdominal obesity, which in turn increases metabolic inhibitory feedback on catecholamine in the brain and Cardiorespiratory Fitness expression. This suggests that the same mechanism linked to insomnia-related hyperactivity may encourage the increased intake of food high in sugar, also the accumulation of belly fat storage, in order to relax the brain's hyperactivity <sup>[4]</sup>. In addition to hereditary elements that influence the probability of developing common mental health problems, environmental and lifestyle risk factors, such as obesity, are also becoming more widely recognised <sup>[1]</sup>.

Many symptoms associated with stress-related tiredness, co-morbid depression, and anxiety are linked to decreased physical activity, according to available scientific literature. As a result, one of the most effective treatment tactics has been increased levels of physical exercise <sup>[13]</sup>. Individuals who showed moderate to high fitness levels reported less burnout and depression symptoms than those with decreased fitness levels <sup>[14]</sup>. Several randomised control studies (RCTs) have found that exercise is useful in reducing common mental health issues <sup>[1]</sup>. In persons with depression, exercise increases cardiorespiratory fitness and lowers depression symptoms. It's uncertain whether Cardiorespiratory Fitness alterations are a predictor of exercise's antidepressant impact in patients with depression <sup>[15]</sup>. Obese people are more prone than non-obese people to report insomnia or sleep problems, according to previous research. Obese people were also considerably more prone to acquire chronic insomnia. The existence of a Sleep Disorder may have an acute or chronic impact on the response to physical exercise. This may have consequences for the effectiveness of physical activity/exercise as an intervention, but it may also aid in the recognition of individuals at higher risk for Sleep Disorder or other prolonged illnesses as a predictive tool <sup>[4]</sup>.

## MATERIALS AND METHODS:

**Study Design:** This was an observational studies among 50 obese individuals

**Study Setting:** This study was carried out via communication and better understanding with the individuals

**Sample Size:** A total of 50 obese individuals were recruited in this study

### Inclusion criteria:

- Voluntary participation
- Age range 18-35 years
- BMI greater than 30

### Exclusion criteria:

- Subjects were excluded if they had on-going infection, anaemia, diabetes
- Any thyroid or cardiovascular disorders or respiratory disorders
- Alcohol abuse
- side effects of any medication that would affect the interpretation of results

**Randomization:** 50 individuals were categorized into two groups

- Group A: The individuals with poor sleep quality and falling under moderate to severe category in depression, anxiety and stress scale- DASS 21
- Group B: The individuals with good sleep quality and falling under normal category in Depression, anxiety and stress scale- DASS 21

### Outcome Measures:

- Depression, Anxiety and Stress scale DASS21
- Pittsburgh Sleep Quality Index PSQI scale

S. NO	COMPONENTS	PEARSON'S CORRELATION COEFFICIENT (r)	p-value (<0.05)
1.	Cardiorespiratory fitness vs. Sleep quality	r= 0.7615	p= <0.00001
2.	Cardiorespiratory fitness vs. Depression, Anxiety, Stress	r= 0.4364	p= <0.029186

## RESULTS:

Group A (25 obese individuals with stress, depression, anxiety and sleep disorders)

The results suggest that 0(0%) individuals out of 25 had excellent cardiorespiratory fitness. 2(8%) individuals had good cardiorespiratory fitness. 1(4%) individuals had above average and 3(11%) individuals had average cardiorespiratory fitness. 2(8%) out of 25 individuals had below average cardiorespiratory fitness, 7(27%) individuals had poor and 10(42%) individuals had very poor cardiorespiratory fitness. Group B (25 obese individuals without stress, depression, anxiety and sleep disorders)

The results suggest that there were 5(20%) individuals out of 25 had excellent cardiorespiratory fitness. 7(28%) individuals had good cardiorespiratory fitness. 3(12%) individuals had above average and 3(12%) individuals had

average cardiorespiratory fitness. 4(16%) out of 25 individuals had below average cardiorespiratory fitness, 2(8%) had poor and 1(4%) had very poor cardiorespiratory fitness.

Correlation was found between cardiorespiratory fitness and Sleep Quality ( $r = 0.7615$ ) and p value is  $<0.00001$ . Depression, Anxiety, Stress were also found to be correlated; the correlation coefficient was  $r = 0.4364$  and p value is  $<0.029168$  [Table 6].

The Cardiorespiratory Fitness (CRF) of Group B was observed to be better than Group A. The effect of Stress, Anxiety, Depression and Sleep disorders in obese individuals has an impact on their Cardiorespiratory Fitness.

## DISCUSSION:

The study revealed that in Group A 8% individuals had good to excellent cardiorespiratory fitness whereas in Group B 48% individuals had good to excellent cardiorespiratory fitness. In Group A 77% individuals had below average to very poor cardiorespiratory fitness whereas in Group B only 28% individuals had below average to very poor cardiorespiratory fitness. In Group A 11% individuals had average to above average cardiorespiratory fitness and in Group B 24% individuals had average to above average cardiorespiratory fitness. According to recent studies Ahmad M. Osailan et.al., (2021) stated that cardiorespiratory fitness and Sleep Quality had no significant association, although Physical Activity and Sleep Quality had a fairly significant inverse link. This implies that people's sleep quality will improve if their activity increases. The study also found that when people reported more physical activity on the International physical activity questionnaires-IPAQ, they were less likely to have poor sleep ratings on the Pittsburgh Sleep Quality Index-PSQI<sup>[4]</sup>

A Kandola et al.(2019) stated that Cardiorespiratory Fitness levels are linked to the probability of developing a prevalent mental health problem over time. Cardiorespiratory Fitness levels may be useful in detecting and avoiding prevalent mental health issues in the general population<sup>[1]</sup>. According to this study, there was a positive correlation seen between Sleep Quality and Cardiorespiratory Fitness. Obese individuals who had poor sleep quality were more likely to have poor Cardiorespiratory Fitness. Agneta Lindegård et.al., (2019) stated that lack of exercise is associated with increased exhaustion/burnout symptoms, poorer sleep quality, and longer symptom duration. Finally, during the follow-ups, all three fitness levels reduce stress-related exhaustion symptoms, suggesting the relevance of time for recovery from stress-related exhaustion symptom<sup>[13]</sup>. Stress was a major factor that influenced the Cardiorespiratory Fitness in obese individuals, individuals who fell under normal category for Depression, Anxiety, and Stress Scale DASS 21 showed better Cardiorespiratory Fitness. Brett A. Dolezal et.al., (2017) states that One of the potential benefits of exercise on sleep is the improvement of body composition. Sleep disturbance is common in Obesity. They compared the effects of a nutritional and exercise programme to a nutritional programme alone on weight loss to see what factors might be linked to sleep problems. They conclude that there is a favourable relationship between self-reported exercise exertion and objectively measured sleep, implying that encouraging exercise as part of daily physical activity likely helps the objective components of sleep<sup>[12]</sup>. Trent A Hargens et al.(2013) stated that sleep disruptions and deprivation, whether caused by insomnia, or a sleep-related movement disorder, appear to be linked to the development or worsening of body obesity, or vice versa. However, it appears that exercise has a beneficial effect on Sleep Disorder. Regular exercise appears to have a positive impact on quality of life and/or severity outcomes in all three situations<sup>[8]</sup>. Exercise can help reduce weight, hence reducing weight related depression, stress, anxiety, improving the sleep quality and thus improving the Cardiorespiratory Fitness.

## CONCLUSION:

It is concluded that obese individuals without stress, anxiety, depression and sleep disorders showed better cardiorespiratory fitness when compared to individuals with stress, anxiety, depression and sleep disorders.

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**DATA AVAILABILITY:**

Data is available under reasonable request to the corresponding author.

**CONFLICT OF INTERESTS:**

The authors declare that they have no conflict of interest.

**REFERENCES:**

1. Kandola A, Ashdown-Franks G, Stubbs B, Osborn DP, Hayes JF. The association between cardiorespiratory fitness and the incidence of common mental health disorders: a systematic review and metaanalysis. *Journal of affective disorders*. 2019 Oct 1;257:748-57.
2. Zhai L, Zhang Y, Zhang D. Sedentary behaviour and the risk of depression: a meta-analysis. *British journal of sports medicine*. 2015 Jun 1;49(11):705-9.
3. Papasavvas T, Bonow RO, Alhashemi M, Micklewright D. Depression symptom severity and cardiorespiratory fitness in healthy and depressed adults: a systematic review and meta-analysis. *Sports Medicine*. 2016 Feb;46(2):219-30.
4. Osailan AM, Elnaggar RK, Alsubaie SF, Alqahtani BA, Abdelbasset WK. The association between cardiorespiratory fitness and reported physical activity with sleep quality in apparently healthy adults: a crosssectional study. *International Journal of Environmental Research and Public Health*. 2021 Jan;18(8):4263.
5. Rahman MS, Helgadóttir B, Hallgren M, Forsell Y, Stubbs B, Vancampfort D, Ekblom Ö. Cardiorespiratory fitness and response to exercise treatment in depression. *BJPsych open*. 2018 Sep;4(5):346-51.
6. Holmlund T, Blom V, Hemmingsson E, Ekblom B, Andersson G, Wallin P, Ekblom-Bak E. Change in cardiorespiratory fitness on self-rated health: prospective cohort study in 98 718 Swedish adults. *Scandinavian Journal of Public Health*. 2021 Oct 19;14034948211047140.
7. Oktay AA, Lavie CJ, Kokkinos PF, Parto P, Pandey A, Ventura HO. The interaction of cardiorespiratory fitness with obesity and the obesity paradox in cardiovascular disease. *Progress in cardiovascular diseases*. 2017 Jul 1;60(1):30-44.
8. Hargens TA, Kaleth AS, Edwards ES, Butner KL. Association between sleep disorders, obesity, and exercise: a review. *Nature and science of sleep*. 2013;5:27.
9. Pronk NP, Martinson B, Kessler RC, Beck AL, Simon GE, Wang P. The association between work performance and physical activity, cardiorespiratory fitness, and obesity. *Journal of occupational and environmental medicine*. 2004 Jan 1:19-25.
10. Yang Y, Shin JC, Li D, An R. Sedentary behavior and sleep problems: a systematic review and meta-analysis. *International Journal of Behavioral Medicine*. 2017 Aug;24(4):481-92.
11. Moreno-Vecino B, Arija-Blázquez A, Pedrero-Chamizo R, GómezCabello A, Alegre LM, Perez-Lopez FR, González-Gross M, Casajús JA, Ara I, EXERNET Group. Sleep disturbance, obesity, physical fitness and quality of life in older women: EXERNET study group. *Climacteric*. 2017 Jan 2;20(1):72-9.
12. Dolezal BA, Neufeld EV, Boland DM, Martin JL, Cooper CB. Interrelationship between sleep and exercise: a systematic review. *Advances in preventive medicine*. 2017 Oct;2017.
13. Lindegård A, Wastensson G, Hadzibajramovic E, Grimby-Ekman A. Longitudinal associations between cardiorespiratory fitness and stressrelated exhaustion, depression, anxiety and sleep disturbances. *BMC Public Health*. 2019 Dec;19(1):1-3.
14. Gerber M, Lindwall M, Lindegård A, Börjesson M, Jonsdottir IH. Cardiorespiratory fitness protects against stress-related symptoms of burnout and depression. *Patient education and counseling*. 2013 Oct 1;93(1):146-52.
15. Al-Mallah MH, Sakr S, Al-Qunaibet A. Cardiorespiratory fitness and cardiovascular disease prevention: an update. *Current atherosclerosis reports*. 2018 Jan;20(1):1-9.