Chapter 5

Summary and Conclusion
Physical activity is a cost effective way to decrease obesity and other life style related health problems. People who exercise regularly are less susceptible to a number of chronic health conditions. Evidence also suggests that regular physical activity can contribute to improved mental health and feeling of well being.

The present study was conducted among 396 adult Punjabi (Khatri and Arora) males and females of Delhi. All the subjects had at least one symptom of metabolic syndrome. Out of 396 subjects, 286 were included as physically active and 110 were in sedentary group.

The concept of metabolic syndrome is useful because of its emphasis on underlying dysmetabolism and consequent co-existing of cardiovascular risk factors. Metabolic syndrome was defined according to the National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) guidelines as, meeting three or more of the following criteria: 1) waist circumference ≥102 cm for men and ≥88 cm for women; 2) serum triglyceride level of ≥ 150 mg/dL; 3) HDL cholesterol level , <40 mg/dL for men and , < 50 mg/dL for women; 4) fasting glucose level ≥ 100 mg/dL or use of antidiabetic medications (insulin or oral agents); or 5) systolic blood pressure ≥ 130 mmHg and/or diastolic blood pressure ≥85 mmHg, or use of antihypertensive medications.

**Objectives of research**

1. To study the socio-demographic profile, lifestyle and health parameters of adult Punjabi males and females of Delhi
2. To study and compare the impact of different patterns of physical activities on various obesity and cardio respiratory markers among adult Punjabi males and females of Delhi
3. To study and compare the impact of different patterns of physical activities on various obesity and cardio respiratory markers among adult Punjabi males and females in different follow up cohorts.
4. To study the distribution of metabolic syndrome (MS) and pre metabolic syndrome (PMS) and its correlation with various anthropometric measurements among adult Punjabi males and females.
5. To study the effect of different patterns of physical activity on symptoms of metabolic syndrome among adult Punjabi females and males.
6. To study the impact of socioeconomic factors on pattern of physical activity and symptoms of metabolic syndrome.
7. To study the effect of life style patterns on cardio vascular health.
8. To estimate the coronary heart disease risk of 10 years among adult Punjabi males and females of Delhi.
9. To find the association of obesity and its covariates with variants of uncoupling protein 1 (UCP 1).

Area and people

The present study was conducted on adult Punjabi (Khatri and Arora) males and females of Delhi. All the subjects were matched for their age, socio economic status, life style pattern and they all shared similar environment. All the subjects were countenance with same life style problems.

More than half of the males were self employed/business men and majority of females were homemaker. All the subjects followed Hindu religion. The present population followed endogamous system. They generally practiced caste endogamy and gotra exogamy which helps in maintaining common gene pool. Marriage was monogamous. Most of the males and females got married between the age of 22-26 years. The general lifestyle of most of the subjects was sedentary with less physical activity. Their staple diet was wheat. Food habits involved lots of fried eatables, fast food and sweets.

Methodology

Present study was follow up in nature with main aim to assess the impact of patterns of physical activity on indicators of metabolic syndrome and respiratory functions over a period of three consecutive months. The data was also collected cross sectionally among both sedentary and physically active group.

Data was collected by multistage stratified sampling method. Out of 456, 396 individuals met the conditions of inclusion criteria. Out of 396, 286 came under
physically active group and 110 under sedentary group. Among active group two categories were further made according to the pattern of physical activity followed, one with regular physical activity (at least 5 days/week brisk walk for 30 minutes and doing yoga for 45 minutes), and second with irregular physical activity (less than 5 days a week with no consistency). The data on sedentary group was taken only once, whereas both the active groups were followed for a minimum of three months.

Follow up Study

Subjects in the present study were voluntarily enrolled after explaining the aim of the study to them. All the subjects suffered from at least one symptom of metabolic syndrome for not less than 5 years. Active group followed the physical activity regime for 5 years but did not show any remarkable change in their health positive or negative by their self reported experience. After enrolling in the study, all anthropometric and physiological tests were performed; their social parameters and medical history were recorded. Wherever and whenever needed meetings were fixed with their doctors for better clarity about their health. According to the health status of the subjects, they were counseled for slight modification in their lifestyle and dietary pattern after consulting their doctors. Those who followed the instructions with respect to diet and exercise religiously were kept in regular physical activity group (RPA) and those who followed their previous routine and did physical activity for less than 5 days a week were kept in irregular physical activity group (IPA). These subjects were then measured again for two subsequent months with one month interval each.

The purpose of the study was explained to each subject and an informed written consent was taken from all the subjects prior to start the study. Ethical clearance was obtained from Departmental Ethical Committee.

The interview schedule was prepared under following headings:

- General information
- Socio economic status
- Physical activity pattern
- Life style pattern and food habits
Following measurements were taken on each subject

- Biological Measurements
- Stature
- Body weight
- Circumferences
- Skin fold thicknesses
- Physiological measurements
- Hematological parameters
- Obesity markers

Findings

Results are described according to objectives of the study under nine heading:

1. *To study the socio-demographic profile, lifestyle and health parameters of adult Punjabi males and females of Delhi*

Socio economic indicators like education, occupation and income of adult Punjabi females and males of Delhi were assessed among subjects in each pattern of physical activity group. Educational status among adult males and females in active group was found to be 52.4% as graduate, which was highest among all categories. Among males, more than half of the population (56.0%) and among females nearly half population (49.1%) was graduate. No subject was found to be illiterate. While among sedentary group, 2.7 % of the population was illiterate and 38.2% were senior secondary. Only 25.4% and 2.7% were graduate and post graduate respectively in sedentary group.

It has been found that among adult males and females of active group, 73.1% females were homemakers, 50% males were self employed and 24% and 18% were in government and private job respectively. While among sedentary group, 86% females were homemaker and 69.8% males were self employed, 3.8% and 17% males were in government and private job respectively.

The socioeconomic indicators were found to be associated with lifestyle health problems. It was found that higher education level and job as a profession led to active life style while lower education level and self employed individual were sedentary in
their life style pattern. This sedentary behavior corresponded to the increasing prevalence of symptoms of metabolic syndrome and obesity risk among them.

More than half of the population in both the group lived in joint families. It has been found that higher percentage of active males (54.0%) and females (80.6%) were vegetarian while higher percentage of non vegetarians was found in sedentary group among males (64.2%) and females (60.9%) respectively. Higher percentage of active males and females were regular in eating their breakfast while in sedentary group comparatively less percentage of males and females had regular breakfast. None of the sedentary group liked normal food, they preferred fried food, sweets and fast food. On the other hand among active group, 9.1% individual had normal food as their first preference followed by fast food, fried food and sweets.

Most of the males and females in active group watched TV for 1-2 hours per day. Higher percentage of males and females watched TV for 2-4 hours and 4 hours in a day respectively among sedentary group.

Most of the active group self perceived their health as average and they routinely went for their health check up compared to their sedentary counterparts. Both the groups preferred allopathic medicines. Smoking status and alcohol consumption was higher among sedentary group of males. All the females in both the groups were non smoker and non alcohol drinkers.

In active group higher percentage of males were regular in their physical activity as compared to females. Data on type of physical activity, duration of physical activity per day, frequency of physical activity performed in a week was collected among regular and irregular active group. Higher percentage of males (50.0%) and females (43.5%) practiced both yoga and walking for at least 30-45 minutes per day and five or more than 5 days a week in the present study.

2. To study and compare the impact of different levels of physical activities on various obesity and cardio respiratory markers among adult Punjabi males and females of Delhi

Sedentary males and females were found to be taller and heavier when compared with the regular activity group or irregular activity group. Regularly active males and
females had lower mean values for various circumferences, skinfold thicknesses, body composition variables, adiposity markers and blood pressure except grip strength and respiratory functions as compared to sedentary group and irregular activity group of males and females.

Regular activity males and females showed similar trend with respect to various anthropometric and physiological variables when compared to irregularly activity group and sedentary group of females and males.

When irregular activity group of females were compared with sedentary group, they were found to be heavier. Weight, circumferences, physiological measurements were lower among sedentary group of females while respiratory functions and adiposity markers were found to be higher among them when compared with irregular active group. On the other hand among males of irregular activity group, except physiological parameters, mean values of all the variables were higher when compared to sedentary group.

The skinfold thickness values at different sites were more among sedentary males and females with a more clear demarcation among females than males when compared to regular physical activity and sedentary group. The mean values of various skinfold thicknesses were higher among both males and females who followed irregular pattern of physical activity as compared to the sedentary group. Active and sedentary males showed similar pattern of fat distribution, with lowest fat deposits at biceps skinfold site and maximum at subscapular skinfold site. The subcutaneous fat distribution pattern differed between active and sedentary females with respect to subscapular skinfold site and calf posterior skinfold site. The pattern of subcutaneous fat was similar among males in regular activity group as well as in irregular physical activity group with the later having consistently more subcutaneous fat. Among adult females the group who exercised regularly was not only leaner than their counterparts, in irregular activity group, they also differed in their fat distribution pattern at sites calf posterior and suprailiac.

3. To study and compare the impact of different patterns of physical activities on various obesity and cardio respiratory markers among adult Punjabi males and females in different follow up cohorts

A marginal but statistically non significant decrease was observed in weight, systolic blood pressure, diastolic blood pressure, fasting blood sugar, fat mass and grand mean
Summary and Conclusion

thickness among males and females in regular physical activity group but reverse trend were observed among males and females in irregular physical activity group.

Fourteen subjects (seven females, seven males) volunteered to be measured monthly a longer period. They were followed up for twelve months. No significant change was observed in cardio metabolic variables and adiposity markers during follow up period among males and females, except for a decrease in systolic blood pressure and increase in haemoglobin level among males. Although they followed a regular pattern of physical activity, some of them reported that the diet regime could not be followed as per instructions due to their visits outside Delhi during this period. Using mixed effect model, it was found that reduction of body mass index (BMI) among females was more in comparison to males.

4. To study the distribution of metabolic syndrome (MS) and pre metabolic syndrome (PMS) and its correlation with various anthropometric measurements among adult Punjabi males and females

Distribution of males and females according to the pattern of physical activity and metabolic syndrome as per the definition of WHO, NCEP ATP III and IDF was calculated. Two categories were formed, one with metabolic syndrome (MS) and other with pre metabolic syndrome (PMS) (risk in less than three variables). Regular physical activity (RPA) was found to be associated with lower percentage of risk of metabolic syndrome according to all the three definitions. Irregular physical activity (IPA) according to WHO and NCEP ATP III showed less percentage of MS (32.1% and 48.2% respectively) as compared IDF (71.4%) among adult females and males.

High density lipoprotein (HDL) showed negative correlation with almost all the anthropometric measurements among females and males. Waist circumference (WTCR), systolic blood pressure (SBP) and diastolic blood pressure (DBP) showed positive and significant correlation with all the anthropometric measurements among both females and males. Fasting blood sugar (FBS) showed positive correlation with weight, circumferences, body composition variables while negative correlation with most of the skinfold thicknesses and physiological parameters like chest expansivity, average grip strength, FEV_{1.0}, BHT and MUAC among both females and males.
Mean, standard deviation and F test of various adiposity markers and respiratory parameters according to number of metabolic syndrome symptoms among adult females and males were analyzed. Mean values of fat percentage, waist hip ratio (WHR), waist height ratio (WHtR), various skinfold thicknesses and grand mean thickness (GMT) were found to be lowest among those who had one symptom of metabolic syndrome (MS) and highest with three or more than three symptoms of MS in both females and males. Average grip strength (AGS) and respiratory functions showed reverse trend.

5. To study the impact of different pattern of physical activity on symptoms of metabolic syndrome among adult Punjabi males and females of Delhi

Variables of metabolic syndrome among adult males and females following regular or irregular pattern of physical activity was considered. All the variables i.e. weight, waist circumference, systolic blood pressure (SBP), diastolic blood pressure (DBP), fasting blood sugar, BMI, WHR, total cholesterol (TC), triglycerides, low density lipoprotein (LDL) and ratio of TC and high density lipoprotein (HDL) showed lower mean values among regular physical activity group as compared to irregular physical activity group among both females and males. HDL among males was found to be lower among regular activity group of males although it was in normal range. The differences between two groups were statistically significant for all the variables except for SBP and DBP among males and females and fasting blood sugar among males.

Females showed higher percentage of metabolic syndrome according to NCEP ATP III definition as compared to their counterpart males. Irregular physical activity was found to be associated with higher risk of metabolic syndrome according to NCEP ATP III definition. The irregular pattern of physical activity increased risk of metabolic syndrome by 5.12 times more among females and 2.59 times more among males.

Females and males with irregular pattern of physical activity had higher mean values for all the variables except blood sugar, BMI and WTCR as compared to regular physical activity group among group having three or more symptoms of metabolic syndrome. Higher mean values of different variables including blood sugar, triglycerides, DBP, waist circumference, BMI and WHR were found among pre metabolic syndrome (PMS) subjects who followed irregular physical activity.
Physical activity pattern as a risk factor for various symptoms of metabolic syndrome using NCEP ATP III definition among adult females and males was evaluated. Females who were irregular in their physical activity showed 2.89 times more risk of abdominal obesity using waist circumference and 4.96 times increased risk of high blood sugar. Adult males who were irregular in their physical activity showed 4.23 times more risk of abdominal obesity using waist circumference.

Females with metabolic syndrome showed highest risk of having large waist circumference (12.71 times) followed by triglycerides (10.83 times), fasting blood sugar (6.76 times) and blood pressure (SBP 3.91 times & DBP 3.72 times). Among adult males with metabolic syndrome, it was found that risk was increased for triglycerides (20.42 times) followed by waist circumference (11.45 times), fasting blood sugar (11.00 times) and blood pressure (SBP 10.28 times & DBP 4.67 times).

6. To study the effect of socioeconomic factors on symptoms of metabolic syndrome and pattern of physical activity

Higher education was comparatively less common among sedentary individual and those who were irregular in their physical activity. In regular physical activity group, more percentage of females were doing jobs than the other two groups of females. Among males, in sedentary and irregular physical activity groups, more percentage of individual were self employed while in regular physical activity group, higher percentage were in service (Govt. or private).

A higher percentage of females and males of regular physical activity group did not miss their breakfast. Sedentary and irregular physical activity group showed higher percentage of skipping their breakfast or taking it on irregular basis among both males and females. Majority of the subjects in all the groups liked to spend their leisure time watching TV followed by reading and other activities but of different durations. Sedentary group of females and males preferred to watch TV for more than 4 hours a day while those who were irregular in their physical activity mostly watched TV for 1-2 hours or 2-4 hours. Regular physical active group liked to watch TV for less than an hour or 1-2 hours.
Summary and Conclusion

A high percentage of regular and irregular physical activity females perceived their health as average when asked about self perception of health, followed by good and poor category. However among males, in sedentary group self perception of their health was average followed by good and best. A small percentage of them reported their health to be poor.

Odds ratio between socio economic factors and pattern of physical activity showed risk factors to be low education level, homemaker status and self employment among irregular pattern of physical activity and sedentary groups of subjects.

7. To study the effect of life style pattern on cardio vascular health

Regular pattern of physical activity group of subjects showed higher percentage of normal values for various cardio-vascular and obesity markers among both females and males. Irregular pattern of physical activity increased the risk of regional and general adiposity markers.

Risk of irregular pattern of physical activity on cardio vascular and respiratory function increased among males and females. Males showed 9.10 times more chances for increased triglycerides levels with irregular pattern of physical activity.

8. To assess the coronary heart disease risk of 10 years among adult population of Delhi

Using Framingham scale, according to LDL points, females who were irregular in their physical activity showed higher risk of coronary heart disease (CHD). 11-20% increased risk was found among 18.7% adult females while in 21-30% and more than 31% risk category, 12.5% individual each were included.

Among males, according to LDL points, those who were irregular in their physical activity showed higher risk of CHD. 11-20% increased risk among 30% of adult males while in 21-30% risk category, 23.3% males were included, and in more than 31% risk category, 43.3% males were included. Higher percentage of risk was found among females and males with irregular pattern of physical activity as compared to those who were regular in their physical activity. Same trend was found with respect to cholesterol points.
9. To find the association of obesity and its covariates with variants of uncoupling protein 1 (UCP 1)

Among females, the polymorphic form (GG genotype) of UCP 1 showed higher mean values of BMI, fat %, GMT, WHR, WHtR, WC, SBP and DBP as compared to other two genotypes. On the contrary, GG genotype among males showed lowest mean values of all the obesity markers and blood pressure and the wild type (AA genotype) showed higher means.

Among females, means of all the skinfolds showed highest values in polymorphic form of UCP 1 when compared to other variants. Suprailiac skinfold thickness showed higher mean value in polymorphic form of UCP 1 among females. Opposite trend was observed among males i.e. lowest mean values were found in GG variant of UCP 1. However, suprailiac skinfold showed highest mean value in polymorphic form among males also.

Among females with heterozygous genotype (AG), correlation of SBP and DBP with WC, fat %, BMI, WHtR and WHR was found to be statistically significant. Among females in polymorphic genotype (GG), DBP was found to be correlated with WC and WHtR only. Among males no association was found between obesity markers and blood pressure in any of the genotypes.

The contrary results found among our females and males with respect to association of UCP1 with hypertension and obesity may partly be due to different pathways followed by this gene for its expression in genders. Further investigation is needed to find the more apparent depiction of uncoupling protein in different genders. The expression of UCP 1 variants in different socio-cultural and ethnic contexts may partially answer this as well as more data would be more explicit in explaining this discrepancy.

Conclusion

The present study was focused on patterns of physical activity and lifestyle health problems. Symptoms of metabolic syndrome are the upcoming problems among adult males and females of developed and developing countries. It was found that regular activity even of shorter duration is more beneficial than the irregularity of physical
activity. Irregular physical activity increases the chance of having symptoms of metabolic syndrome and other health problems. These problems and pattern of lifestyle interlinked with social factors like education, occupation, eating habits etc. Subjects with higher education and involved in jobs were found to be more in physical activity group and lower education and self employed or homemakers were more in sedentary group.

Regular physical activity group showed lower mean values for various cardio metabolic variables like blood pressure, fasting blood sugar, triglycerides, and adiposity markers when compared to sedentary group. Irregular physical activity group showed fluctuations in the mean values when compared to other two groups among females and males. This could be due to regular interruption in their physical activity level, their metabolic rate is also affected.

During the follow up study all the cardio vascular variables i.e. blood pressure, fasting blood sugar, triglycerides and general and regional adiposity markers marginally decreased consistently from first month to third month of follow up among regular activity males and females. Reverse trend was observed among males and females engaged in irregular pattern of physical activity except for respiratory functions.

Irregular activity females and males had higher percentage of metabolic syndrome compared to regular activity group. Mean values of variables of metabolic syndrome among regular activity group of males and females were found to be statistically lower when compared to irregular activity group.

Females and males with irregular pattern of physical activity had higher risk of increasing regional and general adiposity compared to the regular physical activity group.

Higher percentage of LDL and cholesterol risk was found among females and males with irregular pattern of physical activity.

Among females, polymorphic form of genotype (GG) showed high mean values for obesity markers and blood pressure followed by heterozygous form (AG/GA) and wild type (AA type) of UCP 1. UCP1 showed a strong link between blood pressure and
obesity phenotypes among females, so it may be considered an excellent candidate gene for cardiovascular disease among females. On the other hand no association was found among males with polymorphic variant of UCP 1 and the same needs further research.

**Suggestions**

Metabolic syndrome is caused by various cardio metabolic factors acting together. Some can be modified, such as excessive weight, physical inactivity or smoking. Others can’t be controlled, such as having a genetic predisposition or growing older.

Healthy lifestyle changes are the first line of action for control of metabolic syndrome.

- **Lose weight**: People who are overweight /obese should try to reduce their weight and reach a body mass index (BMI) of less than 25.
- **Increase physical activity**: 30 minutes a day of physical activity on most days will increase weight loss, and improve strength and conditioning. People with metabolic syndrome are urged to keep up at least a moderate level of activity but performed regularly.
- **Eat healthy**: Caloric intake should be adjusted with metabolic rate to maintain a healthy weight.
- **Quit smoking**: Smoking cigarettes increases insulin resistance and worsens the health consequences of metabolic syndrome, including risk of heart disease and heart attack.

Medication can help if lifestyle changes alone cannot affect desired goals. Drug treatment in coordination with lifestyle changes can help people lower blood pressure, control cholesterol, quit smoking or lose weight.

There is no magic bullet to treat or prevent metabolic syndrome except healthy lifestyle. Any progress with adopting healthy behaviors lowers the risk of more serious diseases. Regular brisk walking and reduced calories can show immediate gains in reduction of general and regional adiposity, blood pressure, improved cholesterol and blood sugar levels.