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Prevalence of cardiometabolic risk factors among the students of North-east India: A cross sectional study in Vadodara

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Abstract

With changing lifestyle and urbanization, the prevalence of cardio metabolic risk factors are increasing across all ages. Scanty information is available regarding the prevalence of various cardiometabolic risk factors among the youth population of the North East students migrating for Higher Education. A cross sectional study design was used to assess the cardio metabolic risk factors among 168 college students. The overall prevalence of overweight and obesity were 16.67% and 18.45% respectively. The prevalence of dyslipidemia was also found in varied percentages among the subjects. Low levels of HDL cholesterol was found among 29.17% of the subjects, followed by 16.07% of subjects having high TG level and 44.64% subjects having high LDL cholesterol level. As the prevalence of cardio metabolic risk factors were found higher among the subjects, interventions should be focused primarily on intensive lifestyle management to avert the development of diabetes and CVD during the productive years of life.

Keywords: Cardiometabolic risk, hyperlipidemia, overweight, obesity, North-east, cross sectional

1. Introduction

Globalization has created a huge socioeconomic gap among the developing countries (Lai *et al.*, 2019) [1]. The existence of dark disparity between the rich and poor populations within the countries have exerted a strong pressure on people to migrate. The main segment of population is the youth that often migrates for the purpose of higher education or work opportunities (Davies, Blake, & Dhavan, 2011) [2].

Migrants in a host country enter a dietary acculturation process to adapt to the food culture of the host community. This complex process often increases the adoption of unhealthy habits like sedentary lifestyle, consumption of high energy dense foods (Bhopal *et al.* 1999; Fischbacher *et al.* 2004) [3, 4]. Throughout the life course, being overweight and obese is associated with multiple serious health consequences. Obesity is linked to an increased risk of hypertension, many NCDs (such as diabetes, coronary heart disease, stroke, and cancers), and conditions including obstructive sleep apnoea and osteoarthritis (WHO, 2017) [5].

Rapid transition in economy and demography of developing countries are increasing the prevalence of non-communicable diseases (NCDs) across all ages (Ahmed *et al.*, 2019) [6]. NCDs have become a major health concern and main reason for increase in morbidity and mortality worldwide. Mortality from many NCDs took an upward trend worldwide. It has disproportionately inflicted on the populations in low-middle income countries (LMIs), where more or less 75% of deaths occurring globally due to these causes (Gowshall & Taylor-Robinson, 2018) [7]. Globally, Cardiovascular diseases responsible for most NCD deaths, killing 17.9 million people in a year covering 31% of all deaths occurring globally and out of these, almost 85% death are occurring due to stroke and heart attack, followed by cancers (9.0 million), chronic respiratory diseases (3.9million), and diabetes mellitus (1.6 million) (WHO global status report on NCDs, 2017) [8].

In India, The burden of NCDs is escalating greatly, since the last decade. Around 5.7 million of all global deaths are occurring due to non communicable diseases, which has covered up to 60% of all deaths (Nethan, Sinha, & Mehrotra, 2017) [9].

NFHS-4 (2015-2016) data have shown that the prevalence of overweight and obesity among the adult male population of northeast ranges from 10.1-20.6%. Moreover, three northeastern states –Mizoram, Manipur and Arunachal Pradesh are found to be the top three states with high percentage prevalence of overweight and obesity in comparison with the other states of India (NFHS-4, 2015- 16) [10].

2. Materials and Methods

A cross sectional study design was used to assess the cardio metabolic risk factors among college youth belonging to the North East Indian States of The MS University of Baroda. Out of the total 179 (male 105, female 74) North-east students studying in The Maharaja Sayajirao University of Baroda and residing in the hostels of the university, 168 (male 94, female 74) were enrolled for the study. Anthropometric screening was done for 168 students. In the present study a detailed questionnaire was formulated to collect the background information, anthropometric data and medical history. The consumption pattern of foods, physical activity and diabetes risk was also assessed among the youth. Blood test was carried out to collect information regarding FBS, Lipid Profile, apo A, apo B, hs-CRP, and HOMA IR.

2.1 Ethical committee approval

Consent of the ethical committee was acquired prior to conducting the study (IECHR/2019/8). A written consent was also acquired from the subjects.

2.2 Statistical analysis

The data was entered into excel and then analyzed using Microsoft excel (2016) and SPSS (IBM SPSS statistics 22). Mean, standard deviation and percentages were calculated for all parameters that were exposed numerically.

3. Results

3.1 Socio-demographic characteristics

Out of the total 179 (male 105, female 74) North-east students studying in The Maharaja Sayajirao University of Baroda and residing in the hostels of the university, 168 (male 94, female 74) were enrolled for the study. Majority of the population i.e. 70.83% were from Manipur and other students were from Arunachal Pradesh (8.93%), Assam (17.26%), Nagaland (1.19%), Sikkim (1.19%), Tripura (0.59%) and Meghalaya (0.59%).

Majority of the subjects 82.74% were enrolled in graduation courses in the university, 14.28% were doing their post graduation and only 1.78% subjects were doing diploma.

All the subjects were unmarried and almost half of the population (57.73%) lived in nuclear family set up and 33.33% were living in a joint family. Other 8.93% of the subjects were found to be living in extended family. It was seen that 40.47% subjects were falling under upper class family and 27.97% were belonged to upper middle class family. The remaining 5.95%, 7.73% and 2.98% subjects were belonging to middle class, lower middle class and lower class respectively.

3.2 Family history of diseases among the subjects

Information regarding the family history of diseases among the subjects showed that the family history was highest for diabetes mellitus (35.11%) followed by hypertension (26.78%). The prevalence of cancer, hypo/hyperthyroidism, coronary heart diseases (CHD) were 9.52%, 7.74% and 4.17% respectively. Other diseases prevailed among the subjects were asthma (11.90%), stroke (13.69%) etc.

The current and past addiction pattern of the subjects was taken. The current addiction of cigarette smoking was highest (13.69%) followed by alcohol consumption (11.91%). Addiction of tea and coffee was also found to prevail among the subjects covering 9.52% and 11.31% of the total population. The past addiction of alcohol (6.54%) and

cigarette (4.76%) was also seen among the subjects.

3.3 Anthropometric, bio-physical and bio chemical characteristics

The average height of the subjects was 162.29 ± 8.23 cm while mean weight was 59.29 ± 11.69 kg. Table 1 shows the characteristic features of the study population, including BMI, WC, WHR, SBP, DBP, and blood glucose and lipid profiles. The mean values of the variables were as follows: BMI 22.9 ± 3.17 kg/m² (men), 22.60 ± 3.90 kg/m² (women), waist circumference (WC) 82.32 ± 7.55 cm (men) and 79.80 ± 10.70 cm (women), SBP 119.76 ± 10.97 mmHg, DBP 81.58 ± 8.15 mmHg, fasting blood glucose 80.95 ± 6.95 mg/dl, insulin 8.85 ± 6.69 μ IU/ml, HOMA IR 1.13 ± 0.83 , Triglyceride 102.34 ± 56.09 mg/dl, total cholesterol 166.38 ± 29.25 mg/dl, LDL-C 99.23 ± 25.70 mg/dl, HDL-C 43.2 ± 7.93 mg/dl (men) and 51.10 ± 10.10 (women), AIP 0.30 ± 0.18 , Apo a1 1.34 ± 0.18 (g/L) and Apo b 0.82 ± 0.23 (g/L).

3.4 Prevalence of overweight and obesity among the subjects

The overall prevalence of overweight was 16.67% (13.82% in males and 20.27% in Females) and obesity was 18.45% (19.14% in males and 17.57% in Females) according to the Asia-Pacific criteria. (Table2) The abdominal obesity as assessed by WC and WHR revealed that 30.95% (20.21% in males and 44.59% in Females) of the subjects had higher WC and half of the subjects i.e. 51.78% (45.74% in males and 59.46% in Females) were having high WHR increasing the risk for Cardio Vascular Disease. (Table3)

3.5 Prevalence of pre hypertension and hypertension

The prevalence of pre- hypertension was 35.11% and that of stage1 and stage2 hypertension was 4.16% and 1.19% respectively. Prevalence of pre-hypertension and stage-I hypertension was found higher among males than females. Prevalence of pre-hypertension, stage-I and stage-II hypertension among male were 43.62%, 6.38% and 1.06% respectively, whereas among female it was 24.32%, 1.35 and 1.35% respectively. (Figure 1)

3.6 Physical activity profile of the subjects

Physical activity pattern was assessed by International Physical Activity (Short) Questionnaire and the subjects were categorized according to their physical activity under 3 categories- sedentary, moderate and heavy. Around 27.38% of the total subjects were sedentary who burn less than 600 MET minutes/week and 49.40% of subjects were under moderate category. 23.21% of the subjects were coming under heavy category burning more than 3000 minutes/week. The mean hours spend sitting and sleeping were 10.00 ± 2.91 and 7.48 ± 1.29 respectively. (Table4)

3.7 Diabetes risk assessment

Diabetes risk was assessed with the help of "Online Diabetes Risk Assessment" created by IDF. It reveals that around 21.45% subjects were having slightly elevated risk of diabetes followed by moderate risk (4.16%) and high risk (1.78%). Prevalence of slightly elevated risk and moderately risk of diabetes were found comparatively high among females than males. Around 28.38% and 5.41% female were found to be having slightly elevated risk and moderate risk of diabetes, whereas among males it was 15.96% and 3.19% respectively. Moreover 4.05% females were seen to be at high risk of diabetes. (Figure 2)

3.8 Bio-chemical characteristics of the subjects

3.8.1 Glycemic profile of the subjects

Only 1.19% and 0.59% subjects were found to be having high FBS and serum insulin levels respectively. It was revealed that 88.09% of the subjects had optimal insulin resistance and 5.95% subjects had early insulin resistance followed by 4.16% having significant insulin resistance. (Table5)

3.8.2 Lipid profile and inflammation of the subjects

The prevalence of dyslipidemia was found to be prevailing in varied percentages among the subjects. Low levels of HDL cholesterol was found among 29.17% of the subjects, followed by 16.07% of subjects having high TG level and 44.64% subjects having high LDL cholesterol level. Prevalence of high total cholesterol and VLDL cholesterol was reported to be 9.52% and 8.93% respectively.

High cholesterol /HDL ratio was also found among 11.31% of the subjects and the also LDL/HDL ratio was seen high i.e. 4.76% among the subjects. Only a few of the subjects had high levels of apo A1 (1.19%) and apo B (2.38%) levels. The inflammatory marker hsCRP was found to be within the reference range with an average 2.39±5.61. It was observed that out of the total subjects 36.31% had higher hsCRP levels. (Table 5)

3.8.3 Prevalence of atherogenic indices

Prevalence of high atherogenic index of plasma (AIP) was found among 75.59% of the subjects. Prevalence of apoB and apoA ratio was found high among 34.52% of the subjects, which is a good indicator of developing cardiovascular diseases. 29.17% of the subjects were found to be having high non HDLC. Prevalence of other atherogenic indices such as L/H, TC/H and TG/H was ranging from 4.76%-11.31% of the subjects. (Table6)

4. Discussion

Worldwide, the prevalence of overweight and obesity have become more than double since 1980, which reached to 1.9 billion overweight and 600 million obese adults in 2014 (Shannawaz & Arokiasamy, 2018)^[11].

Table 1: Anthropometric, bio-physical and biochemical characteristics of the subjects (Mean±SD)

Variables	Mean	SD
BMI (Kg/m ²)		
Men	22.29	3.17
Women	22.60	3.90
WC (cm)		
Men	82.32	7.55
Women	79.80	10.70
WHR		
Men	0.88	0.05
Women	0.90	0.10
SBP (mmHg)	119.76	10.97
DBP (mmHg)	81.58	8.15
FBS (mg/dl)	80.95	6.95
Insulin (μIU/ml)	8.85	6.69
HOMA IR	1.13	0.83
Triglyceride (mg/dl)	102.34	56.09
Cholesterol (mg/dl)	166.38	29.25
HDL Cholesterol (mg/dl)		
Men	43.22	7.93
Women	51.10	10.10
LDL Cholesterol (mg/dl)	99.23	25.70
VLDL Cholesterol (mg/dl)	20.46	11.21
AIP	0.30	0.25
Apoa1 (g/L)	1.34	0.18
Apob (g/L)	0.82	0.23

Table 2: Prevalence of obesity among the subjects as per Asia Pacific BMI criteria, 2004

Category	BMI(kg/m ²)	Male (n=94) %	Female (n=74) %	Total (n=168) %
Underweight	<18.5	7(7.16)	6(8.10)	13(7.77)
Normal	18.5 – 22.9	56(59.57)	40(54.05)	96(57.14)
Overweight	23 – 24.9	13(13.82)	15(20.27)	28(16.67)
Obese	≥ 25	18(19.14)	13(17.57)	31(18.45)

Table 3: Prevalence of abdominal obesity among the subjects (NCEP ATP III criteria, 2001)

Parameters	Abdominal obesity		Male (n=94)%	Female (n=74)%	Total (n=168)%
	Cut offs				
	Male	Femlae			
WC	≥ 90 cm	≥ 80 cm	19(20.21)	33(44.59)	52(30.95)
WHR	≥ 0.90	≥ 0.85	43(45.74)	44(59.46)	87(51.78)

Table 4: Physical activity profile of the subjects

Category	Cut offs	Male (n=94)%	Female (n=74)%	Total (n=168)%
Sedentary	<600 MET minutes/week	12 (12.77)	34(45.94)	46(27.38)
Moderate	600 – 3000 MET minutes/week	44 (46.80)	39 (52.70)	83(49.40)
Heavy	>3000 MET minutes/week	38(40.43)	1(1.35)	39(23.21)

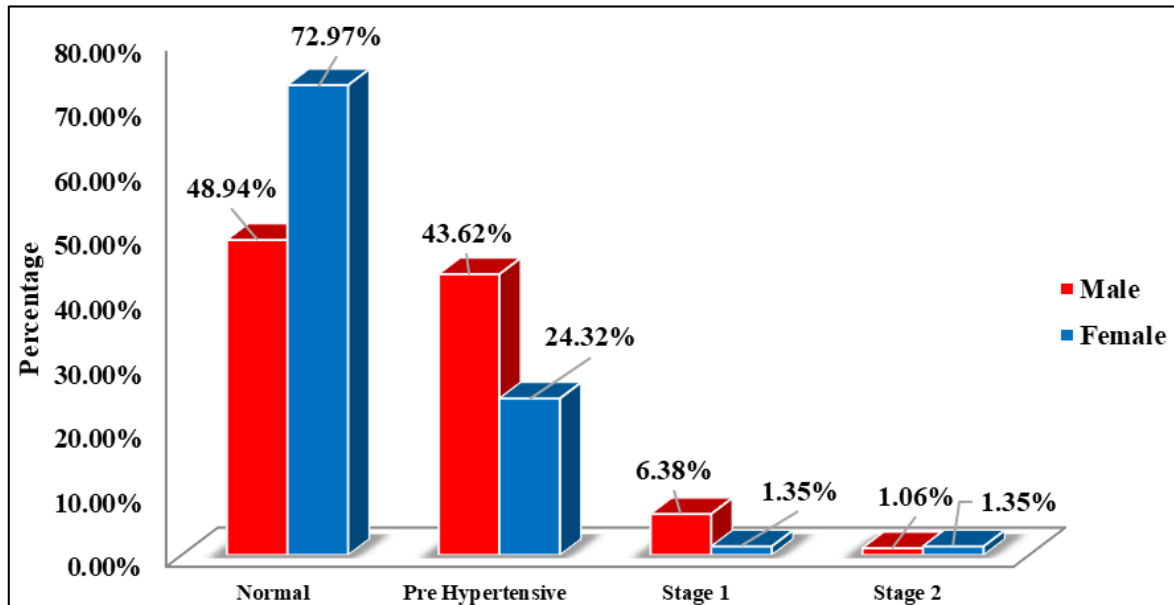


Fig 1: Prevalence of hypertension (2001 NCEP ATP III criteria)

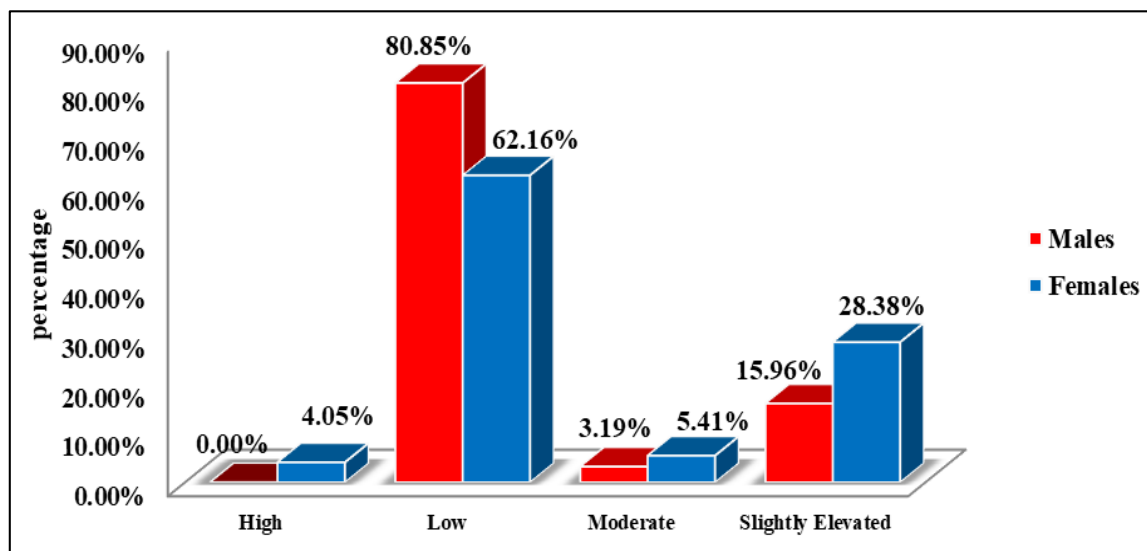


Fig 2: Prevalence of Diabetes Risk

Table 5: Glycemic profile of the subjects (NCEP ATP III criteria, 2001)

Variables	Cut offs	Male (n=94)%	Female (n=74)%	Total (n=168)%
FBS	≥ 110mg/dl	1(1.06)	1(1.35)	2(1.19)
Insulin	≥37.6 μIU/ml	1(1.06)	0	1(0.59)
HOMA – IR	Optimal insulin resistance, <1.9	82(90.11)	66(89.18)	148(88.09)
	Early insulin resistance, ≥1.9	4(4.40)	6(8.11)	10(5.95)
	Significant insulin resistance, ≥2.9	5(5.49)	2(2.70)	7(4.16)

Table 6: Prevalence of dyslipidemia & inflammation among the subjects (NCEP ATP III criteria, 2001)

Variables	Cut offs	Male (n=94)%	Female (n=74)%	Total (n=168)%
Triglyceride	≥150 mg/Dl	19 (20.21)	8 (10.81)	27(16.07)
Cholesterol	≥200 mg/dl	9 (9.58)	7 (9.45)	16 (9.52)
HDL Cholesterol	<40 mg/Dl male, <50 mg/Dl female	39 (41.49)	10 (13.50)	49 (29.17)
LDL Cholesterol	≥100 mg/dl	46 (48.93)	29 (39.10)	75 (44.64)
VLDL Cholesterol	>35 mg/dl	12 (12.77)	3 (4.10)	15 (8.93)
AIP	>0.21	69 (73.40)	33 (44.60)	102 (60.71)
Apoa1 (g/L)	>2.05	1(1.06)	0(0.00)	1(0.59)
Apob (g/L)	>1.3	2(2.13)	2 (2.70)	4 (2.38)
Hs-CRP	>3	13 (13.83)	12 (16.21)	25 (14.88)

Studies indicate that the world is witnessing a real obesity epidemic especially in more industrialized and economically developed countries. This epidemic has even spread to developing nations, wherein changing lifestyles accompanied by rapid urbanization have made it the most frequent metabolic disease, with major repercussions on the health of the population. Obesity is associated with increased morbidity and mortality (Martínez-Ros *et al*, 2001) ^[12].

In the present study, Information regarding the family history of diseases among the subjects showed that the family history was highest for diabetes mellitus (35.11%) followed by hypertension (26.78%). Information regarding addiction pattern was also elicited from the subjects and it was found that the current addiction of cigarette smoking was highest (13.69%) followed by alcohol consumption (11.91%). A study conducted in north India on the Prevalence, Pattern and Familial Effects of Substance Use Among the 256 Male College Students found that alcohol was most commonly used (53.5%), followed by smokers (27.3%) (Gupta S *et al*, 2013) ^[13].

The overall prevalence of overweight was 16.67% (13.82% in males and 20.27% in Females) and obesity was 18.45% (19.14% in males and 17.57% in Females). Similar study conducted among 188 adolescents subjects of Vadodara, India found that the prevalence of obese and overweight were 17.6% (33) and 20.2% (38), respectively (Pathak, S *et al*, 2018) ^[14].

The abdominal obesity as assessed by WC, WHR revealed that 30.95% of the subjects had higher WC and half of the subjects (51.78%) were having high WHR increasing the risk for Cardio Vascular Disease. The prevalence of abdominal obesity was

found higher among females (44.59%) than in males (20.21%), which is in line with a cross sectional study conducted among adults of Kerala (72.60% in female and 39.10% in male) (Sarma *et al*, 2019) ^[15].

Prevalence of pre-hypertension and stage-I hypertension was found higher among males than females. Prevalence of pre-hypertension, stage-I and stage-II hypertension among male were 43.62%, 6.38% and 1.06% respectively, whereas among female it was 24.32%, 1.35 and 1.35% respectively. Similar study conducted among adult students in Bangladesh including 184 adult university students (118 female and 66 male) found that higher prevalence of hypertension in male (12.1%) than in the female (3.4%) students (Ali *et al*, 2018) ^[16].

The data of the physical activity revealed that 27.38% in the present study were found to be physically inactive. Furthermore the average hour spend sitting and sleeping were 10 hours and 7.48 hours respectively, which might be one of the main reason for overweight and obesity. Similar results were found in a cross sectional study conducted on 300 medical and non medical students. 49% medical and 39% non medical students were found physically inactive. (Naim Z *et al*, 2016) ^[17].

Diabetes risk assessment revealed that around 21.45% subjects were having slightly elevated risk of diabetes followed by moderate risk (4.16%) and high risk (1.78%). Prevalence of slightly elevated risk and moderately risk of diabetes were found comparatively high among females than males. Around 28.38% and 5.41% female were found to be having slightly elevated risk and moderate risk of diabetes, whereas among males it was 15.96% and 3.19% respectively. Moreover 4.05% females were seen to be at high risk of

diabetes.

Abnormal lipid levels, another major risk factor for development of cardio vascular diseases were studied in the present study. Low levels of HDL cholesterol was found among 29.17% of the subjects, followed by 16.07% of subjects having high TG level and 44.64% subjects having high LDL cholesterol level. High cholesterol /HDL ratio was also found among 11.31% of the subjects. Prevalence of high AIP was found among 75.59% of the subjects. Prevalence of apoB and apoA ratio was found high among 34.52% of the subjects, which is a good indicator of developing cardiovascular diseases.

Around 29.17% of the subjects were found to be having high non HDL-C. Our results are in line with a cohort study conducted on Prevalence of dyslipidemia among 240 students of a Yemeni University revealed that hyper-triglyceridemia, high LDL-C and low HDL-C among the participating students were 23.8%, 31.7%, and 81.7%, respectively. Low HDL-C was the most prevalent type of dyslipidemia, followed by increased levels of LDL-C. Dyslipidemia is associated with atherosclerosis and increases the risk of CVDs (Al-Duais *et al*, 2019) ^[18].

A study on dyslipidemia and Related Risk Factors among 80 students (17-26 years) of Saudi University Community showed that the prevalence of hypercholesterolemia, hyper-triglyceridemia, high LDL-C, low HDL-C was 17.7%, 5.0%, 16.8%, and 46.3%, 150 respectively. Low HDL-C levels were the main prevalent dyslipidemia among participants. Overweight/obese students were more likely to show at least one undesirable lipid concentration. (Hamam, F *et al*, 2017) ^[19].

Our study also observed an increasing trend in consumption of high fat, energy dense food, sugar as well as meat. Those changes were found to be more prominent among the study population. Moreover, skipping meals and physical inactivity were another reason for increase in obesity as well as hyperlipidemia among the subject. Such changes in lifestyle after migrating to a different region could have contributed to increase in the prevalence of cardiometabolic risk factors.

5. Conclusion

The findings from this study substantiate the information regarding the prevalence of various cardiometabolic risk factors like high triglycerides, cholesterol, LDL, low HDL and abdominal obesity. These risk factors are found to be higher among the subjects indicating that these individuals are at higher risk of various non communicable diseases with advancing age. Interventions should be focused primarily on intensive lifestyle management to avert the development of diabetes and CVD during the productive years of life. Adolescent-specific interventions should be implemented in bringing a positive behavioral change regarding purchasing of food stuff and reading the food packaging labels before buying. Moreover, school or college based interventions would help in educating the adolescents to create awareness about healthy eating habits. Adolescents should be encouraged to prefer traditional and home-made foods instead of foods that are high in fats, sugar and salts. Limiting the consumption of HFSS foods, along with physical activity during the adolescent stage will help to maintain a healthy and productive lifestyle.

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