Obesity and Physical Inactivity: Contributing Factors to Hypertension in Early Adults

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Abstract

Hypertension is a medical condition, in which blood pressure in the arteries is elevated than the normal, having systolic blood pressure more than 120mmHg and diastolic blood pressure more than 80 mmHg. It leads to health complications and increase risk of diseases such as stroke, heart failure, heart attack and even death. The aim of current study was to evaluate nutritional status and activity level among hypertensive early adults in District Mardan Data was collected from the subjects of Public Hospital, Mardan Medical Complex through questionnaire. A complete information about individual sociodemographic, anthropometry and health status were collected, and physical activity was assessed by using GPAQ questionnaire. A total of 150 individuals were included in the study in which 90% were females and 10% were males. Data was analyzed through SPSS Version 22. Majority of the study subjects 88% were married, 70% having nuclear family system, 43% were having elementary education and 43% were working as laborer. Body mass index and waist circumference in female counterpart were found to be positively associated with hypertension and was found statistically significant P=<0.01. Results showed that majority of females were fall in hypertension crisis category with mild activity and males were having hypertension stage 1 with moderate activity. Our study concluded that non-optimal nutritional status and sedentary lifestyle resulted in elevated blood pressure in females therefore lifestyle change such as optimal weight management and physical activity may play key role in reducing risk of hypertension.

Key words: Hypertension, Early Adulthood, Body Mass Index, Waist Circumference, Physical activity.

Introduction:

Hypertension or high blood pressure is a chronic medical condition in which blood pressure in the arteries is raised than the normal. Higher pressure in the blood vessels makes it difficult for heart to pump blood and thus increase burden on heart. It is also known as silent killer because it does not show specific sign and symptoms at initial stage (Sowemimo *et al.,* 2016). It is the main risk factor for heart disease and stroke. Mainly associated risk factors that lead to hypertension are obesity, high salt consumption and lack of physical activity (Ray and Jamdade, 2019).

Obesity and hypertension are closely related. Weight gain is related to an increased risk of developing hypertension while weight loss can help in lowering blood pressure and improving quality of life. Being overweight, makes heart work harder to pump blood throughout the body, that puts pressure on arteries which in turn resist the flow causing rise in blood pressure (Aronow, 2017). Anthropometric measurements are used to determine the composition of body, the key elements included height, weight, body mass index, waist circumference and skinfold thickness. Body mass index is an indicator that is calculated by dividing weight in kg to the square of height in meters. It is positively associated with hypertension, with increasing BMI, the tendency of hypertension increases (Dua *et al.,* 2014). Waist circumference is an indicator used to measure visceral fat. Visceral adiposity is clearly associated with hypertension and cardiovascular risks. (Wang *et al.,* 2019).

Physical activity is the movement of body that requires energy expenditure. Physical activity includes exercises as well as other activities which involve body movement including working tasks, job and household chores. It helps in maintaining a healthy weight and lowers risk of many diseases and also helps in doing daily tasks such as climbing stairs and shopping. Moderate to vigorously intense physical activity improves heart ability in pumping blood throughout the body and strengthen cardiac muscles (Diaz and Shimbo, 2013). Physical activity typically peaks at adulthood including muscle power, sensory abilities and heart functioning (Arnett *et al.,* 2000). Physical inactivity and sedentary behavior play role in development of hypertension in early adults. Low levels of physical activity have a direct linkage with weight gain, which increase the risk of developing hypertension. Physical inactivity is responsible for 3.2 million deaths worldwide annually (Rissardi *et al.,* 2018).

The worldwide prevalence of hypertension among adults rose sharply from 594 million in 1975 to 1.13 billion in 2015 (Riaz *et al.,* 2021). According to American Heart Association an estimated 108 million US adults which are nearly half of all adults in the United States are suffering from high blood pressure (Center for Disease Control [CDC], 2011). Early adulthood is the time of 20 to 40 years in which full physical and intellectual maturation have been attained. Pakistan has a high rate of urbanization in which individuals are consuming diet which is high in sodium, saturated fat and low in fruits and vegetables and also majority of adults are physically inactive (Samir *et al.,* 2011). The National Health Survey of Pakistan (NHSP) estimated that hypertension affects 18% of adults (Shah *et al.,* 2018).

The objectives of the current study are to find the relationship between nutritional status and hypertension in early adults and to evaluate physical activity level in early adults with hypertension.

Methods and Materials:

Sample collection:

A cross sectional study was conducted from 1st March to 30th April 2021 at Mardan Medical Complex, a public hospital in district Mardan. The hospital is well established and provides huge health services to various diseases. An approval for data collection was taken from the Medical Superintendent of respective hospital. Objectives of the study were explained to each participant in detail. Once a person agreed to participate, a consent letter was signed to confirm their participation. A total of 150 samples both men and women of age 20 to 40 years were included in the study.

Data Collection:

Basic information from the study cohort including socio-demographic, marital status, education and employment status were collected through well defined questionnaire. Anthropometric data including height (cm), weight (kg), Body Mass Index (BMI) and Waist Circumference (WC) measurements were also recorded by using standard procedures. Assessment of blood pressure was measured by a trained medical practitioner or nurses follow standard protocol. Activity level of the study subjects was measured by using short form of International Physical Activity Questionnaire (IPAQ). The intensity of physical activity was found out by MET which is metabolic equivalent of task.

Statistical analysis:

All analysis was executed using SPSS 22 version. All continuous data with normal distribution are shown as mean (SD), and categorical variables are expressed as frequency (percentage). Linear regression model was study to show the effect of independent variable on hypertension in early adulthood. Pearson's correlation was used to assess the relationship of education, Body Mass Index (BMI), waist circumference (WC), Physical Activity Level (PAL) and Hypertension of the study subjects.

Results and Discussion:

1. Sociodemographic determinants:

Table 1 shows general determinants of sociodemographic parameters. The results depicts that out of 150 study subjects, 90% (n=136) were females and 10% (n=14) were males. The mean of ages of both genders i-e male and female were 32.43±6.618 and 31.67±5.241 respectively. Sociodemographic determinants include marital status, family type, education and employment status where the highest percentage 88% (132) was married. Similarly, most of the study subjects 70% (106) having nuclear living system, however higher percentage 43% (65) of study cohort having elementary education. Majority of the male subjects and husbands of female subjects 43% (64) were laborer. Marital status and education were found statistically significant ($p<0.001$) when study linear regression. Marital status is considering a measure of social network and its play an important role in the onset of various metabolic diseases.

Our findings were consistent with various studies, their result concluded that married individuals have higher odd ratio of hypertension when compare with unmarried (Ramezankhani *et al.*, 2019; Trivedi *et al.*, 2008; Tuoyire and Ayetey, 2019). Literacy rate is a key determinant in

overall sociodeographic characteristics, studies conducted by Liew *et al.*, (2019), Landsbergis *et al.*, (2015), Trivedi *et al.* (2008) to explore the relationship between poor education and onset of hypertension they concluded that lower educational and occupational levels are associated with increased risk of getting hypertension.

Table 1: Socio-demographic characteristics of the study subjects (N=150)

Variables		n (%) Mean ±SD	P-Value
Gender	Male	14 (10)	Ns
	Female	136 (90)	
Age	Male	32.43±6.618	Ns
	Female	31.67±5.241	
Marital status	Married	132 (88)	P<0.001
	Unmarried	18 (12)	
Type of family	Joint	44 (30)	Ns
	Nuclear	106 (70)	
Education	No	35 (23)	P<0.001
	Elementary	65 (43)	
	High school	25 (17)	
	Graduated	25 (17)	
Job	Labor	64 (43)	Ns
	Others	86 (57)	

2. Anthropometric measurements:

Table 2 showed mean and standard deviation of various anthropometric parameters of the study subjects. The means of weight for male and female were 80.4±11.8 and 75.8±13.5, respectively. Similarly, the means of height, BMI and waist circumference for male and female were 169.3±2.3 and 160.32±6.070, 26.864±4.1897 and 30.289±4.8242 and 99.929±12.4905 and 97.757±13.1995, respectively. However, BMI in both gender and waist circumference of the women were found to have strong positive association with hypertension and were statistically significant at P=<0.01 level. Our findings are consistent with various studies and their result depicts that body mass index and hypertensions are positively correlated (Dua *et al.*, 2014; Hossain *et al.*, 2019; Jiang *et al.*, 2016). Another study conducted by Landi *et al.*, (2018) on association between body mass index and blood pressure which concluded that increased BMI level plays a role in hypertension. Similarly various studies findings showed that increased waist circumference is positively correlated with hypertension (Andeansah *et al.*, 2015, Wang *et al.*, 2019). Another studies from other part of the world investigated the relationship of increased waist circumference

in female and the risk of hypertension, findings of MA *et al.*, (2009) Guagnano *et al.* (2001) Sun *et al.* (2022) depicts strong association of hypertension with waist circumference and concluded that waist circumference has the strong impact on blood pressure.

Table .2 Anthropometric parameters of the subjects (N=150)

Variables		Mean ± SD	P-Value
Weight in Kg	Male	80.4±11.8	Ns
	Female	75.8±13.5	Ns
Height in cm	Male	169.3±2.3	Ns
	Female	160.3±6.0	Ns
Body mass index	Male	28.1±4.3	P<0.01
	Female	30.0±5.3	P<0.01
Waist circumference	Male	112.9±14.0	Ns
	Female	120.3±16.7	P<0.01

3. Health and physical activity status of the subjects:

Hypertension was classified as hypertension stage 1, stage 2 and hypertension crisis and physical activity was categorized as mild, moderate, and vigorous levels. In male 42% (6) of the subjects were in hypertension stage 1 while rest of the subjects were either in hypertension stage 2, 29% (4) or having hypertension crisis 29% (4). Similarly in females the highest percentage of subjects were in hypertension crisis 59% (80) while rest of the subjects were either in stage 1, 19% (26) and 22% (30) in stage 2. Similarly in males the highest percentage 50% (7) were having moderate activity while in females the highest percentage 82% (111) were having mild activity as shown in Table 3. Strong negative relationship was found between hypertension and physical activity level and was statistically significant (P<0.01).

Our findings are consistent with various studies conducted in other parts of the world and their results depicts negative correlation between physical activity and blood pressure, these studies concluded that increase physical activity will minimize the likelihood of hypertention. (Mbijiwe *et al.*, 1970, Teh *et al.*, 2015, Diaz *et al.*, 2013(Pescatello *et al.*, 2019). Another study conducted by Alsairafi *et al.*, (2010) on effect of physical activity on blood pressure which concluded that majority of hypertensive individuals were not physically active and were following a sedentary lifestyle.

Table 3: Prevalence of hypertension and physical activity level of the subjects (N=150)

Variable			n (%)	P-value
Blood pressure	Hypertension stage I	Male	6 (42)	
		Female	26 (19)	
	Hypertension stage II	Male	4 (29)	
		Female	30 (22)	
	Hypertension stage III	Male	4 (29)	
		Female	80 (59)	
Physical activity	Mild activity	Male	5 (36)	<0.01
		Female	111(82)	
	Moderate activity	Male	7 (50)	
		Female	23 (17)	
	High activity	Male	2 (14)	
		Female	2 (1)	

Conclusions and Recommendations:

The results of current study concluded that some of the determinants were found risk factors of hypertension in early adults. These factors included illiteracy, increased BMI cut-offs among male and female counterparts and waist circumference of female study cohorts with sedentary lifestyle. All these factors showed significant relationship with hypertension in early adulthood.

The current study recommends that due to non-optimal nutritional status and physical inactivity the risk of hypertension is increasing so medical health professionals should prescribe a low to moderate physical exercise in prevention and management of hypertension. Effective interventions should be implemented to aware people about weight management and its role towards prevention of hypertension. Screening programs should be launched for early detection of hypertension.

As this study was limited to Mardan only and sample size was small so further research should be conducted to explore the association between hypertension and physical activity.

Authors Contribution:

SA conceived, designed, and did statistical analysis & editing of manuscript

SA, SI, SR & AB did data collection and manuscript writing

SA did review and final approval of manuscript

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References

Alsairafi, M., Alshamali, K., & Al-rashed, A. (2010). Effect of Physical Activity on Controlling Blood Pressure among Hypertensive Patients from Mishref Area of Kuwait. *Electron J Gen Med, 7*(4). Doi:10.29333/ejgm/82889

Andeansah, M., Afiatin, & Sukandar, H. (2015). Correlation between waist circumference and hypertension in jatinangor. *J. Hypertens, 33*(Supplement 2). doi:10.1097/01.hjh.0000469769.81770.95

Arnett, J. J. (2000). Emerging Adulthood: A Theory of Development from the Late Teens Through the Twenties. *American Psychologist, 55*(5), 469-480. Doi:10.1037/0003-066x.55.5.469

Aronow, W. S. (2017). Association of Obesity with Hypertension. *Ann. Transl. Med, 5*(17), 350-350. Doi:10.21037/atm.2017.06.69

CDC.Vital Signs: Hypertension Treatment and Control Increased Significantly from 1999–2002 to 2005–2008. (2011). *Cardiol News, 9*(6), 2. Doi:10.1016/s1544-8800(11)70165-8

Choi, H. M., Kim, H. C., & Kang, D. R. (2017). Sex Differences In Hypertension Prevalence And Control: Analysis Of The 2010-2014 Korea National Health And Nutrition Examination Survey. *PloS One, 12*(5). Doi:10.1371/journal.pone.0178334

Diaz, K. M., & Shimbo, D. (2013). Physical Activity and the Prevention of Hypertension. *Current Hypertens. Rep, 15*(6), 659-668. Doi:10.1007/s11906-013-0386-8

Dua, S., Bhuker, M., Sharma, P., Dhall, M., & Kapoor, S. (2014). Body Mass Index Relates To Blood Pressure Among Adults. *N Am J Med Sci, 6*(2), 89. Doi:10.4103/1947-2714.127751

Everett, B., & Zajacova, A. (2015). Gender Differences in Hypertension and Hypertension Awareness among Young Adults. *Biodemography Soc Biol, 61*(1), 1-17. Doi:10.1080/19485565.2014.929488

Hossain, F. B., Adhikary, G., Chowdhury, A. B., & Shawon, M. S. (2019). Association between Body Mass Index (BMI) and Hypertension in South Asian Population: Evidence From Nationally-Representative Surveys. *Clin. Hypertens*, *25*(1). Doi: 10.1186/s40885-019-0134-8

Landi, F., Calvani, R., Picca, A., Tosato, M., Martone, A. M., Ortolani, E., Marzetti, E. (2018). Body Mass Index is Strongly Associated with Hypertension: Results from the Longevity Check-up 7+ Study. *Nutrients, 10*(12), 1976. Doi: 10.3390/nu10121976

Landsbergis, P. A., Diez-Roux, A. V., Fujishiro, K., Baron, S., Kaufman, J. D., Meyer, J. D., . . . Szklo, M. (2015). Job strain, Occupational Category, Systolic Blood Pressure, and Hypertension Prevalence. *J Occup Environ Med*, *57*(11), 1178-1184. Doi:10.1097/jom.0000000000000533

Liew, S. J., Lee, J. T., Tan, C. S., Koh, C. H., Van Dam, R., & Müller-Riemenschneider, F. (2019). Sociodemographic Factors In Relation To Hypertension Prevalence, Awareness, Treatment And Control In A Multi-Ethnic Asian Population: A Cross-Sectional Study. *BMJ Open, 9*(5). Doi: 10.1136/bmjopen-2018-025869

Ma, L., Lin, X., Wang, Z., Su, R., Hu, R., & Du, M. (2009). Prevalence Of Hypertension And Association of Body Mass Index, Waist Circumference and Lifestyle Factors with Blood Pressure in Mongolian Adults. *Int. J. Cardiol, 137* Doi:10.1016/j.ijcard.2009.09.433

Mbijiwe, J., Chege, P., &Munyaka, A. (2019). Assessment of Physical Activity Level and its Effects on Blood Pressure Control among Hypertensive Patients Attending Kiambu Level Five Hospital, Kenya. *Int. J. Heal. Sci. Res, 9*(8)

Ray, S., & Jamdade, V. (2015). Knowledge Regarding Hypertension and Its Risk Factors among People Residing in Urban Slums. *Asian. Acad. Res. J. Multidiscip*, 1(29), 315-320.

Riaz, M., Shah, G., Asif, M., Shah, A., Adhikari, K., & Abu-Shaheen, A. (2021). Factors Associated With Hypertension In Pakistan: A Systematic Review And Meta-Analysis. *PloS One, 16*(1). Doi:10.1371/journal.pone.0246085

Rissardi, G. D., Cipullo, J. P., Moreira, G. C., Ciorlia, L. A., Cesarino, C. B., Giollo Junior, L. T. Vilela-Martin, J. F. (2018). Prevalence Of Physical Inactivity And Its Effects On Blood Pressure And Metabolic Parameters In A Brazilian Urban Population. *Int. J. Cardio. Sci*. Doi:10.5935/2359-4802.20180064

Samir, N., Mahmud, S., & Khuwaja, A. K. (2011). Prevalence of Physical Inactivity and Barriers to Physical Activity among Obese Attendants at a Community Health-Care Center in Karachi, Pakistan. *BMC Res. Notes, 4*(1). Doi:10.1186/1756-0500-4-174

Shah, N., Shah, Q., & Shah, A. J. (2018). The Burden and High Prevalence of Hypertension in Pakistani Adolescents: A Meta-Analysis of the Published Studies. *Arch. Public Health, 76*(1). Doi: 10.1186/s13690-018-0265-5

Sowemimo, I., Ajayi, I., Akpa, O., & Ossai, N. (2016). Prevalence of Hypertension and Associated Factors among Residents of Ibadan-North Local Government Area of Nigeria. *Nig. J. Cardiol, 13*(1), 67. Doi:10.4103/0189-7969.165168

Teh, C. H., Chan, Y. Y., Lim, K. H., Kee, C. C., Lim, K. K., Yeo, P. S. Nazni, W. A. (2015). Association of Physical Activity with Blood Pressure and Blood Glucose among Malaysian Adults: A Population-Based Study. *BMC Public Health,* 15(1). Doi:10.1186/s12889-015-2528-1

Wang, Y., Howard, A. G., Adair, L. S., Wang, H., Avery, C. L., & Gordon-Larsen, P. (2019). Waist Circumference Change is Associated with Blood Pressure Change Independent of BMI Change. *Obesity, 28*(1), 146-153. Doi:10.1002/oby.22638

Dua, S., M. Bhuker, P. Sharma, M. Dhall and S. Kapoor. 2014. Body mass index relates to blood pressure among adults. North American journal of medical sciences 6: 89.
Guagnano, M., E. Ballone, V. Colagrande, R. Della Vecchia, M. Manigrasso, D. Merlitti, G. Riccioni and S. Sensi. 2001. Large waist circumference and risk of hypertension. International journal of obesity 25: 1360-1364.
Hossain, F.B., G. Adhikary, A.B. Chowdhury and M.S.R. Shawon. 2019. Association between body mass index (BMI) and hypertension in south Asian population: evidence from nationally-representative surveys. Clinical hypertension 25: 1-9.
Jiang, S.Z., W. Lu, X.F. Zong, H.Y. Ruan and Y. Liu. 2016. Obesity and hypertension. Experimental and therapeutic medicine 12: 2395-2399.
Pescatello, L.S., D.M. Buchner, J.M. Jakicic, K.E. Powell, W.E. Kraus, B. Bloodgood, W.W. Campbell, S. Dietz, L. DiPietro and S.M. George. 2019. Physical activity to prevent and treat hypertension: a systematic review. Medicine & Science in Sports & Exercise 51: 1314-1323.
Ramezankhani, A., F. Azizi and F. Hadaegh. 2019. Associations of marital status with diabetes, hypertension, cardiovascular disease and all-cause mortality: a long term follow-up study. PloS one 14: e0215593.
Sun, J.Y., Y.X. Ma, H.L. Liu, Q. Qu, C. Cheng, X.Q. Kong, W.J. Huang and W. Sun. 2022. High waist circumference is a risk factor of new-onset hypertension: Evidence from the China Health and Retirement Longitudinal Study. The Journal of Clinical Hypertension 24: 320-328.
Trivedi, R.B., B. Ayotte, D. Edelman and H.B. Bosworth. 2008. The association of emotional well-being and marital status with treatment adherence among patients with hypertension. Journal of behavioral medicine 31: 489-497.
Tuoyire, D.A. and H. Ayetey. 2019. Gender differences in the association between marital status and hypertension in Ghana. Journal of biosocial science 51: 313-334.