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# BODY MASS INDEX AND ITS CORRELATION WITH SOCIO-DEMOGRAPHIC INDICATORS AMONG STUDENTS OF A MEDICAL INSTITUTION, LAHORE.

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**ABSTRACT**

*The purpose of this study was to assess the status of Body Mass Index (BMI) and to find out the relationship of dietary factors, physical activity, addiction pattern and family history of obesity, diabetes and hypertension with BMI. In addition to identify risk group for focused intervention of modification in lifestyle and information, education and communication (IEC). This is a cross-sectional study on the students of King Edward Medical University {including those of MBBS & BDS), from May 2008 to Sept. 2008. Data was collected from 160 students by systematic random sampling technique, Desired information was collected by administering a questionnaire. Data was compiled, analysed for percentages and proportions, calculation of BMI & factors associated with BMI were evaluated by using SPSS and descriptive analysis technique (Chi-Square) and P value < 0.05 was considered significant. Among the 160 students under study, 68 were males and 92 females. Twenty seven (18.8%) were in category of pre-obese and obese (BMI 25-29.9 & above) and among the rest 119 (74.41%) were within normal range of BMI (18.5-24.9) and 14 (8.8%) were under weight (BMI < 18). Though 27.5% students were asked to take energy dense food 2-3 times/ week but it showed non-significant relationship with BMI (30 & above) (P=0.2219). Significant relationship was observed between high BMI and no sports activity as walking, brisk walking and jogging (Chi square 24.1, 10.7 and P value 0.000019 and 0.001) respectively. Positive family history of obesity, hypertension and diabetes of the respondents had also strong significant relationship with BMI > 29.9. Long study hours (> 5-7 hrs/day) did not show any significant relationship with high BMI (p=0.86). In conclusion though obesity is not high among the students of KEMU (18.8%) the correlating factors as low physical activity, no sports activity and positive family history of obesity, hypertension and diabetes related to the students falling in category of pre-obese and obese are concluding risk factors for their future health.*

***Key words:*** *Body Mass Index, Students (KEMU), Correlates.*

## INTRODUCTION

Body Mass Index (BMI) is calculated from a person's body weight and height. BMI is a reliable indicator of body fatness It does not measure body fat directly, but correlates to direct measures of body fat, such as underwater weighing and dual energy x-ray absorptiometry (DXA).[1,2] BMI can be considered an alternative for direct measures of body fat. Additionally, BMI is an inexpensive and easy-to-perform method of screening for weight categories that may lead to health problems.[3] BMI is used as a screening tool to identify possible weight problems for adults. However, BMI is not a diagnostic tool. For example, a person may have a high BMI. However, to determine if excess weight is a health risk, a healthcare provider would need to perform further assessments. These assessments might include skin-fold thickness measurements, evaluations of diet, physical activity, family history, and other appropriate health screenings.[4] Calculating BMI is one of the best methods for population assessment of overweight and obesity. As calculation requires only height and weight, it is inexpensive and easy to use for clinicians and for the general public. The use of BMI allows people to compare their own weight status to that of the general population.[5]

$$\text{BMI} = \frac{\text{Weight (in Kg)}}{\text{Height (in m}^2\text{)}}$$

| BMI | Weight Status |
|---|---|
| Below 18.5 | Underweight |
| 18.5 – 24.9 | Normal |
| 25.0 – 29.9 | Overweight |
| 30.0 & above | Obese |

Obesity develops when energy intake continuously exceeds energy expenditure, causing a fundamental chronic energy imbalance. Societal and

behavioral changes over the last decades are held responsible for the considerable increase in sedentary lifestyles and inappropriate dietary patterns. The role of dietary fat and other dietary factors in the etiology and maintenance of excess weight is controversial.[7] The increasing prevalence of obesity worldwide is a major public health concern.[8] Adverse secular trends of obesity have been observed in both developed and developing countries. In low-income countries, obesity is more common among middle-aged women, people of higher socioeconomic status, and people living in urban communities. In more affluent countries, obesity is not only common among middle-aged persons but is becoming increasingly prevalent among younger adults and children.[9] The prevalence of obesity in the western countries is suggested to vary between 15 and 20 percent.[10] According to the World Health Organization, this global epidemic is replacing more traditional public health concerns, such as malnutrition and infectious diseases, as one of the most significant contributors to ill health.[11] Overweight and obesity, often measured as body mass index (BMI), have been shown to be associated with adverse levels of blood pressure and serum lipids.[12] Longitudinal studies demonstrate a direct association between increase in BMI and adverse changes in most of the established risk factors for cardiovascular disease.[13] To reverse the ongoing obesity epidemic, it is important to assess lifestyle determinants of BMI and its increase over time. Cross-sectional studies have addressed this issue,[14] but only a few longitudinal studies have assessed the associations between lifestyle factors and BMI.[15] In the Tromsø Study, a longitudinal study of more than 11,000 men and women who had their height and weight measured at least three times between 1979–1980 and 2001, aimed to assess the associations between lifestyle factors and BMI and its change over time using multilevel analyses.[16]

The purpose of this study was to investigate the dietary factors associated with body mass index (BMI), and to analyse whether dietary intake varies between medical undergraduates along with different levels of sports participation.

## SUBJECTS AND METHODS

The subjects were the students from MBBS & BDS classes (1st and 2nd year) in KEMU. Minimum calculated sample of 160 students was taken and they were interviewed using systematic random sampling technique: Every 10th student of each class was interviewed, after getting a sampling frame from attendance register of each class. A self structured questionnaire was administered to the study subjects and required information was collected. Weight and height of each study subject was recorded by standardised weighing scale and by measuring tape against the wall method respectively. Data was compiled and analysed by the help of SPSS version 10. Frequency distribution, percentages, proportions, BMI calculation, cross-tabulation of variables, means and standard deviations of continuous variables were calculated and statistical test (Chi-square) was applied to find out statistical significance between dependent and independent variables (BMI and its correlates). P value < 0.05 was found to be significant.

**Operational definitions for correlates of BMI;**

- Sports activity of subjects daily, 2-3 times/ week or occasionally.
- Physical exercise as 30 min. walk or jogging daily or weekly.
- Study hours/day while sitting in the chair.
- Consumption of energy dense food, daily, weekly or monthly.
- Family history of obesity, diabetes and hypertension.
- Smoking and drug addiction behaviour of respondents.

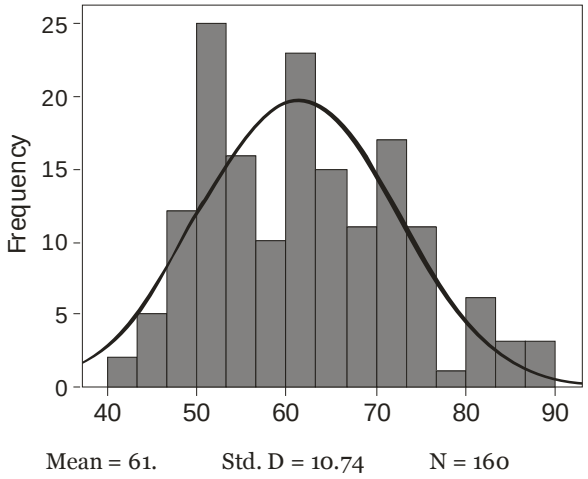
## RESULTS

A total of 160 medical students were recruited to the study, 68 males and 92 were females. Among them 61.3% students were between age group of 21 -27 years, 35.6% between 25-27 years and 3.1% were 25 years and above. Minimum age among subjects was 17 years and maximum was 28 years. Ages were normally distributed with mean age of 21.4, median of 21.30 and mode of 24.0 with a standard deviation of 2.0.

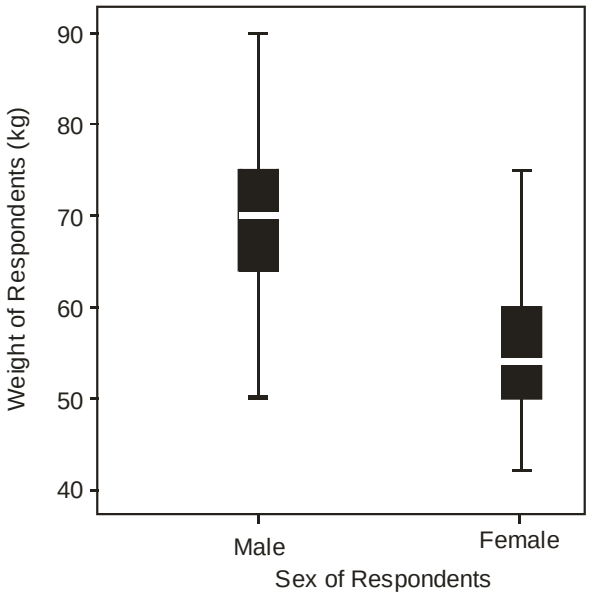
Minimum weight of subjects was 42 kg and maximum 90 kg, mean weight was 62.59 kg with a median of 60, mode 50 and standard deviation of +10.74 kg. Most of the respondents were between weights of 50 – 75 kg. Mean weight among males was 70 kg with inter quartile range of 40 kg and mean weight among females was 55 kg with inter quartile range of 32 kg (Graph 1 & 2).

Height was normally distributed among respondents with mean of 1.65 meters and mode of 1.60 with a standard deviation of .09. Minimum height was 1.37 and maximum height was 1.88. Mean height in males was 1.73 meters and among females it was 1.63 meters in females. Height was normally distributed among respondents with a mean of 1.65 meters and mode of 1.60 with a standard deviation of .09. Minimum height was 1.37 and maximum height was 1.88 meters. Mean height in males was 1.73 meters and among females it was 1.63 meter.

Seventy four percent (74.4%) of the respondents were between normal range of BMI (18.5 -24.9),




**Graph 1:** *Weight of Respondents (kg).*




**Graph 2:** *Weight distributions among gender.*

15.6% were over weight (BMI 25.0 – 29.9), 8.8% were underweight (BMI < 18.5) & 1.3% were obese (BMI 30.0 and above).Mean BMI in the series was 22.3 with a median of 22.1 and mode of 22.3 and standard deviation of 2.87 suggesting a normal distribution of BMI among series. Mean BMI among females was 22.0 with inter quartile range of 11.0.

Mean BMI among males was 27.0 with inter quartile range of 13.0. Among the 160 students 81.2% were used to study for 5-6 hrs/day, 14.2% for 7 -10 hours per day and 4.6% study for more than 10 hours / day.

Seventy five per cent of the subjects were either not or occasionally involved in some out door and indoor sports activity. Among the remaining 10 per cent had sports activity on regular basis and rest 15 per cent had sports activity 2-3 times/week. Thirty two point five percent (32.5%) students were not doing any walk, jogging or Gym. activity while 28.8%, 30.0% and 8% were doing just walk, brisk walk and jogging for 30 minutes/day respectively. Only 6% of the students told that they take energy dense food (pizza, burgers, biryani etc.) daily, 27.5% 2-3 times/week and 66.5% on monthly basis.

History of Obesity in family was 24.6% students 39% had history of diabetes and 36.4% had hypertension in the family. Multiple risk factors were reported in 17.9% subjects. Ninety six point nine 96.9% of the respondents did not smoke while 3.1% were used to smoke 10 cigarette per day and none of the respondents was drug abused.

Occupation of respondent's parents depict that most of them belonged to upper middle class with 25% having one of the parents as doctor, 20.0% respondents' parents were teachers, 16.9%, 15.6% and 12.5%, of respondents' parents were engineers, office workers, bankers and lawyers respectively. In majority (78.1%) of respondents mothers were house wives.

In less than half (48.1%) of the respondents were over weight and obese (BMI 25 and above, had a positive history of obesity in family. The respondents who were under weight and normal (BMI 18-24.9) had positive family history of obesity in 19.5%. (Chi-square 9.959, P < .002).

The (11.3%) students with +ve family history of diabetes were over weight and obese (BMI 25 and above), whereas 41.9% with a family history of diabetes were under weight and normal (BMI 18 - 24.9). Regarding no family history of diabetes 5.6% students were over weight/obese (BMI 25 and above) whereas 41.3% were underweight/normal respectively. Significant relationship was observed between high BMI and +e family history of diabetes (Chi-square 8.16, p= 0.0042). Twenty (22.2%) of the respondents with family history of hypertension were over weight or obese (BMI 25 and above) and 70 (77.8%) were normal/underweight, while 7(10%) respondents with no family history of diabetes were obese / over-weight and 63 (90%) were normal or under weight. The relationship was significant (Chi-square 4.19, p= 0.04051). Thirteen (48.15%) respondents who were used to do some out door sports regularly 2-3 times/ week were over weight or obese (BMI 25 and above) and 102 (76.6%) were normal/ under weight. When cross tabulated with 14 (51.85%) over weight and 31 (33.30%) with normal BMI among those who had no sports activity, showed significant relationship (chi - square 85.21, p = 0.000001).

**Table 1:** *Characteristics/variables of students under study (n = 160).*

| S. No | Characteristics / Variables | No. | (%) | Mean | Standard Deviation |
|---|---|---|---|---|---|
| 1. | Sex | | | | |
| | Male | 68 | (42.5) | | |
| | Female | 92 | (57.5) | | |
| 2. | Age (years) | | | | |
| | 17 – 20 | 57 | (35.6) | | |
| | 21 – 24 | 98 | (61.3) | 21 – 24 yrs. | 2.002 yrs. |
| | 25 & > | 05 | (3.1) | | |
| 3. | Weight distribution (kg) | | | | |
| | 40 – 60 | 71 | (44.37) | | |
| | 61 – 80 | 79 | (49.37) | 61.5 kg | 10 kg |
| | 81 & > | 10 | (06.36) | | |
| 4. | Height distribution (meters) | | | | |
| | 1.40 – 1.60 | 45 | (28.12) | | |
| | 1.61 – 1.80 | 104 | (65) | 1.656 m | .09007 m |
| | 1.81 & > | 11 | (6.88) | | |
| 5. | Body Mass Index distribution (BMI) | | | | |
| | Under weight (BMI < 18.5) | | | | |
| | | 14 | (8.8) | | |
| | Normal (BMI = 18.5 – 24.9) | | | | |
| | | 119 | (74.4) | | |
| | Over weight (BMI = 25 – 29.9) | | | | |
| | | 25 | (15.6) | 22.37 | 2.8774 |
| | Obese (BMI = 30 & >) | | | | |
| | | 2 | (1.3) | | |
| 6. | Study hours / day among respondents | | | | |
| | 5 – 6 | 129 | (81.2) | | |
| | 7 – 10 | 24 | (14.2) | | |
| | > 10 | 4.4 | (4.6) | | |
| 7. | Respondent's sports activity (Indoor / outdoor) | | | | |
| | Regular | 16 | (10) | | |
| | 2 – 3 times / week | 24 | (15) | | |
| | Don't play or very occasionally | | | | |
| | | 120 | (75) | | |
| 8. | Physical activity walk, jogging or Gym. Activity | | | | |
| | No exercise | 52 | (32.5) | | |
| | 30 min. walk daily | 46 | (28.8) | | |
| | 30 min. brisk walk | 48 | (30.0) | | |
| | Jogging / Gym. Activity | 14 | (0.8.7) | | |

The subjects (11.3%) who performed exercise were over weight or obese (BMI 25 & above), 55.6% of the respondents who played some out door sports were under weight or normal (BMI 18-24.9). Those who did not play any out door sports were over weight or obese (BMI 25 and above). Those (27.5%) who did not do any out door exercise were under-weight or normal (BMI 18 – (24.9). There is a non- significant relationship between BMI and exercise. (Chi-square .001 P > .05) (Table no: 27)

The 27 (16.87%) students who were overweight and obese (BMI 25 & >), 13.1% were studying for 5 -6 hours / day, 3.1% studied for 7-10 hrs./day and only one (0.6%) was used to study for > than 10 hrs. / day. Among the 133 (83.13%) who were within normal limits or under weight subjects 67.50% of them were used to study for 5-6 hrs. / day, 11.9% for 7-10 hrs./ day and 8.87% were used to study for > 10 hrs. of study / day. There is a non-significant relationship between BMI and the duration of study hours. (Chi-square. 334 P > .05).

Twenty one of the 27 respondents who were over weight or obese (BMI 25 and

above) said that they take energy dense food (bur-ger, Mayonnaise and biryani / pulao) daily, while 88 were under weight or normal (BMI 18 -24.9) and were us-ed to take energy dense food daily. Three (n-3) overweight and 35 nor-mal weight students we-re used to have energy dense food 2 – 3 times / wk. Again 3 obese and 10 normal weight stu-dents were used to have this type of food mon-thly. Analysis sho wed Chi-square 2.29 and P value 0.224.

| S. No | Characteristics / Variables | No. | (%) | Mean | Standard Deviation |
|---|---|---|---|---|---|
| 9. | Dense energy food intake among respondents (Burgers (Biryani / mayonnaise) | | | | |
| | Daily | 1 | (0.6) | | |
| | 2 – 3 times / wk. | 44 | (27.5) | | |
| | Monthly | 115 | (66.5) | | |
| 10. | Family history of obesity | | | | |
| | Yes | 39 | (17.9) | | |
| | No | 121 | (75.4) | | |
| 11. | Family history of | | | | |
| | Diabetes | 89 | (56.22) | | |
| | Hypertension | 90 | (58.1) | | |
| 12. | Smoking among students | | | | |
| | Yes | 5 | (3.1) | | |
| | No | 155 | (96.8) | | |
| 13. | Drug abuse | | | | |
| | Yes | 0 | (0.00) | | |
| | No | 160 | (100) | | |
| 14. | Occupation of: Fathers | | | | |
| | Doctors | 38 | (25) | | |
| | Agriculturists | 05 | (3.00) | | |
| | Teachers | 32 | (20) | | |
| | Businessmen | 35 | (20.9) | | |
| | Bankers / Engineers / Lawyers | 10.9 | (10.6) | (10.6) | |
| | Mothers | | | | |
| | Working | 124 | (78.1) | | |
| | Non-working | 36 | (20.9) | | |

## DISCUSSION

Among the 160 students under study 27 (17%) were found pre-obese and obese (BMI 25-29.9 &>) and about all these had sedentary life style i.e. no sports or any other physical activity. Obesity is a world wide wide escalating problem caused by a complex interaction of genetic, socio-demographic, behavioural and environmental factors. There is evidence that obesity develops when energy intake continuously exceeds energy expenditure, causing a fundamental chronic energy imbalance. Societal and behavioral changes over the last decades are held responsible for the considerable increase in sedentary life-styles,[17] as well as inappropriate dietary patterns including snacking, large portion sizes, soft drinks, high fat and energy dense diets.[18] The role of high dietary fat intake in the aetiology and maintenance of excess weight is controversial. Positive associations between dietary fat and excess body fat were observed in some studies, but not in others.[19]. Other dietary factors besides dietary fat are now considered to influence obesity i.e. carbohydrate, protein, fiber, energy density and glycaemic index.[20-21] Results of our study regarding relationship between BMI and high energy dense food are also incongruent to the positive association (P=0.2219). A better understanding of these factors is essential to innovate more appropriate health policies. The relative importance of dietary intake in the development of obesity is difficult to establish because of dietary reporting bias. In general, inaccurate energy intake reports result from under recording and under eating during the period of dietary registration or a combination of both.[22] Over recording may also occur, though infrequent. Studies identifying low energy reporters and factors associated with underreporting used the doubly labeled water technique,[23] or the ratio of energy intake to basal metabolic rate.[24,25] It has been observed that overweight and obese individuals tend to underreport their dietary intake to a greater extent than normal weight individuals.[26-27] This phenomenon may lead to the paradoxical observation that obese individuals appear to eat less than lean individuals. Sex, age, smoking,

**Table 2:** *Body Mass Index (BMI) by its correlates (n = 160).*

| Variables/ Correlates | | Body Mass Index (BMI) | | | | | | | | P.Value |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 18.5-24.9 & < 18 normal & underweight | | 18.5-24.9 Normal | | 25.0-30 & > Over weight & obese | | >30.0 Obese | | |
| | | No. | (%) | No. | (%) | No. | (%) | No. | (%) | |
| Outdoor/ Indoor Games | Regular | 69 | (51.8) | | | 4 | (14.8) | | | Pearson chi-square=85.21 p=0.0001 |
| | 2-3 times/ weeks | 33 | (24.8) | | | 9 | (33.0) | | | |
| | Occasional | 31 | (23.4) | | | 14 | (55.5) | | | |
| Walk/Jogging for 30 min/day | Yes | 89 | (66.9) | | | 9 | (33.3) | | | Pearson chi-sq.=10.67 p=0.0019 |
| | No | 44 | (33.1) | | | 18 | (66.7) | | | |
| Duration of study hours/day | 5-6 hrs/day | 108 | (81.2) | | | 21 | (13.1) | | | Pearson chi-square=0.334 p=0.86 |
| | 7-10 hrs/day | 19 | (14.2) | | | 5 | (3.1) | | | |
| | >10 hrs/day | 6 | (4.6) | | | 1 | (0.6) | | | |
| Intake of energy dense Food | Daily | 88 | (55) | | | 21 | (13.1) | | | Pearson chi-square=2.9 p=0.2247 |
| | 2-3 times/wk | 35 | (21.8) | | | 3 | (1.87) | | | |
| | monthly | 10 | (6.27) | | | 3 | (1.87) | | | |
| Family history of obesity | Yes | 26 | (19.5) | | | 13 | (48.1) | | | Pearson chi-square=9.959 |
| | No | 107 | (80.5) | | | 14 | (51.9) | | | p=0.002 |
| Family history of diabetes | Yes | 67 | (50.3) | | | 22 | (81.4) | | | Pearson chi-square=8.16 p=0.004 |
| | No | 66 | (49.7) | | | 5 | (18.6) | | | |
| Family history of hypertension | Yes | 70 | (77.8) | | | 20 | (22.2) | | | Pearson chi-square=4.19 p= 0.0401 |
| | No | 63 | (90) | | | 7 | (10) | | | |

physical activity level, educational level, body image, health consciousness and social desirability are other factors reported to affect the accuracy of self-reported dietary intake.[28-29] Some studies have examined the association of nutritional intake with BMI[30] and more specifically with overweight and obesity.[31-32] However, for a number of populations, including the Flemish, information on this relationship is missing. Also, although the associations of abdominal obesity with type 2 diabetes, cardiovascular disease and mortality appear to be stronger than for general obesity, only a few studies have reported results describing the relationship between dietary intake and waist circumference in a cross-sectional[33-34] or prospective design.[35-36] Moreover, dietary intake was not always the main focus in these studies.

In the present study among the 27 overweight and obese students 13 (48.1%) had positive family history of obesity while only 19.5% among the normal weight students. It had statistically significant association (p > =0.002). Similarly the over weight and obese students had positive family history of diabetes and hypertension up to significant statistical approach (p < 0.004 and 0.04) respectively and 30.7% of the respondents had family history of

obesity among all the risk factors, 66.9% had family history of diabetes among all the risk factors, 74.0% had hypertension. Similar study conducted in diabetic centre London, showed strong statistical association between obesity and above mentioned clinical diseases in the family.[37]

Regular and 2-3times/week sports activity whether indoor or outdoor among students of KEMU (under study) showed strong statistical relationship (highly significant, $p < 0.000001$) with normal BMI. Similarly regular brisk walk or jogging for 30 min/ day was also strongly related to normal BMI or vise a versa with high BMI ($p < 0.00109$). A study conducted to investigate the relationships of physical activity types and sedentary behaviour with BMI and waist circumference (WC). The sample comprised 6215 adults (2775 men, 3440 women) aged 16 years and living in Scotland. Self-reported physical activity of moderate to vigorous intensity (MVIA) included domestic activity, walking, and sports and exercises. MVIA levels were classified as being inactive, being insufficiently active, being sufficiently active for general health benefits and being sufficiently active for obesity prevention. Sedentary time was defined as television and other screen-based entertainment time (TVSE). Dependent variables were BMI-defined obesity (BMI-OB) and WC-defined obesity (WC-OB). TVSE was positively related to both WC-OB (adjusted OR 1.69 (95% CI 1.39, 2.05) for >/= 4 h of TVSE per d compared with < 2 h/d) and BMI-OB (OR 1.88; 95% CI 1.51, 2.35) independently of MVIA. In conclusion, physical activity and sedentary behavior were independently related to obesity. Public health recommendations should both promote physical activity and discourage engagement in sedentary pursuits.[38]

The number of study hours/ day (5-6 and 7-10 hrs. /day) among the respondents did not show any significant relationship with high and normal BMI in study (p=0.86).

It is **concluded** that although obesity is not very high among the students of KEMU (18.8%) but the correlating factors as low physical activity, no sports activity and positive family history of obesity, hypertension and diabetes are related to category of pre-obese and obese risk factors for their future health. Therefore public health recommendations should both promote physical activity and discourage engagement in sedentary pursuits. Hence this is the risk group for focused intervention of modification in lifestyle and information, education and communication (IEC).

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