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METABOLIC SYNDROME;

ARE OUR WOMEN AT RISK TO DEVELOP. A STUDY AT ABBASI SHAHEED HOSPITAL

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ABSTRACT: Metabolic syndrome is a congregation of central obesity, dyslipidemia, raised blood sugar levels, increasing the individual's susceptibility to Type II Diabetes and cardiovascular diseases. **Objectives:** (1) To determine the prevalence of metabolic syndrome in young, urban, female population. (2) To determine the risk factors in poor, urban, female population. **Study Design:** This was a descriptive cross sectional study. **Setting:** The department of Gynae/ Obst Unit II KMDC/Abbasi Shaheed hospital. **Period:** One year starting from January 2016 to December 2016. **Material and Method:** Approval was taken from ESRC of KMDC. All healthy asymptomatic married/single women between 18-49 years of age were included while women <18 or >50 years of age, diabetic, hypertensive or having bleeding disorders were excluded from study. Laboratory data included blood sugar, triglycerides, HDL-cholesterol, collected by phlebotomist from the participants in fasting state through venipuncture. A Chi-square test was applied to evaluate the association of demographic group variables and metabolic syndrome. P-value <0.05 was considered as statistically significant. There was no conflict of interest. **Result:** A total of 343 participants were recruited. The socio and demographic data is summarized in Table-I. The prevalence of Metabolic syndrome was found to be high. 227(66.2%) of participants were having Metabolic syndrome according to NCEP ATP III criteria. 63(18.4 %) had history of PIH while 52(15.2%) had family history of hypertension and 126(36.7 %) had family history of both Hypertension and Diabetes. 232 (67.6 %) of women had sedentary life style and only 3(0.9%) practiced aerobic exercises. 287(83.7%) had their waist circumference of >80cm, the mean systolic blood pressure was 127.5 +-23.76 while the mean diastolic blood pressure was 86.99+-57.36. The mean of BMI was at higher level 30.97+-6.41. Obesity is the most common risk factor for Metabolic syndrome. The mean of fasting blood sugar was 105.08+-42.16 which was on higher side. The mean of Triglycerides 142.43+-61.12 and HDL 39.04+-12.45 were within normal limits. Increased prevalence was observed in women who had PIH during pregnancy and childbirth 25.1% v 5.2%(p value=0.001). **Conclusion:** Prevention and treatment of metabolic syndrome is a big challenge. Lifestyle interventions should begin from the early childhood to reduce weight and to prevent development of obesity and metabolic syndrome.

Key words: Obesity, overweight, sedentary lifestyle, lifestyle modifications, non-communicable diseases

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INTRODUCTION

Metabolic syndrome has become a public health concern in the world. It is a major cause of morbidity and mortality. Many studies have shown strong association of metabolic syndrome with coronary artery disease, Type ii Diabetes and Stroke.[1] Beyond these diseases, individuals with MS are highly susceptible to other conditions like Polycystic ovary syndrome, fatty liver, cholesterol gall stones, asthma, sleep disturbances, and some forms of cancer.[2]

A recent hospital based survey from Pakistan and India has shown that prevalence of Metabolic syndrome is 34.8% and 25.3% respectively.[3] Due to this high prevalence, the risk of cardiovascular disease and Diabetes are markedly increasing.

The definition of metabolic syndrome given by American Heart Association and The National Heart, Lung and Blood Institute (AHA/NHLBI) in 2005 declared that a clinical diagnosis of metabolic syndrome can be established if

any three of the following factors are present i.e Elevated, a. Triglycerides >150mg/dl (1.7mmol/l) b. Waist circumference >80cm, c. Fasting glucose >100mg/dl (5.6mmol/l) d. Systolic Blood pressure /Diastolic Blood pressure >130/85mmHg and Decreased HDL-Cholesterol[4]<50mg/dl(1.29mmol/l).

The prevalence of Metabolic syndrome increases with age. The highest recorded prevalence worldwide is in Native Americans with nearly 60% of women post-menopausal.[5] Changes in hormonal levels with decrease in estrogen is the main factor for metabolic syndrome at menopausal transition.[6] But surprisingly, South Asian women are more prone to have Metabolic syndrome at a pre-menopausal age as compared with Caucasians.[7]

It is hard to talk exactly how long pre menopause last. According to International Menopause Society 2015 It begins when a young girl has first period and ends with the first typical signs of menopause such as hot flushes, mood swing etc. Changes in lifestyle, physical inactivity, lack of education, nutritional status as well as environmental and social factors are responsible for this rising prevalence of Metabolic syndrome at a younger age.[8]

ATPIII considered the obesity (BMI>25 kg/m^2 according to WHO) epidemic as mainly responsible for the rising prevalence of metabolic syndrome. The accumulation of fat in a central distribution has emerged as a cardiovascular risk factor independent of overall obesity.[9]
Several cross sectional studies have established that overweight and obesity are clearly associated with risk components of Metabolic syndrome.[10] Obesity in terms of waist circumference is found to be 46-68% of the Pakistani population.[11] Pakistan is a low income developing country and most of the families due to financial and cultural factors are forced to take carbohydrate containing diet, a strong contributing factor of weight gain.

Physical inactivity is another strong contributing factor for increased prevalence of Metabolic syndrome at pre-menopausal. Epidemiological studies have shown a direct relationship between lack of physical activity and Metabolic syndrome.[12]

Sedentary lifestyle, availability of new technology, increased use of television, lack of playgrounds, along with lack of security and social restrictions are important factors for our women becoming obese.[13,14]

Unfortunately, there are no nationally representative studies that have yet been done in Pakistan to evaluate the prevalence and risk factors for Metabolic syndrome among a young and middle aged poor urban women. Abbasi Shaheed Hospital, a tertiary care hospital, is an ideal place where health care providers can identify these women who are at risk to develop Metabolic syndrome so that treatment and preventive strategies can be evolved to prevent risk of Diabetes and Cardiovascular diseases in later life. Therefore, a study was planned to identify the risk factors of Metabolic syndrome among the above population. The objectives of study were to identify the risk factors of Metabolic syndrome among Premenopausal women.

MATERIALS AND METHODS

This was a descriptive cross sectional study, conducted in the department of Gynae/ Obst Unit II KMDC/Abbasi Shaheed hospital over a period of one year. Approval was taken from ESRC of KMDC. The participants were recruited from all outdoor patients visiting for various gynecological problems as well as paramedical staff, birth attendants and indoor patients' and their attendants. All healthy asymptomatic married/single women between 18-49 years of age were included while women <18 or >50 years of age, diabetic, hypertensive or having bleeding disorders were excluded from study. An informed written as well as verbal consent was taken from all participants.

The data was collected through completing questionnaire followed by clinical examination of participating women and collection of laboratory investigations.

The questionnaire design specifically for

this study, contains demographic characters including information regarding the subjects age, marital status, education, ethnicity, employment, obstetrical history, family history of hypertension, diabetes. Information regarding life style behavior including, dietary history, physical activity and socioeconomic status.

Keeping in view, the multiethnic population visiting at Abbasi Shaheed hospital, the questionnaire was translated to different regional and national language of the participants from the original English version. All the participants answered on the questionnaire followed by clinical examination by gynecologist under the supervision of Principal investigator. The clinical examination included measurement of Blood pressure, Body weight, height, waist circumference. Body weight and height was measured in an upright position with light clothing and no shoes. BMI was calculated as body weight(kg) divided by body height(m)^2. BMI was classified according to WHO criteria.

Waist circumference was measured in centimeters at the midpoint between the iliac crest and lower rib margin at the end of expiration, while standing. Laboratory data included blood sugar, triglycerides, HDL-cholesterol, collected by phlebotomist from the participants in fasting state through venipuncture.

All participants were evaluated by the Principal investigator, an awareness programme regarding modification of lifestyle, dietary advice, encourage physical activity was conducted within hospital and referred to medical department for control of blood sugar and dyslipidemia.
It is ongoing activity in the department of Gyne/ Obst.

The sample size calculation was done using WHO software edited by L. Lemeshow and S-K-Lwange. The reference study used for this sample size calculation is Prevalence and Risk factors for Metabolic syndrome in Asian Indian. A community study from urban eastern India. J. Cardiovascular Disease Research2012 july-sep;3(3):204-2011.For our study the sample size calculated is 343.Patients were selected by Non-probability convenience sampling technique.

Data was collected through a questionnaire and was analyzed by SPSS version 17. Continuous variables like age, clinical examination findings, lab results etc. was presented as Mean ±Standard Deviation, Median, Range, 95% CI whereas categorical variables like marital status, education, ethnicity, family history, metabolic syndrome, number of risk factors were presented in frequency and percentages. A Chi-square test was applied to evaluate the association of demographic group variables and metabolic syndrome. P-value <0.05 was considered as statistically significant.

There was no conflict of interest.

RESULT

A total of 343 participants were recruited. The socio and demographic data is summarized in table
1. The age of the participants were mostly between 36-40 years 87(25.4%). Married 282 (82.2%) and multiparous 267 (77.8 %). As far as education was concerned, 151 (44.0%) were highly educated. As this study was conducted in Karachi urban city, 270 (78.7%) belong to Urdu speaking/Sindhi group. Another emerging group was Pakhtoon, 46 (13.4 %). 190 (55.4%) of participants were household women while 134 (39.1%) were part timer workers.

Regarding past obstetrical history, 63 (18.4%) had history of PIH while 52(15.2%) had family history of hypertension and 126 (36.7%) had family history of both Hypertension and Diabetes. Regarding dietary habits 203 (59.2%) of participants ate carbohydrate containing diet routinely.
As far as physical activity was concerned,232 (67.6%) of women had sedentary life style and only 3 (0.9%) practiced aerobic exercises. Regarding socioeconomic status 162 (47.2%) of women belong to middle class families.

As shown in table 1, majority of participants had central deposition of fat ,287(83.7%) had their waist circumference of >80cm, the mean systolic

blood pressure was 127.5 +-23.76 while the mean diastolic blood pressure was 86.99+-57.36. The mean of BMI was at higher level 30.97+-6.41. The mean of fasting blood sugar was 105.08+-42.16 which was on higher side. The mean of Triglycerides 142.43+-61.12 and HDL 39.04+-12.45 which were within normal limits.

As shown in Figure I, the total prevalence of Metabolic syndrome was found to be high in the study subjects. 227 (66.2%) of participants were having Metabolic syndrome according to NCEP ATP III criteria.

Figure II has shown prevalence of individual components of Metabolic syndrome.139 (61.2%) had hypertension, 148 (65.2%) had raised blood sugar, while 339.57 (99%) had>80 cm of waist circumference indicating that obesity is the most common risk factor for Metabolic syndrome.

Table 2 shows association of demographic and clinical parameters with Metabolic syndrome. The prevalence of Metabolic syndrome had a very significant association with age. As age progress, the number of participants having Metabolic syndrome increased from 3.5% v 30.8% from 18-40 years of age (p value=0.001). As far as ethnicity was concerned, there was no significant association with Metabolic syndrome. Regarding dietary habits, no association was observed because most of our participants ate carbohydrate containing diet.

Employment had a significant association with Metabolic syndrome prevalence. Increased prevalence of Metabolic syndrome was seen in those subjects who were household as compared to working 65.2% v 5.7% (p value=<0.001).

Another significant association was observed with physical activity and Metabolic syndrome. Those women leading sedentary lifestyle were more likely to have Metabolic syndrome as compared to those exercised 77.5% v 0% (p value=0.001) indicating that physical activity is an important risk factor for Metabolic syndrome.

Increased prevalence was observed in those participants who had developed PIH during pregnancy and childbirth as compared to those who remains normotensive 25.1% v 5.2% (p value=0.001) indicating an important risk factor for Metabolic syndrome.

As far as family history of hypertension and diabetes were concerned, it has a significant influence on the prevalence of Metabolic syndrome. Participants who had family history of hypertension, were at high risk to develop Metabolic syndrome as compared to those who were normotensive 19.4% v 6.9% (p value=0.001) and those who had family history of Diabetes were likely to had Metabolic syndrome 21.6% v 12.9% (p value=0.001).

As far as BMI was concerned, it has a great influence on the prevalence of Metabolic syndrome. Increased prevalence of Metabolic syndrome was observed in those participants who have had high BMI as compared to those who have normal BMI 73.6% v 5.7%(p value=0.001) indicating that obesity is a significant risk factor for Metabolic syndrome.

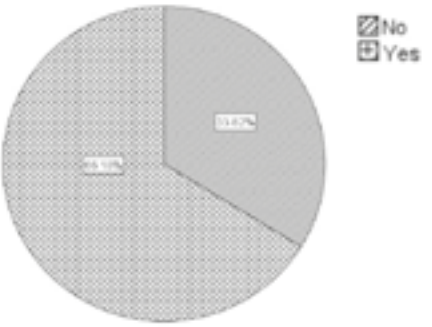


Figure-1. Frequency of Metabolic Syndrome in Study Population (n=343)

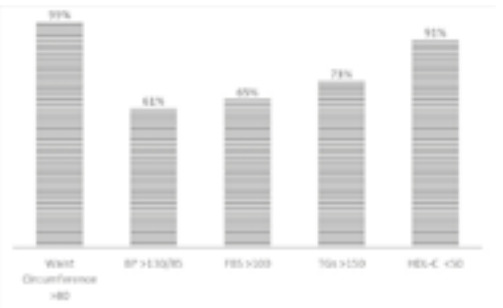


Figure-2. Percentage of Factors Contributing in Metabolic Syndrome (n=227)

Variables	n (n%)
Age groups (years)	
18-25	55 (16%)
26-30	53 (15.5%)
31-35	62 (18.1%)
36-40	87 (25.4%)
41-45	53 (15.5%)
46-49	33 (9.6%)
Literacy	
Primary	99(28.9%)
Secondary	151(44.0%)
Not Literate	93(27.1%)
Marital Status	
Married	282(82.2%)
Un-married	50(14.6%)
Widow	7 (2%)
Divorced	4 (1.2%)
Employment	
Household	190(55.4%)
Part time	134(39.1%)
Full time	19(5.5%)
Ethnicity	
Sindhi/Urdu Speaking	270(78.7%)
Pukhtoon	46 (13.4%)
Punjabi	25(7.3%)
Balochi	2(0.6%)
Parity	
Nulliparous	76(22.2%)
Multiparous	267 (77.8%)
Obstetric history	
PIH	63(18.4%)
Diabetes	7(2.0%)
Both	18(5.2%)
Nil	255(74.3%)
Family History of	
Hypertension	52(15.2%)
Diabetes	64(18.7%)
Both	126(36.7%)
None	101(29.4%)
Dietary History	
CHO	203(592%)
Mix	140(40.8%)
Physical Activity	
Sedentary	232(67.6%)
Exercise >2hrs	108(31.5%)
Aerobic exercise	3(0.9%)
Social History	
Poor	144(42.0%)
Fair	12(47.2%)
High	37(10.8%)
Waist Circumference	
<80	56(16.3%)
>80	287(83.7%)
Systolic Blood Pressure (mmHg)*	127.5 ±23.76
Diastolic Blood Pressure	86.99±57.36
Height (cm)*	153.43±5.58
Weight (kg)*	72.92±15.55
BMI (kg/m²)*	30.97±6.41
Fasting Blood Sugar (mg/dL)*	105.08±42.16
Triglycerides (mg/dL)*	142.43±61.12
HDL-Cholesterol (mg/dL)*	39.04±12.45

Table-I. Demographics& Study Characteristics (n=343) *presented in Mean ±SD

Variables	Metabolic Syndrome n (n%)	No Metabolic Syndrome n (n%)	P-value
Age groups			
18-25	8 (3.5%)	47 (40.5%)	
26-30	25 (11%)	28 (24.1%)	
31-35	45 (19.8%)	17 (14.7%)	0.001
36-40	70(30.8%)	17(19.5%)	
41-45 years	49(21.6%)	4(7.5%)	
46-49years	30(13.2%)	3(9.1%)	
Ethnicity			
Sindhi/Urdu	174(76.7%)	96(82.8%)	
Punjabi	15(6.6%)	10(8.6%)	0.186
Balochi	2(0.9%)	0(0%)	
Pukhtoon	36(15.9%)	10(8.6%)	
Dietary			
CHO	142(62.6%)	61(52.6%)	
Protein	0(0%)	0(0%)	0.049
Fat	0 (0%)	0(0%)	
Mix	85(37.4%)	55(47.4%)	
Life style			
Sedentary	176(77.5%)	56(48.3%)	
Walking/d	51(22.5%)	57(49.1%)	0.001
Aerobic exercise	0(0%)	3(2.6%)	
Employment			
Household	148 (65.2%)	42 (36.2%)	
Part Time	66 (29.1%)	68 (58.6%)	< 0.001
Full Time	13 (5.7%)	6 (5.2%)	
PIH	57(25.1%)	6(5.2%)	0.001
Hypertension	44(19.4%)	8(6.9%)	0.001
Diabetes	49(21.6%)	15(12.9%)	0.001
BMI Groups			
Underweight (< 18 kg/m²)	0(0%)		
Normal (18 – 24.99 kg/m²)	13(5.7%)	3(2.6%)	
Overweight (25 – 29.99 kg/m²)	47(20.7%)	51(44%) 20(17.2%)	0.001
Obese (≥ 30 kg/m²)	167(73.6%)	42(36.2%)	

Table-II. Association of Metabolic Syndrome with Risk Factors

DISCUSSION

This first time cross-sectional study done on poor and middle class female population of urban Karachi, aged between 18-49. The prevalence of METS was found to be 66.2% (227 respondents). The pattern followed a rising prevalence with increasing age with the prevalence being 3.5% in the age group between 18-25, and maximum prevalence of 21.6% being found in the age group 41-45 years. In Pakistan, no studies have yet been conducted solely on female population. However studies done in other South Asian countries on young females have shown the prevalence to be between 6.8 to 17.5 percent.[7,8,10,20,30,31,35] A study conducted in Pakistan which was not gender-specific, showed a prevalence between 39%-45%.[11] However, another study conducted in Pakistan found a prevalence of 23.6% in the age group 30-39, while between 40-49 the prevalence rate was 20.3%.[35]

The high prevalence rate shown in our study and the one done by Samad Shera was because the number of married multiparous women were more compared to the studies done in other South Asian countries in which the age was taken as between 17-25 years. These were younger, educated individuals, leading a healthy lifestyle.

Abdominal obesity is quite prevalent in South Asia, with females outnumbering males.[16] Several studies have shown that South Asians are at a greater risk of CVD because of their increased body fat and increased abdominal fat distribution at similar BMIs than Caucasians.[8,15,23] The prevalence of obesity and metabolic syndrome is on the rise, leading to increased morbidity. Since obesity tracks from childhood into adulthood, the clinical events must be recognized earlier.[8] Physiological changes in females have been explored that tend to increase the risk of inactivity, obesity and metabolic syndrome.[34] Pregnancy is another stage marked with weight gain, and retaining this body weight contributes to overweight and obesity in women of childbearing age.[32] An observational study which was a part of SWAN study found that mean weight gain of women in midlife was 2.8 kg and waist circumference increase of 2.2 cm. Increase in physical activity could bring about a reduction of 0.32 kg.[33]

In our study, 287 women (83.7%) had a waist circumference of greater than 80 cm. As WHO criteria was used for assessment of BMI, those having a BMI of (25-29.99 kg/m^3), 47 had metabolic syndrome (20.7%), while those obese (>30 kg/m^3), 167 females, with a prevalence of metabolic syndrome (73.6%), shows that obesity acts as an independent risk factor for development of metabolic syndrome and increasing risk of Type-II Diabetes and CVD.

According to the Global Burden of Disease study, published in the Lancet, Pakistan has been declared the 9th most obese country. Increased technological advancements come with a price, leading to sedentary lifestyle, which is described as a lifestyle with no or irregular physical activity. Total daily physical activities, including occupational, household, and leisure time activities have much reduced. Increased urbanization and high rise living, lack of space and parks, with social inhibitions of women, has led to a negative impact on the physical activity. In our study, 232 women (67.6%) were having a sedentary lifestyle which was associated with a prevalence of 77.5% among 176 women, were not involved in any kind of physical activity, 31.5% did some exercise, while 0.9% were involved in aerobic exercises and none of them suffered from metabolic syndrome

Diabetes is highly prevalent, with Asia contributing to 60%.[36] By the year 2030, it is expected to reach-, and Pakistan would be 4th on the list. Pakistan has undergone almost 50% urbanization[10], along with the use of energy-rich processed foods.[40] Even the local variant of fast food burger is very high in trans fatty acids, because of deep frying and low costs. Pakistanis develop IGT at a younger age, many having strong family history, clustering of cardio-metabolic disorders and high genetic susceptibility.

Metabolic syndrome is a growing global problem

and is a major contributor to cardiovascular disease in the future. Hypertension in pregnancy poses a threat for the future development of cardiovascular risk. In our study, we had 57 patients, who had history of pregnancy induced hypertension (25.1%) suffering from metabolic syndrome. A paper published in the American Journal of Obs and Gynae[37] found an increased incidence of metabolic syndrome and hypertension after a mean follow up of 2.5 years. Similarly, another study in Finland on 12,055 women with pregnancy induced hypertension, were followed for a period of 35 years, were found to be associated with subsequent cardiovascular disease and arterial hypertension.[38]

In our study, most of the patients were on a carbohydrate rich diet.

Ethnicity, along with economic discrimination, lifestyle factors including diet, physical activity, genetic heritage based on geographic origin, along with low education group was more likely to have METS. High education, high income, less likely to have METS. Asian consume more carbohydrates with lower fruit intake, leading to increased post-prandial hyperglycemia and insulin resistance.[1] In our study, most of the females interviewed were consuming a CHO rich diet. However, no direct relationship was found between diet and metabolic syndrome.

CONCLUSION

Female life expectancy has increased to 67.8%, however this has also has increased the risk of non-communicable diseases. The study found a 66.2% prevalence of METS (227 respondents), but its features can start presenting at least 10 years prior to the development of diabetes or cardiovascular disease. The underlying cause is our worsening lifestyles that have become increasingly sedentary. Other causes such as PCOS also play a major role in the development of MS. Equally responsible is the lack of awareness amongst even the educated about the repercussions of our unhealthy lifestyles.

RERERENCES

1. Prasad. K, Prianga. **R Metabolic syndrome among Sri Lankan adult: Prevalence, Patterns and correlates.** Diabetol Metab Synd. 2012; 4:24.

2. Grundy.S.M, Cleeman. J.I, Daniels. S.R et al, **Diagnosis and management of metabolic syndrome an American Heart Association/National Heart, Lung, and Blood Institute scientific statement, Current opinion in cardiology.** 2007; vol.21, no, I, 162-172.

3. Mirsa A, Khurana L. **The metabolic syndrome in South Asians: epidemiology, determinants and prevention.** Metab Syndr Relat Disord.2009; 7:497-514.

4. GrundySM, BrewerHBJr, CleemanJI. **Definition of Metabolic Syndrome-Report of the National Heart, Lung, and Blood Institute / American Heart Association Conference on Scientific Issues Related to Definition Circulation** 2004; 109:433-438.

5. Alberti KG et al. **The IDF Epidemiology Task Force Consensus Group.** The metabolic syndrome. Lancet. 2005; 366: 1059.

6. Manouchehr N, Mehrnaz I, Mehrdad L. **Metabolic Syndrome in pre-menopausal and postmenopausal women with type 2 diabetes: loss of protective effects of premenopausal status.** Journal of Diabetes & Metabolic Disorders 2014, 13:102.

7. Prasad DS, Kabir Z, Das B C. **Prevalence and risk factors for metabolic syndrome in Asians Indians: A community study from urban Eastern India.** J Cardiovasc Dis Res 2012; 3:204-211.

8. PrasadD S, Kabir Z, Dash AK. **Cardiovascular risk factors in developing countries: A review of clinic-epidemiological evidence.** CVD Prev Control. 2010; 5:115-23.

9. Sang, Woo, Oh. **Obesity and Metabolic syndrome in Korea.** Diabete Metabol J.2011; 35(6):501-566.

10. Nilofer S, Khuaja A K, Rehman A. **Retrospective analysis of Metabolic syndrome.** J of Family Medicine .2012; 2012:

11. BasitA, SheraAS. **Prevalence of metabolic syndrome in Pakistan.** Metab Syndr Relat Disord. 2008; 6(3): 171-5.

12. Emmanuel G, Guilherme V. **Physical exercise and Metabolic syndrome.** Bras ModEsporta.2004; 10(4): 325-326.

13. Chaudhry, M.A.; Ahmad, F.; Ashraf, M.Z. **Frequency of overweight and obesity in students of medical College Lahore.** Ann. Pak. Inst. Med. Sci. 2012, 8, 137–

140.

14. Hingorjo, M.R.; Syed, S.; Qureshi, M.A. **Overweight and obesity in students of a dental college of Karachi: Lifestyle influence and measurement by an appropriate anthropometric index.** J. Pak. Med. Assoc. 2009, 59, 528–532.

15. Misra, A.; Khurana, L. **Obesity related non-communicable diseases: South Asians vs White Caucasians.** Int. J. Obes. 2011, 35, 167–187.

16. Misra, A; Shrivastava, U. **Obesity and Dyslipidemia in South Asians.** Nutrients 2013. 5, 2708-2733.

17. Harding S, Rosato MG, Cruickshank JK. **Lack of change in birth weights of infants by generational status among Indian, Pakistani, Bangladeshi, Black Caribbean, and Black African mothers in a British cohort study.** Int J Epidemiol 2004; 33: 1279–85.

18. Misra A. **Impact of ethnicity on body fat patterning in Asian Indians and blacks: relation with insulin resistance [editorial].** Nutrition 2003; 19: 815–16.

19. **Association of household and community socioeconomic position and urbanicity with underweight and overweight among women in Pakistan,** Janjua NZ, Mahmood B, Bhatti JA, Khan MI.

20. Hydrie MZ, Shera AS, Fawwad A, Basit A, Hussain A. **Prevalence of metabolic syndrome in urban Pakistan (Karachi): Comparison of newly proposed International Diabetes Federation and Modified Adult Treatment Panel III criteria.** Metab Syndr Relat Disord. 2007; 7:119-24

21. Hakeem R, Shaikh Z & Ziaee M. **Socio economic differences in frequency of food consumption and dietary trends in urban areas of Karachi, Pakistan.** Pak J Biol Sci 2004;7, 822–826.

22. Iqbal R, Anand S, Ounpuu S, et al. **Dietary patterns and the risk of acute myocardial infarction in 52 countries: results of the Interheart study.** Circulation 2008;118, 1929–1937.

23. Jafar TH, Jafary FH, Jessani S, et al. **(Heart disease epidemic in Pakistan: women and men at equal risk.** Am Heart J 2005; 150, 221–226.

24. Jafar TH, Levey AS, Jafary FH, et al. **Ethnic subgroup differences in hypertension in Pakistan.** J Hypertens 2003;21, 905–912.

25. Jafar TH**. Women in Pakistan have a greater burden of clinical cardiovascular risk factors than men.** Int J Cardiol 2006;106, 348–354.

26. Janjua NZ, Iqbal R & Mahmood B. **Association of socioeconomic position with under- and over nutrition in Pakistan.** Ann Epidemiol 2011;21, 884–891.

27. Jain J, Rao T, Desmukh P, Banait S**. Prevalence and Correlates of Metabolic Syndrome in Young Population: A Cross Sectional Study.** J Diabetes Metab 2015; 6: 503. doi:10.4172/2155-6156.1000503

28. Pandit K, Goswami S, Ghosh S, Mukhopadhyay P, Chowdhury S. **Metabolic syndrome in South Asians. Indian Journal of Endocrinology and Metabolism.** 2012;16(1):44-55. doi:10.4103/2230-8210.91187.

29. Shah, T., Jonnalagadda, S.S., Kicklighter, J.R. et al. J Immigrant Health (2005) 7: 117. doi:10.1007/s10903-005-2645-5

30. Sharad R. Jain, Komal H. Shah, Himanshu N. Acharya, Kaushik Barot, and Kamal H. Sharma, **"Prevalence and Predictors of Metabolic Syndrome in Young Asymptomatic Gujarati Population,"** International Journal of Chronic Diseases, vol. 2015, Article ID 365217, 7 pages, 2015. doi:10.1155/2015/365217

31. Ahmad M, Hassan S, Hafeez F, Jajja A. **Prevalence of various Components of metabolic syndrome in your younger population.** Pak J Physiol 2011; 7(2): 46-49.

32. M.N. van Poppel, M.A. Hartman, K. Hosper, M. van Eijsden: **Ethnic differences in weight retention after pregnancy: the ABCD study,** Eur J Pub Health, 22 (2012), pp. 874–879.

33. B. Sternfeld, H. Wang, C.P. Quesenberry Jr., et al. **Physical activity and changes in weight and waist circumference in midlife women: findings from the Study of Women's Health Across the Nation.** Am J Epidemiol, 160 (2004), pp. 912–922

34. Obesity and the Metabolic Syndrome in Developing Countries **Anoop Misra and Lokesh Khurana.** The Journal of Clinical Endocrinology & Metabolism 2008 93:11.

35. Hussain Z, Sherwani MK, Mehmood S. **Prevalence of metabolic syndrome; its risk factors and viral hepatitis B & C in underprivileged suburban population of Lahore, Pakistan.** Professional Med J 2016; 23(4):434-443. DOI: 10.17957/ TPMJ/16.3227

36. Ramachandran A, Snehalatha C, Shetty AS, Nanditha A. **Trends in prevalence of diabetes in Asian countries. World Journal of Diabetes.** 2012; 3(6):110-117. Doi: 10.4239/wjd. v3. i6.110.

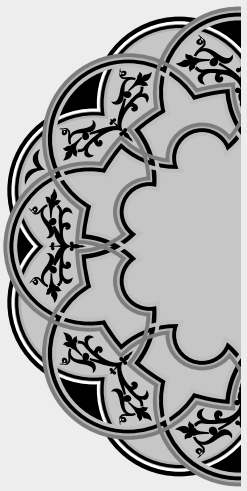
37. **Cardiovascular risk factors in women who had hypertensive disorders late in pregnancy: a cohort study, Hermes, Wietske et al.** American Journal of

Obstetrics & Gynecology, Volume 208, Issue 6, 474.e1 - 474.e8

38. **Elevated Blood Pressure in Pregnancy and Subsequent Chronic Disease Risk: Tuija Männistö, Pauline Mendola, Marja Vääräsmäki, Marjo-Riitta Järvelin, Anna-Liisa Hartikainen, Anneli Pouta and Eila Suvanto, Circulation.** 2013; 127:681-690

39. Pérez MP, Roux JAFL, Benaiges A, Llauradó G, Botet JP. **Ethnic Differences in the Risk of Developing Metabolic Syndrome or its Components in Women with a History of Gestational Diabetes Mellitus.** J Diabetic Complications Med 2016;1:109. doi:10.4172/jdcm.1000109

40. KATARIA, Ishu; CHADHA, Ravinder; PATHAK, Renuka. **Metabolic syndrome in adults: relation with diet and other lifestyle factors.** Reviews in Health Care, [S.l.], v. 6, n. 3, p. 99-124, July 2015. ISSN 2038-6702.



"It's better to be slapped by the truth than kissed with a lie."

Unknown

AUTHORSHIP AND CONTRIBUTION DECLARATION

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