Metabolic Syndrome in an Adult Rural population of Surat

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Abstract: Objectives: To evaluate of the metabolic syndrome in a rural population of Surat, a zone located to the South of Gujarat. Methods: Randomly selected adults >20 years were studied using stratified sampling. Metabolic syndrome was diagnosed using Adult Treatment Panel-III (ATP-III) guidelines when any three of the following were present: (1) triglycerides ≥150 mg/dl, (2) HDL cholesterol < 40 mg/dl in men and <50 mg/dl in women, (3) systolic blood pressure ≥130mmHg or diastolic blood pressure ≥85mmHg, (4) fasting plasma glucose ≥100 mg/dL and (5) Truncal obesity (waist circumference more than 102 cm in men and >88 cm in women). Results: Metabolic syndrome was present in 23.6% subjects, 22.9% in men and 24.6% in women (P>0.05). The prevalence increased from 8.1% in the population younger than 30 y to 37.6% in ages more than 60 years. Low HDL was the most common metabolic abnormality in both sexes. The prevalence of obesity (BMI ≥ 30 kg/m2), hypercholesterolemia (≥200 mg/dl) and high LDL cholesterol (≥130 mg/dl) was greater in the metabolic syndrome group than normal subjects (P<0.05). Conclusion: There is a high prevalence of metabolic syndrome in this rural population of Surat. Focus of cardiovascular prevention should be undertaken in this area. [Vaghela P et al NJIRM 2013; 4(5) : 55-59]

Key Words: Metabolic Syndrome, Prevalence, HDL-c, Hypertension.

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Introduction: The metabolic syndrome has emerged as an important clinical entity over the last two decades following Raeven's description of a clustering of risk factors for coronary artery disease in 1988 [1.] The specific components of the metabolic syndrome include: central obesity, glucose intolerance, elevated triglycerides, low levels of high density lipoprotein cholesterol (HDL), and hypertension [2.] The components occur together more frequently than expected by chance, and when grouped together they result in an increased risk for cardiovascular disease and diabetes mellitus [2,3.]

Several organizations have published diagnostic criteria for the metabolic syndrome [4-9.] In 2005 the American Heart Association and the National Heart Lung and Blood Institute AHA/NHLBI and the International Diabetes Federation (IDF) published criteria [5,6] for the diagnosis of the metabolic syndrome which were designed to have practical application in epidemiological studies. The AHA/NHLBI criteria were essentially a revision of the 2001 National Cholesterol Education Programme NCEP Adult Treatment Panel III ATP-III criteria 4. Both the IDF and the revised ATP-III used the five components mentioned above but differed in that the IDF criteria regarded central obesity as a required component with the diagnosis being made if any two of the other components were present, while the revised ATP-III criteria could be based on any three of the five components.

More recently both groups met with other representatives from the World Heart Federation, International Atherosclerosis Society, and International Association for the Study of Obesity and published a revised set of criteria [10] in order to harmonize the definition of the metabolic syndrome. Worldwide, prevalence estimates for the metabolic syndrome in men range from eight percent in India to 24 percent in the United States and for women from seven percent in France to 46 percent in India [11.] Prevalence estimates varied with sex, age and ethnicity [12,13.] The aim of this study was to investigate the prevalence of the metabolic syndrome in a rural population of Surat using the ATP-III guidelines.

Material & Methods: A cross-sectional study of participants from rural area of Surat. 278 Participants were interviewed and examined between March 2008 and Jun 2008 and were 18-85 years old at the time of enrollment. Measurements of blood pressure and anthropometry (weight, height, waist and hip circumference) completed.

Blood pressure was measured using a mercury sphygmomanometer. Waist and hip circumferences were measured using a non-stretchable nylon tape. Questionnaires were administered during face to face interviews. Data on personal and family medical history, socioeconomic status, physical activity and habits were collected. A fasting blood sample was obtained by venepuncture to measure fasting glucose, triglycerides and high density lipoprotein cholesterol. Glucose was measured using the glucose oxidase method, while HDL-cholesterol and triglycerides were measured directly using enzymatic techniques.

In this study, subjects with three or more of the following five risk factors of the criteria of the modified NCEP III were defined as having metabolic syndrome: (1) triglycerides ≥150 mg/dl, (2) HDL cholesterol < 40 mg/dl in men and <50 mg/dl in women, (3) systolic blood pressure ≥130mmHg or diastolic blood pressure ≥85mmHg, (4) fasting plasma glucose ≥100 mg/dL and (5) Truncal obesity (waist circumference more than 102 cm in men and >88 cm in women). Subjects with a history of hyperlipidemia, hypertension, or diabetes were considered to have the risk factor, regardless of the biochemical or clinical values. All participants gave verbal consent. Data collected were double entered into Microsoft Excel database. Tests of significance like Pearson's Chi- square test, Student's t test and ANOVA were applied to find out the results. A two tailed p value < 0.05 was taken for statistical significance.

Results: The prevalence of the metabolic syndrome in the study population was 23.6%. The prevalence of metabolic syndrome was the same in women and men (24.6% versus 22.9 %,) (P = 0.4 >0.05). There was a significant age related increase in the prevalence of metabolic syndrome in both of the genders. Prevalence of metabolic syndrome increased from 8.1% within the 20–29-year-old group to 47.6% in people more than 60 years of age. The prevalence of individual components of the metabolic syndrome is reported in Table 1. In men and women, respectively, Hypertension in 39(28.7%) and 49(34.5%), low HDL cholesterol in 84(61.8%) and 118(83.1%), high triglycerides in 60(44.1%) and 57(40.1%), and impaired fasting glucose or diabetes in 29(21.3%) and 36(25.4%). Low HDL-C was the most common metabolic abnormality in both sexes.

Table 1: Age related Prevalence of individual abnormalities of the Metabolic Syndrome

Age groups (Years)	FBG (>110 mg/dl)	High TG	Low HDL	High WC	High BP
Men					
21-30	03(10.3%)	09(31.0%)	16(55.2%)	01(3.4%)	03(10.3%)
31-40	03(14.3%)	11(52.4%)	13(61.9%)	01(4.7%)	04(19.0%)
41-50	05(20.0%)	12(48.0%)	16(64.0%)	04(16.0%)	06(24.0%)
51-60	06(25.0%)	14(58.33%)	16(66.7%)	04(16.7%)	10(41.7%)
>60 Yrs	12(32.4%)	14(37.8%)	23(62.2%)	19(51.5%)	16(43.2%)
Total	29(21.3%)	60(44.1%)	84(61.8%)	29(21.3%)	39(28.7%)
Women					
21-30	2(06.66%)	07(23.3%)	24(80.0%)	04(13.3%)	02(6.6%)
31-40	3(13.6%)	07(31.8%)	18(81.8%)	09(40.9%)	03(13.6%)
41-50	5(21.7%)	06(26.1%)	20(86.9%)	14(60.9%)	06(26.1%)
51-60	9(34.6%)	15(57.7%)	23(88.4%)	15(57.7%)	12(46.1%)
>60 Yrs	17(41.5%)	22(53.6%)	33(80.5%)	25(60.9%)	26(63.4%)
Total	36(25.4%)	57(40.1%)	118(83.1%)	67(47.1%)	49(34.5%)
Both Total	65(23.4%)	117(42.1%)	202(72.7%)	96(34.5%)	88(31.7%)

Table 02: Comparison between subjects with Normal people & Metabolic Syndrome

Variables	Normal(N)		Metabolic Syndrome(MS)	
	Mean	SD	Mean	SD
BMI (kg/m2)	23.6	3.4	27.8	4.6
WC (cm)	81.6	11.2	95.6	12.1
BP (mm Hg)				
Systolic	114	9.6	146	21.6
Diastolic	74.6	7.6	86.8	13.2
Cholesterol (mg/dl)	168.6	30	226.4	50.2
Triglyceride (mg/dl)	94.3	22.4	278.6	56.8
LDL-C(mg/dl)	94.8	28.5	137.8	32.9
HDL-C (mg/dl)	44.6	4.6	32.6	3.8

Mean serum HDL-C was 32.6 ± 3.8 mg/dl in those with the metabolic syndrome and 44.6 ± 4.6 mg/dl in normal individuals (P < 0.001). Most of those with metabolic syndrome had three components of the syndrome 75.6% & 24.4% subjects had four components. None of the people had five components.

Figure 01: Comparison of Normal Group(N) with Metabolic Syndrome(MS)

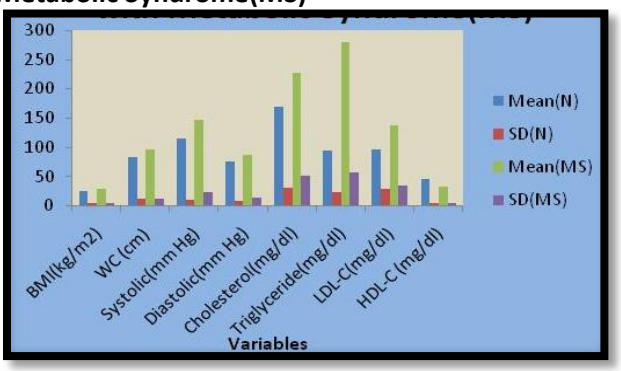

Table 2 shows the mean value of coronary risk factors in subjects with metabolic syndrome as compared to those without. BMI ≥ 30 kg/m2 as well as high total and LDL cholesterol, which are not part of the metabolic syndrome, are also more prevalent among men and women with this condition. Elevated LDL-C more than 130 mg/dl was found in 13.5% of normal men versus 44.1% of those with metabolic syndrome (P<0.05). In females high LDL-C was detected in 19.6% versus 58% in normal subjects and those with metabolic syndrome respectively (P<0.05).

Discussion: The results of this study indicate that according to ATP III criteria, 23.6% of the studied adult population has metabolic syndrome. The prevalence of Metabolic Syndrome varies considerably worldwide. Some of the differences in the prevalence of MS might arise from varied definitions of the syndrome. For instance, Trevisan et al. [14] reported a prevalence of 3–3.5% in Italy on the basis of the presence of all five criteria. However, a wide variation in the prevalence can be observed even with using the same diagnostic criteria. For example, the frequency of MS in a sample of the Chinese population was recorded as 9.8% for men and 17.8% for women [15.] In a rural area of South Korea, MS was found to affect 29.4% of the adult population above 40 years of age [16,] and similar values were established in Mexico, where 26.6% of the population studied exhibited the syndrome [17.] Although the prevalence of the metabolic syndrome in this study is higher than some previously reported from the USA, Italy, and Finland [18, 14, 16, 19,] it is close to that reported from Brazil [20,] Indian urban population [21,] and some reports from the US [22.] The exact reasons for high prevalence of MS in our study remain to be determined, but it is evident that substantial socioeconomic changes have occurred in the population over the past decades and the transition from a traditional to a western-like rural lifestyle has been associated with adverse changes in lifestyle habits.

In our study the single most common abnormality was low HDL-C overall 73%, which is more than what had previously been reported from USA [23,] Turkey [24], Italy [25], Canada [26], and UK [27]. A high prevalence of low HDL-C has been reported previously in Iranian population [28] and is very close to that was reported from Turkish [29]. This could not only be attributed to environmental factors but may also be due to genetic predispositions. Previous family and twin studies have suggested that genetic polymorphism accounts for 40–60% of the interindividual variation in plasma HDL-C level. Low HDL-C was more prevalent in females in our study. Most of the women had HDL-C concentrations between 45 and 50 mg/dl and the

prevalence drops significantly in males (83.1%for women versus 61.8% for men). A positive effect of age on the prevalence of the syndrome in both sexes was detected in this study and resulted in 37.6% of MS in subjects more than 60 years. This effect has been reported in other studies [18.] Age-related increases in insulin resistance have been shown in young, middle-aged, and elderly healthy normal-weight adults [30,] and an age related difference in the degree of clustering of risk variables [31] has been reported too.

Conclusion: The present study from the rural area of Surat demonstrated that Metabolic Syndrome is a serious problem among the rural area of Surat populations of this country affecting primarily older individuals. Since the Indian population, composed mainly of young people, it is very likely that the prevalence of Metabolic Syndrome will be even greater in the next decades. The prevention and treatment of this condition is of major public concern and urgently requires the application of appropriate policies and considerable investment.

References:

1. Reaven GM: Banting lecture 1988. Role of insulin resistance in human disease. Diabetes 1988, 37:1595-1607.
2. Eckel RH, Grundy SM, Zimmet PZ: The metabolic syndrome. Lancet 2005, 365:1415-1428.
3. Ford ES: Risks for all-cause mortality, cardiovascular disease, and diabetes associated with the metabolic syndrome: a summary of the evidence. Diabetes Care 2005, 28:1769-1778.
4. Executive Summary of The Third Report of The National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, And Treatment of High Blood Cholesterol In Adults (Adult Treatment Panel III). JAMA 2001, 285:2486-2497.
5. Alberti KG, Zimmet P, Shaw J: The metabolic syndrome--a new worldwide definition. Lancet 2005, 366:1059-1062.
6. Grundy SM, Cleeman JI, Daniels SR, Donato KA, Eckel RH, Franklin BA, et al.: Diagnosis and management of the metabolic syndrome: an American Heart Association/National Heart, Lung, and Blood Institute Scientific Statement. Circulation 2005, 112:2735-2752.
7. Balkau B, Charles MA: Comment on the provisional report from the WHO consultation. European Group for the Study of Insulin Resistance (EGIR). Diabet Med 1999, 16:442-443.
8. Einhorn D, Reaven GM, Cobin RH, Ford E, Ganda OP, Handelsman Y, et al.: American College of Endocrinology position statement on the insulin resistance syndrome. Endocr Pract 2003, 9:237-252.
9. World Health Organization: Definition, diagnosis and classification of diabetes mellitus and its complications. Part 1: diagnosis and classification of diabetes mellitus. 1999.
10. Alberti KGMM, Eckel RH, Grundy SM, Zimmet PZ, Cleeman JI, Donato KA, et al.: Harmonizing the Metabolic Syndrome: A Joint Interim Statement of the International Diabetes Federation Task Force on Epidemiology and Prevention; National Heart, Lung, and Blood Institute; American Heart Association; World Heart Federation; International Atherosclerosis Society; and International Association for the Study of Obesity. Circulation 2009, 120:1640-1645.
11. Cameron AJ, Shaw JE, Zimmet PZ: The metabolic syndrome: prevalence in worldwide populations. Endocrinol Metab Clin North Am 2004, 33:351-75.
12. Ford ES, Giles WH, Dietz WH: Prevalence of the metabolic syndrome among US adults: findings from the third National Health and Nutrition Examination Survey. JAMA 2002, 287:356-359.
13. Guize L, Thomas F, Pannier B, Bean K, Danchin N, Benetos A: (Metabolic syndrome: prevalence, risk factors and mortality in a French population of 62 000 subjects). Bull Acad Natl Med 2006, 190:685-697.
14. M. Trevisan, J. Liu, F. B. Bahsas, and A. Menotti, “Syndrome X and mortality: a population-based study. Risk Factor and Life Expectancy Research Group,” American Journal of Epidemiology, vol. 148, no. 10, pp. 958–966, 1998.
15. D. Gu, K. Reynolds, X.Wu, et al., “Prevalence of the metabolic syndrome and overweight among adults in China,” The Lancet, vol. 365, no. 9468, pp. 1398–1405, 2005.

16. K. J. Greenlund, R. Valdez,M. L. Casper, S. Rith-Najarian, and J. B. Croft, “Prevalence and correlates of the insulin resistance syndrome among Native Americans. The Inter-Tribal Heart Project,” Diabetes Care, vol. 22, no. 3, pp. 441–447, 1999.
17. F. Azizi, F. Raiszadeh, P. Salehi, et al., “Determinants of serum HDL-C level in a Tehran urban population: the Tehran Lipid and Glucose Study,” Nutrition,Metabolism and Cardiovascular Diseases, vol. 12, no. 2, pp. 80–89, 2002.
18. E. S. Ford, W. H. Giles, and W. H. Dietz, “Prevalence of the metabolic syndrome among US adults: findings from the Third National Health and Nutrition Examination Survey,” Journal of the American Medical Association, vol. 287, no. 3, pp. 356–359, 2002.
19. B. Isomaa, P. Almgren, T. Tuomi, et al., “Cardiovascular morbidity and mortality associated with themetabolic syndrome,” Diabetes Care, vol. 24, no. 4, pp. 683–689, 2001.
20. G. Vel´asquez-Mel´endez, A. Gazzinelli, R. Cˆorrea-Oliveira, A. M. Pimenta, and G. Kac, “Prevalence of metabolic syndrome in a rural area of Brazil,” Sao Paulo Medical Journal, vol. 125, no. 3, pp. 155–162, 2007.
21. R.Gupta, P. C.Deedwania, A. Gupta, S. Rastogi, R. B. Panwar, and K. Kothari, “Prevalence of metabolic syndrome in an Indian urban population,” International Journal of Cardiology, vol. 97, no. 2, pp. 257–261, 2004.
22. E. S. Ford, W. H. Giles, and W. H. Dietz, “Prevalence of the metabolic syndrome among US adults: findings fromthe third National Health and Nutrition Examination Survey,” Journal of the American Medical Association, vol. 287, no. 3, pp. 356– 359, 2002.
23. G. Heiss, I. Tamir, C. E. Davis, et al., “Lipoprotein-cholesterol distributions in selected North American populations: the lipid research clinics program prevalence study,” Circulation, vol. 61, no. 2, pp. 302–315, 1980.
24. A. Onat, G. Surdum-Avci, M. Senocak, E. Ornek, and Y. Gozukara, “Plasma lipids and their interrelationship in Turkish adults,” Journal of Epidemiology and Community Health, vol. 46, no. 5, pp. 470–476, 1992.
25. The Research Group ATS-RF2 of the Italian National Research Council, “Distribution of some risk factors for atherosclerosis in nine Italian population samples,” American Journal of Epidemiology, vol. 113, pp. 338–346, 1981.
26. D. R. MacLean, A. Petrasovits, P. W. Connelly, M. Joffres, B. O’Connor, and J. A. Little, “Plasma lipids and lipoprotein reference values, and the prevalence of dyslipoproteinemia in Canadian adults. Canadian Heart Health Surveys Research Group,” Canadian Journal of Cardiology, vol. 15, no. 4, pp. 434–444, 1999.
27. J. I. Mann, B. Lewis, J. Shepherd, et al., “Blood lipid concentrations and other cardiovascular risk factors: distribution, prevalence, and detection in Britain,” British Medical Journal, vol. 296, no. 6638, pp. 1702–1706, 1988.
28. F. Sharifi, S. N. Mousavinasab, R. Soruri, M. Saeini, and M. Dinmohammadi, “High prevalence of low high-density lipoprotein cholesterol concentrations and other dyslipidemic phenotypes in an Iranian population,” Metabolic Syndrome and Related Disorders, vol. 6, no. 3, pp. 187–195, 2008.
29. R. W. Mahley, J. P´epin, K. Erhan Palaoˇglu, M. J. Malloy, J. P. Kane, and T. P. Bersot, “Low levels of high density lipoproteins in Turks, a population with elevated hepatic lipase: high density lipoprotein characterization and genderspecific effects of apolipoprotein E genotype,” Journal of Lipid Research, vol. 41, no. 8, pp. 1290–1301, 2000.
30. R. A. DeFronzo and E. Ferrannini, “Insulin resistance: amultifaceted syndrome responsible for NIDDM, obesity, hypertension, dyslipidemia, and atherosclerotic cardiovascular disease,” Diabetes Care, vol. 14, pp. 173–194, 1991.
31. W. Chen, W. Bao, S. Begum, A. Elkasabany, S. R. Srinivasan, and G. S. Berenson, “Age-related patterns of the clustering of cardiovascular risk variables of Syndrome X from childhood to young adulthood in a population made up of black and white subjects: the Bogalusa Heart Study,” Diabetes, vol. 49, no. 6, pp. 1042–1048, 2000.

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