Gender Differences in Pulse Pressure of Type II Diabetics with Raised HBA1C

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ABSTRACT

Aim: To find out the gender differences in pulse pressure (PP) of Type II Diabetics with raised HBA1C.

Methods: This is a Cross sectional study carried out in the outpatient departments and wards of all Medicine units of Khyber Teaching Hospital, Peshawar. Its duration is from May 15th to August 3rd, 2017. A total of 70 Diabetic patients above the age of 40 were included in the study. Their height and weight were recorded and BMI calculated. Their Blood pressure (BP) was also measured and the pulse pressure determined. The most recently performed HBA1C test values along with fasting and random blood sugar values were noted.

Findings: The mean pulse pressure of males was 61.4 mm Hg, and females was 55.1 mmHg, this difference was not statistically significant, $p>0.05$. The mean SBP and DBP values were similar between the two genders. The mean HBA1C values were higher in females than males.

Conclusion: PP does not differ in the two genders. However, there is a difference in diabetic control between the two.

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1. Introduction:

Women and men differ in terms of weight, height, systolic blood pressure (SBP) and pulse pressure (PP). This difference in PP is manifest at the level of peripheral large and small arteries. In men pulse pressure is correlated with systolic and diastolic blood pressure (DBP). While in women pulse pressure is also correlated with age, height, SBP and mean arterial pressure (MAP), and it is not correlated with DBP. SBP is generally higher and there is no difference in mean and DBP in men (Asmar et al., 1997).

PP depends on stroke volume and compliance; compliance is a byproduct of the stiffness of arteries. The stiffer the artery less the compliance and wider the pulse pressure gap ("Mean Arterial Pressure and Pulse Pressure," n.d.). Factors affecting PP are exercise, obesity, vitamin D levels, Magnesium levels and diet ("Widened Pulse Pressure: Definition, Causes & Treatments," 2017). Exercise reduces blood pressure and hence pulse pressure. Obesity causes increased risk of atherosclerosis and hence decreases compliance of vessels, which leads to raised
pulse pressure. Vitamin D antagonizes the effects of angiotensin converting enzyme, which lowers pulse pressure by 5 mmHg. Magnesium deficiency leads to a rise in pulse pressure ("Widened Pulse Pressure: Definition, Causes & Treatments," 2017).

When it comes to increased arterial stiffness due to diabetes, hypertension may act as a confounder. A study conducted on normotensive type II diabetics showed that diabetic patients have higher arterial stiffness (Yeboah, Antwi, & Gyan, 2016). In essential as well as secondary hypertension arterial compliance is reduced due to age related structural changes in the arterial walls this, in turn, leads to raised pulse pressure. However, according to a study conducted in Chengdu, pulse pressure could not be a predictor of type II diabetes (Liu et al., 2014).

Increased PP may raise the chances of developing type II Diabetes Mellitus (DM). Moreover, raised pulse pressure may lead to deranged cardiovascular events as

well as mortality. Elevated PP is associated with risk of DM in females but not in males. This difference may have been due to sex hormones, and the onset of menopause in women (Wang et al., 2017). There are various mechanisms through which estrogen affects connective tissue. It may have a protective role when it comes to aortic stiffness. If hormone replacement therapy is given to post-menopausal women, then the non-diabetics may have improved arterial stiffness while the diabetics will not. (Angelis et al., 2004) With menopause, estrogen levels fall, which leads to reduced arterial compliance in women and hence raised pulse pressure, this can be reversed by giving hormone replacement therapy to women (Kawecka-Jaszcz, Czarnecka, Olszanecka, Rajzer, & Jankowski , 2002)

The sympathetic system is generally more active in males while parasympathetic is more dominant in females (Dart, Du, & Kingwell, 2002). Sympathetic over activity may be a cause of raised pulse pressure, this over-excitability may in-turn lead to increased insulin resistance, obesity, and metabolic syndrome (Zhang et al., 2016). Hence, if the rise in PP can be controlled, diabetes could be prevented (Wang et al., 2017). According to a study conducted in China raised pulse pressure may lead to type II diabetes in women aged 52-59 years (Zhang et al., 2016).

According to a cohort study in the US, raised PP is not a risk factor for cardiovascular mortality (Borrell & Samuel, 2015). According to a Swedish study, male patients have better glycemic and blood pressure control hence have lowered pulse pressure than females (Nilsson et al., 2004).

HBA1C measures glycated hemoglobin and is a marker of predicting diabetic control over last 2-3 months. Target HBA1C for people with diabetes is 48 mmol/mol (6.5%) ("Guide to HbA1c," 2017). According to a study by Nakhjavani et al. PP has no relation to diabetic control (Nakhjavani et al., 2015).

The objective of this study is to find out the differences in pulse pressure gender wise in type II diabetics with raised HBA1C.

2. Materials and Methods:

This is a cross sectional study conducted from May 15th to August 3rd, 2017. It was carried out in the outpatient department and the wards of all the Medicine Units of Khyber Teaching Hospital. A total of 70, both male and female patients above the age of 40 and who were Type II Diabetics were included in the study. The demographic features were documented. The height was recorded using a standard stadiometer, for bed-ridden patients a measuring tape was used. Weight was also recorded and then the BMI was calculated using the formula; BMI= weight (kg)/Height(m)^2 ("Body Mass Index," 2017).

For BP measurement a mercury sphygmomanometer was used. Both systolic (SBP) and diastolic (DBP) were noted and pulse pressure calculated by the formula; Pulse Pressure= SBP-DBP. (Sheps, 2016). Family history, as well as the history of previously diagnosed hypertension, was also taken.HBA1C was noted for their records along with fasting blood sugar (FBS) and random blood sugar (RBS).

The data was entered and analyzed using SPSS version 20.0. Descriptive statistics were determined and student t test applied to compare the values for males and females.

3. Results:

The sample included 33 (47%) males and 37 (53%) females. The mean pulse pressure of males was 61.4 mm Hg with a standard deviation (SD) of 13.3 mm Hg while females was 55.1 mmHg with an SD of 14.8. When t test was applied it wasn't significant so null hypothesis couldn't be rejected, p>0.05.

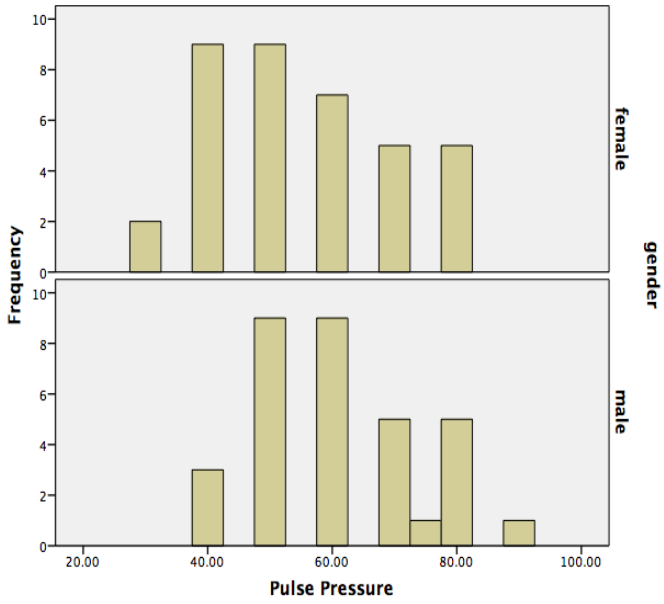

Figure 1. Gender Wise Pulse Pressure

However, it is seen in figure 1 that in females, greater numbers of subjects have PP in the 40-50 range whereas, in males, it is in the 50-60 range.

The mean SBP was 142 mmHg for females and 148 mmHg for males. The difference between the two wasn't statistically significant, p>0.05. Similarly, the DBP for females was 86.9 mmHg and for males was 87.4 mmHg and their difference wasn't significant.

The mean HBA1C for males was 9.78 and for females, it was 11.67, the t test showed that the difference between the two was significant, p<0.05.

Table 1: *Random and Fasting Blood Sugar*

Gender	Random Blood Sugar		Fasting Blood Sugar	
	Mean	Standard deviation	Mean	Standard deviation
Male	258.7	86.7	152.7	41.6
Female	302.04	99.9	177.8	78.4

The mean BMI for males was 27.7 and for females, it was 28.6, the difference between them was not significant.

Table 2: *Family History and Hypertension*

Gender	Family History of Diabetes		Hypertension	
	Present	Absent	Present	Absent
Male	25 (75.7%)	8 (24.24%)	21 (63.6%)	12 (36.26%)
Female	21 (56.7%)	16 (43.24%)	27 (73%)	10 (27%)

4. Discussion:

Whether gender is a risk factor in non-communicable diseases such as Diabetes is still under debate. PP is a marker or indicator of impending disease. Its difference or similarity between the two sexes could help us decide a path of action, may it be prevention or management of a particular disease (Anish et al., 2013). Gender differences arise from a complex interplay between genetic, endocrine and social factors. These factors may then influence the body parameters such as BP, pulse pressure, blood glucose and even the development of various diseases (Kautzky-Willer, Harreiter, & Pacini, 2016).

The average pulse pressure in our study was almost the same for both males and females and the difference was not statistically significant. It showed a normal distribution. PP, which is a manifestation of arterial stiffness is affected by age, gender, and BP values (Kim et al., 2014). According to a study, PP is lower in females as compared to men up till early adulthood but higher in old age (Skurnick, Aladjem, & Aviv, 2010). Raised pulse pressure is associated with an increased risk of Diabetes Mellitus, so optimum steps must be taken to control the rise in PP (Wang et al., 2017).

In our study, the SBP and the DBP were almost the same too in both the genders. What differed was, the HBA1C values, female diabetic patients had higher HBA1c values than males. Hence, this showed poor diabetic control among females. According to a study conducted by Armed Forces Institute of Pathology Rawalpindi, HBA1C shows no difference among males and females in healthy individuals, however, age does have a role in HBA1C values being high (Khawar, Late, Khan, & Khan, 2011). According to another study conducted in Pakistan over a period of three years, diabetic women showed poor glycemic control with raised HBA1C values as compared to males (Khan, & Saeed, 2009). Hence, although normal individuals may not differ in HBA1C values gender wise, when it comes to diabetics difference is present between the two sexes. Factors that may affect diabetic control include the duration of diabetes, lower level of education, higher BMI, hypercholesterolemia, hypertriglyceridemia, poor adherence to prescribed dietary regimens and lack of physical activity (Khattab, Khader, Al-Khawaldeh, & Ajlouni, 2010).

The average FBS and RBS in our study were also higher among females. The BMI did not show much difference between the two sexes. A study result showed that women generally showed poor control of diseases such as diabetes this could be due to the fact that they have a sedentary life style and also have to take care of the family as well as cope with the disease (Siddiqui, Khan, & Carline, 2013). The results also showed that majority of the subjects both, males and females, had a family history of diabetes and had comorbid hypertension.

5. Conclusion:

It can be concluded that Pulse pressure does not differ in both the genders. However, what differs is in their diabetic control, which is poorer in females than males. So there may not be much difference in factors that lead to diabetes but once it develops its progression differs between the two sexes.

Conflicts of Interest:

Authors declared no conflicts of interest.

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References:

1. Angelis, L. De, Millasseau, S. C., Smith, A., Viberti, G., Jones, R. H., Ritter, J. M., & Chowienczyk, P. J. (2004). Sex Differences in Age-Related Stiffening of the Aorta in Subjects With Type 2 Diabetes. *Hypertension*, *44*, 67–71.
2. Anish, T. S., Shahulhameed, S., Vijayakumar, K., Joy, T. M., Sreelakshmi, P. R., & Kuriakose, A. (2013). Gender Difference in Blood pressure, Blood Sugar, and Cholesterol in Young Adults with Comparable

Routine Physical Exertion. *Journal of Family Medicine and Primary Care*, *2*, 200–3.
3. Asmar, R., AM, B., JM, C., B, L., GM, L., & ME, S. (1997). Influence of gender on the level of pulse pressure: the role of large conduit arteries. *Clinical and Experimental Hypertension*, *19*, 793–811.
4. Kim, J. Y., Park, J. B., Kim, D. S., Kim, K. S., Jeong, J. W., Park, J. C., ... & Chung, N. (2014). Gender difference in arterial stiffness in a multicenter cross-sectional study: the Korean Arterial Aging Study (KAAS). *Pulse*, *2*(1-4), 11-17.
5. Body Mass Index. (2017). In *Wikipedia*.
6. Dart, A. M., Du, X., & Kingwell, B. a. (2002). Gender, sex hormones and autonomic nervous control of the cardiovascular system. *Cardiovascular Research*, *53*, 678–687.
7. Guide to HbA1c. (2017). Retrieved July 15, 2017, from http://www.diabetes.co.uk/what-is-hba1c.html
8. Kawecka-Jaszcz, K., Czarnecka, D., Olszanecka, A., Rajzer, M., & Jankowski, P. (2002). The effect of hormone replacement therapy on arterial blood pressure and vascular compliance in postmenopausal women with arterial hypertension. *Journal of human hypertension*, *16*(7), 509.
9. Kautzky-Willer, A., Harreiter, J., & Pacini, G. (2016). Sex and gender differences in risk, pathophysiology, and complications of type 2 diabetes mellitus. *Endocrine Reviews*, *37*, 278–316.
10. Khan D. A., & Saeed M., K. F. (2009). Is glycemic control in patients with type-2 diabetes in Rawalpindi improving? *Journal of Ayub Medical College, Abbottabad : JAMC*, *21*, 62–65.
11. Khattab, M., Khader, Y. S., Al-Khawaldeh, A., & Ajlouni, K. (2010). Factors associated with poor glycemic control among patients with Type 2 diabetes. *Journal of Diabetes and Its Complications*, *24*, 84–89.
12. Khawar, S., Late, A., Khan, D. A., & Khan, F. A. (2011). Determination of glycosylated hemoglobin reference range in an adult population attending a military care set up in Rawalpindi. *Pakistan Armed Forces Medical Journal*, *61*.
13. Liu, K., Wang, Y., He, J., He, S., Liao, H., Si, D., … Chen, X. (2014). Is pulse pressure a predictor of diabetes in Chinese Han nationality population? A 15-year prospective study in Chengdu community. *International Journal of Cardiology*, *176*, 529–532.
14. Borrell, L. N., & Samuel, L. (2015). The effect of pulse pressure on all-cause and cardiovascular-specific mortality risks in US adults. *Ethnicity & disease*, *25*(2), 152-156.
15. Mean Arterial Pressure and Pulse Pressure. (n.d.). Retrieved July 15, 2017, from https://courses.washington.edu/conj/circulation/reflectedPulse.htm
16. Nakhjavani, M., Aa, N., Heidari, B., Ghazizadeh, Z., Larry, M., & Esteghamati, A. (2015). Pulse pressure does not predict the response of diabetic nephropathy to glucose-lowering therapy. *Diabetes and Vascular Disease Research*, *12*, 150–151.
17. Nilsson, P. M., Theobald, H., Journath, G., Fritz, T., Nilsson, P. M., Theobald, H., … Fritz, T. (2004). Gender differences in risk factor control and treatment profile in diabetes : a study in 229 Swedish primary health care centers. *Scandinavian Journal of Primary Health Care*, *22*, 27–31.
18. Sheps, S. G. (2016). Pulse pressure: An indicator of heart health? - Mayo Clinic. Retrieved July 5, 2017, from: http://www.mayoclinic.org/diseases-conditions/high-blood-pressure/expert-answers/pulse-pressure/faq-20058189
19. Siddiqui, M. A., Khan, M. F., & Carline, T. E. (2013). Gender differences in living with diabetes mellitus. *Materia Socio-Medica*, *25*, 140–2.
20. Skurnick, J. H., Aladjem, M., & Aviv, A. (2010). Sex differences in pulse pressure trends with age are cross-cultural. *Hypertension*, *55*, 40–47.
21. Wang, P., Li, Y., Liu, X., Wang, Q., Guo, Y., Zhao, Y., … Wang, C. (2017). *Independent and cumulative effects of resting heart rate and pulse pressure with type 2 diabetes mellitus in Chinese rural population* (Vol. 7:2652). Springer US.
22. Widened Pulse Pressure: Definition, Causes & Treatments. (2017). *New Health Advisor*. Retrieved from http://www.newhealthadvisor.com/Widened-Pulse-Pressure.html
23. Yeboah, K., Antwi, D. A., & Gyan, B. (2016). Arterial Stiffness in No hypertensive Type 2 Diabetes Patients in. *Int J Endocrinol*, *2016*, 8.
24. Zhang, L., Wang, B., Wang, C., Li, L., Ren, Y., Zhang, H., … Hu, D. (2016). High pulse pressure is related to the risk of type 2 diabetes mellitus in Chinese middle-aged females. *International Journal of Cardiology*, *220*, 467–471.

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