Original Article

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Metabolic Syndrome among Secondary School Teachers: Exploring the Ignored Dimension of School Health Programme

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ABSTRACT

Introduction: The rising trend of obesity, insulin resistance, metabolic abnormalities, pro atherogenic factors are important determinants of both the non-communicable diseases and metabolic syndrome. Employees especially school teachers have chronic stress which predisposes them to metabolic syndrome (MS). Thus, increasing the possibility of premature mortality due to CVD and T2DM and escalating the health care cost is affecting their families.

Aim: To assess the prevalence and the risk factors influencing metabolic syndrome among secondary school teachers.

Materials and Methods: A cross-sectional study among secondary school teachers of Mysore city. A self administered, pretested and structured questionnaire based on the WHO Steps Approach for NCD evaluation. Data was analysed in SPSS version 20, chi-square test for categorical variables and t-test for continuous variable was applied along with logistic regression analysis to determine the independent predictors of MS.

Results: The prevalence of MS was 115 (38.3%). It increased from 6 (14.3%) in 21-30 years to 40(56.3%) in > 50 years age group. However, 144(48.0%) had ≤ two risk factors, 121(40.3%) had ≥ 3 risk factors and 7(2.3%) had all the five risk factor.

Conclusion: All components of MS were statistically significant in their association with the metabolic syndrome disease complex. The School health programme can be utilised as an opportunity to screen the teachers and provide primary preventive care.

Keywords: Metabolic syndrome, Risk factors, Lifestyle, Screening

INTRODUCTION

Today the world is witnessing an increasing trend of Non Communicable Diseases (NCDs). The metabolic abnormalities leading to Cardio Vascular Diseases (CVD) and Type 2 Diabetes Mellitus (T2DM) have a significant impact on health, morbidity, mortality, work performance and health care cost affecting younger Indian population. Urbanization, risk behaviours like stress, inadequate sleep, physical inactivity and change in dietary pattern are the factors influencing the modern day silent epidemics of NCDs especially the middle income countries undergoing epidemiologic and economic transition. The rising trend of obesity and Insulin Resistance (IR), along with a constellation of metabolic abnormalities like hyperlipidemia, hyperglycaemia and hypertension lead to development of Metabolic Syndrome (MS). This is a disturbing development affecting the health of its people and the nation as a whole by causing premature mortality, escalating the heath care cost and its indirect effect on the families.

MS is a complex web of metabolic factors that are associated with a 2-fold risk of CVD and a 5-fold risk of type 2 diabetes mellitus. Individuals with MS have a 30%–40% probability of developing diabetes and/or CVD within 20 years, depending on the number of components present [1]. South Asians have higher risk to develop Type 2 Diabetes Mellitus (T2DM) and Coronary Vascular Disease (CVD). Insulin resistance and clustering of other pro atherogenic factors are important determinants of both NCDs and MS [2,3].

Chronic stress due to prolonged exposure to work stress, repeated stress over a period of time damages the Hypothalamo-Pituitary Axis (HPA) resulting in a maladaptive process as well as inflammatory factors like C- Reactive Protein (CRP) causes depression and poor health habits leading to development of MS [4,5]. Various studies have revealed that employees with chronic stressful life events related to finance and chronic work stress, are more likely to have the MS than other stressful events [6,7].

Teaching school children especially at the secondary school level has been identified as one of the most stressful professions today as they are supposed to handle children in the stage of transition from childhood to adolescence, making the working conditions vulnerable to stressful working environment [8]. The stress among school teachers not only affects their health but also adversely affects the students and their learning environment [9].

Though there is ample literature available on work related stress and mental health problems among school teachers, their physical health have so far not been explored. Hence with this background the current study was conducted with the objectives to assess stress, the prevalence and the risk factors influencing metabolic syndrome among secondary school teachers in Mysore city of Karnataka.

MATERIALS AND METHODS

This cross-sectional study was done in Mysore city, with 213 secondary schools and 1924 secondary school teachers working in these schools. 300 Secondary school teachers aged 20 years and above, with at least one year of teaching experience and who gave consent to participate in the study were included.

Sample size was estimated based on CURES 2006 Chennai study which reported a prevalence of 25.8% MS (with a relative allowable error of 20%) according to International Diabetic federation (IDF) criteria [10]. Relative allowable error of 20% was considered and the sample was estimated to be 288, adding 10% of non response the final sample was 320, of which 300 subjects were considered for analysis as their proforma were complete.

Multistage sampling technique was adopted where, in the first step all the secondary schools in Mysore city were stratified into, Government (39), Private aided (67) and Private unaided schools (109) and from each of these strata teachers were selected by probability proportionate to size technique.

A self administered, pretested and structured questionnaire based on the WHO Steps Approach for NCD evaluation was used to assess the socio-demographic profile, disease profile, level of physical activity and habits (smoking, alcohol, diet). The blood

pressure and anthropometric measurements including weight, height and waist measurements were obtained using standard techniques [11]. Stress was evaluated using Gurmeet Singh's Presumptive Stressful Life Events Scale (PSLES). It's a 51 item scale based on Holmes and Rahe scale, which includes both positive and negative life events and validated for use in Indian population [12,13]. The fasting blood sample was taken for analysing fasting blood sugar, triglycerides and HDL cholesterol levels. The estimation of blood glucose was done by using GOD/PAP method, HDL cholesterol by Direct Immunodilution method and the triglyceride by GPO-PAP method using RX DYTONA and RX series auto analyser. The physical activity was calculated and categorised based on MET units using the GPAQ Analysis Guide [14]. The institutional ethics committee clearance, permission of the regional Deputy Director of Public Instructions DDPI, principals and the written informed consent of the teachers was obtained before starting the study.

The metabolic syndrome was defined based on the IDF consensus 2014 criteria. Central obesity measured as waist circumference (>80 cm in females and> 90cm in males of Asian origins), is central to the diagnosis along with any two of the following criteria if present was characterised as Metabolic Syndrome:

1) Fasting blood glucose ≥ 100mg/dl or previously diagnosed as diabetic,
2) Hypertension ≥ 130/ 85 mmHg or previously diagnosed as hypertensive,
3) Dyslipidemia
   i) Triglycerides ≥ 150 mg/dl and/ or,
   ii) HDL C ≤ 40mg/dl in males and ≤ 50 mg/dl in females or previously diagnosed as Dyslipidemia or on medication for the same [15].

STATISTICAL ANALYSIS

Data collected was entered in MS Excel 2010 and analysed using SPSS version 20. Descriptive statistical measures such as mean, standard deviation for continuous variables and number and percentage for categorical variables were used. Comparison between continuous variables was done using independent t-test and for categorical variables by using Chi-square test. Binary logistic regression analysis was done to see the factors which were independent predictors of Metabolic Syndrome. The differences and associations were interpreted as statistically significant at p<0.05.

RESULTS

General characteristics

In the present study among 300 secondary school teachers, 112 (37.3%) were males and 188 (62.7%) were females. A 58 (19.3%) of them belonged to Government school, 97 (32.3%) to Private aided schools and 145 (48.3%) to Private Unaided schools.

The mean age of males was 44.7+ 9.5years and of females was 41.26 + 10.2years with an overall mean age of 42.5+10.1 years. Most of the teachers, 253(84.3%) were married, 195(65.0%) of them were staying in nuclear families. A 47.6% of singles were in the age group of 21-30 years. Overall teaching experience of the participants ranged from one to 34 years, most 65 (21.7%) of them had an experience of 15 years [Table/Fig-1].

Metabolic Syndrome

[Table/Fig-1] show the prevalence of MS among the secondary school teachers of Mysore city was seen in 115 (38.3%). The prevalence of MS increased from 6(14.3%) in 21-30 years to 40(56.3%) in >50 years age group. A 40(35.7%) of males and 75(39.9%) of females had MS and the male: female ratio was 1:1.12, where the difference was statistically not significant. A 51.7% (30) of teachers working in government schools were affected with metabolic syndrome.

Taking the family history into account 69(23.0%) and 58(19.3%) had history of T2DM and 54(18.0%) and 58(19.3%) had history of hypertension in their father and mother respectively. The maternal history of DM and paternal history of hypertension was significantly associated with the presence of MS. Level of physical activity was a significantly associated with development of MS as 74(36.5%) of those who did not do any form of exercise had MS ($p < 0.05$). Blood pressure, triglycerides and HDL cholesterol levels were affected by the level of physical activity.

[Table/Fig-2] Show the difference in the mean with respect to age, experience in years, obesity (WC, BMI) hypertension (SBP & DBP) and biochemical parameters like TGs, HDL C, FBG, was statistically significant between the two groups.

A total of 67(20.3%) had fasting blood glucose ≥100mg/dl or reported being diabetic and on treatment. A 143(47.7%) of the teachers were hypertensive with ≥130/85mmHg or on treatment for hypertension, 105(35.0%) had systolic hypertension and 85(28.3%)

Variable	Metabolic Syndrome		Total (N=300)	*p*
	Present (n=115)	Absent (n=185)		
Age (years)				
21-30	6(14.3)	36(85.7)	42(14.0	0.001
31-40	26(28.3)	66(71.7)	92(30.7)	
41-50	43(45.3)	52(54.7)	95(31.7)	
>50	40(56.3)	31(43.7)	71(23.7)	
Sex				
Male	40(35.7)	72(64.3)	112(37.3)	0.471
Female	75(39.9)	113(61.7)	188(62.7)	
Type of School				
Government	30(51.7)	28(48.3)	58(19.3)	0.063
Private Aided	35(36.1)	62(63.9)	97(32.3)	
Private Unaided	50(34.5)	95(65.5)	145(48.3)	
Experience in Years				
1-5	7(13.7)	44(86.3)	51(17.0)	0.001
6-10	11(22.4)	38(77.6)	49(16.3)	
11-15	22(33.8)	43(66.2)	65(21.7)	
16-20	30(51.7)	28(48.3)	58(19.3)	
21-25	22(62.9)	13(37.1)	35(11.7)	
>25	23(54.8)	19(45.2)	42(14.0)	
Father h/o DM				
Present	32(46.4)	37(53.6)	69(23.0)	0.117
Absent	83(35.9)	148(64.1)	231(77.0)	
Mother h/o DM				
Present	29(50.0)	29(50.0)	58(19.3)	0.04
Absent	86(35.5)	156(64.5)	242(80.7)	
Father h/o HTN				
Present	27(50.0)	27(50.0)	54(18.0)	0.052
Absent	88(35.8)	158(64.2)	246(82.0)	
Mother h/o HTN				
Present	28(48.3)	30(51.7)	58(19.3)	0.08
Absent	87(36.0)	155(64.0)	242(80.7)	
Physical activity				
Intense physical activity	3(15.0)	17(85.0)	20(6.7)	0.012
Moderate physical activity	38(49.4)	39(50.6)	77(25.7)	
Sedentary	74(36.5)	129(63.5)	203(67.7)	

[Table/Fig-1]: Socio demographic profile and family history of the study population.
Note: Chi-square and Fisher-exact probability test, figures in parenthesis indicate percentages.

had diastolic hypertension on examination. A 123(41.0%) of the teachers had hypertriglyceridemia i.e. ≥ 150mg/dl and 92(30.7%) had low HDL-C (≤ 40mg/dl in males and ≤ 50mg/dl in females) however, the overall prevalence of dyslipidemia was seen in 139 (46.3%) [Table/Fig-3].

In the present study majority of them 141(47.0%) had moderate stress and only 42(14.0%) had severe stress. Among those with Metabolic Syndrome, 51(44.3%) of the subjects had no stress, 46(40.00%) and 18(15.6%) with moderate and severe stress

Variable	Total (N= 300)	Metabolic Syndrome		p-value
		Present (n=115)	Absent (n= 185)	
Age	44.7 ± 9.5	46.6 ± 8.2	39.8 ± 10.3	< 0.001
Experience in Years	15.2 ± 9.0	18.9± 8.2	12.9 ± 8.8	0.001
Weight	66.5 ± 12.7	73.6 ± 11.1	61.8± 11.4	0.001
Per Capita oil consumption per month	1.03 ± 0.41	1.1 ± 0.5	1.01 ± 0.36	0.146
Waist circumference	85.9 ± 11.2	92.9 ±7.2	81 .6 ± 11.01	0.001
BMI	25.7 ± 4.9	28.4 ± 4.1	24.1 ± 4.5	0.001
Systolic Blood pressure	123 ± 15.9	131.4 ± 15.5	118.6 ± 14.3	0.001
Diastolic Blood pressure	80.1 ± 10.2	85.2 ± 10.1	76.9 ± 8.9	0.001
Fasting Blood glucose level	93.1 ± 31.8	101.3 ± 34.1	87.6 ± 30.0	0.001
Triglycerides	149 ± 78.4	188.8 ± 80.2	124.13± 67.3	0.001
HDL-C	52.9 ± 12.9	50.4 ± 11.3	54.2 ± 14.3	0.012

[Table/Fig-2]: Association of metabolic risk factors among subjects with and without MS.
Note: Independent sample t-test.

Variable	Metabolic Syndrome		Total (N=300)	p-value
	Present (n=115)	Absent (n=185)		
Waist circumference				
Normal	0 (0)	110(100)	110(36.7)	0.001
Obesity (M > 90 cm, F > 80 cm)	115(60.5)	75(39.5)	190(63.3)	
Diabetes				
Normal	69(29.6)	164(70.4)	233(77.7)	X^2= 33.92, p 0.001
Pre diabetes	30(71.4)	12(28.6)	42(14.0)	
Diabetes	16(64.0)	9(36.00	25(8.3)	
Hypertension				
Present	81(56.6)	62(43.4)	143(47.7)	0.001
Normal	34(21.7))	123(78.3)	157(52.3)	
Systolic Hypertension				
Present	70(66.7)	35(33.3)	105(35.0)	X^2= 54.86 p 0.001
Normal	45(23.1)	150(76.9)	195(65.0)	
Diastolic Hypertension				
Present	58(68.2)	27(31.8)	85(28.3)	0.001
Normal	57(26.5)	158(73.5)	215(71.7)	
Triglycerides				
Normal	33(19.6)	144(81.4)	177(59.0)	0.001
Hypertriglyceridemia	82(66.7)	41(13.70	123(41.0)	
HDL				
Normal	65(31.3)	143(68.8)	208(69.3)	0.001
Low HDL-C (M <40, F <50)	50(54.3)	42(45.7)	92(30.7)	
Stress				
No stress	51(43.6)	66(56.4)	117(39.0)	0.108
Moderate Stress	46(32.9)	95(67.1)	141(47.0)	
Severe Stress	18(42.9)	24(57.1)	42(14.0)	

[Table/Fig-3]: Association of metabolic risk factors among subjects with and without MS.
Note: Chi-square test, Fisher-exact probability test

respectively. However, the difference in prevalence between the various groups was statistically not significant (X^2 =3.50; p= 0.108). Any form of stress was more common among the teachers working in private sector, and in the middle age group (30-50 years). The proportion of following risk factors– hypertension (SBP & DBP), hypertriglyceridemia, dyslipidemia, diabetes and metabolic syndrome increased with the degree of stress.

However, among those who had metabolic syndrome the proportion of BMI, SBP, TGs, HTN and dyslipidemia increased with the degree of stress, though the association was statistically significant (p<0.013) only for dyslipidemia and no other socio demographic or metabolic risk factors were showed statistical significant associations.

A 115(60.5%) of obese individuals based on waist circumference, 93 (59.2%) of obese individuals based on BMI, 50(75.8%) of the diabetics, 81 (56.6%) of hypertensive, 82(66.7%) of subjects with hypertriglyceridemia and 50(54.3%) with low HDL were characterised as having Metabolic Syndrome. All the components of Metabolic Syndrome according to IDF criteria were significantly associated (p< 0.001) with development of Metabolic Syndrome.

The most common risk factors were obesity 190 (63.3%), hypertension 143(47.7%) and dyslipidemia 139(46.3%). However, obesity 128(68.0%) and low HDL-C 90(47.8%) and was common among females, whereas, hypertriglyceridemia 63(56.3%) and systolic hypertension 57 (50.9%) was more common among males. However, 144(48.0%) had ≤ two risk factors, 121(40.3%) had ≥ 3 risk factors and 7(2.3%) had all the five risk factor. After our study the prevalence of hypertension increased from 43 (14.3%) to 143 (47.6%), T2DM from 27(9.0%) to 66 (22.0%) and dyslipidemia from 12 (4.0%) to 139 (46.3%) [Table/Fig-4].

Thus, screening for NCDs using can help in early diagnosis and timely appropriate interventions to alter the natural course of the disease [Table/Fig-5].

Sl.No	Risk factor	No. of subjects	Percentage
1	Obesity a) Waist Circumference b) BMI- i) Overweight ii) Obese	 190 58 157	 63.3 19.3 52.3
2	Fasting blood glucose > 100mg/dl (or diabetics)	66	22.0
3	Blood pressure> 130/85 mmHg (or Hypertensive) a) SBP b) DBP	143 105 85	47.7 35.0 28.3
4	Triglycerides > 150mg/dl	123	41.0
5	HDL-C <40mg/dl for M and < 50mg/dl for F	92	30.7
6	Dyslipidemia (TG> 150mg/dl or low HDL-C or both)	139	46.3
7	None of the risk factors	35	11.6
8	Any one of the risk factors	70	23.3
9	Any two of the risk factors	74	24.6
10	Any three of the risk factors	88	29.3
11	Any four of the risk factors	26	8.6
12	All five of the risk factors	7	2.3
13	< 3 of the risk factors	144	48.0
14	>3 of the risk factors	121	40.3

[Table/Fig-4]: Distribution of risk factors of Metabolic Syndrome among the study subjects (N=300).

DISCUSSION

The present study was done in Tier II city where subjects were exposed to work related stress and urbanization effects, thus following the trend seen in larger cities like Bangalore, Chennai and other western developed countries. The study results are similar to the global scenario wherein about 40% of the adult population

Sl.No	Variable	Previously Diagnosed	Currently Diagnosed
		Present	Present
1	Hypertension	43(14.3)	143(47.6)
2	Diabetes	27(9.0)	66(22.0)
3	Dyslipidemia	12(4.0)	139(46.3)

[Table/Fig-5]: Distribution of study participants according to history of hypertension, diabetes and dyslipidemia with newly identified subjects at the end of the study. (N=300).
Figures in parenthesis is percentages

above 20 years is affected with MS as in US and Europe and other South Indian studies [10,16].

The prevalence increased with age from 14.3% in 21-30 years age group to 56.3% in > 50 years age group. The CURES 34 study and DS Prasad et al., revealed that the prevalence of Metabolic Syndrome ranged between 5.1% to 8.9% in 20-29 years age group depending on the definition used [10,17]. The higher prevalence of MS in younger age 14.3% compared to the other studies is of particular concern, as they will have a more prolonged exposure to atherosclerotic risk factors associated with MS and its consequences [10,17].

The prevalence of MS was 35.7% in males and 39.9% in females in the ratio of 1:1.2 respectively. However, the difference between the two groups in not statistically significant, thus both men and women are at equal risk of developing Metabolic Syndrome. The following studies in different cities of India i.e CUPS 2003, CURE34, DS Prasad et al., in urban eastern India and Gupta et al., in Jaipur revealed higher prevalence of MS among females but a study among migrant Asians showed no difference in sex preference [10,17-20]. According to the systematic review done by Mc Andrew et al., the sex related differences are not universal but are related to SES status, work related stress, body fat composition and ethnicity [21].

In the present study maternal history of diabetes (OR-1.81) and paternal history of hypertension (OR-1.79) were significant risk ($p<0.05$) factors for the development of metabolic abnormalities in their offspring. Similar findings had been observed by the INTERHEART 51 countries study and among Asian migrant in US [20,22]. Ranjitha et al., study among Asian migrants in US revealed a prevalence of diabetes was significantly higher among individuals who had a first-degree relative with diabetes (11.6%) than among individuals without a family history (5.0%), corresponding to a crude odds ratio of 2.3 [20]. The INTERHEART 51 countries study revealed family history of hypertension was independently associated with an odds ratio of 1.55(99% CI 1.44-1.67) and PAR was 12.0% (99% CI 9.2%- 15.1%) for development of CHD in the offspring, more so in the younger individuals [18]. The current study agrees with the above study findings. Thus, the family history can be a simple tool to evaluate and educate the community about the familial occurrence of metabolic abnormalities and also help in screening as suggested by MDRF in using the IDRS risk score [23].

The presence of obesity (WC) with any two of the factors T2DM, hypertension, HTN and Low HDL-C were considered to identify MS. 265(88.3%) had at least one risk factor, 144(48.0%) had ≤ two risk factors and 121(40.3%) had ≥ 3 risk factors, and about 7(2.3%) of the subjects had all the five risk factors. Similarly, Chennai based CURES 34 study also found 78.6%, 84.1% and 80.3% of the subjects had at least one abnormality and 1.7%, 2.7% and 1.2% had all five abnormalities according to WHO, IDF and ATPIII criteria used respectively [10]. Prabhakar D et al., found that only 15% of the study population was free of any risk factor, 85% had at least one risk factor and 47% had two risk factors [24]. Apurva Sawant et al., found that 95% of the subjects had at least one abnormality using the modified NCEP ATP III criteria [1].

The most common risk factor observed were obesity 63.3%, hypertension 47.7% and dyslipidemia 46.3%. Low HDL-C 39.4% and obesity 68.6% was common in females, whereas, systolic hypertension 50.9% and hyper triglycerides 56.3% was common among males. DS Prasad et al., revealed that low HDL-C 84.5% and hypertension 56.8% was the commonest abnormality among females whereas, hypertension 69.3% followed by central obesity 41.9% was commonest among males [17]. Migrant Asians in US showed that the prevalence of obesity and low HDL-C was higher in females and males had higher frequency of TG and HTN [20]. The most frequent contributing components of MS were IFG 62.5%, high triglyceride levels 42.3%, and low HDL-C levels 37.7%.16 The findings are similar to other comparative studies.

A study showed people with chronic work stress were twice likely to develop MS than those without work stress (OR= 2.25, 95% CI=1.31- 3.85). Stressful life events related to finance, health and workload were associated with insulin resistance, obesity and triglycerides had a higher odds for having IGT, however, stress did not associate significantly with IFG, HDL cholesterol, or blood pressure [5,25]. Though the present study could not statistically associate stress with MS, the proportion of risk factors increased with level of stress.

After our study the prevalence of hypertension increased from 43 (14.3%) to 143(47.6%), T2DM from 27(9.0%) to 66(22.0%) and dyslipidemia from 12(4.0%) to 139(46.3%). Thus, screening for NCDs using can help in early diagnosis and timely appropriate interventions to alter the natural course of the disease.

Most of the programmes are directed towards stress management for teachers to improve the learning environment for students and thus neglecting their physical health status. Since, health appraisal of school personal is a component of school health programme SHP it needs to be emphasised, to have an holistic approach toward the health of the teachers which will help in creating awareness initially and then later on, motivate them to adopt healthy lifestyle. In the present scenario where the metabolic abnormalities among school children is increasing and programmes like CHETANA and MARG are being initiated to reduce obesity and IR among school children, the teachers health needs should also be addressed for creating healthy learning environment [26,27].

LIMITATION

A larger sample would be needed to further explore the relation between stress and MS as this study was based on self administered questionnaire and not on biochemical test that were employed in the other studies, which were laboratory based. As well as if other highly stress full occupations should be compared.

CONCLUSION

Prevalence of metabolic syndrome among secondary school teachers of Mysore city was 38.3%. The prevalence in the younger population 20-30 years age group is 14.3%, thus exposing them to the metabolic risk factors for a longer duration and its consequences. Older age, physical inactivity, family history of diabetes and hypertension, obesity, increased fasting blood glucose; blood pressure, triglycerides and low HDL-C were the risk factors that led to metabolic syndrome. The huge difference between already known status of T2DM, HTN and dyslipidemia and that detected by the study emphaszes on the need to screen the individuals at regular intervals to identify them as early as possible. Therefore, screening for NCDs will help in creating awareness initially and then later on, motivate them to adopt healthy lifestyle.

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