

A Survey on Metabolic Syndrome prevalence in Punjabi Community of India

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Abstract

The metabolic syndrome (MS) is a group of physiological and biochemical derangements that if left untreated, may lead to cardiovascular diseases, diabetes, non-alcoholic fatty liver disease, stroke or even turn cancerous in future. At present, due to increasing health awareness, metabolic syndrome is matter of research for health professionals and academia. It is well versed that Indian Punjabi community's cuisine is crazy rich, therefore objective was to analyze the metabolic syndrome prevalence in women of Indian Punjabi Community. A target segment of Fifty women of 18-55 years age group were selected from Indian Punjabi community from New Delhi. A non-experimental cross-sectional survey was done to identify subjects for metabolic syndrome using International Diabetes Federation criterion. The results showed 35% subjects (17 out of 50) were suffering from metabolic syndrome. The prevalence rate was really very alarming and there is an urgent need of making suitable strategy to cut the menace of this affluent disorder.

Key words

Metabolic disorders, Punjabi community, hypertension, insulin resistance, obesity

Introduction

Non-communicable diseases like cardiovascular disease (CVD), obesity and type 2 diabetes mellitus are emerging as global pandemics in the current years in excessively higher proportions in developing countries like India (Terzic & Waldman, 2011). Unhealthy dietary patterns and a sedentary lifestyle are somewhat seen practically worldwide more often inspite of the incidence of communicable diseases across the countries (Wang *et al.*, 2016). An assemblage of abnormalities in the metabolism that causes an increase in the risk of getting diabetes and cardiovascular diseases is called metabolic syndrome (Eckel, 2012). "It is defined as a cluster of at least three out of five clinical risk factors: abdominal (visceral) obesity, hypertension, elevated serum triglycerides, low serum high-density lipoprotein (HDL) and insulin resistance" (Alberti *et al.*, 2009). Metabolic Syndrome is believed to affect global adult population about 20% at large. Amongst the major factors causing metabolic syndrome the abdominal (visceral) obesity is estimated to be the main risk that is quiet prevalent all over the world (Haffner & Taegtmeyer, 2003).

Across the world obesity and overweight are causing concerns. "According to the recent estimates in 2010, approximately 1.0 billion adults are overweight and 475 million were obese" (IOTF Report, 2010). Metabolic syndrome is clearly the main precursor to develop other such diseases.

Diagnostic criteria for Metabolic Syndrome

Metabolic syndrome has been defined according to the combined definition given by International Diabetes Federation, National Heart, Lung and Blood Institute, American

Heart Association, World Heart Federation, International Atherosclerosis Society and International Association for the study of Obesity.

As per this consensus statement, three out of any five risk factors have to be abnormal for the identification of metabolic syndrome.

1. Abdominal obesity or waist circumference

Men ≥ 90 cm / 36 inches

Women ≥ 80 cm / 32 inches

2. Plus any two of the following:

- Triglycerides
 ≥ 150 mg/dL
- HDL cholesterol
 < 40 mg/dL (men)
 < 50 mg/dL (women)
- Blood pressure
Systolic BP ≥ 130 mmHg
Diastolic BP ≥ 85 mmHg
- High fasting blood glucose
 ≥ 100 mg/dL

Imbalanced diet has been associated and identified as a prominent factor for these metabolic syndrome diseases (Pitsavos, 2006). Frequent eating of energy dense foods including excess consumption of ghee is observed a part of lifestyle of Indian women. Also Indian women follow sedentary lifestyle with doing very little household chores (Gupta *et al.*, 2004; Misra *et al.*, 2005).

Therefore, by realizing a dire need, the present study was aimed to find out the metabolic syndrome prevalence in women of the Indian Punjabi community belonging to the same geographical area and its correlation with nutritional status and lifestyle practices.

Objectives

- To collect demographic profile of the female Punjabi community
- To appraise lifestyle of people of Punjabi community such as physical activity status, smoking, alcohol, gutkha, supari consumption and sleep patterns as risk factors 1
- To assess nutritional status of the selected samples using anthropometry, biomedical & biochemical profile and dietary recall as risk factor 2
- To study pre-existing health issues and family history of the same as risk factors 3
- To find out correlation of risk factors with metabolic syndrome

Research Methodology

Sample selection

The study sample of 50 members of the Punjabi community residing in Punjabi Bagh, New Delhi participated in this study. Stratified Random Sampling was done to take the sample size.

Inclusion criteria

1. Females of Punjabi community
2. Participants were in the 18-55 years age group
3. Willingness to participate in the study

Exclusion criteria

1. Participants suffering from medical complications (transient ischemic attack, bypass surgery, kidney diseases), overt cardiovascular disease or
2. diabetes
3. Pregnant women
4. Age group below 18 years or more than 55 years
5. Participants on treatment with drugs that may interfere with test results

Duration of the study

The study was conducted over a period of six months in which a period of intervention was of three months.

Study Design & data collection

- A non-experimental descriptive design using ex post facto (cross sectional survey) was used to obtain demographic profile, physical activity, smoking history, consumption of alcohol, family history of non-communicable diseases and sleep patterns using a structured questionnaire. Data was collected using a structured questionnaire for all above parameters.
- The physical activity level of the participants was assessed using the "PHYSICAL ACTIVITY INDEX given by Sharkey & Gaskill (2007).
- Anthropometric measurements: As anthropometric measurements are very helpful in determining individual's health status so measurements like height, weight, waist circumference, blood pressure (both systolic and diastolic) were measured. Weight using digital weighing machine, height using analogue measuring tape, waist circumference and hip circumference using circumference measuring tape and systolic and diastolic blood pressure using automatic digital BP monitor. Body mass index = weight (kg)/ ht (m²).
- Biochemical estimations: Samples were tested for different biochemical parameters which included estimation of serum HDL, serum triglycerides, cholesterol and fasting blood glucose levels. The biochemical estimations were carried out in a standard laboratory using following methods -
 - Estimation of plasma glucose levels using the GOD/POD enzymatic method
 - Estimation of serum total cholesterol by enzymatic kit method
 - Estimation of serum triglycerides by enzymatic kit method
 - Estimation of serum HDL-C by the enzymatic kit method
 - Dietary assessment: A self-administrated food frequency questionnaire and a structured two day dietary recall was used as a part of dietary assessment of the participants. Nutrient intake was calculated from the data obtained and compared with the recommended dietary allowances as prescribed by the Indian council for Medical Research (2010).
- Participants were observed for the metabolic syndrome presence or absence using IDF (International Diabetes Federation) criterion for metabolic syndrome
- Data was analysed statistically

Results and Discussion

After observing significance of metabolic syndrome on health, morbidity and mortality status of population, present study was carried out to find out metabolic syndrome prevalence and its association with various risk factors. Data collected was presented in following headings -

1. Demographic profile of the selected samples
2. Life style practices (smoking, consumption of alcohol, gutkha, supari, physical activity and sleep pattern)
3. Health status & family history
4. Nutrition status assessment (Anthropometric, biochemical and dietary profile)
5. Screening of metabolic syndrome
6. Co-relation of metabolic syndrome with nutritional status, lifestyle and existing health status

1. Demographic profile

The demographic profile of the participants has been presented in table 1.

Particulars		N=50	Percent
Age	18-24 years	8	16
	24-30 years	9	18
	30-36 years	8	16
	36-42 years	11	22
	42-50 years	5	10
	50-55 years	9	18
Marital status	Never married/ Unmarried	13	26
	Married	37	74
	Separated	-	-
	Divorced	-	-
	Widowed	-	-
Educational qualification	No formal schooling	3	6
	Less than primary school	2	4
	Primary school completed	8	16
	High school complete	9	18
	College/Pre-University/University completed	28	56

Table 1: Demographic profile of the participants.

Age and Marital status: Table 1 indicates that age of the participants from 18-55 years. Twenty two percent of the participants were between 36-47 years, 18 percent were between 50-55 years and 24-30 years, 16 percent were between 18-24 years and 30-36 years and 10 percent were between 42-50 years. Majority of the participants (74%) were married.

A study by Prasad *et al.* (2012) showed considerably higher prevalence rates of metabolic syndrome in older age groups.

Education: With regard to the educational qualification of the participants 56 percent were graduated, 18 percent have completed their high school, 16 percent completed their primary education, 6 percent have not completed their formal schooling and only a small portion of 4 percent has studied less than primary school.

2. Lifestyle practices: Lifestyle behaviours such as smoking, alcohol use, pan, supari, gutka usage, physical inactivity and sleep patterns were studied and presented in following tables.

Smoking and alcohol use: The percent distribution of participants based on smoking, alcohol use, pan, supari, gutka usage is presented in table 2.

Particular	N=50	Percent
Smoking habits	Never	50
	Rarely	-
	Sometimes	-
	1-2 times in a wee	-
	Everyday	-
No. of cigarettes smoked (N=50)	Light (1-5)	-
	Moderate (6-10)	-
	Heavy (11-20)	-
Passive smoking	Yes	-
	No	-
Alcohol use	Yes	21
	No	29
Alcohol consumption	Never	29
	Rarely	13
	Sometimes	5
	1-2 times in a week	3
	Everyday	-
No. Of alcoholic drinks	1-2 drinks	13
	2-5 drinks	7
	5-10 drinks	1
	More than 10 drinks	-
		-
Paan, Supari, Gutk chewing	Never	-
	Rarely	1
	Sometimes	-
	1-2 times in a week	-
	Everyday	-
	Once	1
	2-3 times	-

	4-5 times	-	-
	More than 6 times	-	-

Table 2: Percent distribution of participants based on smoking, alcohol, pan, gutka, supari usage.

Smoking habit and number of cigarettes smoked: It was observed that 100 percent of the participants do not have the habit of smoking.

Alcohol consumption: With regard to alcohol consumption 42 percent of the participants consumed alcohol as against 58 percent who did not consume alcohol. Based on the number of alcoholic drinks consumed 26 percent were categorized as light drinkers (1-2 drinks), 14 percent were moderate drinkers (2-5 drinks) and 2 percent were heavy drinkers (5-10 drinks).

Paan, Supari, Gutka chewing habit: Only 2 percent of the people have the habit of chewing them and that too very rarely.

Lifestyle behaviours such as inefficient diet, lesser sleep duration and lack of major physical activity are linked with metabolic syndrome (Mnatsakanova *et al.*, 2009).

Physical activity pattern: As age advances, obesity and similar metabolic disorders crop up due to lack of physical activity. Higher levels of physical inactivity have been shown to promote increase in body weight, body fat and potential health issues. The percent distribution of participants based on physical activity pattern is presented in table 3.

Particular		N=50	Percent
Physical activity	Yes	50	100
	No	0	0
Intensity	Sustained heavy breathing and perspiration	7	14
	Intermittent heavy breathing and perspiration eg. Tennis	6	12
	Moderate heavy eg. Cycling	7	14
	Moderate eg. Volleyball, softball	2	4
	Light eg. Walking	30	60
Frequency	Daily or almost	45	90
	3-5 times a week	1	2
	1-2 times a week	1	2
	Few times a month	-	-
	Less than once in month	3	6
Duration	More than 60 minutes	15	30
	30-60 minutes	17	34
	20-30 minutes	39	78
	Less than 20 minutes	4	8

Types of activity	Walking	45	90
	Jogging	4	8
	Yoga	7	14
	Swimming	-	-
	Cycling	2	4
	Gym workout	8	16
	Other outdoor activities	2	4

Table 3: Percent distribution of participants based on physical activity.

*N exceed 100 due to multiple responses

Physical activity: Regular physical activity was observed in 90 percent of the participants against 10 percent who were not following a regular physical activity regimen.

Frequency, duration and type of activity: When the participants were questioned for frequency, type and duration of activity they were involved in, 90 percent of the participants reported involving in some kind of exercise everyday while rest of the 10 percent were engaged in physical activity irregularly. Engaging in physical activity for more than 30 minutes was reported by 64 percent of the participants. 90 percent were involved in walking, 16 percent were involved in gym workout, 14 percent were involved in yoga, and 8 percent were involved in jogging while 4 percent were involved in cycling and other outdoor activities.

Physical Activity Index Scoring: The physical activity level was assessed by using the Physical Activity Index Scoring. The percent distribution of participants by scores obtained in evaluation of the physical activity pattern is presented in table 4.

Physical activity pattern evaluation			N=50	Percent
Evaluation	Fitness category	Scores		
Very active lifestyle	High	100	6	12
Active & healthy	Very good	80-100	6	12
Active	Good	60-80	6	12
Acceptable (could be better)	Fair	40-60	2	4
Not good enough	Poor	20-40	29	58
Sedentary	Very poor	Under 20	1	2

Table 4: Percent distribution of participants based on physical activity scores.

Results indicated that maximum participants exhibit a low fitness level. Majority of participants (58%) in the present study lead a poor lifestyle as can be seen from their physical activity scores. Two percent of the participants lead a sedentary lifestyle, while people leading a active, active and healthy and very active lifestyle was to be found 12%. Only 4% of the participants lead an acceptable lifestyle which can be improved.

Physical activity and age: The comparison of the mean physical activity scores of the participants by age is presented in table 5.

Variables	Age (years)					
	18-24	24-30	30-36	36-42	42-50	50-55
Physical activity score	5 ± 0	4.4 ± 0	4.7 ± 1.414	4.7 ± 2.828	5 ± 0	4.3 ± 2.82

Table 5: Comparison of mean physical based on age.

Table 5 indicates the comparison of the physical activity scores of the participants by age. The physical activity scores differed significantly between the participants of different age groups indicating the fitness levels of the participants were significantly affected by age. The mean physical activity scores were higher in participants who were in 18-24 and 42-50 years of age.

Sleep Quality: Lesser irregular sleep causes sleep deprivation amongst the masses directly related to sleep disorders. Table 6 is depicting percent distribution of participants on the basis of their sleep duration.

Particulars		N=50	Percent
Duration of sleep	<5 hours	5	10
	5-7 hours	17	34
	7-9 hours	21	42
	9-12 hours	7	14
	>12 hours	0	0

Table 6: Percent distribution of participants based on duration of sleep.

The sleep duration of the participants was assessed to determine the extent to which it affects participant's lifestyle. It was seen that maximum participants ie., 42% were taking a good sleep of 7-9 hours. Thirty four percent participants were taking sleep of 5-7 hours, 14% were taking a sleep of 9-12 hours while 10% of the participants were taking a sleep less than 5 hours and their sleep debt has a harmful impact that could trigger metabolic syndrome.

3. Health Status & Family History

Lack of physical fitness, improper diet is the factors associated with the declining health of the participants. Table 7 is presenting the percent distribution of participants based on medical history.

Particulars		N=50	Percent
Medical history	Obesity	5	10
	Hypertension	1	2
	High cholesterol	0	0
	Diabetes mellitus	2	4
	Vision problems	1	2
	Cataract	0	0
	Hearing difficulty	0	0
	Varicose vein	0	0

Type of treatment	Heart disease	0	0
	Thyroid disorders	1	2
	Kidney disorders	0	0
	Undergone surgery	11	22
	Others	9	18
	Medications	0	0
	Diet	0	0
	Both	0	0
	Mineral supplement	15	30

Table 7: Percent distribution of participants based on personal medical history.

Based on the self-reported medical history of the participants table 12 indicates the presence of following diseases, obesity (10%), hypertension (2%), Diabetes (4%). The prevalence of diabetes, hypertension, obesity and central obesity and hypercholesterolemia are considered to be the major risk factors of non communicable diseases (Esteghamati *et al.*, 2009). Vision problems (2%) were reported by a small percent of the participants, while 22% of the participants have undergone surgery and 18% of the participants faced some other medical problems such as PCOD, migraine etc.

Oral health: There is a well-documented relationship between metabolic syndrome and periodontal disease. Both of these are associated with systemic inflammation, insulin resistance and endothelial dysfunction and these two are linked through a common patho physiological pathway. The percent distribution of participants based on oral health is presented in table 8.

Particulars		N=50	Percent
Dental problems	Yes	12	24
	No	38	76
Dental problems faced	Bleeding gums	1	2
	Dental caries	5	10
	Loss of teeth	5	10
	Others	1	2

Table 8: Percent distribution of participants based on oral health.

Twenty four percent of the participants in the presented study indicated that they had dental problems. Dental caries (10%) and loss of teeth (10%) were the most prevailed dental problem followed by bleeding gums (2%) and other problems (2%). It is speculated that eating sugary and processed foods that offer very little protection to the teeth might be the reason for dental caries among this population.

Family history of diseases: A likely family history of metabolic disorders is also an important means for diagnosis and assessment of risk (Rich *et al.*, 2009). Identification of familiar risk is likely to be of benefit because person's who are at risk can prevent or postpone the onset of the disease condition through lifestyle and medical therapy (Pereria *et al.*, 2002). Hence the information regarding family history and personal history of diseases was elicited from the form the participants.

Metabolic syndrome is subjective to the nutrition intake, physical activeness and socio-economic factors like family history along with behavioural factors (Liese *et al.*, 1997). To a

large extent metabolic syndrome can be reasoned by the familiar causes of diabetes, hypercholesterolemia and hypertension. The percent distribution of the participants based on family history is presented in table 9.

Family member	Disease condition						
	Obesity	Heart diseases	High blood pressure	Diabetes	Thyroid disorder	Cancer	Dyslipidemia
Father	2	2	-	4	-	-	-
Mother	-	2	2	-	-	-	-
Brother	-	-	-	-	-	-	-
Sister	2	-	-	-	-	-	-
Paternal grand parents	-	-	2	8	-	-	-
Maternal grand parents	-	-	-	2	2	2	-
Son	-	-	-	-	-	-	-
Daughter	-	-	-	-	-	-	-
Husband	-	4	6	6	-	-	-
Wife	-	-	-	-	-	-	-

Table 9: Percent distribution of participants based on family history of diseases.

The percentage of paternal grandparents has a history of diabetes and high blood pressures are 8% and 2% respectively. Husband suffered from diabetes, high blood pressure, heart disease are 6%, 6% and 4% respectively. The percentage of participants with a maternal history of cancer, thyroid and diabetes was 2% each. Obesity was seen in both father and sister with prevalence of 2% each. The percentage of participants with a mother's history of high blood pressure and heart disease was 2% each.

4. Nutritional status assessment

a. Anthropometric measurements: Anthropometric measurements like height, body weight, waist circumference was measured and Body Mass Index calculated for all participants. The mean anthropometric measurements were presented in table 10.

Anthropometric measurements	N=50 (Mean $\pm$ SD)
Height (cm)	185.24 $\pm$ 12.204
Body weight (kg)	65.13 $\pm$ 0.707
Waist circumference (cm)	86.7 $\pm$ 6.363
BMI (kg/m ²)	25.66 $\pm$ 0.070

Table 10: Mean anthropometric measurements of the participants.

The BMI of the participants was calculated using the body weight and height measurements. The percent distribution of participants based on the cut-off values for Body Mass Index, waist circumference and hip circumference as indicators of obesity is presented in table 11.

Anthropometric measurements				N=50	Percent
BMI (kg/m ²)	Underweight	<18.5	Low	-	-
	Normal	18.5-22.	Average	10	20
	Over weight	23-24.9	Increased	16	32
	Obese I	25-29.9	Moderate	20	40
	Obese II	≥30	Severe	4	8
Waist circumference	Female (<80 cm)			33	66
	Female (>80 cm)			17	34
Hip circumference	Female (<97 cm)			33	66
	Female (>97 cm)			17	34

Table 11: Percent distribution of participants based on BMI, waist circumference & hip circumference.

*Abdominal obesity criteria (waist and hip circumference cut-off points) for South Asians (Misra et al. 2009)

Body Mass Index: The results of the present study indicate that 20 percent of the participants had normal weight. Based on the BMI values 40 percent and 8 percent of the participants were in the obese I and II categories respectively, while 32 percent were overweight. BMI is considered to be a strong predictor of metabolic syndrome and a high BMI is robustly associated with an in higher risk for metabolic syndrome (Cameron *et al.*, 2004).

Waist circumference: Table 16 indicated that 34 percent had a waist circumference of more than 80 cm while 66 percent of the participants had a waist circumference of less than 80 cm. As per the waist circumference cut off points for South Asians, a waist circumference of >80cm indicates abdominal obesity which is an risk factor of metabolic syndrome.

Hip circumference: Table 16 indicates that 34 percent had a hip circumference of more than 97 cm while 66 percent of the participants had a hip circumference of less than 97 cm. As per the hip circumference cut-off points for South Asians, a hip circumference of >97 cm indicates abdominal obesity which is the other risk factors of metabolic syndrome.

b. Biomedical & biochemical status

Blood Pressure levels

The systolic and diastolic blood pressure of the participants were measured in the seated position after a five minute gap using a digital blood pressure measuring machine and recorded in mmHg. The mean blood pressure levels of the participants and percent distribution of participants according to blood pressure level is presented in table 12.

Blood Pressure (mmHg)		N=50	Percent	Mean ± SD
Systolic blood pressure	Normal (<120mmHg)	27	54	110.407±7.071
	Pre hypertension (120-130mmHg)	15	30	121.75±0.707
	Stage I hypertension (131-159mmHg)	7	14	134.714±7.071
	Stage II hypertension	1	2	161±0

	(≥160mmHg)			
Diastolic blood pressure	Normal (<80mmHg)	16	32	74.437±3.535
	Pre hypertension (80-89mmHg)	26	52	81.653±3.535
	Stage I hypertension (90-99mmHg)	4	8	93.5±1.414
	Stage II hypertension (≥100mmHg)	4	8	109.75±13.435

Table 12: Distribution of participants based on Blood Pressure levels.

Table 12 indicates that 54% and 32% of the participants had normal systolic and diastolic blood pressure respectively. 30% of the participants had a systolic blood pressure of 120-130 mmHg and were identified to be pre hypertension stage. 14% and 2% of the participants were identified to be of stage I and stage II respectively. Based on diastolic blood pressure levels are pre-hypertension, stage I hypertension and stage II hypertension was observed in 52, 8 and 8 percent of the participants.

c. Dietary Practices: Dietary patterns may be very important in the prevention of chronic diseases. Healthy dietary practices are very important for the promotion of public health by improving their nutritional status and reducing risk factors responsible for morbidity and mortality due to many degenerative diseases. Overall food pattern is important in comparison of a single nutrient. The dietary practices of the subjects and their relationship with the risk factors of metabolic syndrome are presented in tables below.

Particulars		N=50	Percent
Type of meal	Vegetarian	5	10
	Lacto-vegetarian	16	32
	Lacto-ovo-vegetarian	3	6
	Ovo-vegetarian	2	4
	Non-vegetarian	24	48
Meal time regularity	Regular	37	74
	Irregular	13	26
Skipping meals	Yes	22	44
	No	28	56
Meal skipped	Breakfast	24	48
	Lunch	8	16
	Dinner	5	10
Frequency of skipping meals	Everyday	12	24
	Alternate days	1	2
	Twice a week	3	6
	Once a week	3	6
	Rarely	3	6
Appetite	Good	33	66
	Fair	10	20

	Poor	4	8
Place of eating foods	Home	42	84
	Hotel	22	44
	Cafeteria	-	-
	Mess	-	-

Table 13: Percent distribution of participants based on dietary habits.

Type of meal: Majority of the participants were non- vegetarian (48%) 32 percent were lacto vegetarian, 10 percent were vegetarian, 6 percent were lacto- ovo vegetarian and 4 percent were ovo vegetarian. Results of the Adventist Health study 2 suggest that a vegetarian diet is associated with prevention of metabolic risk factors.

Regularity of meals: Results indicate that 26 percent of the participants did not have meals at regular timings whereas 74 percent of the participants managed to have meals at regular timings in a day.

Skipping meals: Fifty six percent of the participants had a habit of having meals on time, while 44 percent had a habit of skipping meals. It was seen that maximum participant (48%) skipped their breakfast, 16 percent of the participants skip their lunch while only 10 percent of the participants skip their dinner.

Twenty four percent of the participants had a habit of skipping meals everyday while 6 percent of the participants had a habit of skipping meals twice a week, once a week and rarely each and only 2 percent of the participants skip their alternate meals.

Appetite: It was seen that 66 percent of the participants had a good appetite. 20 and 8 percent have their fair and poor appetite respectively.

Place of eating food: It was seen that 84 percent of the participants prefer to eat food at home when they skip their meals and stay hungry till their next meal while 44 percent of the participants prefer to eat at hotel when they skip their meals. Changes in the pattern of food consumption and higher levels of sedentary lifestyle are also a direct linkage to obesity and thereby Metabolic Syndrome.

Compensation of meal skipped: Distribution of participants based on food items consumed to compensate for meal skipped is presented in table 14.

Particulars	N=50	Percent
Coffee/Tea	33	66
Nankeen/Chips	-	-
Samosa/Kachodi/Pakor/Fast foods (fried rice, pizza, noodles burger, momos, spring rolls etc.)	5	10
Cakes	-	-
Biscuits	4	8
Cold drinks/Carbonated beverages	3	6
Fruits/Salads	5	10
Fruit juices	5	10
Stay hungry till the next meal	20	40

Table 14: Percent distribution of participants based on compensation of the meal skipped.

The current results of the study indicate that majority of participants (66%) compensated for the meal skipped by drinking coffee/ tea. 10% participants also ate samosas,

fruits/salads and fruit juices each. 8% of the participants were found to be eating biscuits to compensate the skipped meal while 6% preferred cold drinks/carbonated beverages. On the other hand 40% of the participants reported that they would stay hungry till the next meal.

Eating out: The distribution of participants according to the practice of eating out is presented in table 15.

Particulars		N=50	Percent
Habit of eating out	Yes	44	88
	No	6	12
How often	Everyday	14	28
	Alternate	29	58
	During weekends	12	24
	Occasionally	3	6
Most preferred eating outlets	North Indian	7	14
	South Indian	20	40
	Chinese	4	8
	Italian	2	4
	Tandoori	7	14
	Fast food outlets	19	38
	Street foods	18	36

Table 15 Percent distribution of participants based on the practice of eating out.

Table indicates that majority of the participants (88%) had the habit of eating out. 28 and 58 percent of the participants were in the practice of eating out regularly and on alternate days respectively. South Indian meals (40%) and fast food outlets (38%) were the most preferred food items while eating out.

Food item	Frequency of consumption					
	Daily	4days/ week	1-2 days week	Monthly	Rarely	Never
Rice	100.0	-	-	-	-	-
Chapati	24.7	1.005	1.19	-	-	-
Paranthas	1.30	0.94	1.29	0.99	0.14	-
Pooris	3.82	-	-	4.41	2.18	-
White bread	0.13	1.00	2.50	1.03	-	-
Brown bread	-	0.15	0.63	1.62	2.26	-
Sewiyan	-	0.15	0.63	1.67	2.26	-
Noodles/ Pasta/ Macroni	0.08	0.20	12.13	1.27	1.19	-
Cornflakes	0.3	0.68	1.5	3.6	4.3	-
Biscuits/Rusk	94.7	-	-	-	-	-
Oats	0.43	1.37	2.89	-	-	-
Dhaliya	-	0.38	0.6	0.12	0.9	-
Dhal preparations	2.37	0.16	0.84	-	-	-
Sprout preparations	-	0.02	0.63	2.01	2.001	-
Fried vegetable	0.80	1.69	1.50	0.45	0.21	-

preparations						
Cooked vegetables	3.11	0.92	0.63	-	-	-
Vegetable salad	0.69	1.02	2.95	-	-	-
Vegetable gravy preparations	0.11	1.07	1.11	1.51	0.80	-
Fried potato preparations	0.14	0.30	1.93	1.68	0.58	-
Red meat preparations	0.06	1.19	1.69	1.42	0.29	-
Liver (goat/ chicken)	0.06	0.42	1.99	1.54	0.65	-
Chicken (boiled/ roasted)	0.55	2.78	0.88	0.31	0.196	-
Chicken gravies	6.4	1.36	3.66	65.76	3.12	-
Fish (Boiled/ stewed/ roasted)	0.11	0.76	2.39	0.93	0.47	-
Fried fish	1.06	1.00	1.63	0.72	0.24	-
Fish gravy preparations	-	0.15	.002	0.03	6.41	-
Egg preparations	1.24	2.11	0.89	0.18	0.22	-
Egg with yolk preparations	-	1.06	0.34	0.09	0.11	-
Egg gravy preparations	1.24	1.05	0.55	0.09	0.11	-
Curd	1.85	1.52	0.77	0.56	-	-
Buttermilk	1.46	1.16	1.42	0.67	-	-
Milk preparations	-	0.44	0.78	1.59	1.84	-
Panner preparation	-	5.89	6.66	1.32	-	-
Chap preparations	-	-	0.05	267	2.11	-
Fruits	3.05	4.19	3.53	2.11	1.14	-
Ice-cream	-	0.018	0.29	-	-	-
Cakes	-	-	-	-	100.0	-
Salty snacks (chips/ namkeens/ mathri/ samosa/ kachori, etc.,)	1.36	0.74	1.23	0.82	0.50	-
Any other junk food (pizza, burger, etc.)	9.84	7.32	2.58	6.31	1.62	-

Table 16: Frequency of consumption many types of foods.

Information obtained from the food frequency questionnaire helped to characterize the usual food consumption of the participants and understand their dietary patterns. Data obtained from table 18 indicates that rice was consumed by all the participants and chapatti was eaten frequently. Consumption of healthy foods such as brown breads, oats, dalia etc. was very low. More percent of participants prefer cooked vegetables instead of vegetable salad or vegetable gravy preparation whereas chicken gravies and fried fish were preferred over boiled or roasted chicken and boiled, stewed and roasted fish respectively. Egg preparations and egg gravy preparations were preferred over egg with

yolk preparations. Curd was preferred over buttermilk by the participants. People do not preferred milk, paneer or chaap preparations. Consumption of fruits was preferred over cakes or ice creams. Any other junk food was more preferred over the salty snacks such as chips, namkeens etc. It indicated that the participants were not following healthy dietary pattern.

5. Screening for Metabolic Syndrome

Although BMI, LDL- cholesterol and total-cholesterol levels are not a part of diagnostic procedure for metabolic syndrome they were determined in the study as they are important indicators of cardiovascular health. LDL-cholesterol and total-cholesterol and levels of >100mg/dL and 200mg/dL respectively and BMI above 24.9 kg/m² was considered as a risk for metabolic syndrome and cardiovascular disease.

Anthropometric measurements, blood pressure levels and biochemical profile of the participants: The mean anthropometric measurements, blood pressure levels and biochemical profile of the 20 participants who were screened for the risk of metabolic syndrome is presented in table 17.

Parameters		Participants n=20
		Mean± SD
Age in years		43.55±8.66
Anthropometric measurements	Height (cm)	172.42±5.55
	Body weight (kg)	80.60±11.95
	BMI (kg/m ²)	27.09±3.78
	Waist circumference (cm)	94.93±7.30
Blood pressure levels	Systolic (mmHg)	121.94±10.11
	Diastolic (mmHg)	84.41±12.83
Biochemical profile	Total cholesterol mg/dl	195.53±34.77
	Triglycerides mg/dl	152.16±64.94
	HDL-cholesterol mg/dl	38.65±7.87
	LDL-Cholesterol mg/dl	157.71±38.22
	VLDL-Cholesterol mg/dl	30.51±14.0
	Fasting plasma glucose mg/dl	114.71±40.66

Table 17: Anthropometric measurements, blood pressure levels and biochemical profile of the participants screened for metabolic syndrome (n=20).

The mean age of the participants (n=20) of the third phase of the study who were screened for the presence of metabolic syndrome was 43.5±8.66 years.

Anthropometric measurements: Results presented in the table 32 indicates that the participants had a higher mean of anthropometric measurements and indices like waist circumference and BMI when compared to the normal cut off values.

Blood pressure levels: The mean systolic and diastolic blood pressure of the participants indicates that the participants were in pre hypersensitive stage.

Biochemical profile: Data from the above table indicates that the mean total cholesterol was within the desirable range but the mean triglyceride levels was above the optimal level. The mean HDL-cholesterol was less than the desirable value but the mean LDL and VLDL levels were found to be higher than the optimal values. The mean fasting plasma glucose levels indicate impaired glucose tolerance in the participants.

6. Co- relation of metabolic syndrome with nutritional status, lifestyle and existing health status

The percent distribution of the participants according to the presence of metabolic syndrome components as presented in table 18.

Metabolic syndrome	Number of components present	N=20	Percent
Presence	3	4	20
	4	3	15
	5	10	50
		17	85
Absence	0	-	-
	1	2	10
	2	1	5
		3	15

Table 18 Percent distribution of participants based on the presence of metabolic syndrome.

Based on the above data 20 women of Punjabi community were screened for the presence or absence of metabolic syndrome. Amongst 20 participants screened, the metabolic syndrome prevalence in the study was 85%.

Prevalence of metabolic risk factors: The percent distribution of participants based on the metabolic risk factors is presented in table 19.

Metabolic syndrome risk factors	Prevalence n=17		Mean $\pm$ SD
	N	%	
Waist circumference (cm)	14	82.35	94.937.30
Body Mass Index (kg/m ²)	14	82.35	27.093.78
Systolic blood pressure (mmHg)	5	29.41	121.9410.11
Diastolic blood pressure (mmHg)	6.	35.29	84.412.83
Total cholesterol (mg/dL)	7	41.17	195.5334.77
Triglycerides (mg/dL)	7	41.17	152.1669.94
HDL cholesterol (mg/dL)	12	70.58	38.657.87
LDL cholesterol (mg/dL)	13	76.47	127.8132.25
Fasting plasma glucose (mg/dL)	9	52.94	114.7140.66

Table 19 Percent distribution of participants based on the metabolic risk factors.

Anthropometric measurements: Table 19 indicates that the participants are at a great risk for metabolic syndrome and other cardio vascular diseases as majority of participants had elevated waist circumference (82.35%) and high body mass index (82.35%).

Blood pressure levels: Elevated systolic and diastolic blood pressure levels including hypertension was found in 29.41 percent and 35.29 percent of the participants respectively.

Biochemical profile: Results indicate that 41.17 percent of participants suffer from Hypercholesterolemia and Hypertriglyceridemia. Low levels of HDL and elevated LDL

cholesterol was seen in 70.58 percent and 76.47 percent respectively. Elevated fasting plasma glucose levels were seen in 52.94 percent of the participants. The results indicate a high prevalence of metabolic risk factors among the participants.

Risk factors of MS components and other CVD risk factors		With metabolic syndrome		Without metabolic syndrome	
		N=17	Percent	N=3	Percent
Waist circumference (cm)		16	94.11	2	66.66
Body Mass Index (kg/m ²)		16	94.11	2	66.66
Hypertension	Systolic BP (mmHg)	7	41.17	-	-
	Diastolic BP (mmHg)	9	52.94	1	33.33
Total cholesterol (mg/dL)		9	52.94	1	33.33
Triglycerides (mg/dL)		11	64.70	1	33.33
HDL cholesterol (mg/dL)		14	82.35	2	66.66
LDL cholesterol (mg/dL)		13	76.47	2	66.66
Fasting glucose (mg/dL)		15	88.23	1	33.33

Table 20. Prevalence of metabolic risk factors in presence & absence of metabolic syndrome

Table 20 indicates that there is a high prevalence of the metabolic risk factors in participants who had metabolic syndrome (n=17) as against those who did not have metabolic syndrome (n=3).

Anthropometric measurements: Among the participants who were diagnosed with metabolic syndrome 94.11 percent had elevated waist circumference and high BMI each while among the participants who did not have metabolic syndrome elevated waist circumference and body mass index was seen in 66.66 percent of the participants.

Blood pressure: Results indicate elevated systolic and diastolic blood pressure in 41.17 and 59.24 percent of the participants with metabolic syndrome while prevalence of elevated diastolic blood pressure was 33.33 percent and the participants who did not have metabolic syndrome.

Lipid profile: High total cholesterol level was seen in 52.94 percent of the participants who had metabolic syndrome while among those who did not have metabolic syndrome. 33.33 percent had hypercholesterolemia. There was high prevalence (64.70%) of hypertriglyceridemia in participants with metabolic syndromes while in participants who did not have metabolic syndromes the prevalence was very low (33.33%). A higher prevalence of elevated LDL cholesterol levels were observed in participants (76.47%) and without (66.66%) metabolic syndrome. Result indicated a high prevalence (82.35%) of low HDL cholesterol levels in participants who had metabolic syndrome while 66.66 percent of the participants without metabolic syndromes had low HDL cholesterol levels.

Fasting plasma glucose: Results indicate a high prevalence of impaired fasting glucose among participants who had metabolic syndrome. Elevated fasting glucose levels was seen in 88.23 percent of the participants with metabolic syndrome as against 33.33 percent in participants who were not having metabolic syndrome.

Conclusion

In India, epidemiological studies are being undertaken on the prevalence of hypertension, diabetes and metabolic syndrome but there is no adequate data on people of Punjabi community. Therefore, this study was conducted among the women of Punjabi community to evaluate and determine the risk factors of metabolic syndrome. Fifty women of Punjabi community of 18-55 years participated in the study. A non-experimental, cross sectional design was adopted and a structured pre tested questionnaire was used to obtain information pertaining to demographic status, occupational details, lifestyle practices (smoking and alcohol use, physical activity), sleep quality, health status, family history of non-communicable diseases and dietary habits. Anthropometric measurements such as body height, weight and waist circumference were recorded, BMI was calculated, systolic and diastolic blood pressure were measured for all the participants in the study. Finally 85% participants (17 out of 20) were found to have metabolic syndrome was considered present in individuals with three or more components.

It is necessary to educate the Punjabi people about physical impact of metabolic syndrome. It is necessary to educate them on eating healthy and undertaking substantial physical activities in order to stay healthy. Equally important is to devote time and energy towards other health promoting programmes such as quitting smoke and alcohol consumption, weight loss, cholesterol control and managing diabetes and blood pressure management in order to stay healthy and thus reduce the chances of occurrence of metabolic syndrome.

References

1. Adventist Health Study 2. Loma Linda University Health. <https://adventisthealthstudy.org/studies/AHS-2>.
2. Alberti, K.G.M.M., Eckel, R.H., Grundy, S.M., Zimmet, P.Z., Cleeman, J.I. & Donato, K.A. (2009). 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
3. Beltrán-Sánchez, H., Harhay, M.O., Harhay, M.M. & McElligott, S. (2013). Prevalence and Trends of Metabolic Syndrome in the Adult U.S. Population, 1999-2010. *J. Am. Coll. Cardiol.*, **62**, 697-703.
4. Cameron, A.J., Shaw, J.E. & Zimmet, PZ. (2004). The metabolic syndrome: prevalence in worldwide populations. *Endocrinology and Metabolism Clinics of North America*, **33(2)**, 351-375.
5. Eckel, R.H. (2012). The metabolic syndrome. In: Longo DL, Fauci AS, Kasper DL, Hauser SL, Jameson JL, Loscalzo J, eds. *Harrison's Principles of Internal Medicine*. 18th edition. 2012:1992.
6. Esteghamati, A., Meysamie, A., Khalilzadeh, O., Rashidi, A., Haghighizadeh, M., Asgari, F., Kamgar, M., Gouya, M.M. & Abbasi, M. (2009). Third national Surveillance of Risk Factors of Non-Communicable Diseases (SuRFNCD-2007) in Iran: methods and results on prevalence of diabetes, hypertension, obesity, central obesity, and dyslipidemia. *BMC Public Health*, **29**, 9-167.
7. Gupta, R., Deedwania, P.C., Gupta, A., Rastogi, S., Panwar, R.B. & Kothari, K.. (2004). Prevalence of metabolic syndrome in an Indian urban population. *Int. J. Cardiol.* **97**, 257-261.
8. Haffner, S. & Taegtmeyer, H. (2003). Epidemic Obesity and the Metabolic Syndrome. *Circulation* 108: 1541-1545. International Association for the Study of obesity. *Circulation*. **120(16)**, 1640-5. <https://doi.org/10.1161/CIRCULATIONAHA.109.192644>.

9. Liese, A.D., Maye-Davis, E.J., Tyroler, H.A., Davis, CE., Keil, U., Schmidt, M.I., Brancati, F.L. & Heiss, G. (1997). Familial components of the multiple metabolic syndrome: the ARIC study. *Diabetologia*, **40**, 963-970.
10. Misra, A., Wasir, J.S. & Pandey, R.M. (2005). An evaluation of candidate definitions of the metabolic syndrome in adult Asian Indians. *Diabetes Care*, **28**, 398.
11. Misra, A., Jywardhema, R. & Anoop, S. (2019). Obesity in South Asia: Phenotype, morbidities and mitigation. *Current Oesity Reports*, **8**, 43- 52.
12. Mnatsakanova, A., Gu, J.K., McCanlies, E.C., Hartley, T., Andrew, M.E., Violanti, J.M. et al. (2009). Lifestyle characteristics of police officers from a North east urban police department. Souce: Work, Stress and health; Global Concerns and Approaches. The 8th International Conference on Occupational Stress and Health, November 5-8, 2009, San Juan, Puerto Rico, Washington, DC: American Psychological Association
13. Nutrient Requirements and recommended dietary allowances for Indians. A Report of the Expert group of the Indian council for Medical Research (2010), National Institute of Nutrition, Hyderabad 500007, Andhra Pradesh, India
14. Pereria, M.A., Jacobs, D.R., Van Horn, L., Slattery, M.L. & Kartashov, A.I. (2002). Dairy consumption, obesity, and the insulin resistance syndrome in young adults: the CARDIA Study. *JAMA*, **287**, 2081-2089.
15. Prasad, D.S., Kabir, Z., Dash, A.K. & Das, B.C. (2012). Prevalence and risk factors for metabolic syndrome in Asian Indians: A community study from urban Estern India. *J. Cardiovasc. Dis. Res.*, **3(3)**, 204 – 211.
16. Pucci, G., Alcidi, R., Tap, L., Battista, F., Mattace-Raso, F. et al. (2017). Sex- and gender-related prevalence, cardiovascular risk and therapeutic approach in metabolic syndrome: A review of the literature. *Pharmacol Res.*, **120**, 34-42.
17. Rich, E.C., Bruke, W., Acaton, C.J., Haga, S., Pinsky, L., Short, M.P. et al. (2005). Reconsidering the family history in primary care. *J. Gen. Intern. Med.* **2(3)**, 315.
18. Sharkey, B.J. & Gaskill, S.E. (2007). Fitness & Health. 6th edition, Human Kinetics publications.
19. Terzic, A. & Waldman, S. (2011). Chronic disease: the emerging pandemic. *Clin. Translat. Sci.*, **4**, 225-6.
20. The global epidemic. IOTF report. 2010. Available at <http://www.iaso.org/iotf/obesity/obesitytheglobalepidemic/>.
21. Wang, H., Naghavi, M., Allen, C., Barber, R.M. & Bhutta, Z.A. (2016). Global, regional and national life expectancy, all-cause mortality, and cause-specific mortality for 249 causes of death, 1980-2015: a systematic analysis for the Global Burden of Disease Study 2015. *Lancet*, 1459-1544.