Original Article

# Gender Difference in Blood Pressure, Blood Sugar, and Cholesterol in Young Adults with Comparable Routine Physical Exertion

**T. S. Anish[1,2], Safraj Shahulhameed[1], K. Vijayakumar[1,2], Teena Mary Joy[2], P. R. Sreelakshmi[2], Anu Kuriakose[2]**

*[1]Health Action by People (HAP), [2]Department of Community Medicine, Government Medical College, Thiruvananthapuram, Kerala, India*

## Abstract

**Context:** Gender differences in the risk of developing non-communicable diseases (NCD) are a matter of debate. The susceptibility of a woman to NCD should be evaluated taking into consideration the social factors that limit the physical activity among women. It will be interesting to note what will happen if women are allowed to take part in physical exercise to the extent of men. **Aims:** To find out the gender difference in the pattern of the clinical and biochemical indices related to NCD in young adults with comparable daily physical activity. **Settings and Design:** This is an institution-based cross-sectional study and the setting was Lekshmibhai National College for Physical Education (LNCPE), Thiruvananthapuram, Kerala, India. **Materials and Methods:** The study participants were students who were regularly involved in more than three hours of physical exercise daily at least for the previous one year. The information on socio-demography, anthropometry, and blood pressure was recorded. Blood samples were taken for laboratory examination. **Results:** Out of 150 students registered, 126 (84%) in the age group of 17 to 25 years who fulfilled the eligibility criteria were studied. Fifty-five (43.7%) of them were women. Systolic blood pressure, fasting blood sugar, and low-density lipoprotein were found significantly lower in women. No significant difference was noted in the case of diastolic blood pressure and total cholesterol. **Conclusion:** Gender differences exist for NCD risk factors among young adults with comparable physical activity and physical exertion seems to be more protective for females.

**Keywords:** Gender and NCD, gender difference in blood pressure, gender difference in blood sugar, gender difference in cholesterol

## Introduction

The role of gender in determining the occurrence of non-communicable diseases (NCDs) is a matter of debate. There are many studies which give evidence for the fact that NCDs are distributed differently across gender. A multi-centric cross-sectional survey involving five Asian countries including India argued that male gender is a risk factor for NCD.[1] At the same time, surveys conducted in Pacific island population revealed that the prevalence of diabetes mellitus and other NCDs are rapidly increasing among women compared to men.[2]

Access this article online

Quick Response Code:

Website: www.jfmpc.com

DOI: 10.4103/2249-4863.117424

The role of gender in determining the transition process from a status of chronic NCD like diabetes to a cardiovascular event like myocardial infarction (MI) or stroke is also not clear. A 7.6 year follow up of the Middle East population which covers more than 5000 individuals showed that the cardiovascular risk among newly diagnosed diabetics was more among men.[3] However, fatal cardiovascular outcomes like mortality due to anterior wall myocardial ischemia (AMI) are more common among diabetic women compared to men with diabetes.[4]

Risk factors for NCDs like unhealthy diet and lack of physical exercise are on the rise among women. Studies conducted even among rural African population suggested a marginal elevation of risk factors for NCDs among women compared to men.[5] A study from the rural population in Kerala had also indicated the high prevalence of risk factors among women compared

**Address for correspondence:** Dr. T. S. Anish, Department of Community Medicine, Government Medical College, Thiruvananthapuram, Kerala - 695 011, India.
E-mail: doctrinets@gmail.com

to men.[6] But this pattern may be influenced by the social system existing in the community, where in women are seldom encouraged to participate in physical activities.[7] Other social factors like urbanization can also influence the physical activity of girl children. Data from Tamilnadu, India, suggested that urbanization is associated with lower levels of physical activity among women.[8] As the life-style contributing to the NCDs start even from the childhood,[9,10] the abstinence from physical activity may be a contributor to the high prevalence of risk factors among women. These facts indicate that the high risk status of women regarding NCDs are less biological and more social.

There is enough evidence to suggest the beneficial effects of physical exercise but less data on the gender differences of these effects.[11,12] The available information should be read in the context of social forces acting against women and making them more vulnerable to NCDs. Studies elsewhere seldom compared the gender differences in the biochemical and clinical predictors of NCDs among people on high amount of physical activity. It will be interesting to note what will happen if girls are allowed to take part in physical exercise to an extent comparable to that of boys.

The data obtained from the medical check-up program for students of Bachelor of Physical Education (BPE) course at Lekshmibhai National College for Physical Education (LNCPE), Thiruvananthapuram, provided an opportunity to the same. Hence, the objective of the study is to find out the gender difference in the pattern of the clinical and biochemical indices related to NCD morbidity in young adults with significant and comparable daily physical activity.

## Materials and Methods

This is an institution-based cross-sectional study and the setting was LNCPE, Thiruvananthapuram, Kerala, India. LNCPE is a part of the academic wing of the Sports Authority of India, functioning under the Department of Youth Affairs and Sports, Ministry of Human Resource Development, Government of India. The study period was March 2008.

The study participants were students who had successfully completed the first year of the BPE course with a total duration of three years. The eligibility criterion of the current study was students within the age of 17 to 25 years who undertook more than three hours of supervised physical exercise daily for the previous one year. The overall sample size was 150, 50 students from each batch. The information on socio-demography and anthropometry was collected using a structured proforma. Written informed consent was obtained from every participant before blood collection and physical examination. The study protocol was approved by the institutional ethical board of Health Action by People (HAP).

Anthropometric measurements and blood pressure assessment were done by paramedical workers. Blood pressure was taken using a digital sphygmomanometer (Omron) after the completion of the interview. The digital sphygmomanometer was standardized using mercury sphygmomanometer on the previous day of data collection. Two readings were taken in sitting posture and the average was put as the individual score. Blood samples were taken after overnight fasting (at least 10 h after the last meal). Dietary advises were given to the participants one week prior to the data collection for reliable results. Laboratory examination was done at clinical laboratory of HAP, Thiruvananthapuram. The study variables were measured in mean with standard deviation (SD) and the difference in means were tested using the independent sample *t* test.

## Results

Out of the total 150 students registered, 126 (84%) fulfilled the eligibility criteria and studied. Fifty-five (43.7%) of them are women. The mean (SD) age of men in the group 20.4 (1.9) years was significantly older than women with 19.4 (1.6) years ($P = 0.003$). However, age was not considered as an interacting variable for further analysis because the mean difference was only of one year and we presume that this difference has not a significant stake on the outcome variables. Both men [20.5 (2.1) kg/m$^2$] and women [20.3 (2.1) kg/m$^2$] in the study were having comparable body mass indices (BMI), $P = 0.92$. The mean waist circumference [72.3 (5.7) cm for men and 65.9 (6.1) cm for female] and the waist hip ratio [0.80 ($3.6 \times 10^{-2}$) for men and 0.74 ($5.9 \times 10^{-2}$) for women] were significantly higher in the case of males as expected because of the biological differences. No significant difference has been noted in hip circumference [89.7 (5.3) cm for men and 89.5 (4.5) cm for women]. In the case of the outcome factors studied, systolic blood pressure (SBP), fasting blood sugar (FBS), and low-density lipoprotein (LDL) were found significantly lower in women [Table 1]. No significant difference was noted in the case of diastolic blood pressure (DBP) and total cholesterol.

## Discussion

In our study, a gender difference was seen for NCD risk factors among young adults with comparable physical activity. SBP, FBS, and LDL were found to be significantly lower in women.

Gender differences in clinical and biochemical profile of people who undergo regular physical exercise have not been the focus

**Table 1: Distribution of clinical and biochemical factors with respect to gender**

| Factor | Women mean (SD) | Men mean (SD) | *P* value (*t* test) |
|---|---|---|---|
| Blood pressure (systolic)* | 105.0 (9.92) | 114.2 (9.03) | <0.001 |
| Blood pressure (diastolic) | 66.3 (9.93) | 65.1 (6.02) | 0.448 |
| FBS* | 70.8 (9.48) | 74.9 (11.40) | 0.031 |
| Total cholesterol | 177.5 (26.06) | 168.7 (26.10) | 0.064 |
| LDL* | 96.4 (14.78) | 104.4 (16.50) | 0.006 |

**P* value - significant

of much research. There is ample evidence that moderate to heavy physical exercise can reduce the chance of cardiovascular events like myocardial infarction and stroke.[13,14] It has also been demonstrated that community-based interventions can bring out reductions in NCD and its risk factors prevalent in the community.[13]

A study conducted among trained athletes revealed that the variability of heart rate induced by stress is less among people with a habit of regular strenuous exercise.[15] The paper argued that it was because of the favorable autonomous responses. However, the observation in a few individuals (seven men and six women) did not bring out a significant difference across gender.[15] Another study on 26 female athletes randomized into two groups based on physical activity had also demonstrated the positive effect of exercise in the cardiovascular profile.[16] The incremental advantage of women on blood pressure due to walking was documented among diabetic patients.[17] A 1,000 steps/day increment is associated with important blood pressure decrements among women with type-2 diabetes but the data were inconclusive among men.[17]

The plausible mechanism suggested for this kind of an observation is that the endogenous hormones of women are less atherogenic and has got less effect on insulin resistance. Neither estrogen nor androgen is now considered as a protective agent against diabetes or cardiovascular morbidities.[18,19] But the effect of female sex hormones are found milder and the increased levels of androgens are considered a risk factor for cardiovascular events even among women.[18] Another argument is that even though the mechanisms responsible for the gender differences in BP control and regulation are not clear, there is some evidence that interactions between sex hormones and the kidneys could play a role. Both endogenous and exogenous female sex hormones markedly influence the systemic and renal hemodynamic response to salt and water retention.[20]

In short, the biochemical indicators of NCD were appearing to be against men in current study compared to women. The high burden of NCD among women as noted elsewhere[2,4,6] should be discussed in par with the fact that physical exercise in women is seldom promoted even during childhood.[7] The current study indicates that women may be protected from risk factors of many NCD compared to men if the physical exercise is promoted among them.

Our study addresses a gap in the literature in relation to gender differences among men and women of comparable physical activity. The major strength of current study is that the population is homogeneous and physical exercise is a routine for all the study participants. So the observed difference can be attributed to gender with a high degree of certainty. The sample size is large when compared to similar studies conducted among people involved in physical exercise as a part of their profession or career.[15,16] The major weakness of the study is that it did not document the differences in the dietary pattern of study participants that can influence the clinical and biochemical indicators. However, we were not expecting a major difference in dietary pattern of the participants. More than 80% of the study participants were residents of the institution and sharing the same menu at least for the past one year.

The major implication of the study is that it brings out the importance of all inclusive exercise promotion programs which give equal importance to the women segment of the community. But these campaigns or programs to promote physical exertion for better health of the community may not translate to the behavior of women because of the social system which prevents them from being physically active in a level comparable to men. The current study brings out evidence that the benefits of physical activity among women are greater than that of men. Also, it is logical to believe that the protection attributed by physical exercise will be more in the case of women where the risk of NCD attributed to other habits like smoking and alcoholism is less.

With the incidence of NCD is rising among women, it is imperative that urgent steps should be taken to increase the level of physical activity among women. Our study indicates that community programs to reduce NCDs can be more effective if the observed gender difference in physical activity is taken into account and programmes tailored with the existing social customs in mind. Equity is one of the major principles of primary health care philosophy and it could not be addressed by quantifying the health risks of socially disadvantaged groups like women.

## Strengths and limitations

The study participants are not representatives of the general public. However, the study provides some information on the gender selective advantages of physical exercise in which there is a scope of an investment. A major strength of the study is that it is based on data from a group of individuals to whom physical exercise is a part of their curriculum. Factors such as alcohol intake and differences in diet might have contributed to the observed differences even though the structure of the study setting does not allow many variations in these factors.

## Acknowledgement

We acknowledge the staff and students of LNCPE, Thiruvananthapuram.

## References

1. Ahmed SM, Hadi A, Razzaque A, Ashraf A, Juvekar S, Ng N, *et al.* Clustering of chronic non-communicable disease risk factors among selected Asian populations: Levels and determinants. Glob Health Action 2009; NCD Suppl: 68-75.
2. Collins VR, Dowse GK, Toelupe PM, Imo TT, Aloaina FL, Spark RA, *et al.* Increasing prevalence of NIDDM in the Pacific island population of Western Samoa over a 13-year period. Diabetes Care 1994;17:288-96.
3. Hadaegh F, Fahimfar N, Khalili D, Sheikholeslami F, Azizi F. New and known type 2 diabetes as coronary heart disease

equivalent: Results from 7.6 year follow up in a Middle East population. Cardiovasc Diabetol 2010;9:84.

4. Meisinger C, Heier M, von Scheidt W, Kirchberger I, Hörmann A, Kuch B. Gender-Specific Short and Long-Term Mortality in Diabetic Versus Nondiabetic Patients With Incident Acute Myocardial Infarction in the Reperfusion Era (the MONICA/KORA Myocardial Infarction Registry). Am J Cardiol 2010;106:1680-4.
5. Oladapo OO, Salako L, Sodiq O, Shoyinka K, Adedapo K, Falase AO. A prevalence of cardiometabolic risk factors among a rural Yoruba south-western Nigerian population: A population-based survey. Cardiovasc J Afr 2010;21:26-31.
6. Thankappan KR, Shah B, Mathur P, Sarma PS, Srinivas G, Mini GK, *et al*. Risk factor profile for chronic non-communicable diseases: Results of a community-based study in Kerala, India. Indian J Med Res 2010;131:53-63.
7. Kimm SY, Glynn NW, Kriska AM, Barton BA, Kronsberg SS, Daniels SR, *et al*. Decline in physical activity in black girls and white girls during adolescence. N Engl J Med 2002;347:709-15.
8. Allender S, Lacey B, Webster P, Rayner M, Deepa M, Scarborough P, *et al*. Level of urbanization and noncommunicable disease risk factors in Tamil Nadu, India. Bull World Health Organ 2010;88:297-304.
9. Misigoj-Duraković M, Duraković Z. The early prevention of metabolic syndrome by physical exercise. Coll Antropol 2009;33:759-64.
10. Khuwaja AK. Epidemic of obesity: Prevention must start in childhood. J Ayub Med Coll Abbottabad 2004;16:93.
11. García-Ortiz L, Grandes G, Sánchez-Pérez A, Montoya I, Iglesias-Valiente JA, Recio-Rodríguez JI, *et al*. Effect on cardiovascular risk of an intervention by family physicians to promote physical exercise among sedentary individuals. Rev Esp Cardiol 2010;63:1244-52.
12. Lakka TA, Bouchard C. Physical activity, obesity and cardiovascular diseases. Handb Exp Pharmacol 2005;170:137-63.
13. Harati H, Hadaegh F, Momenan AA, Ghanei L, Bozorgmanesh MR, Ghanbarian A, *et al*. Reduction in incidence of type 2 diabetes by lifestyle intervention in a middle eastern community. Am J Prev Med 2010;38:628-36.e1.
14. Willey JZ, Moon YP, Paik MC, Boden-Albala B, Sacco RL, Elkind MS. Physical activity and risk of ischemic stroke in the Northern Manhattan Study. Neurology 2009;73:1774-9.
15. Brown SJ, Brown JA. Resting and postexercise cardiac autonomic control in trained master athletes. J Physiol Sci 2007;57:23-9.
16. Pigozzi F, Alabiso A, Parisi A, Di Salvo V, Di Luigi L, Spataro A, *et al*. Effects of aerobic exercise training on 24 hr profile of heart rate variability in female athletes. J Sports Med Phys Fitness 2001;41:101-7.
17. Manjoo P, Joseph L, Pilote L, Dasgupta K. Sex differences in step count-blood pressure association: A preliminary study in type 2 diabetes. PLoS One 2010;5:e14086.
18. Ding EL, Song Y, Manson JE, Rifai N, Buring JE, Liu S. Plasma sex steroid hormones and risk of developing type 2 diabetes in women: A prospective study. Diabetologia 2007;50:2076-84.
19. Lambrinoudaki I, Christodoulakos G, Rizos D, Economou E, Argeitis J, Vlachou S, *et al*. Endogenous sex hormones and risk factors for atherosclerosis in healthy Greek postmenopausal women. Eur J Endocrinol 2006;154:907-16.
20. Pechère-Bertschi A, Burnier M. Female sex hormones, salt, and blood pressure regulation. Am J Hypertens 2004;17:994-1001.

**How to cite this article:** Anish TS, Shahulhameed S, Vijayakumar K, Joy TM, Sreelakshmi PR, Kuriakose A. Gender difference in blood pressure, blood sugar, and cholesterol in young adults with comparable routine physical exertion. J Fam Med Primary Care 2013;2:200-3.

**Source of Support:** Nil. **Conflict of Interest:** None declared.