

## Profile and associated factors of Syndrome-X at a tertiary hospital in Western Maharashtra

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**Abstract:** *Background:* India is in the midst of epidemiological transition with increasing global burden of chronic non-communicable diseases accounting for 60% of the global deaths, 80% of which are in the developing World. Syndrome-X is rising globally, especially Indians being the highly susceptible group. This study aimed to explore the clinico-epidemiological profile of Syndrome-X cases and also to find the association of certain correlates of Syndrome-X. *Material and Methods:* A cross-sectional study was conducted in a nearby registered multispecialty hospital, involving data collection by personal interview technique using predesigned proforma, combined with clinical examination, anthropometry and results of investigations of all patients of Syndrome-X during one calendar year. *Result:* Out of total 7680 patients, Syndrome-X was observed in 1613 (21%). Male:Female ratio was 2.52:1. Majority cases (72%) were in the age group of 60+ to 80 years and 75% were married. The subjects from urban area were 68.5%, Hindus being 48.6% and 46% belonged to lower socio-economic class. Chest pain was the most common clinical complaint. 893 (55.4%) cases had the positive family history of two/more diseases. 87% had no habit of doing exercise, 52.9% had irregular dietary habits, 58.7% were found to be obese. The association between increasing Waist hip ratio, fasting Blood Glucose, Blood Pressure levels and dyslipidemia was found to be statistically highly significant ( $p < 0.0001$ ). *Conclusion:* The overall prevalence of Syndrome-X is still high, with an upward trend in geriatric population. So, appropriate intervention measures are needed for prevention & control of NCDs and their risk factors, which is only possible by a comprehensive approach.

**Keywords:** Syndrome-X; clinical profile; socio-behavioural correlates; Maharashtra

### Introduction

Syndrome-X also known as Metabolic Syndrome, Insulin Resistance Syndrome (IRS), New World Syndrome, Deadly Quartet, Reaven's Syndrome, New World Syndrome, Civilization Syndrome [1], is a cluster of diabetes mellitus, hypertension, obesity, dyslipidemia and heart disease [2]. It has been assigned International Classification of Disease (ICD.9) code 277.7, as the 'Dysmetabolic syndrome'. According to NCEP ATP III definition of Syndrome-X,  $\geq 3$  of the following criteria need to be fulfilled [3]:

- Fasting plasma glucose  $>6.1$  m.mol/l (110 mg/dl)
- Blood pressure  $\geq 130 / 85$  mm Hg
- Triglycerides  $\geq 1.7$  m.mol/l (150 mg/dl)
- HDL  $<40$  mg/dl for men and  $<50$  mg/dl for women.

- BMI  $>29.40$  kg/m<sup>2</sup> or waist circumference  $>102$  cm (males),  $>85$  cm (females).

A modified definition of metabolic syndrome incorporating new cut-off points for waist circumference is studied for Asian Indians in India and migrant Asian Indians in Singapore. The South East Asian definition includes two new parameters; modified waist circumference cut-off point ( $>90$  cm in males and  $>80$  cm in females), modified body mass index cut-off point ( $>23$  kg/m<sup>2</sup>) [3]. In past, the lifestyle was simpler, stress and strains were not perceived, but now-a-days, quality of life has changed and there are many modifications evident in the life style of people. Changes in food habits, sedentary patterns, lack of adequate exercise, job pressures, social tensions, feeling insecurity due to variable reasons causing excessive stress, these all lead

to psychosomatic and psychosocial problems like hypertension, dyslipidemia and hyperglycemic states at earlier ages. All these conditions have a strong behavioural bias [4-5]. Prevalence of Syndrome-X varies across the globe. The current overall prevalence in Americans is about 25% (70 million) and about 1.6% Indians are susceptible to develop Syndrome-X in lifetime [6]. The overall incidence of Syndrome-X in India—according to Kasiliwal in 2005 is 28.5%, by Guptha 2004 is 25%, by Ram Chandra in 2003 is 41%. In India, the overall incidence of metabolic syndrome is 29% highest at age group 40-50 years i.e. 33.7% and at 50-60 years i.e., 20.6 [3].

Established Syndrome-X is not curable but, can only be intervened [4]. To evolve the suitable preventive as well as intervention strategies the study of natural history of Syndrome-X is essential. The present study was planned with a view to study the clinico-epidemiological profile of Syndrome-X cases and also to explore the association of various correlates of Syndrome-X in a delineated geographic area.

### Material and Methods

*Type of study:* Cross-sectional hospital based study was conducted in a involving of all patients of Syndrome-X during one calendar year.

*Study area:* A nearby registered, reputed private multispecialty hospital with outdoor, indoor and emergency medical care facilities along with the requisite biochemical and pathological laboratory. Preliminary pilot survey indicated that, the cases of Syndrome-X and/or the individual constituent diseases of Syndrome-X form a sizeable proportion of the total cases (about 20%) in this hospital.

*Study period:* One calendar year (2009-2010).

*Study sample:* All cases of Syndrome-X reporting to this hospital during the study period.

*Materials used:* The standardization of the instruments was ensured prior to the start of the study. All the required investigations were done in the same laboratory. The data collection was done by personal interview technique using predesigned proforma, combined with clinical examination, anthropometry. The information regarding results of investigations was taken from

the hospital record after taking verbal consent of the patient.

*Definitions:* According to Nordic Nutrition Recommendations, irregularity in taking meals was considered when presence of one of the following factors [7]:

1. Skipping one meal a day for at least two days, not inclusive of the religious fast.
2. Habitual deviation of atleast three hours from the regular hours of taking morning/evening meals.
3. Substitution of lunch/dinner by breakfast/snacks at least 4 times a week.
4. Frequent hotelling and consumption of aerated beverages/soft drinks.

*Ethical Aspects:* Obtaining informed consent from the patients, ensuring confidentiality and secrecy of patient's details was done.

*Statistical Analysis:* Analysis of the data with the help of appropriate statistical tests.

### Results and Discussion

Out of total 7680 patients, Syndrome-X was observed in 1613 (21%). The estimated prevalence of Syndrome-X is about 20% in India. In Philippines as well as in British adults, the prevalence is estimated to be one out of five i.e. 20% [8]. A similar hospital based study conducted in New Delhi, indicated the overall prevalence of Syndrome-X being 29%, lower in men (24.4%) than in females (40.3%). From Table-1, it is seen that Syndrome-X was found in 1155 (71.7%) males and 458 (28.3%) females. The age-wise distribution shows that, none of the cases were below 40 years of age. The proportion of cases increased with increasing age, being 10% in 40 + to 50 years age group, and showed rapid increase till the age of 70+ to 80 years. This was found to be statistically highly significant.

At the global scenario including the Indian subcontinent is indicative of the continuously increasing incidence and prevalence of diabetes, hypertension and obesity and their occurrence at an earlier age, it is logically expected to find the cases of Syndrome-X around the adulthood i.e. 40 years of age or

earlier [2]. Contrary to this explanation, the cases were seen in more numbers beyond the age of 50 years and the clustering was seen densely in the age group of 60+ to 80 years. The possible explanation can be as follows: Obesity,

hypertension and diabetes, the classical components of Syndrome-X generally do not appear all at a time, one precedes another. This takes considerable time depending on the influence of various affecting factors.

<b>Table-1: Socio-demographic profile of Syndrome-X patients</b>			
<b>Variables</b>	<b>Males (%) (n=1155)</b>	<b>Females (%) (n=458)</b>	<b>Total (%) (n=1613)</b>
<b>A. Age Range (Years)</b>			
40+ to 50	145 (12.15)	16 (3.49)	161 (10.00)
50+ to 60	141 (12.20)	145 (31.65)	286 (17.70)
60+ to 70	403 (34.89)	209 (45.63)	612 (38.00)
70+ to 80*	368 (32.07)	88 (19.21)	456 (28.40)
Above 80	98 (8.48)	0 (00.00)	98 (5.90)
$\chi^2 = 149.51, df= 3, p<0.001, \text{Highly significant}$			
<b>B. Residence</b>			
Urban	801 (69.40)	303 (66.16)	1104 (68.50)
Rural	354 (30.60)	155 (33.84)	509 (31.50)
<b>C. Religion</b>			
Hindu	535 (46.32)	249 (54.37)	784 (48.55)
Muslim	207 (17.92)	46 (10.04)	253 (15.68)
Christian	46 (3.98)	47 (10.26)	93 (5.76)
Others	367 (31.77)	116 (25.33)	483 (30.00)
<b>D. Socio-economic status**</b>			
Upper	150 (12.99)	24 (5.25)	174 (10.80)
Middle	427 (37.00)	270 (58.95)	697 (43.20)
Lower	578 (50.01)	164 (35.80)	742 (46.00)
<b>E. Marital status</b>			
Married	901 (78.00)	308 (67.25)	1209 (74.95)
Unmarried	196 (16.97)	121 (26.41)	317 (19.65)
Widow/er or divorcee	58 (5.03)	28 (6.14)	86 (5.40)
*-Pooling of rows 4 <sup>th</sup> and 5 <sup>th</sup> was done,**- Upper middle is clubbed with upper and lower middle is clubbed with lower socio-economic status, for the ease of analysis.			

It is evident from above Table-1, that the proportion of patients from urban area was 68.5% and of the rural patients was 31.5%. The majority of the patients were Hindus 784 (48.55%), Muslims being 253 (15.68%) and minority were Christians 93 (5.76%). Socio-economic status of the patients was classified using Modified Kuppaswamy's classification [9] for urban cases and Modified B.G. Prasad's Classification [10] for rural cases. It was observed that 742 (46%) study subjects were from lower socio-economic status followed by 697 (43.2%) belonging to middle and rest 174 (10.8%) in upper socio-economic status. The proportion of married patients was 75%, 19.7% were unmarried and

minority (5.40%) of the patients were widow/er or divorcee.

The elaboration of various socio-demographic factors described in present study do not find place in Western studies. The survey of literature over Syndrome-X indicated that, in the developed countries major focus is on the management, control and prevention of the component diseases. The Indian studies over this subject could not be identified in the literature, so to have the comparative account and discussion of above mentioned factors is not possible. Thus, this study can be regarded as preliminary base-line study of Syndrome-X

<b>Table-2: Distribution of study subjects based on clinical variables</b>			
<b>Variables</b>	<b>Males (%) (n=1155)</b>	<b>Females (%) (n=458)</b>	<b>Total (%) (n=1613)</b>
<b>A. Clinical feature/s*</b>			
Chest pain	515 (44.60)	185 (40.52)	700 (43.40)
Giddiness	350 (30.32)	87 (19.20)	437 (27.09)
Breathlessness	197 (17.05)	72 (15.85)	269 (16.68)
Headache with/without excessive sweating	373 (32.30)	79 (17.30)	452 (28.02)
Others (excessive thirst, dizziness etc)	520 (45.02)	174 (38.06)	694 (43.03)
Total	1955 (76.61)	597 (23.39)	2552 (100.00)
<b>B. Disease/s**</b>			
Diabetes Mellitus	756 (65.45)	227 (49.56)	983 (60.94)
Hypertension	561 (48.57)	326 (71.17)	887 (54.99)
Obesity	138 (11.94)	200 (43.66)	338 (20.95)
IHD/AMI <sup>#</sup>	212 (18.35)	38 (8.29)	240 (14.87)
Total	1667 (67.82)	791 (32.18)	2458 (100.00)
Rate of positive family history per person	1.44	1.72	1.51
* Clinical features are not mutually exclusive, ** Multiple responses, #IHD-Ischemic heart disease, AMI- Acute myocardial infarction.			

From above Table-2, among the complaints, chest pain accounted for 700 (43.4%), followed by other complaints like feeling excessive thirsty, dizziness etc in 694 (43.03%), headache with excessive sweating in 452 (28.02%), giddiness in 437 (27.09%) and breathlessness in rest 269 (16.68%). All clinical features are indicative of the quartet disease and their complications. Out of this quartet, Ischemic heart disease (IHD) is condition largely influenced by obesity, diabetes and hypertension. These three diseases are inter-related, they augment the effect of each other and are the risk factors for the other diseases within the group. Thus they form the essential 'Triad of Syndrome-X' [11].

The positive family history in relation to the pertinent near relatives (upto three generations) only was considered for the purpose of recording. The above Table-2 shows that, the family history of diabetes mellitus in the patients was 60.94%, followed by hypertension, 54.99%, then the obesity, 20.95% and IHD/AMI, 14.87%. Overall rate of positive family history per person was found to be 1.51. The diseases included in the 'Triad of Syndrome-X' definitely have a genetic/heridofamilial component along with

other factors, making them the diseases of multi-factorial origin. In addition to genetic component, the obesity may also be due to the feeding habits and nutritional practices in the families. So, diabetes mellitus, hypertension and other cardiovascular diseases have strong correlation with obesity. Any of these diseases do also lead to IHD and its consequences like AMI [12]. Therefore, the positive family history of all these four conditions was studied in the cases. The term 'Quartet of Syndrome-X' can be meaningfully applied to these four conditions.

Table-3 shows, the positive family history to all four diseases was observed in the less number of cases (2%), followed by the positive family history for three diseases in 85 cases (10.33%). The history of two diseases was obtained in maximum cases (88.47%). In this group, majority gave the family history of diabetes and hypertension (302 patients) i.e. 38.22% followed by hypertension and obesity (149 patients) i.e. 18.86%. The quartet of syndrome X is known to be greatly influenced by variety of modifiable risk factors, hence these were studied as in the Table-4.

<b>Table-3: Distribution based on positive family history of &gt;1 conditions of quartet</b>				
Sr No.	Family History of Disease	Males (C)# (n=573)	Females (C) (n=320)	Total (C) (n=893)
<b>A) 2 diseases</b>				
1	DM* + HTN**	184 (368)	118 (236)	302 (604)
2	DM + Obesity	84 (168)	41 (82)	125 (250)
3	DM + IHD	40 (80)	60 (120)	100 (200)
4	HTN + Obesity	118 (236)	31 (62)	149 (298)
5	HTN + IHD	51 (102)	20 (40)	71 (142)
6	Obesity + IHD	39 (78)	4 (8)	43 (86)
	Total	516 (1032)	274 (548)	790 (1580)
<b>B) 3 diseases</b>				
1	DM + HTN +IHD	21 (63)	18 (54)	39 (117)
2	HTN + IHD + Obesity	24 (72)	32 (96)	46 (138)
	Total	45 (135)	40 (120)	85 (255)
<b>C) 4 diseases</b>				
1	HTN + DM + Obesity + IHD	12 (48)	6 (24)	18 (72)
#- Figures in parenthesis represent disease conditions, *DM- Diabetes mellitus, **HTN-Hypertension.				

<b>Table-4: Distribution of cases based on Lifestyle, dietary patterns and BMI</b>				
Variables		Males (%) (n=1155)	Females (%) (n=458)	Total (%) (n=1613)
<b>A. Habits/Lifestyle*</b>				
Addictions**		887 (76.80)	0 (0.00)	887 (55.00)
Sedentary Habits		720 (62.40)	364 (79.50)	1084 (67.20)
Stress & Strain		924 (80.00)	305 (66.60)	1229 (76.19)
No Exercise		1028 (89.00)	376 (83.00)	1404 (87.04)
Total		1155 (71.60)	458 (28.40)	1613 (100.00)
<b>B. Dietary patterns</b>				
Type of diet	Vegetarian	207 (17.92)	86 (18.77)	293 (18.16)
	Mixed	948 (82.08)	372 (81.23)	1320 (81.83)
	Total	1155 (71.60)	458 (28.40)	1613 (100.00)
Habits	Regular	534 (46.32)	225 (49.33)	759 (47.05)
	Irregular	621 (53.67)	233 (50.66)	854 (52.94)
	Fried/Spicy/Junk	737 (63.84)	305 (66.66)	1042 (64.60)
	Total	1155 (71.60)	458 (28.40)	1613 (100.00)
<b>C. BMI (kg/m<sup>2</sup>)</b>				
25-29.99 Pre-obese		487 (42.12)	179 (39.20)	666 (41.28)
30-34.99 Class I Obese		409 (35.46)	204 (44.66)	613 (38.00)
35-39.99 Class II Obese		259 (22.42)	75 (16.14)	334 (20.70)
Total		1155 (71.60)	458 (28.40)	1613 (100.00)
**-Pan/gutka/tobacco/smoking/alcohol, **-Multiple responses present.				

As per Table-4: A, 87% of total study subjects had no habit of doing any physical exercise, of which males constituted 89% and females for 83%. Mental stress and strain was present in 1229

(76.19%) patients. In this group there were 924 males (80%) and 305 females (66.6%) patients. The stress and strain was felt by these people due to multiple reasons like

retirement, loss of job, tension/anxiety due to present disease, marriage of daughter, financial problems, quarrels etc. Another largest group was the patients with sedentary habits comprising of 67.2%. The sedentary habits were seen more in females (79.5%) than in males (64.2%). Sedentary habits bring about various metabolic changes in the human body. Addictions (in any form) were exclusive to males and were found in as many as 55% of the total study subjects.

As per Table-4.B, total 293 (18%) patients, constituted by 207 males (17.92%) and 86 females (18.77%) were Vegetarian, remaining 82% had mixed dietary patterns. The irregularity in taking meals was observed in 854 (52.94%) patients, while 759 (47.05%) patients took regular meals. In addition to studying the regularity in the diet, the practice of consuming deep fried, spicy, oily and hot foods, fast/junk food in sumptuous amounts were also recorded. 64.6% i.e. 1042 patients had such habits and the frequency in both genders was comparable. These foods provide much of the unwanted saturated fats, free radicals, triglycerides and overdose of salt, thus contributing to hypertension and obesity specially when combined with alcohol, tobacco, sedentary habits and stress and strain. Thus, all these modifiable factors act independently as well as in combination to produce synergistic effect in establishing the quartet of Syndrome-X.

Body mass index (BMI) in the adults is an indicator of obesity. From Table-4.C, 666 (41.48%) cases were found to be 'pre-obese' followed by 613 (38%) in Class-I Obesity and rest 334 (20.7%) in Class-II. However, no patient was found in Class-III obesity. Various studies carried out by Diabetes Research Center, Madras in different parts of India indicate that, the increased body weight even within the permissible level of body mass does confer the risk of diabetes mellitus to the adult populations in our country [13].

As per the cut off points of WHR for males and females according to WHO guidelines Table-5.A shows, 928 (80%) males and 360 (78.6%) females had the WHR more than desirable. The difference was statistically highly significant. This finding again indicates that, even in the pre-

obese state as per BMI values, the WHR helps in identification of more cases of obesity. This condition is true for India as well as various other countries. Lapidus et al (1984) [14] also successfully used the WHR measurement as a correlate to predict development of diabetes, MI, angina, stroke and death. Insulin resistance, development of hyperglycemic state and resultant diabetes, is a major possible hazard of uncontrolled obesity.

Table-5.B indicates that, the difference between two groups having cut off points of blood glucose of 110 mg% was statistically highly significant. However, the subjects having lesser blood glucose (<110 mg/dl), was more in females (34.93%) than males (16.36%). Every patient in the present study was receiving anti-diabetic treatment, despite this, majority of these had the higher levels of fasting blood glucose. This may be on account of stabilization of blood sugar levels at higher level as the diabetic state advances over period of years. The clinical presentation of diabetes, the pertinent investigations and treatment of these cases clearly indicated that, the patients belong to Type II diabetes mellitus (Non insulin dependent type diabetes) only.

Table-5.C shows, that just over 1/4<sup>th</sup> of the patients (25.18%) had Blood Pressure reading <140/90 mm of Hg. As the hypertension continues for longer duration even with the treatment, the basal Blood Pressure settles at a higher level than normal, in the patients. This is the only plausible reason for the higher level of Blood Pressure in 1207 (74.82%) of the cases. The difference in two groups was statistically highly significant.

Table-5.D depicts that the qualitative component of increased adiposity (i.e. obesity) is the abnormalities in the serum lipid profile. Considered together, all such anomalies are termed as dyslipidemias. The table shows that, the total patients without dyslipidemia were more i.e. 65% and the difference between two genders was statistically highly significant.

<b>Table-5: Association of certain variables with Syndrome-X with Waist-Hip Ratio (WHR)</b>							
<b>Variables</b>	<b>Males (%) (n=1155)</b>	<b>Females (%) (n=458)</b>	<b>Total (%) (n=1613)</b>	<b>χ<sup>2</sup></b>	<b>df</b>	<b>p-value</b>	<b>Statistical Significance</b>
<b>A. Waist Hip Ratio*</b>							
More than desirable	928 (80.35)	360 (78.65)	1288 (79.85)	11.19	1	0.001	HS
Less than desirable	227 (19.65)	98 (21.39)	325 (20.15)				
<b>B. Blood Glucose (mg/dl)</b>							
> 110	966 (83.65)	298 (65.33)	1264 (78.36)	66.68	1	0.001	HS
< 110	189 (16.36)	160 (34.93)	349 (21.64)				
<b>C. Blood Pressure (mm of Hg)</b>							
≥140/90	900 (78.00)	307 (67.20)	1207 (74.82)	25.49	1	0.001	HS
<140/90	255 (22.00)	151 (32.96)	406 (25.18)				
<b>D. Dyslipidemia</b>							
Present	446 (38.60)	116 (25.30)	562 (34.84)	25.49	1	0.001	HS
Absent	709 (61.40)	342 (74.70)	1051 (65.16)				
*Desirable WHR: In males- 0.9, In females- 0.85							

### Conclusion

In the present study, the overall prevalence of Syndrome-X was 21%. The disease is seen more in geriatric population and shows upward trends beyond 40 years of age, males becoming affected more than females. Majority of the subjects were Hindus and were residing in urban area. Majority of the patients belonged to lower socio-economic status, indicating that those who cannot cope up with the psycho-social stress more prone to develop Syndrome-X. Chest pain was the most common clinical complaint. Overall rate of positive family history per person was found to be 1.51. The family history of diabetes mellitus was found in majority of the patients. 893 (55.4%) cases had the positive family history of two/more diseases.

Sedentary life style, consumption of high calories, high fat food, irregularities in food habits and addictions seems to contribute in development of Syndrome-X. The usual progression of diseases of Syndrome-X seems to be obesity, hypertension and diabetes in that order. However, the definite comment cannot be made regarding relation of these diseases with the dose (intensity) or duration of exposure to these factors. The association between increasing Waist hip ratio, fasting Blood Glucose, Blood Pressure levels and dyslipidemia was found to be statistically highly significant (p<0.0001).

### Recommendations

1. Though it is not pertinent to apply the observation of hospital based study to general population in the light of fact that, obesity, hypertension and diabetes mellitus (and consequently the IHD) are showing slow but continuous upward trends, it is desirable to suggest the appropriate intervention measures.
2. Syndrome-X is currently seen to be affecting geriatric population. So, the health service must be directed with a geriatric bias. In such services, the incorporation of strategies to reduce and control of body weight, blood pressure and blood sugar level seems highly essential.
3. The special provision may be required in the hospital to tackle the problem of quartet diseases for the obvious reasons even for the adolescent age and above.
4. The education of people regarding life style and dietary modification should be important component in health care with the need of developing socio-psychiatric counseling need to be emphasized.
5. Obesity, hypertension and diabetes mellitus are the conditions which follow one another, if one is tackled, the other automatically decreases in proportion. Therefore, a single important measure of

leaving the sedentary life and resorting to the regular and adequate physical exercise needs to be encouraged. If this is combined with mind relaxation activities, the problem of Syndrome-X can be controlled to a certain extent.

### Limitations

1. As this is a hospital based study, the generalization of prevalence rates is not possible nor can the representativeness of the sample be commented.
2. Though the possible precautions were taken to minimize the inter-observer bias and instrumental bias, however, it cannot be ruled out.
3. As this is probably the first study on this subject in Western Maharashtra and as the search in the libraries of six medical colleges as well as on the internet yielded scarce literature on the topic proper, the discussion over many aspects remains inadequate.
4. The possibility of recall bias in the patients and tendency to provide irrelevant/

incomplete/false information, especially regarding their habits, lifestyles and psychosocial stress factors, may induce certain element of bias.

5. As the study was conducted in private hospital due to time constraints thorough in-depth enquiry and further verification attempts were not possible, which is possible other-wise in government hospital.
6. Due to the specified nature of the patient types in this particular hospital, the correlation of factors like role of Type-I diabetes mellitus, the nature of various interventional strategies in prevention and control of Syndrome-X could not be studied. Thus, similar such studies involving larger sample size and covering the more variables are desirable.

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