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A Study to Determine Aerobic Capacity in Early Adulthood to Identify the Adverse Effect of Sedentary Lifestyle

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Abstract

Background: Sedentary lifestyles, marked by prolonged periods of physical inactivity such as extensive computer use and sitting, have become increasingly prevalent with digitalization and morden work enviroments. Early adulthood age is critical period where lifestyle habits are established, making it essential to study the health impacts of behaviour during this stages.

Aims: The primary aim of this study is to determine the aerobic capacity (VO2max) in early adulthood to identify the adverse effects of a sedentary lifestyle. Additionally, this research seeks to explore the differences in VO2max between males and females within this age group.

Setting: This cross-sectional study was conducted among a sample of young adults aged 18-25 years from rennaisance educational institution.

Design: The study utilized a stratified random sampling method to select participants. VO2max was measured using a standard treadmill test, and physical activity levels were assessed through a validated self-report questionnaire. Statistical analyses were performed to compare the VO2max values between genders and against established average values for early adulthood.

Keywords: Aerobic Capacity, VO2max, Early Adulthood, Sedentary Lifestyle, Gender Differences, Physical Activity.

INTRODUCTION

In recent decades, the rise of sedentary lifestyles has become a pressing public health issue, contributing significantly to the global burden of chronic diseases. With technological advancements and modern conveniences, physical inactivity has surged, especially among young adults. This trend poses a substantial threat to overall health and well-being, with numerous studies linking sedentary behavior to adverse outcomes such as obesity, cardiovascular disease, diabetes, and premature mortality[6]

Early adulthood, a critical phase of life marked by the transition from adolescence to full maturity, presents a unique window for investigating the long-term effects of lifestyle choices. During this period, individuals often establish patterns of behavior that persist into later life, making it an essential target for interventions aimed at promoting physical activity and preventing chronic diseases.[12]

especially young adults, rather than the known impact of physical activity on health and diseases most of the populations are following the sedentary lifestyle. As sedentary lifestyle leads of early onset and progression of lifestyle disease such as diabetes, cardiovascular disease, hypertension, and obesity. It is thus necessary to study the lifestyle acquaintances and document it on regular basis to bring about the necessary change in society.

Aerobic capacity, a key indicator of cardiovascular fitness, serves as a valuable measure for assessing the impact of physical activity on health. Higher levels of aerobic capacity are associated with a lower risk of chronic diseases, improved mental health, and enhanced quality of life.[11] Conversely, a sedentary lifestyle can lead to a decline in aerobic capacity, setting the stage for a host of health complications.

The average VO2max value, a common measure of aerobic capacity, for individuals in early adulthood (ages 18-25) ranges between 38-48 mL/kg/min for males and 27-37 mL/kg/min for females, depending on various factors such as fitness level, genetics, and lifestyle.[3,5] These values highlight the potential for significant variance in aerobic capacity, influenced by lifestyle choices, particularly the level of physical activity.

This study aims to explore the aerobic capacity of individuals in early adulthood to identify the adverse effects of a sedentary lifestyle. By examining the relationship between physical activity levels and aerobic capacity, we seek to provide evidence-based insights that can inform public health strategies and individual lifestyle choices. Our goal is to underscore the importance of maintaining an active lifestyle during this pivotal stage of life and to highlight the long-term health benefits of regular physical activity.

In the following sections, we will delve into the methodology, data analysis, and findings of our study, offering a comprehensive understanding of how sedentary behavior impacts aerobic capacity in early adulthood. By shedding light on this critical issue, we hope to contribute to the growing body of knowledge that underscores the necessity of physical activity for a healthier, more vibrant future.

SUBJECT AND METHOD

Participants

A total of 41 participants are participated in the study out which 24 were females and 17 were males. between the age group of 18 to 25 years.

participants comprise of college going young adults and must follow the sedentary life style. A questionnaire is filled through the participants to ensure their sedentary behavior, early teenagers and above 25 years of age were excluded. Participants with any systemic disease were excluded.

Study design and research method

This cross-section of study among the participants are college going students and follow the sedentary lifestyle in the rennai sance university, Indore from april 5, 2024. To ensure their sedentary behavior we had ask them to fill a questionnaire on sedentary behavior, those participants who has any systemic disease, like b.p, diabetes, arrythemias, pcod, obesity.

Participants were invited for this study is by reaching them to personally in the campus.

Instrumentation and study tool

The tool used for data collection for this study were treadmill, pulse oximeter, paper pen, cooper test, BMI, inch tape.

On treadmill participant has to run continuously for 12 min, the note their kms that the had run for 12 min, put the values in coopers test equation I,e;

VO2max = (22.351 x kilometers) - 11.288, before starting the run for 12 min on treadmill participants must have done a warm up activity of 5 min.

It was a single-visit study where participants had to give their basic details like height, weight, age and had to fill the questionnaire containing questions for sedentary behavior . All the participants were screened for eligibility by checking if they fit in the inclusion criteria, once they decided to volunteer for the study.

Eligible participants were asked to fill out the consent form to provide consent for taking part in this study voluntarily

Medical history of such participants was obtained to decide their eligibility and eligible participants were then recruited.

Participants were given the freedom to quit from the study if they change their minds at any time period during the ongoing study. Data were collected by the method of convenience sampling. By the end of the study, all the values were recorded

Statistical analysis:

After the data collection, data obtained in the assessment form. This data transferred to the excel sheet. Descriptive statistics perform to calculate mean standard deviation frequency and percentage of each variable.

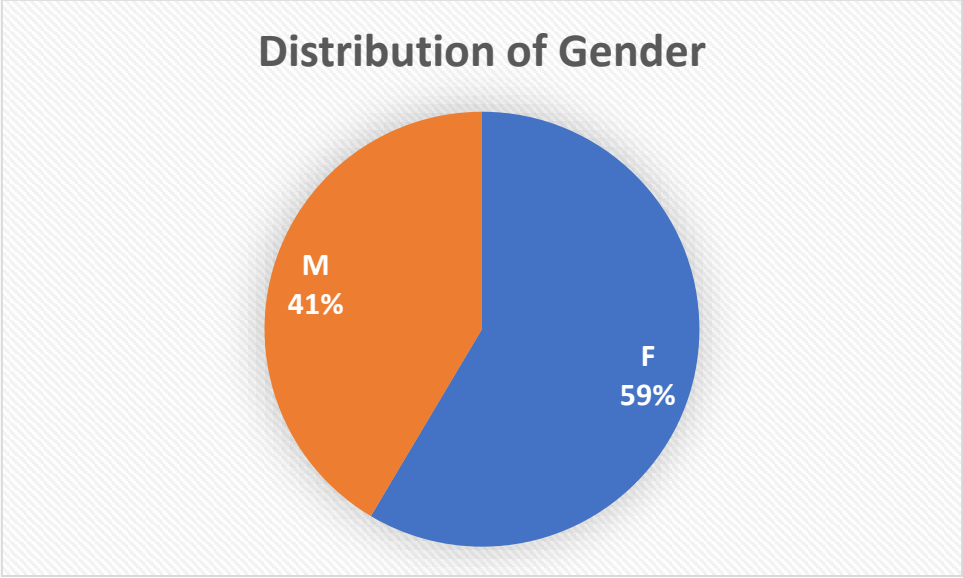
RESULTS

Descriptive Analysis:

Demographic Variables:

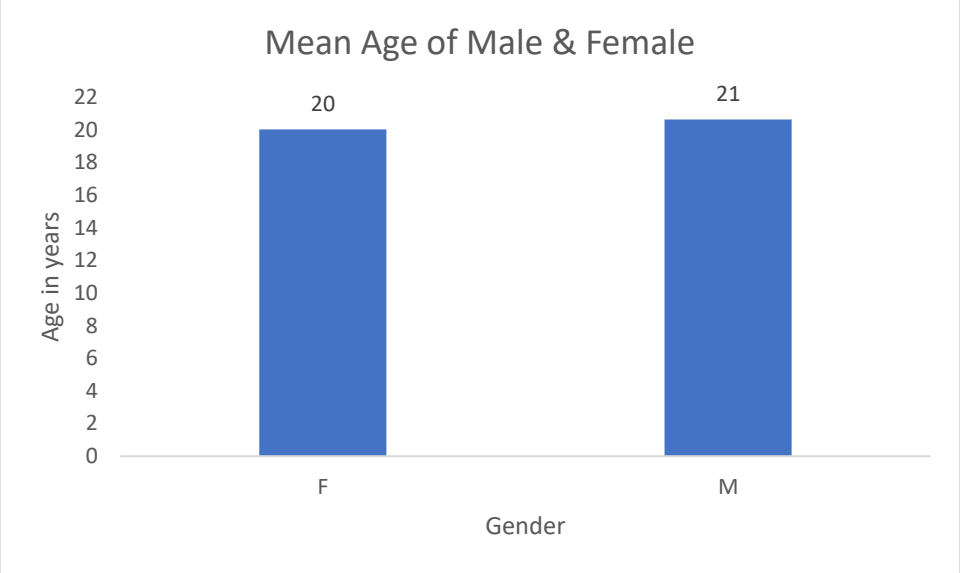
Gender: Out of 41 students, 24 were females and remaining 17 were male.

Figure 1



Age: The bar plot shows average age of male students was 21 years and average age of female students was 20 years.

Figure 2



Inferential Analysis:

Ha_1: There is major decreased value of vo2 max in female students.

Table 1: Descriptives of VO2 of Female Students

	N	Mean	Median	SD	SE
Vo2 max	24	11.5	11.0	4.65	0.949

Table 2: One Sample T-Test

		Statistic	df	P	Mean difference
Vo2 max	Student's t	-19.5	23.0	1.000	-18.5

Note. H_a $\mu > 30$

Table 2 provides the results of a one-sample t-test comparing the sample mean VO2 max to a hypothesized population mean of 30.

The descriptive statistics in Table 1 indicate that the mean VO2 max of the female students in the sample is much lower than 30 (the mean is 11.5).

The results of the one-sample t-test in Table 2 show:

A t-statistic of -19.5, which is a very large negative value, indicates that the sample mean is much lower than the hypothesized mean.

A p-value of 1.000, which suggests that the observed data are very consistent with the null hypothesis (i.e., there is no statistically significant difference from the hypothesized mean of 30).

Given the context and the note provided, the alternative hypothesis (Ha: $\mu > 30H_a$) is not supported by the data. The sample mean is significantly less than 30, and the p-value indicates that we fail to reject the null

hypothesis. This means there is no evidence to suggest that the true mean VO2 max of female students is greater than 30 based on this sample.
Ha_2: There is major decreased value of vo2 max in male students.

Table 3: Descriptives of VO2 of Male Students

	N	Mean	Median	SD	SE
Vo2 max	17	26.7	25.0	8.68	2.10

Table 4: One Sample T-Test

		Statistic	df	P	Mean difference
Vo2 max	Student's t	-3.97	16.0	0.999	-8.35

Note. H_a $\mu > 35$

Table 3 provides the results of a one-sample t-test comparing the sample mean VO2 max to a hypothesized population mean of 35.
The descriptive statistics in Table 3 indicate that the mean VO2 max of the male students in the sample is lower than 35 (the mean is 26.7).
The results of the one-sample t-test in Table 4 show:
A t-statistic of -3.97, which is a large negative value, indicates that the sample mean is lower than the hypothesized mean.
A p-value of 0.999, which suggests that the observed data are very consistent with the null hypothesis (i.e., there is no statistically significant difference from the hypothesized mean of 35).
Given the context and the note provided, the alternative hypothesis (Ha: $\mu > 35 H_a$) is not supported by the data. The sample mean is significantly less than 35, and the p-value indicates that we fail to reject the null hypothesis. This means there is no evidence to suggest that the true mean VO2 max of male students is greater than 35 based on this sample.
H0_3: There is no significant difference of VO2 between the female and male students.

Figure 3: Mean of VO2 w.r.t. Gender

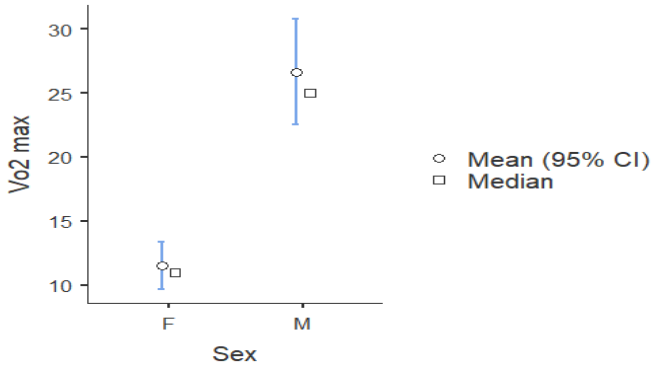


Table 5: Group Descriptives

	Group	N	Mean	Median	SD	SE
Vo2 max	F	24	11.5	11.0	4.65	0.949
	M	17	26.7	25.0	8.68	2.10

Table 6: Independent Samples T-Test

		Statistic	df	p	Mean difference	SE difference
Vo2 max	Student's t	-7.23	39.0	< .001	-15.1	2.09

Note. $H_a\ \mu_F \neq \mu_M$

Table 6 provides the results of an independent samples t-test comparing the mean VO2 max values between the two groups (female and male students).
The descriptive statistics in Table 5 show that the mean VO2 max is significantly higher for male students (26.7) compared to female students (11.5).
The results of the independent samples t-test in Table 6 show:
A t-statistic of -7.23, indicating a substantial difference between the groups.
A p-value of < .001, which is highly significant. This means there is a very low probability that the observed difference in means is due to random chance.
A mean difference of -15.1, indicating that the mean VO2 max of female students is 15.1 units lower than that of male students.
The standard error of the mean difference is 2.09, showing the variability of the difference between the group means.
Given the context and the note provided, the alternative hypothesis ($Ha:\mu F \neq \mu MH_a$) is strongly supported by the data. There is a statistically significant difference between the mean VO2 max of female and male students, with male students having a higher mean VO2 max than female students in this sample.
H0_4: There is no difference in the mean VO2 max values among students aged 19, 20, 21, and 24. That is, the mean VO2 max for students in these age groups is equal.

Figure 4: Mean of VO2 w.r.t. Age

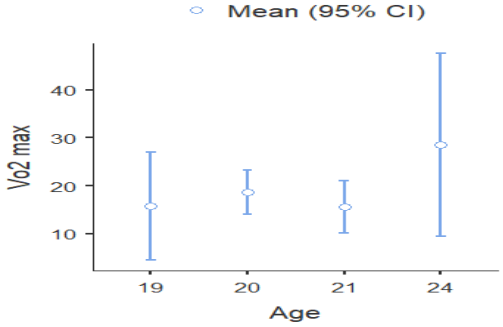


Table 7: Group Descriptives of VO2 w.r.t Age of Students

	Age	N	Mean	SD	SE
Vo2 max	19	7	15.7	12.24	4.63
	20	21	18.6	10.23	2.23
	21	11	15.6	8.11	2.45
	24	2	28.5	2.12	1.50

Table 8: One-Way ANOVA (Welch's)

	F	df1	df2	p
Vo2 max	8.58	3	10.5	0.004

Table 9: Games-Howell Post-Hoc Test – Vo2 max

		19	20	21	24
19	p-value	—	0.940	1.000	0.124
20	p-value		—	0.791	0.025
21	p-value			—	0.009
24	p-value				—

Table8 provides the results of a one-way ANOVA test comparing the mean VO2 max across the different age groups. The p-value of 0.004 indicates that there is a statistically significant difference in the mean VO2 max values among the different age groups.

Table 9 provides the results of the Games-Howell post-hoc test, which identifies which specific age groups have significantly different mean VO2 max values.

Comparison between Age 19 and other ages

Age 19 vs. Age 20: p-value = 0.940 (not significant)

Age 19 vs. Age 21: p-value = 1.000 (not significant)

Age 19 vs. Age 24: p-value = 0.124 (not significant)

Comparison between Age 20 and other ages

Age 20 vs. Age 21: p-value = 0.791 (not significant)

Age 20 vs. Age 24: p-value = 0.025 (significant)

Comparison between Age 21 and Age 24

Age 21 vs. Age 24: p-value = 0.009 (significant)

Table 7 shows that the mean VO2 max varies across different age groups, with age 24 showing the highest mean (28.5), although this group has a very small sample size.

The results of the one-way ANOVA (Table 8) indicate that there is a statistically significant difference in mean VO2 max across the age groups ($p = 0.004$).
The post-hoc test results (Table 9) provide more detail on where these differences lie:
The mean VO2 max for age 24 is significantly different from ages 20 ($p = 0.025$) and 21 ($p = 0.009$).
There are no significant differences between the other age groups (e.g., 19 vs. 20, 19 vs. 21, 20 vs. 21).
This suggests that the significant difference found in the ANOVA is primarily due to the higher VO2 max in the age 24 group compared to the other age groups, particularly ages 20 and 21.

Discussion

findings of this study reveal a significant reduction in VO2max values among both male and female participants when compared to the established average values for early adulthood. This trend underscores the pervasive impact of sedentary lifestyles on aerobic capacity and overall cardiovascular health.

Gender Differences in VO2max

One of the key observations from our research is the significant difference in VO2max values between males and females. On average, males in early adulthood have higher VO2max values compared to females. This disparity is well-documented in the literature and can be attributed to several physiological factors, including differences in muscle mass, hemoglobin levels, and cardiac output.[8] Our results are consistent with these findings, further emphasizing the inherent physiological differences between genders.

Impact of Sedentary Lifestyles

The lowered VO2max values in our study cohort highlight the adverse effects of sedentary lifestyles. Physical inactivity has been shown to lead to declines in aerobic capacity, which in turn increases the risk of chronic diseases such as cardiovascular disease, diabetes, and metabolic syndrome.[13] This is particularly concerning given the increasing prevalence of sedentary behaviors among young adults, driven by changes in work environments and recreational activities.

Public Health Implications

The significant reduction in VO2max values among our participants signals a need for urgent public health interventions. Promoting regular physical activity during early adulthood is crucial for maintaining cardiovascular fitness and preventing the onset of chronic diseases. Public health strategies should focus on creating environments that encourage active lifestyles, such as accessible recreational facilities and community-based fitness programs.[10]

Recommendations for Future Research

Future research should aim to explore the underlying factors contributing to the decline in aerobic capacity among young adults. Longitudinal studies examining lifestyle behaviors, dietary patterns, and genetic predispositions can provide deeper insights into the mechanisms driving these trends. Additionally, intervention studies focusing on specific physical activities and their impact on VO2max could inform targeted public health strategies.

Limitations

It is important to acknowledge the limitations of our study. The cross-sectional design precludes the establishment of causality between sedentary behavior and reduced VO2max. Furthermore, self-reported physical activity levels may be subject to recall bias. Future studies employing objective measures of physical activity, such as accelerometers, would enhance the accuracy of the findings.

Conclusion

The study reveals significant differences in VO2 max levels among students. Male students exhibit significantly higher VO2 max than female students, and students aged 24 outperform younger age groups. These findings highlight critical insights into gender and age impacts on aerobic capacity, emphasizing the need for tailored fitness approaches.

Our study underscores the critical importance of maintaining an active lifestyle to preserve aerobic capacity and prevent chronic diseases. The significant differences in VO2max values between genders and the overall decline in these values among young adults highlight the need for targeted public health interventions

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