

Correlation of Fasting Serum Glucose and Serum Total Cholesterol in Sedentary Male

*Yeasmin F¹, Nessa A², Sharmin A³, Suchi SS⁴

Sedentary behavior has significant deleterious effects on human health. Sedentary behaviors associated with cardiovascular and metabolic disorders by decreasing lipoprotein lipase activities, impaired lipid and carbohydrate metabolism. This cross sectional study was done to see the association between fasting serum glucose and serum total cholesterol in sedentary male. This study was conducted in the Department of Physiology, Mymensingh Medical College, Bangladesh from July 2021 to June 2022. A total number of 100 subjects were included in this study. Among them, fifty (50) sedentary males were taken as study group (Group II) and fifty (50) active males were taken as control group (Group I). Age of both control and study group ranged from 25-60 years. Data were expressed as mean±SD and statistical significance of difference among the group was calculated by unpaired students' 't' test & Pearson's correlation coefficient test. Both of these biochemical parameters showed statistically significant difference in study group. The mean±SD of fasting serum glucose of control group (Group I) and study group (Group II) were 4.45±0.51 mmol/L and 5.91±0.60 mmol/L; and the mean±SD of serum total cholesterol level of control group (Group I) and study group (Group II) were 176.14±27.16 mg/dl and 252.58±18.97 mg/dl respectively. Fasting serum glucose and serum total cholesterol shows positive correlation in study group in comparison to control group. From this finding it can be concluded that there was significant correlation of fasting serum glucose and serum total cholesterol in sedentary males.

[Mymensingh Med J 2024 Oct; 33 (4): 1054-1057]

Key words: Sedentary, Insulin resistance, Dyslipidemia

Introduction

Now a day sedentary behavior is a public health concern in the modern world¹. Sedentary behavior is defined as “any waking behavior characterized by a low expenditure of energy while in sitting or reclining posture”. The example of sedentary behaviors include sitting or lying posture while watching TV, desk work, playing video game, driving car, using a computer or mobile devices and reading book etc². Sedentary behavior is mostly common in the workplace because office workers spent about 70.0% of their time in sitting position at their work place³. During the 21st century, sedentary lifestyle is significantly increased due to rise in desk jobs and increase use of technologies such as laptops and internet¹. According to World Health Organization “Physical activity is defined as any voluntary bodily movement produced by skeletal muscles that require energy expenditure”. Physical activity includes all activities which are performed during leisure time, transport or work e.g. walking, cycling, wheeling and sports⁴. Sedentary lifestyles are a major risk factor for metabolic dysfunctions such as elevated serum total cholesterol, triglycerides and reduced insulin

sensitivity, hypertension, obesity etc⁵. On the other hand regular physical activity prevents non-communicable diseases such as hypertension, stroke, diabetes and several cancers. Thus it helps to improve the quality of life⁴. People who sit more than four hours per day have a 40.0% higher risk than those who sit fewer than four hours per day.

1. *Dr Fahmida Yeasmin, Lecturer, Department of Physiology, Mymensingh Medical College (MMC), Mymensingh, Bangladesh; E-mail: fahmidasomc47@gmail.com

2. Professor Dr Akhtarun Nessa, Professor & Ex-Head, Department of Physiology, MMC, Mymensingh, Bangladesh

3. Dr Afroza Sharmin, Assistant Professor, Department of Physiology, MMC, Mymensingh, Bangladesh

4. Dr Sayeda Sultana Suchi, M Phil (Physiology) Final Part Student, Department of Physiology, MMC, Mymensingh, Bangladesh

*for correspondence

Original Contribution

People who exercise at least four hours per week are as healthy as those that sit fewer than four hours per day⁶. A lack of physical activity is one of the leading causes of preventable death worldwide⁷. Physical inactivity is the fourth leading modifiable risk factor for global mortality and it accounts for 6.0% of total mortality in the world⁸. A sedentary lifestyle is strongly associated with CVD, DM, dyslipidemia and premature mortality. The total daily sedentary time and television viewing time were correlated with an increased all-cause mortality risk⁹. Therefore this study was done to see the correlation of fasting serum glucose and serum total cholesterol in sedentary male.

Methods

This cross sectional analytical type of study was conducted in the Department of Physiology, Mymensingh Medical College, Bangladesh from July 2021 to June 2022 with the consideration of Institutional Review Board (IRB) clearance Memo No. MMC/IRB/2022/446 Dated: 10/04/2022. One hundred (100) subjects (50 sedentary male as study group and 50 non-sedentary male as control group) aged between 25 to 65 years were enrolled in this study. All the subjects were male and free from other chronic illness such as diabetes, cardiovascular diseases, chronic renal failure, hepatic impairment, hyperlipidemia, Cushing's syndrome. Subjects were selected from Mymensingh Medical College and Mymensingh locality. After proper counseling, written informed consent was taken. Fasting serum glucose was measured by enzymatic Glucose-Oxidase/ peroxidase (GOD-POD) method in auto analyzer. Serum total cholesterol was measured by

enzymatic end point method (cholesterol oxidase/ peroxidase) method in auto analyzer. Data were expressed as mean±SD and statistical significance of difference among the group was calculated by unpaired students' 't' test and Pearson's correlation coefficient test. Statistical analysis was done by using Statistical package for social science (SPSS), version-26.0. P value <0.001 was considered as statistically highly significant.

Table I: Group of the subjects

Group	Number of subjects (n)
Group I (Control group)	50 (Active male)
Group II (Study group)	50 (Sedentary male)

Results

The mean±SD of fasting serum glucose of control group (active male) and study group (sedentary male) were 4.45±0.51 mmol/L and 5.91±0.60 mmol/L respectively. The mean±SD of serum total cholesterol level of control group (Group I) and study group (Group II) were 176.14±27.16 mg/dl and 252.58±18.97 mg/dl respectively. From this study it was found that there was a significant difference of these parameters between the two groups and that was statistically highly significant (p<0.001). With the help of Pearson's correlation coefficient test, the link between the two parameters was established. Figure 1 shows a relationship between fasting serum glucose and serum total cholesterol in study group and it is positive.

Table II: Comparative study of fasting serum glucose and serum total cholesterol between control and study group

Parameters	Control group (Group I)	Study group (Group II)	p value
	Mean±SD	Mean±SD	
Fasting Serum Glucose(mmol/L)	4.45±0.51	5.91±0.60	<0.001
Serum Total Cholesterol (mg/dl)	176.14±27.16	252.58±18.97	<0.001

Table III: Correlation of fasting serum glucose and serum total cholesterol among the study group

Parameters	Pearson r value	r ² value
Fasting serum glucose Serum total cholesterol	0.424	0.1802

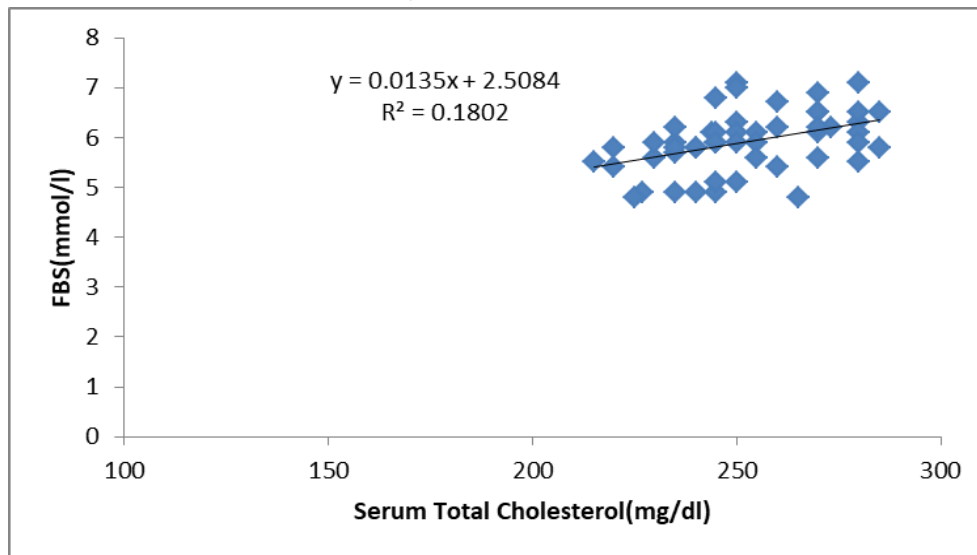


Figure 1: Scatter diagram showing positive correlation between fasting serum glucose and serum total cholesterol

Discussion

In this study Mean value of Fasting Serum Glucose was increased in study group in comparison to control group. Result was statistically highly significant ($p < 0.001$). Similar result was found from studies conducted by Kinoshita et al.¹⁰; Ghosh et al.¹¹; Xiao et al.¹². Mean value of serum total cholesterol was increased in study group than control group. Ebele et al.¹³; Mahmood et al.¹⁴ also found that serum total cholesterol increased in sedentary male. This study was carried out to see the changes of fasting serum glucose and serum total cholesterol in sedentary male. There was a positive correlation between these two biochemical parameters in sedentary male. The potential mechanism between sedentary time and fasting serum glucose involves markers of inflammation, insulin resistance and adiposity¹⁵. Sedentary behavior is associated with reduced insulin sensitivity and GLUT 4 transporters, which results in diabetes risk. Further increased inflammatory markers expression such as IL-6, cytokines, ROS causes damage to the β cell¹⁶. There is strong evidence which indicates that, sedentary behavior is closely associated with islet cells insufficiency. An inactive lifestyle can also give rise to insulin resistance by increasing islets' workload and lowering their efficiency through various pathways such as ER (endoplasmic reticulum) stress, mitochondrial dysfunction, oxidative stress and inflammation. Thus causes the apoptosis and death of beta cells.

Beta cell failure causes rising of fasting blood sugar¹⁷. Sedentary lifestyle is related to insulin resistance. Insulin resistance itself was associated with high rates of cholesterol synthesis and low rates of cholesterol absorption due to decrease glucose uptake by cell^{17,18}. Insulin resistance increase lipolysis and thus increases FFA in circulation and in turn increase cholesterol synthesis^{19,20}.

Conclusion

From this study, it may be concluded that there is a positive correlation between fasting serum glucose and serum total cholesterol in sedentary male. Sedentary behavior have wide ranging adverse effects on human body which include increasing all-cause mortality, cardiovascular mortality and risks of metabolic disorders such as diabetes mellitus, hypertension and dyslipidemia. So, sedentary lifestyle should be avoided to prevent the mortality and other metabolic disorders. Public awareness should be built about this lifestyle.

References

1. Roux EL, Jong ND, Blanc S, Simon C, Bessesen DH, Bergouignan A. Physiology of physical inactivity, sedentary behaviors and non-exercise activity: Insights from space bed rest model. *The Journal of Physiology*. J Physiol. 2022;600(5):1037-51.

2. Sedentary Behaviour Research Network. SBRN Terminology Consensus Project: 2017-2020. Ottawa: Sedentary Behaviour Research Network; 2020. Available from: <https://www.sedentarybehaviour.org/sbrn-terminology-consensus-project/>.
3. Rosenkranz SK, Mailey EL, Umansky E, Rosenkranz RR, Ablah E. Workplace Sedentary Behavior and Productivity: A Cross-Sectional Study. *Int J Environ Res Public Health*. 2020;17(18):6535.
4. Physical activity. World Health Organization. 2020. Available from: <https://www.who.int/newsroom/fact-sheets/detail/physical-activity>.
5. Park JH, Moon JH, Kim HJ, Kong MH, Oh YH. Sedentary Lifestyle: Overview of Updated Evidence of Potential Health Risks. *Korean J Fam Med*. 2020;41(6):365-73.
6. Dunstan DW, Owen N. New exercise prescription: don't just sit there: stand up and move more, more often. *Archives of Internal Medicine*. 2012;172(6):500-1.
7. Lopez AD, Mathers CD, Ezzati M, Jamison DT, Murray CJ. Global and regional burden of disease and risk factors, 2001: systematic analysis of population health data. *Lancet*. 2006;367(9524):1747-57.
8. Global recommendations on physical activity for health. World Health Organization. 2010. Available from: <https://www.who.int/publications/i/item/9789241599979>.
9. Rillamas-Sun E, LaMonte MJ, Evenson KR, Thomson CA, Beresford SA, Coday MC et al. The influence of physical activity and sedentary behavior on living to age 85 years without disease and disability in older women. *J Gerontol A Biol Sci Med Sci*. 2018;73:1525-31.
10. Kinoshita K, Ozata N, Yamaguchi T, Moral K. Association of sedentary behaviour and physical activity with cardiometabolic health in Japanese adults. *Scientific Reports*. 2022;12(2262):790-800.
11. Ghosh E, Biswas PK, Sen S, Parvin N, Nath MC. Comparison of Cardiovascular Risk factors between Sedentary and Non sedentary workers in Rajshahi Metropolitan Area. *IOSR JDMS*. 2020;19(2):41-6.
12. Xiao J, Shen C, Chu MJ, Gao YX. Physical Activity and Sedentary Behavior Associated with Components of Metabolic Syndrome among People in Rural China. *PLoS ONE*. 2016;11(1):50.
13. Ebele JI, Emeka EN, Ignatus CM, Sials AU, Chikaodili CI. Effect of Sedentary Work and Exercise on Lipid and Lipoprotein Metabolism in Middle-aged Male and Female African Workers. *Asian Journal of Medical Sciences*. 2009;1(3):117-20.
14. Mahmood IK, Khan MM, Rahman MK. A Comparison of Lipid Profile between Sedentary and Non sedentary Workers. *J TAJ*. 2009;22:10-4.
15. Chen Y, Yang J, Su J, Qin Y, Shen C, Li Y, Lu S, Pan E, Gao Y, Miao D, Zhang N, Zhou J, Wu M. Physical activity, sedentary time and their associations with clustered metabolic risk among people with type 2 diabetes in Jiangsu province: a cross-sectional study. *BMJ Open*. 2019;9(8):e027906.
16. Chandrasekaran B, Ganesan TB. Sedentarism and chronic disease risk in Covid-19 lockdown - a scoping review. *Scott Med J*. 2021;66(1):3-10.
17. Yaribeygi H, Maleki M, Sathyapalan T, Jamialahmadi T, Sahebkar A. Pathophysiology of Physical Inactivity-Dependent Insulin Resistance: A Theoretical Mechanistic Review Emphasizing Clinical Evidence. *J Diabetes Res*. 2021;2021:7796727.
18. Pihlajamäki J, Gylling H, Miettinen TA, Laakso M. Insulin resistance is associated with increased cholesterol synthesis and decreased cholesterol absorption in normoglycemic men. *J Lipid Res*. 2004;45(3):507-12.
19. Pihlajamäki J, Gylling H, Miettinen TA, Laakso M. Insulin resistance is associated with increased cholesterol synthesis and decreased cholesterol absorption in normoglycemic men. *J Lipid Res*. 2004;45(3):507-12.
20. Xiao X, Luo Y, Peng D. Updated Understanding of the Crosstalk Between Glucose/Insulin and Cholesterol Metabolism. *Frontiers in Cardiovascular Medicine*. 2022. Available from: <https://www.frontiersin.org/articles/10.3389/fcvm.2022.879355>.