Original Research Article

Prevalence of Metabolic Syndrome, Its Co-Morbidities and Effect of Treatment and Lifestyle Modification in Rural Females

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ABSTRACT

The metabolic syndrome is a constellation of interrelated risk factors of metabolic origin-(metabolic risk factors)-that appear to directly promote the development of atherosclerotic cardiovascular disease.

A cross-sectional study was done among rural population of Jaipur district to identify the prevalence of metabolic syndrome in rural females. This was followed by a trial of lifestyle modification and treatment for a period of 6 months among selected participants. The trial compared [1] standard-of-care with [2] standard-of care plus Comprehensive Lifestyle Modification Programme of 16 weeks duration with follow up at 6 months among eligible female participants having Metabolic Syndrome. Out of 450 rural females, 84 (prevalence 18.6%) were fulfilling the diagnostic criteria for metabolic syndrome. They were randomly divided into two groups (1) intervention & (2) control group.

The simple intervention of lifestyle and dietary modification yielded statistically significant positive favorable alterations in the risk factors for future serious complications of atherosclerotic cardiovascular diseases. They can be further studied at a larger scale to pass on the benefits to the population at large by implementing a community-based multidisciplinary healthy lifestyle intervention; specifically, to the understudied and underserved rural female population.

Keywords: Metabolic syndrome, Comprehensive life style modification programme, Rural females.

INTRODUCTION

The metabolic syndrome is a constellation of interrelated risk factors of metabolic origin-metabolic risk factors-that appear to directly promote the development of atherosclerotic cardiovascular disease (ASCVD).The major underlying risk factors for the syndrome are abdominal obesity and insulin resistance; other contributory factors are physical inactivity, aging, and hormonal imbalance. The most widely recognized of the metabolic risk factors are atherogenic dyslipidemia, elevated blood pressure, and elevated plasma glucose. Individuals with these characteristics commonly manifest a pro-thrombotic state and a pro-inflammatory state as well. Metabolic syndrome is often accompanied by other medical conditions notably fatty liver, cholesterol gallstones, obstructive sleep apnea, gout, depression, musculoskeletal diseases, polycystic ovarian syndrome. In 2001, the National Cholesterol Education Program (NCEP)[1] Adult Treatment Panel III (ATP III) introduced alternative clinical criteria for defining the metabolic syndrome. The purpose of ATP III 1. was to identify people at higher long-term risk for ASCVD who deserved clinical lifestyle intervention to reduce risk.

To reduce lifetime risk for ASCVD, all individuals found to have the metabolic syndrome deserve long-term management and follow-up in the clinical setting. The primary aim is to reduce the underlying risk factors. Both weight reduction and its

maintenance at a lower weight are best achieved by a combination of reduced caloric intake and increased physical activity and the use of the principles of behavioral modifications. Effective weight loss requires a strict adherence to all the above cited modalities.

Diagnostic Criteria for Metabolic Syndrome-

The new clinical definition of the Metabolic Syndrome given by National Cholesterol Education Programme /Adult treatment Panel III (NCEP-ATPIII)[2] has been modified for Indian standards, and was used to define Metabolic Syndrome.

It requires the presence of at least 3 of the following 5 risk factors:

1. Central Obesity: Waist circumference > 90 cm in male & >80 cm in female; (modified for Indian standards).
2. Triglycerides :>150 mg/dl.
3. HDL Cholesterol: Men <40mg/dl, Women <50mg/dl.
4. Blood Pressure: Systolic >130mm Hg /Diastolic >85mm Hg.
5. Fasting glucose: >100mg/dl.

Aims & Objectives

1. To study the burden of Metabolic Syndrome and its components in rural females.
2. To study the effect of treatment and lifestyle modification after a period of 6 months.

MATERIALS & METHODS

The present study was carried out in villages in the vicinity of Jaipur city, capital of Rajasthan (India). Case selection for the study was done at villages 50 km away from South-East of Jaipur Urban; and all villages within five km radius (8 villages). The health services in this area are mainly rendered by CHC Chaksu located at Tehsil headquarters of Chaksu, Jaipur, Rajasthan.

The present study was a cross-sectional study among rural population of Jaipur district. This was followed by a trial of lifestyle modification and treatment for a period of 6 months among selected participants.

The interventional trial compared [1] standard-of-care with [2] standard-of care plus Comprehensive Lifestyle Modification Programme (CLMP)[3] of 16 weeks duration with follow up at 6 months among eligible female participants having Metabolic Syndrome. The study duration was of one and half years (Jan 2018 to May 2019) after the commencement of the study. Considering the prevalence of metabolic syndrome as approximately 24.9% in rural areas and absolute error of 4%, the calculated sample size came out to be 470.The study participants were females aged 20 years or more.

Inclusion criteria:

1) Permanent residents of the area for at least last one year.
2) Those who had given informed written consent in presence of a literate witness.

Exclusion criteria:

1) Pregnant women,
2) Overt psychosis
3) Unwilling persons or not able to accord consent due to one reason or the other.

RESULTS

Table 1: Socio-demographic characteristics of study participants by study groups (N=84)

Socio-demographic characteristics	Intervention group	Control Group	P value
Age (years), mean (SD)	43.48(12.13)	46.09(11.42)	0.06
Education, n (percent)			0.23
Illiterate	18(43.90)	22 (51.16)	
Up to Primary	14(34.15)	16(37.21)	
Middle	6(14.63)	3(6.98)	
Higher Secondary or above	3(7.32)	2(4.65)	
Occupation, n (percent)			0.52
Skilled or Unskilled	7(17.17)	7 (16.28)	
Homemaker	30(73.17)	34(79.07)	
Unemployed or Retired	4(9.76)	2(4.65)	
Marital Status, n (percent)			0.858
Married	37(90.24)	36(83.72)	
Widowed	3(7.32)	2(4.65)	
Single	1(2.44)	5(11.63)	

Table 2: Baseline Clinical measurements of study participants by study groups (N=84)

Baseline variable	Intervention group(n=41)	Control group(n=43)	P value
Weight (kg), mean (SD)	58.93(10.53)	59.84(7.98)	0.42
Waist circumference (cm), mean (SD)	86.98(8.79)	86.62(10.80)	0.75
BMI (Kg/M^2) mean (SD)	22.23(4.93)	22.53(5.15)	0.61
Systolic BP (mmHg), mean (SD)	135.96(17.01)	139.46(19.79)	0.11
Diastolic BP (mmHg), mean (SD)	80.18(12.03)	81.12(13.05)	0.53

Table 3: Baseline Biochemical Parameters of study participants by study groups (N=84)

Baseline variable	Intervention group(n=41)	Control group(n=43)	P value
Fasting Plasma Glucose (mg/dl), mean (SD)	109.79 (41.09)	110.46(45.12)	0.89
Total Cholesterol (mg/dl), mean (SD)	181.52(31.25)	180.04(42.36)	0.36
Triglycerides (mg/dl), mean (SD)	164.94(74.76)	167.29(75.55)	0.79
HDL Cholesterol (mg/dl), mean (SD)	37.87(7.55)	38.20(7.42)	0.71

Table 4: Changes in Physical Parameters at 6 months by study groups (N=79).

	Intervention group (N=38)	Control Group (N=41)	P value
Weight (kg), mean (SD)	58.33(7.38)	60.44(8.32)	0.23
Waist Circumference (Inch), mean (SD)	86.67(6.52)	86.2(14.04)	0.84
BMI (Kg/M2) mean (SD)	21.73(2.80)	22.53(2.86)	0.21
Systolic BP (mmHg), mean (SD)	123.31(7.70)	128.57(14.11)	0.04
Diastolic BP (mmHg), mean (SD)	79.5(2.0)	81.13(4.6)	0.04

Table 5: Changes in Biochemical Characteristics at 6 months by study groups (N=79).

	Intervention group (N=38)	Control Group (N=41)	P value
Fasting Plasma Glucose (mg/dl), mean (SD)	104.60(9.39)	119.42(13.69)	0.03
Total Cholesterol (mg/dl), mean (SD)	172.10(41.55)	179.27(39.58)	0.43
Triglycerides (mg/dl), median (SD)	162.62(48.27)	164.50(60.73)	0.88
HDL Cholesterol (mg/dl), mean (SD)	39.09(9.38)	39.6(9.65)	0.81

DISCUSSION

The present study entitled "Prevalence of Metabolic Syndrome, its co-morbidities and Effect treatment and lifestyle modification in females: A rural population based cross sectional study" was carried out in eight rural villages of Jaipur District from May 2018 to April 2019.

A total of 450 rural eligible females were included in the study. The blood samples were collected and sent for laboratory analysis after baseline contact. An intervention of 4- month diet and exercise program of the Comprehensive life style modification programme (CLMP) was implemented. The control group participated in a one-hour health education group session on diabetic diet that is routinely taught by a dietician in the clinic at the beginning of the study. The females

of both groups were followed after 6 months for the effectiveness of intervention.

Out of total 450 study participant females, 84 were found to be positive for metabolic syndrome. This gives a prevalence of 18.6% for metabolic syndrome among rural females of 5 Jaipur District.

The overall prevalence of MetS of 18.6% in our study is within this range. Our study has similar prevalence with Chow et al[4]. (18.4%) & Deepa et al.[5](18.3%)

A 4-month diet and exercise program Comprehensive Lifestyle Modification Programme (CLMP) focusing on improving self-efficacy, including mastery of experience, vicarious experience, social persuasion, and reducing stress reactions was delivered to study participants of intervention group. The participants were

again accessed after 6 months. The present study found that the intervention significantly reduced the mean weight of study participants.

The mean BMI of intervention group females was 22.23kg/m2 while mean BMI of control group females was 22.53 kg/m2. The difference being statistically non significant.

These results are in accordance of a Diabetes Prevention Program in which participants randomly assigned to an intensive lifestyle intervention (including a low-calorie, low-fat diet and weight loss) showed a lower 3-year cumulative incidence of Metabolic syndrome when compared with those who received metformin or placebo. In the our study, the mean fasting plasma glucose of intervention group females post-intervention was 104.60 mg/dl while that of control group females was 119.42 mg/dl. (p>0.05). Similar non-significant improvement in fasting glucose have been reported in a randomized trial of advice only v/s established lifestyle modifications for lowering blood pressure (EST) v/s EST + Dietary approach to stop Hypertension(DASH)[6] diet in all arms after 6 months.

The intervention group received printed and online programme materials and motivational support, and the control group was waitlisted to receive the programme after post-test data collection.

CONCLUSION
The present study concluded as follows:

1 Out of 450 females, 84 were found to fulfill the diagnostic criteria for metabolic syndrome as per NCEP-ATP III. This gives a prevalence of 18.6% for metabolic syndrome among rural females of Jaipur District. They were randomly assigned to the intervention group (43 females) & control group (41 females).

2 Nine females (20.93%) of intervention group had family history of diabetes, CAD, stroke in comparison of five females (21.19%) in the control group.

3. The mean baseline weight of intervention group females was 58.93 kg in comparison of 59.84 kg mean weight of control group. The present study found that the intervention significantly reduced the mean weight of study participants (p<0.05).

4. The mean baseline waist circumference of both groups conformed to the criteria of central obesity, i.e.>80 cm. The present study found that six months after CAMP intervention of four months, there was significant reduction in waist circumference (p<0.05).

5. The mean baseline SBP of both groups was in the hypertensive range. After intervention in the present study, the mean Systolic BP (mmHg) of intervention group females reduced by 6 9.1% from baseline while reduction in control group females was 7.8%.

6. The mean baseline DBP of intervention group females was 80.18 mm of Hg in comparison of mean DBP of 81.12 mm of Hg among control group females(p>0.05). The mean Diastolic BP (mmHg) of intervention group females post-intervention reduced by 0.8% while there was no reduction in control group females.

7. The present study found that the mean baseline fasting plasma glucose of all females was above the normal range of normoglycemia. This finding suggests high prevalence of hyperglycemia. The mean baseline fasting plasma glucose of intervention group females was 109.79 mg/dl in comparison of 110.46 mg/dl mean fasting plasma glucose of control group (p>0.05). In the present study, the mean fasting plasma glucose of intervention group females post-intervention reduced by 4.7% while there was no change among control group females.

8. On analyzing total cholesterol of study participants, the mean total cholesterol of intervention group females was found to be 181.52 mg/dl while mean total cholesterol of control group females was 180.04 mg/dl (p>0.05).In the present study, in the intervention group the post- intervention mean total cholesterol decreased by 5.1% as

compared to 0.4% mg/dl in the control group females.

9. It was observed in the present study that average baseline levels of triglycerides were above normal for females of both groups, i.e. >150 mg/dl. The mean triglycerides (mg/dl) post-intervention reduced in both groups (1.4% in intervention vs 1.6 % in controls).

10. The mean baseline HDL cholesterol of both groups was abnormally low (<50 mg/dl). The current study revealed that the mean HDL cholesterol (mg/dl) of intervention group females post-intervention increased by 3.1% while that of control group females increased by 3.5%. There were significant changes in behavior of study participants after the intervention.

11. The study observed that before intervention only two females (8.16%) in intervention group were consuming >5 servings of fruit and vegetables per day which increased to 12 females after intervention (p<0.05).

12. On the basis of self-reporting of physical activity by study participants, only six females (14.63%) in intervention group were physically active before intervention which increased to 10 females after intervention. This difference before and after intervention was statistically significant (p<0.05).

13. Alcohol consumption was reported by six females (14.63%) in intervention and four females (9.3%) in control group. After the intervention eight females quit smoking and five females quit drinking alcohol. The difference in habitual use of tobacco and alcohol before and after intervention was found significant on statistical analysis (p<0.05).

In conclusion, it can be safely inferred that the current study was instrumental in identifying rural females at potential risk of developing complications of Metabolic Syndrome. The simple intervention of lifestyle and dietary modification yielded statistically significant positive favorable alterations in the risk factors for future serious complications of ASCVD. They can be further studied at a larger scale to pass on the benefits to the population at large by implementing a community-based multidisciplinary healthy lifestyle intervention; specifically to the understudied and underserved rural female population.

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