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COVARIATES OF OBESITY AMONG AFFLUENT KHATRI BOYS AND GIRLS OF CHANDIGARH AGED 11 TO 17 YEARS

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ABSTRACT

The present study is based on a cross-sectional sample of 1076 boys and girls (B: 540 and G: 536) ranging in age from 11 to 17 years, attending public schools in Chandigarh. Height, weight and BMI were taken on each subject using standard techniques. Information on family history of overweight/obesity and hypertension, dietary habits, dietary pattern, physical activity and television viewing were recorded using interview based schedule. According to BMI classification for Asian Indians, 37.0% Khatri boys and 43.1% Khatri girls were found to be normal; 35.4% boys and 28.5% girls fell in the category of underweight; 20.9% boys and 20.7% girls were overweight and 6.7% boys and 7.6% girls were obese The results clearly indicate that faulty dietary habits, low physical activity, duration of television viewing were found to be chief promoters of obesity .Odds ratios demonstrate that of all the covariates of obesity, eating while watching TV (2.83);consumption and frequency of junk food(2.65); non vegetarianism (1.84); breakfast skipping(1.63); television viewing for more than two hours (1.54)and family history of hypertension and obesity were positively associated with likelihood of being overweight and obese and indulgence in physical activity and outdoor games(4.2)decreased obesity.

Keywords: Body mass index, Overweight, Obesity, Physical Activity, Dietary Habits.

INTRODUCTION

Obesity arises as a result of a chronic positive energy balance with energy intake consistently outweighing expenditure. This can arise through an excess food intake, minimal energy expenditure or via a combination of both. Obesity is accumulation of excess fat to such an extent that health is impaired. When energy intake consistently exceeds energy expenditure there is an accumulation of excess adipose tissue, which builds up over a period of time and leaves a person at risk of overweight and obesity. The magnitude of the energy imbalance does not need to be large for a person to be at risk, for example it has been suggested that a negative energy imbalance of just 100 kcal/day would prevent unhealthy weight gain in approximately 90% of the US population (Hill *et al*. 2003). An imbalance between energy intake and expenditure could arise as a result of excess calorie intake, reduced physical activity or more likely through a combination of both.

The recent increases in child overweight and obesity are largely attributed to social and environmental forces which are not under the individual control of children and which, in turn, influence eating and physical activity behaviors (Swinburn *et al*., 1999). Important social changes have affected family eating patterns like the increased consumption of fast foods, pre prepared meals, and soft drinks. Likewise, the amount of physical activity that children engage in has been reduced by an increased use of cars, an increase in the amount of time spent watching television (with multiple TV channels around the clock) and playing sedentary games, and a decrease in the opportunities for physical activity on the way to school, at school, or during leisure time. Appropriate nutrition is essential for proper growth and development. Adequacy of nutrition depends on eating habits.

There is consistent evidence of positive associations between parental and offspring adiposity, with the offspring of overweight and obese parents at greater risk of obesity than those with normal weight parents (Parsons *et al*. 1999; Jotangia *et al*. 2005; Reilly *et al*. 2005). Research to date has focused mostly on the adiposity of offspring in childhood or adolescence (Maffeis *et al*. 1998; Burke *et al*. 2001; Davey Smith *et al*. 2007; Griffiths *et al*. 2007; Kivimaki *et al*. 2007; Lawlor *et al*. 2007), Khadilkar *et al*.2009; Marwaha *et al*.2011;Kaur et al,2012) although some studies (Charney *et al*. 1976; Lake *et al*. 1997; Whitaker *et al*. 1997; Williams, 2001; Crossman *et al*. 2006; Abu-Rmeileh *et al*. 2008; examine whether the association with parents is evident in the offspring's adulthood. Persistence of the association into the offspring's adulthood would be expected, given that adiposity tracks from childhood to adulthood (Parsons *et al*. 1999; Freedman *et al*. 2005). Gene–environment interaction may potentially be important in explaining why the direct effects on BMI tend to be so weak for the

common loci and could in part explain some of 'the missing heritability' in obesity (Manolio *et al*. 2009).Obesity is a problem of nutrient imbalance. More foodstuffs are stored as fat than are used for energy and metabolism. Most surveys suggest that energy intake is significantly lower in the overweight than in those of normal weight (Baecke *et al*. 1982). Researchers and public-health officials nonetheless insist that obesity is caused by overeating, without attempting to explain how these two notions can be reconciled. This increase in energy intake was "attributable primarily to an increase in carbohydrate intake." The NHANES (2005-06) data suggests that either calorie or carbohydrates could account for the increase in weight.

As incomes go up, the food basket becomes more diversified. Cereal consumption decreases and the consumption of other foods increase. Even though people spend a smaller share of their income on food, they spend more in absolute terms. The urban food basket is the most diversified. Urban people consume fewer cereals and more of other items. Protective foods such as pulses, fruit and vegetables, milk, eggs and meat (including mutton) are easily available in the urban environment.

In the past, the diet was not only rich in whole grains (rich in fiber) but there were also much higher grades of physical activity and this could explain the low prevalence of obesity and diabetes. This scenario is now replaced not only by excess intake of refined grains (low in fibre and micronutrients) but is also associated with sedentary activity and these could be the major drivers of the obesity, diabetes and CVD epidemic in India (Mohan *et al*. 2010).The affluent children today in India are taller and heavier than their counterparts 40 years ago(Khadilkar *et al.*2009;Marwaha *et al.* 2011) Children and young people are unwilling to give up sedentary behaviours and therefore, the development of interactive media games offers a potential strategy to increase physical activity.The purpose of the present study was to assess the covariates of overweight and obesity among affluent Hindu Khatri boys and girls of Chandigarh aged 11 to 17 years. The study included family history of overweight/obesity and hypertension, dietary habits and dietary pattern, physical activity and television viewing and explores the association and correlation of these parameters with overweight and obesity.

MATERIAL AND METHOD

Data on 1076 subjectswhich included 540 boys and 536 girls ranging in age from 11 to 17 years was drawn from various public and convent schools of Chandigarh through interview based schedule. Height and weight were taken on these subjects employing standard anthropometric techniques given by Weiner and Lourie, (1981). Body mass index was computed from height and weight. The cut off points for body mass index recommended by World health organization (2004) for Asian Indians were followed to classify boys and girls. Out of a total sample of 540 boys and 536 girls, 37.0% Khatri boys and 43.1% Khatri girls were found to be normal; 35.4% boys and 28.5% girls fell in the category of underweight; 20.9% boys and 20.7% girls were overweight and 6.7% boys and 7.6% girls were obese.For prevalence of hypertension the recommendations of Seventh Joint National Committee on the Prevention, Detection, Evaluation and Treatment of High Blood Pressure were followed. Prevalence of hypertension was 6.29% among boys and 4.66% in girls. The prevalence of prehypertension was 4.63% and 5.60% in boys and girls, respectively. In all, 89.07% boys and 89.74% girls were normotensive.

The subjects were investigated for family history of overweight/obesity and hypertension, dietary habits and dietary pattern, physical activity and television viewing. Family history of obesity and hypertension wasrecorded by askingthe subjects if their parents were consistently obese and suffering from hypertension or not. Subjects were investigated for their dietary habits and dietary pattern and were asked in yes and no while ascertaining vegetarian and non-vegetarian status and skipping of breakfast. Daily meal frequency was assessed from information on number of meals consumed per day by the subjects:Consuming three or less than three meals ($\geq$3) and consuming five or more than five meals ($\leq$5). Subjects were distributed in two categories on the basis of their visit to restaurant: Visit more than once and those who do not. Subjects were asked if they consumed Junk food /fast food or not. Eating while watching television is very common. Subjects were investigated about their television viewing habit while eating in terms of yes or no.

Dietary intake was assessed using food frequency questionnaire which gathered information on daily and weekly bases. For quantitative and qualitative analysis of dietary intake, a twenty four hour recall method was used in which the respondents were required to give details of all the food (types and quantity) consumed by them from morning till night . In addition to this, information was also sought regarding any special changes made in the food intake pattern on holidays. The subjects were also asked to specify any beverages consumed by them /any flavoring agents used in the milk/ the amount of sugar added to the milk in tea spoons. To get an idea about the consumption of invisible fat, the subjects were asked to specify the type of milk used (whole/skimmed) whether the family meal could be rated as very oily/ oily/less fat. For assessment of the quantity of food, the subjects were asked to tell the frequency of consumption of foods. Frequency of consumption of basic foods like whole grains/wheat/rice, vegetables, fruits, non-vegetarian and milk and milk products were studied. Frequency of consumption of fast foods like Soft drinks/juices, pastries/ice creams, maggie, potato chips/popcorn/packed foods, pizza/burger/samosa and chocolates/sweets were investigated as those consuming everyday, 3-5 times a week and $\leq$ 2 times a week.

The subjects were asked about their physical activity, types of physical activity done and games played, duration of physical activity according to age and nutritional status. Information on physical activity such as participation in indoor and outdoor games (hrs/week), aerobic exercises (hrs/day) like jogging, cycling, walking, *gym* and others (swimming/yoga/dancing) and time spent watching television, video and computer games during

school time and holidays was collected. Television viewing was studied for the percentage of subjects and the duration according to nutritional status and age. All these parameters were studied according to the total percentage present and according to its prevalence in obese + overweight, normal and thinness category subjects as per BMI classification for Asian Indians. Since there were very few number of obese and overweight boys and girls than normal and thinness category subjects in most of the age groups therefore, the factors associated with overweight and obesity have been studied by combining the total number of overweight + obese boys and girls and according to sex as well.

RESULTS

Table 1 presents the percentage prevalence of family history of overweight/obesity and hypertension in Khatri boys and girls of Chandigarh. It was found that in the combined sample of the present study 45.8% overweight/obese, 35.3% normal and 30.2% thinness category subjects reported the prevalence of family history of overweight and obesity as compared to 69.8% thinness category, 64.7% normal and 54.2% overweight/obese category subjects with no family history of overweight and obesity. The chi square value revealed significant difference between the two (χ^2= 17. 429, p= .000***). It was hence found that the prevalence of family history of obesity was significantly high in obese and overweight and could significantly contribute to obesity in children. When studied according to sex, overweight +obese boys and girls showed highest prevalence of family history of obesity i.e. boys 40.3% (60) and 51.3% (78) in girls. It was reported that girls showed higher prevalence of family history of obesity [39.7% (213)] compared to boys 33.5% (181) as was evident from statistically significant sex differences among girls (Boys: χ^2= 4.592, p= .101 and Girls:χ^2= 18.180, p= .000***).The prevalence of family history of hypertension was found to be highest among overweight + obese children (combined sample) followed by normal and thinness category subjects, respectively, thereby indicating that obesity contributes to hypertension or vice versa(χ^2= 20.99, p= .000***).

Table 1: Family History of Overweight/Obesity and Hypertension among Khatri boys and girls of Chandigarh

Variable		Thinness	Normal	Overweight + Obese	Total	χ^2, df, p-0.000
		% (N)	% (N)	% (N)	% (N)	
History of Ow. + Ob. (Boys)	Yes	32.5% (62)	29.5% (59)	40.3% (60)	33.5%(181)	4.59,2, 0.101
	No	67.5% (129)	70.5% (141)	59.7% (89)	66.5% (359)	
History of Ow. + Ob. (Girls)	Yes	27.5% (42)	40.3% (93)	51.3% (78)	39.7% (213)	18.180,2, 0.000***
	No	72.5%(111)	59.7% (138)	48.7% (74)	60.3% (323)	
History of Ow. + Ob. (Total)	Yes	30.2%(104)	35.3% (152)	45.8% (138)	36.6% (394)	17.429,2, 0.000***
	No	69.8% (240)	64.7% (279)	54.2% (163)	63.4% (682)	
History of Hypertension(Boys)	Yes	25.1% (48)	33.5% (67)	38.9% (58)	32.0% (173)	7.628,2, 0.022*
	No	74.9% (143)	66.5% (133)	61.1% (91)	68.0% (367)	
History of Hypertension(Girls)	Yes	27.5% (42)	45.0% (104)	44.1% (67)	39.7% (213)	13.535,2, 0.001***
	No	72.5% (111)	55.0% (127)	55.9% (85)	60.3% (323)	
History of Hypertension(Total)	Yes	26.2% (90)	39.7% (171)	41.5% (125)	35.9% (386)	20.993,2, 0.000***

Table 2: Distribution of Khatri boys and girls based on vegetarian and non-vegetarian status and skipping of meals as per BMI Classification

SEX		BMI CLASSIFICATION (WHO) ASIAN INDIANS			Total (1076)	χ^2, df, p-0.000
		Thinness (344)	Normal (431)	Overweight /Obese (301)		
Boys (540)		%(N)	%(N)	%(N)	%(N)	
	Vegetarian	42.9% (82)	44.0%(88)	38.3%(57)	41.5%(224)	1.254,2,.534
	Non-vegetarian	57.1%(109)	56.0%(112)	61.7%(92)	58.0%(313)	
Girls (536)	Vegetarian	47.7%(73)	42.4%(98)	43.4%(66)	44.0%(236)	1.098,2,.578
	Non-vegetarian	52.3%(80)	57.6%(133)	56.6%(86)	55.8%(299)	

Total (1076)	Vegetarian	45.1%(155)	43.2%(186)	40.8%(123)	43.1%(464)	1.15,2,.563
	Non-vegetarian	54.9%(189)	56.8%(245)	59.1%(178)	56.9%(612)	
Skipping of breakfast						
Boys (540)		**%(N)**	**%(N)**	**%(N)**	**%(N)**	
	Yes	38.7%(74)	43.5% (87)	47.0%(70)	42.8%(231)	2.39,2,.303
	No	61.3%(117)	56.5%(113)	53.0%(79)	57.2% 309)	
Girls (536)	Yes	39.2% (60)	49.9%(115)	63.8%(97)	50.7% 272)	18.61,2,.000***
	No	60.8% (93)	50.1%(116)	36.2%(55)	49.3% 264)	
Total (1076)	Yes	39.0%(134)	46.8%(202)	55.5%(167)	46.7%(503)	17.62,2,.000***
	No	61.0%(210)	53.1%(229)	44.5%(134)	53.3%(573)	

*p < 0.05, **< 0.01, ***< 0.001

Table 2 shows the food habits of the Khatri boys and girls based on vegetarianism and non-vegetarianism. The highest prevalence of vegetarian subjects in the total sample was found in thinness category (45.1%), followed by normal (43.2%) and overweight/obese category (40.8%) whereas highest prevalence of non-vegetarian subjects was reported in overweight/obese category (59.1%), followed by normal (56.8%) and thinness category (54.9%), respectively. There were no statistically significant differences in the percentage prevalence of vegetarian and non-vegetarian among the subjects classified in three categories and also among boys, girls and total sample. In boys, the highest number of non-vegetarian were from overweight + obese [61.7% (92)] group followed by thin [57.1% (109)] and normal [56.0 % (112)] group, whereas, in girls the highest number of non-vegetarian were normal [57.6% (133)] followed by overweight+ obese [56.6% (86)] and thin [52.3% (80)] subjects. Vegetarianism was higher in girls as compared to boys. i.e. [44.0% (236) *vs.* 41.5% (224)] whereas, non-vegetarianism was higher in boys i.e [58.0% (313) *vs.* 55.8% (299)] than in girls.

Meal skipping is common among adolescents, especially during middle and late adolescence. Breakfast is the most commonly skipped meal and is attributed to lack of time, desire to sleep longer in the morning, lack of appetite, and dieting to lose weight. It is evident from the table that majority of girls [50.7% (272)] skipped meals as compared to boys [42.8% (231)]. The percentage of subjects who skipped meals in overweight/obese, normal and thinness categories was 55.5%, 46.8% and 39.0%, respectively. It was observed that as the frequency of skipping meals in overweight/obese subject increased, the risk of overweight/obesity also increased significantly. There was statistically significant difference between subjects skipping meals and not skipping meals (χ^2 value = 17.62, p= .000***) in the three groups. Similar trend was witnessed in boys and in girls with higher percentage prevalence of skipping breakfast in overweight+obese category than normal and thin subjects.

Table 3: Distribution of Khatri boys and girls based on eating in school, number of meals consumed per day, restaurant visit per week and eating junk food among thin, normal and overweight+obese categories

SEX	**BMI classification (WHO) Asian Indians**			**Total (1076)**	**χ^2, df, p-0.000**
	Thinness (344)	**Normal (431)**	**Overweight /Obese (301)**		
	%(N)	**%(N)**	**%(N)**	**%(N)**	
Packed Lunch (Boys)	78.5%(150)	62.0%(124)	60.0%(90)	67.4%(364)	24.16,4,.000***
Buy from School (Boys)	19.4%(37)	28.0%(56)	35.0%(52)	26.9%(145)	
Do not eat (Boys)	2.1%(4)	4.6%(20)	5.0%(7)	5.7%(31)	
Total (Boys)	100%(191)	100%(200)	100%(149)	100%(540)	
Packed Lunch (Girls)	73.2%(112)	70.1%(162)	57.9%(88)	67.5%(362)	38.39,4,.000***
Buy from School (Girls)	23.0%(15)	18.0%(41)	35.6%(55)	20.74%(111)	
Do not eat (Girls)	16.9%(26)	11.9%(28)	6.5%(9)	11.76%(63)	
Total (Girls)	100%(153)	100%(231)	100%(152)	100%(536)	42.57,4,.000***
Packed Lunch (Total)	76.2%(262)	66.4%(286)	59.1%(178)	67.5%(726)	
Buy from School (Total)	15.1%(52)	22.5%(97)	35.6%(107)	23.8%(256)	
Do not eat (Total)	8.7%(30)	11.1%(48)	5.3%(16)	8.7%(94)	
Total	100%(344)	100%(431)	100%(301)	100%(1076)	

Number of Meals					
≤3(Boys)	27.4%(52)	37.5%(75)	58.7%(87)	39.6%(214)	34.58,2,.000***
≥5(Boys)	72.8%(139)	62.5%(125)	41.3%(62)	60.4%(326)	
Total (Boys)	100%(191)	100%(200)	100%(149)	100%(540)	
≤3(Girls)	60.1%(92)	29.4%(68)	59.5%(90)	46.6%(250)	48.31,2,.000***
≥5(Girls)	39.9%(61)	70.6%(163)	40.5%(62)	53.4%(286)	
Total (Girls)	100%(153)	100%(231)	100%(152)	100%(536)	
≤3	41.8%(144)	33.2%(143)	58.8%(177)	43.1%(464)	47.78,2,.000***
≥5	58.2%(200)	66.8%(288)	41.2%(124)	56.9%(612)	
Total	100%(344)	100%(431)	100%(301)	100%(1076)	
Visit to Restaurant					
Visit more than once (Boys)	42.9% (82)	51.8%(10)	59.0%(88)	50.7% (274)	8.91,2,.012*
Visit Once or no(Boys)	57.1%(109)	48.2%(96)	41.0%(61)	49.3% (266)	
Visit mere than once (Girls)	44.0%(67)	50.5% (117)	51.0% (78)	48.9% (262)	2.24,2,.326
Visit Once or no(Girls)	56.0% (86)	49.5% (114)	49.0% (74)	51.1% (274)	
Visit more than once (Total)	43.3%(149)	52.7%(227)	55.1%(166)	49.8%(536)	10.51,2,.005**
Visit Once or no (Total)	56.7%(195)	47.3%(204)	44.9%(135)	50.2%(540)	
Eating Junk Food					
Yes (Boys)	61.8% (118)	78.5%(157)	88.6%(132)	75.4%(407)	34.09,2,.000***
No (Boys)	38.2%(73)	21.5%(43)	11.4%(17)	24.6%(133)	
Yes (Girls)	70.0% (107)	73.2%(169)	84.9%(129)	75.6%(405)	10.47,2,.005**
No (Girls)	30.0%(46)	26.8%(62)	15.1%(23)	24.4%(131)	
Yes (Total)	65.4%(225)	75.6%(326)	86.7%(261)	75.4%(812)	39.36,2,.000***
No (Total)	34.6%(119)	24.4%(105)	13.3%(40)	24.6%(264)	

*p < 0.05, **< 0.01, ***< 0.001

In the total sample the percentage of subjects bringing packed lunch to school was 76.2% in thinness category, 66.4% in normal and 59.1% among overweight/obese category (Table 3). The total percentage of subjects bringing packed lunch was 67.5%. It was observed that as the frequency of children bringing tiffin to school increased, the risk of overweight and obesity decreased, as was evident from statistically significant chi square values in boys and girls. The percentage of subjects buying eatables from school canteen was found to be 15.1% in thinness category, 22.5% normal and 35.6% among overweight/obese category. There was significant difference reported in adolescents classified in three categories i.e. packed lunch, buy from school and do not eat in school categories as was clear from statistically significant chi square value in boys, girls as well as in total sample. It is evident that overweight+obese subjects indulged more in canteen eating than their normal and thin counterparts.

Table 3 exhibits that maximum percentage of overweight+obese boys consumed ≤3 meals a day (58.7%) followed by normal (37.5%) and thin (27.4%) boys.The highest number of subjects indulging in five or more meals were normal boys and girls and less than three meals were overweight+obese category boys and girls. There were statistically significant difference reported in boys and girls and total sample in the number of meals consumed (χ^2= 47.78, p= .000***).Visit to restaurant more than once was reported to be 43.3% in thin, 52.7% in normal and 55.1% in overweight/obese subjects (Table 3). It was found that highest number of subjects going to restaurant more than once was found in overweight+obese subjects and least in thin subjects. There was significant difference reported in the total sample (χ^2 = 10.51; p=.005**). Boys and girls showed similar trend for visit to restaurant once a week or not with highest number of thin subjects and least number in overweight+ obese subjects in this group.Junk food consumption was significantly high in overweight+obese boys and girls as compared to their normal and thin counterparts. 75.4% of total subjects consumed junk food and only 24.6% subjects did not have any junk food. Consumption of junk food was seen in 88.6% overweight+ obese boys and 84.9% overweight+ obese girls; 78.5% boys and 73.2% girls from normal category and 61.8% boys, 70.0% girls from thinness category.

Table 4: Percentage prevalence of physical activity and duration of physical activity according to sex among thin, normal and obese Hindu Khatri boys and girls

	Thinness (344)	**Normal (431)**	**Obese+ Overweight (301)**	**Total**	**χ^2, df, p-0.000**
	% (N)	**% (N)**	**% (N)**	**% (N)**	
Yes (Boys)	96.3% (184)	94.0% (188)	72.5% (108)	88.8% (480)	56.62,2,.000***
No (Boys)	3.7% (7)	6.0% (12)	27.5% (41)	11.1% (60)	
Yes (Girls)	85.6% (131)	76.6% (177)	54.0% (82)	72.8% (390)	41.65,2,.000***

No (Girls)	14.4% (22)	23.4% (54)	46.1% (70)	27.2% (146)	
Yes (Total)	91.6% (315)	84.7% (365)	63.1% (190)	80.9% (870)	90.74,2,.000***
No (Total)	8.4% (29)	15.3% (66)	36.9% (111)	19.1% (206)	
Duration of Physical Activity					
Don't	29	66	111	206	110.86,6,.000***
	8.4%	15.3%	36.9%	19.1%	
<1hr	205	203	88	496	
	59.6%	47.1%	29.2%	46.1%	
1-2 hr	81	108	78	267	
	23.5%	25.1%	25.9%	24.8%	
>2hr.	29	54	24	107	
	8.4%	12.5%	8.0%	9.9%	
	344	431	301	1076	
	100.0 %	100.0 %	100.0%	100.0 %	

*p < 0.05, **< 0.01, ***< 0.001

Table 4 presents the percentage prevalence and duration of physical activity according to nutritional status. Out of the total sample, 19.1% subjects did not indulge in any physical activity. Maximum number of overweight+obese subjects (36.9%) belonged to this category. According to duration of physical activity the highest percentage of subjects out of total sample (46.1%) devoted ≤ 1 hour to exercise/games which included 59.6% thin, 47.1% normal and 29.2% overweight+obese. This was followed by subjects who exercised for 1-2 hours, forming 24.8% (267) of the total sample [Normal= 25.1% (108), Thin= 23.5% (81) and Overweight+ Obese=25.9% (78)]. 9.9% of subjects exercised for ≥ 2 hours. The highest number of subjects in this class were from normal [12.5 %(54)] category, followed by thin (8.4%) and overweight category (8.0%). There was statistically significant difference reported in the duration of physical activity (χ2= 110.86, 6, .000***).

Table 5: Age wise distribution of Khatri boys and girls according to physical activity

		AGE GROUP							
		11	12	13	14	15	16	17	Total
Yes	Number	142	147	158	137	110	88	88	870
	%	94.7%	93.6%	95.2%	87.8%	73.8%	59.1%	59.1%	80.9%
No	Number	8	10	8	19	39	61	61	206
	%	5.3%	6.4%	4.8%	12.2%	26.2%	40.9%	40.9%	19.1%
Total	Number	150	157	166	156	149	149	149	1076
	%	13.9%	14.6%	15.4%	14.5%	13.8%	13.8%	13.8%	100.0%

It is evident from the table that 94.7 % (142) subjects at the age of 11 years showed indulgence in physical activity which decreased to 59.1% (88) at 17 years representing 80.9 % (870) of the total sample indulging in physical activity. 870 boys and girls out of 1076 subjects indulged in physical activity and games. In general Khatri adolescents participated in physical exercises like cycling (16.0%), walking (12.8%), Jogging (10.5%), Dance (7.1%), Swimming (5.9%) and Skipping (5.3%). The outdoor games played by Khatri adolescents were Cricket (11.3%), Football (11.0%), Basketball (8.4%), Lawn tennis (4.2%), Badminton (4.0%) and Skating(3.6%). In addition to this, highest contributors to games were boys whereas girls showed maximum contribution to physical activity. The distribution of indoor games studied showed that, the highest percentage of subjects played computer games, which account for 40.0% (186) of the total sample followed by Video games 20.0% (93), Carom board= 19% (88), Ludo= 13.0% (60) and Play station= 8.0% (37).

Table 6: Percentage prevalence of duration of television viewing and eating while watching television according to nutritional status of Hindu Khatri boys and girls of Chandigarh

		Thinness	**Normal**	**Obese+ Overweight**	**Total**	**χ^2, df, p-0.000**
Don't see	Number	31	37	3	71	38.78,6,.000***
	%	9.1%	8.6%	1.0%	6.6%	
<1hr	Number	154	169	120	443	
	%	44.8%	39.2%	40.0%	41.17%	
1-2 hr	Number	116	132	98	346	
	%	33.7%	30.6%	32.6%	32.2%	
>2hr.	Number	43	93	80	216	
	%	12.5%	21.6%	26.6%	20.1%	
Total	Number	344	431	301	1076	
	%	100.0%	100.0%	100.0%	100.0%	
Eating while watching television						
Yes		205	257	243	705	42.8,2, .000
		59.6%	59.7%	80.7%	65.5%	
No		139	174	58	371	
		40.4%	40.3%	19.3%	34.5%	
*p < 0.05, **< 0.01, ***< 0.001						

Television viewing was seen in 1005 subjects out of 1076 subjects. Table 6 presents the duration of TV viewing by Khatri boys and girls. It showed that maximum number of subjects watched TV for less than one hour 41.17 % (443) followed by 1-2 hours 32.2 % (346). The numbers of subjects watching TV for more than 2 hours were 20.1 % (216) whereas; no TV viewing was seen in 6.6 % (71) subjects. It was evident from tablethat maximum number of subjects of thin, obese+overweight and normal watched TV for >1 hour followed by 1-2 hours and < 2 hours. Statistically significant difference was reported in television viewing when studied according to duration of television viewing. It was evident that out of 1076 subject 705 boys and girls ate while watching television as compared to 389 subjects who did not watch television while eating any meal. Out of 705 boys and girls watching television while eating, 59.6% were thin, 59.7% were normal and 80.7% were overweight+obese. There was significant difference reported between the three groups with respect to television viewing (χ^2= 42.8,2, .000) while eating.

DISCUSSION

Obesity is a multifactorial disease and its development results from genetic and environmental factors and a variety of metabolic, social and cultural interactions (Claessens *et al*. 2000). It has been argued that the environment has a prominent role in the development of childhood obesity because the changes in its prevalence have paralleled the rapid changes in the lifestyle of the population in the second half of this century, which has become increasingly sedentary, with low levels of physical activity (Maffeis, 2000). The covariates of obesity are complex and include genetic, biological, behavioral and cultural factors. Although certain medical disorders can cause obesity, less than one percent of all obesity is caused by physical problems. Obesity in childhood and adolescence can be related to poor eating habits, overeating, lack of exercise, family history of obesity, medical illnesses, medications, stressful life events or changes, family and peer problems, low self-esteem and depression or other emotional problems. However, technological progression has reduced the relative price of food and contributed to the increase in obesity and this increased availability of food might well have overstrained will power and led to suboptimal consumption decisions relative to adolescents own standards. Based on proxy measures for experienced utility, it is possible to directly address whether certain observed behavior is suboptimal and therefore reduces a person's well-being. It is generally accepted that dietary habits established during childhood and adolescence tend to be carried into adulthood and are difficult to alter (Coulson *et al*. 1998; Hill *et al*. 1998). For instance, early exposure to fruit and vegetables or to foods high in energy, sugar and fat has been related to adolescents liking for, and consumption of, these foods (Hill *et al*. 1998), a dietary practice that may continue into adulthood (Lien *et al*. 2001). As Vereecken *et al*. (2004) noted, the World Health Organization recognizes that 'young people who develop healthy eating habits early in life are more likely to maintain them in maturity and to have reduced risk of chronic diseases, cancer, non-insulin dependent diabetes mellitus and osteoporosis'.The association between family affluence and healthy habits is consistent with the findings of others that social status and income predict healthier food attitudes and a better diet (Margetts *et al.* 1998; Johansson *et al.* 1999). Amongst adolescents this relationship may be mediated in part by snacking behaviour, since a disadvantaged home life has been linked to less regular meal patterns and a higher consumption of sweet and fatty snacks in US adolescents (Siega-Riz *et al*, 1998).Gender differences in food choice are widely reported (Wardle *et al*. 2004). Haste, (2004) noted that 'the goals of fitness and desirable weight are salient for both sexes but expressed in different ways. These gender differences in eating patterns related to girls increased concerns about weight and shape rather than health.

In the present study the highest number of non-vegetarian boys were from overweight+ obese 61.7% (92) group followed by normal 56.0% (112) and thin 7.1%(109) group, whereas, in girls the highest number of non-vegetarian were normal 57.6%(133) followed by overweight+ obese 56.6 % (86) and thin 52.3% (80) subjects. In Hindu Khatri boys and girls vegetarianism was higher in girls as compared to boys. i.e. (44.0 % (236) *vs*. 41.5 % (224) (Table2) whereas non-vegetarianism was higher in boys i.e. (58.0 %(313) *vs*. 55.8 %(299)) than girls. Odds ratio revealed more non vegetarianism (OR= 1.84; 95%CI= 1.41-2.41) contributing to overweight and obesity. Vegetarianism means different things to different people. Traditionally health, together with taste and ethics, were assumed to be the major reasons why young people choose to adopt a vegetarian diet (Haste, 2004). Shrivastav *et al*. (1997) conducted a study on 1000 adolescents (10-18 years) and observed that the consumption of non-vegetarian items was more common in high socio economic group in comparison to low socioeconomic group. Vegetarians have been reported to have lower body mass indices than non-vegetarians, as well as lower rates of death from ischemic heart disease, lower blood cholesterol levels, lower blood pressure, and lower rates of hypertension, type 2 diabetes. According to the Vegetarian Society (2000), the number of vegetarians in the UK has more than doubled at the end of the last century, rising from 2.5% in 1988 to almost 7% in 1998 (four million), but the proportion of young people (15- to 19-year-olds) who are vegetarian is even higher (11%). Key, (2006) supported vegetarianism by stating that vegetarian diets are heterogeneous as their effect is on the nutritional status, health and longevity. The British Nutrition Foundation Survey (Goldberg, 2003) found that more girls (16.8% of 11–13-year-olds and 15% of 14–16-year-olds) than boys (11.5% of 11–13-year-olds and 10.5% of 14–16-year-olds) claimed to be vegetarian. The present study also showed more girls consuming vegetarian diets than boys. Haste, (2004) in a recent survey of 687 British children and young people aged 11–21 years found that 9.5% of the sample could be categorized as vegetarian. Research indicates that teenage vegetarians weigh less than non-vegetarian adolescents which may reinforce this dietary pattern amongst young people (Hebbelnick *et al*. 1999).

Adolescents are skipping one or the other meal regularly. Missing meals is a common phenomenon among adolescents (French *et al.* 2001). Studies have shown that teenagers who have healthy eating behaviours were more likely to perform better academically then teenagers who have unhealthy eating behaviours (Pollitt and Mathew, 1998; Kleinman. *et al*. 2002; Affenito, 2007). Skipping of breakfast in the present study was common among Khatri boys as well as girls but percentage of girls skipping meals in the pooled sample (50.7%) was more as compared to boys (42.8%). A tendency to skip breakfast was seen to be more frequent among overweight+obese boys (47.0%) and girls (63.8%) as compared to their normal (B: 43.5%; G: 49.9%) and thin (B: 38.7%; 39.2%) counter parts (Table2). Odds ratio revealed that the adolescents who did not take breakfast were 1.6 times more likely to be overweight/obese than the adolescents who took breakfast regularly. (OR=1.63; 95% CI=1.25-2.13; p= .000***). Overweight girls skipped breakfast more frequently than overweight boys. Moy *et al*. (2006) revealed that adolescent girls were found to skip meals more than adolescent boys and the possible reasons for this phenomenon were body image concern and trying to lose weight as those who perceived themselves to be overweight.

Table7: Odds ratio and 95% confidence interval of various covariates of overweight and obesity

Variable	Odds Ratio	95% Confidence Interval	p-value
Non vegetarianism	1.84	1.41-2.41	.000***
Skipping of breakfast	1.63	1.25-2.13	.000***
≤3 meals a day	2.43	1.84-3.19	.000***
Visit more than once to restaurant per week	1.30	.99-1.71	.050*
Eating Junk food	2.65	1.84-3.83	.000***
Buying food from school canteen	2.29	1.64-2.99	.000***
Watching TV for ≥ 2 hours	1.54	1.12-2.11	.007*
Eating while watching TV	2.83	2.06-2.91	.000***
Family History of Overweight	0.62	0.43-0.89	.009*
Family History of Hypertension	1.40	1.06-1.85	.016*
Physical Activity	4.18	3.04-5.74	.000***

Skipping breakfast may affect concentration, learning, and school performance (CDC, 1996). National data show that among adolescents, 24% of females and 20% of males skipped breakfast on the day of a survey (Lin *et al*. 1996) and the percentage of youth skipping breakfast increases with age, especially for females. Among adolescents 14-18 years old, 34% of girls and 28% of boys ate nothing for breakfast compared to only 15% among boys and girls ages 9-13 years old. Young people who skipped breakfast had lower total daily energy, vitamin and mineral intakes compared to those who ate breakfast. Overall, the odds of dietary inadequacy were two to five times higher for those who skipped breakfast than for those who ate breakfast (Nicklas *et al*. 1998). Lunch is skipped by almost one-quarter of adolescents (Gleason *et al*. 2001). A study was conducted in Bornova which examined the factors that influence food choice and skipping meals in adolescents. Skipping meals may be considered as an indicator of their erratic eating behaviour and is associated with health compromising eating behaviours and less adequate dietary intakes. The study by Croll *et al*. (2001) revealed that adolescents cite lack of time and peer related social pressures as barrier to healthy eating. The importance of family meals has been increasingly studied recently and the findings revealed that participants who had meals with their family members were less likely to skip meals in comparison to those who ate with peers or ate alone (Videon and Manning, 2003; Cason, 2006; Stang *et al*. 2007, Bhuvaneswari and Nazni, 2011).

In the present study the boys and girls who bought Lunch from school canteen were 2.3 times more likely to be overweight/obese (OR=2.29; 95% CI=1.64-2.99) in comparison to their counterparts who brought lunch from home. Similar findings have been reported by Veugelers *et al*. (2005); Prabhjot, (2009). Eating patterns have changed among children and adults. Trends in fast food restaurant use and snacking habits thus show that the quality of diet of children and adolescents has deteriorated over the past several years. In the present study the percentage of Hindu Khatri boys and girls who visited restaurant more than once a week was49.8% which included 43.3% thin, 52.7% normal and 55.1% overweight/obese (Table3). The highest number of subjects going to restaurant more than once was found in overweight+obese category and least in thin subjects. Odds ratio(OR=1.30; 95% CI=.99-1.71) revealed that adolescents who visit restaurant more than once a week are 1.3 times more likely to be overweight+obese than the adolescence who did not visit restaurant or visit only once a week (Table7). These results are consistent with other studies which showed an association between frequency of restaurant visit and obesity (Leonard *et al*. 2000; Goyal *et al*. 2010).

The present study showed increased junk food consumption has positive relation with prevalence of obesity and overweight. These results correlate well with previous reports which suggest that junk food (pizza, burger, cheese, butter, oily items, chocolates, fried, high fat and sugary) intake tends to be more common among overweight and obese adolescents than among normal-weight adolescents (Wolfe *et al*. 1994; Birch and Fisher, 1998). Junk food contains more amount of fat than carbohydrate and protein (Blundell *et al*. 1993; Roll *et al*. 1994; Poppitt, 1995). Fat is less satiating than carbohydrate and dietary fat is stored more efficiently than carbohydrate or protein which finally results in obesity or overweight (Tanasescu *et al*. 2000). Snacks account for 25-33% of daily energy intakes among adolescents. The prevalence of snacking and proportion of calories and nutrients from foods consumed as snacks has risen during the period from 1977 to 1996 (Jahns *et al*. 2001). In the

present study maximum snack/Junk food consumption was seen in the overweight+obese category among both Khatri boys and girls (88.6%) as compared to normal and thin adolescents (Table3). From odds ratio it was revealed that tendency to become overweight+obese was 2.6 times higher for those adolescents who consumed snacks/junk foods than those who did not (OR= 2.65; 95% CI= 1.84-3.83) (Table 7). Similar findings have been reported by Kalpana *et al*. (2007); Aggarwal *et al*. (2008) and Kaur *et al*. (2008) and Nazni and Bhuvaneswari, (2011) food choices made by adolescents while snacking tend to be high in sugar, sodium, and fat, while relatively low in vitamins and minerals. Soft drinks are the most commonly chosen beverages for adolescents and account for about 6% of total caloric intake (Subar *et al*. 1998). This high consumption of soft drinks increases the risk for bone fractures over an individual's lifetime (Wyshak, 2000).

The present study showed that maximum percentage of overweight+obese subjects consumed ≤3 meals (58. 7%) followed by thin (41.8%) and normal subjects (33.2%) a day while maximum number of normal subjects consumed ≥5 meals (66.8%) a day followed by thin (58.2%) and the least percent of overweight+obese (41.2%) subjects had five meals (Table3). Odds ratio analysis (OR= 2.43; 95%CI= 1.84-3.1) revealed that ≤3 meals among adolescents significantly increased the risk of overweight+obesity by 2.4 times than those consuming ≥5 meals (Table7).Similar findings have been reported by Siega *et al*. (1998); Nicklas *et al*. (2001); Barba *et al*. (2006) and Mota *et al*. (2008). Thus, numbers of small meals increase the metabolic rate which plays significant role in maintaining the normal body weight. Therefore, having small five to six meals consisting of healthy food instead of three large meals should be recommended for early prevention of overweight and obesity. However longitudinal studies can provide a better insight in this dimension. Regarding food preferences in the present study maximum number of overweight+obese subjects preferred paranthas, butter, cold drinks, chocolates, ice creams, chips and fast foods including pizza, burgers, samosa and maggie as compared to normal and thin subjects who consumed more milk, fruits, whole grains and vegetables and consumed fast foods with lesser frequencies.

Table 8: Odds ratio and 95% confidence interval of frequencies of various covariates of overweight and obesity

Variable	Odds Ratio	95% Confidence Interval	p-value
Vegetables	2.50	1.79-3.49	.000***
Fruits	0.78	.585-1.02	.074
Non Vegetarian	1.86	1.27-2.75	.001**
Pastries/Ice creams	1.72	1.28-2.30	.000***
Potato Chips/Pop corns/packed foods	1.62	1.20-2.19	.001**
Pizza /Burger/Samosa	3.80	2.61-5.72	.000***
Chocolates	1.58	1.10-2.26	.012*
Soft drinks/Juices	1.62	1.20-2.23	.002**
Milk	0.86	.63-1.19	.383

In addition to these factors, increased frequency of fast foods like pizza/burger/samosa (OR = 3.8; 95% CI= 2.61-5.72), non-vegetarian foods (OR= 1.86; 95 CI= 1.27-2.75), pastries/ Ice Creams (OR=1.72; 95% CI=1.28-2.3), soft Drinks/ juices (OR=1.62; 95% CI=1.19-2.23), potato Chips/pop corns/packed foods (OR=1.62; 95% CI=1.20-2.2), chocolates/ sweets (OR=1.58; 95% CI=1.10-2.26) were found to be the positive contributors of obesity whereas on the contrary higher consumption of milk (OR= .86; 95% CI= .63-1.19) and fruits (OR= .78 ; 95% CI= .59-1.03) decreased obesity (Table 8).

Reduced physical activity among children and adolescents nowadays contributes significantly towards obesity. Long school hours, the ordeal of getting ready for school and tuitions increases inactivity. Without activity, even the recommended calories lead to a positive energy balance, which accumulates as body fat, contributing to obesity. Physically inactive and sedentary lifestyles are thought to be associated with increases in overweight and obesity. Children's physical activity levels seem to be decreasing, while the time spent on television viewing, computers and video games has increased. The present study revealed statistically significant differences between the prevalence of physical activity among boys, girls and pooled sample (χ^2 =90.74 where p=.000**). The maximum number of subjects not indulging in physical activity included overweight+obese (36.9%) followed by normal (15.3%) and thin (8.4%) adolescents (Table 4). It was clear from the odds ratio analysis that subjects not indulging in physical activity showed increased risk of obesity by four times than those doing physical activity (OR= 4.2; 95% CI= 3.04-5.74; p: <.000***) (Table7).

Several authors have supported that physical inactivity is strongly associated with a high prevalence of childhood obesity (Maffeis *et al*. 1998; Andersen *et al*. 1998; Carvalhal *et al*. 2006; Kumar *et al*. 2007; Kaur *et al*. 2008). Similar findings have been reported by the present study. According to Sweeting, (2008) differences in overweight and obesity prevalences between boys and girls can result from differences in biology (patterning of body fat, fat levels at which health risks become apparent, levels of resting energy expenditure and energy requirements, ability to engage in certain physical activities) and differences due to society or culture (food choices and dietary concerns, overall physical activity levels, body satisfaction and the long-term psychosocial consequences). In the present study the percentage prevalence of physical activity was high among Khatri boys compared to girls (88.88% (480) *vs.* 72.8 %(390)). This observation is in consensus with the previous studies (Van Mechelen *et al*. 2000; Magalhães *et al*. 2002; Trost *et al*. 2002; Riddoch *et al*. 2004; Dencker *et al*. 2006; Pereira *et al*. 2010). These gender differences may be due to the fact that boys

participate in substantially greater amounts of vigorous physical activity including outdoor games. According to Sallis, (1995) it is unknown if the primary mechanism behind the sex differences in physical activity levels is biological or due to different processes of socialization. The present study also confirmed the occurrence of a decreased trend in physical activity levels with age among Khatri boys and girls. It may be attributed to lack of time due to long school hours, the ordeal of getting ready for school and tuitions for competitive examinations increases inactivity. An inverse relationship between physical activity levels and age has been reported by many studies (Casperson *et al*.2000; VanMechelen *et. al*. 2000; Trost *et al*. 2002; Riddoch *et al*. 2004). Casperson *et al*. (2000) suggested decline in physical activity may occur after age 12. The children who prefer indoor games are at a higher risk of being obese since they expend much less energy as compared to the more physically active children. It was also observed from the data, that majority of respondents had computer and video games at their homes. They spent large amount of time in front of these electronic gadgets after coming from school and number of hours further increased on holidays. This contributes to an increasingly sedentary life style and in the genesis of weight problems (Fontvieille *et. al*. 1993). Strong bones, good muscle tone, and lower risk of developing chronic diseases are some of the key benefits derived from regular physical activity. Furthermore, being physically active promotes psychological well-being and reduces feeling of depression and anxiety. Some studies showed that children who are more physically active showed higher academic performance. Team games and play promote positive social integration and facilitate the development of social skills in young children. According to Strong *et al*. (2005), school-aged children should participate daily in 60 min or more of moderate to vigorous physical activity, in order to yield beneficial health and behavioural outcomes. Moderate to high levels of physical activity are associated with many positive effects in children's health including increases of bone mineralization (Lima *et al*. 2001), levels of HDL cholesterol (Saakslahti *et al*. 2004), psychological health (Parfitt *et al*. 2009), muscular strength, flexibility, cardiorespiratory resistance (Guy and Micheli, 2001) and insulin resistance (Sardinha *et al*. 2008).

A significant difference between overweight+obese, normal and thin children is seen with regard to hours spent on TV watching (χ^2=38.78, p=<0.000***) in the present study (Table6).Odds ratio indicated that adolescents who watched TV for two or more hours were 1.5 times more likely to be overweight than those who watched it for less than two hours. Eating while watching television increased the likelihood of overweight and obesity 2.8 times compared to normal and thin subjects (OR= 2.83; 95% CI= 2.06-2.91; p= 0.000) (Table7). Kaur *et al*. (2008) found that watching more than 2 hours of television doubled the odds of being overweight in a follow up as compared to watching television for less than two hours per day. Numerous studies (Dietz *et al*. 1985; Gortmaker *et al*. 1996; Guillaume *et al*. 1997; Anderson *et al*. 1998; Hernandez *et al*. 1999; Eisenmann *et al*. 2002; Marshall *et al*. 2004; Angelopoulos *et al*. 2006) have shown that time spent watching television viewing is strongly associated with the risk of being obese in children and adolescents. However, the majority of research has been population-based, which focuses on the risk of being obese versus normal weight. Padez *et al*. (2005) showed a significant increase in overweight (OR= 1.36; 95% CI= 1.2-1.5) and obesity (OR= 1.63; 95% CI= 1.53-1.72) with television viewing. Television viewing time has been shown to increase caloric intake (Wiecha *et al*. 2006; Blass *et al*. 2006) It has also been shown that television viewing time increases the serving size of fried foods and baked sweets by as much as 1.4 servings per week (Wiecha *et al*. 2006). Each hour increase in television viewing was associated with an additional 167 kcal/d and with increases in the consumption of foods commonly advertised on television. Kuriyan *et al*. (2007) showed increased hours spent watching television were directly correlated with increased BMI in children of Bangalore. Kotian *et al*. (2010) conducted a multivariate logistic regression analysis and revealed that risk of overweight was 7.3 times higher among those who reported watching television and playing games on computer for ≥4 hours/day. The growing number of obese children worldwide indicates the importance of studying obesity related issues within this group. Pearson *et al*. (2011) found that adolescents who watched more than two hours of Television viewing per day had higher intakes of energy-dense snacks and beverages, and lower intakes of fruit. Children enrolled on the Planet Health Intervention were followed for a period of time with baseline viewing, change in television viewing and total energy intake all related to BMI. Baseline television viewing time and change in television viewing both predicted a change in total daily energy intake, with each hour of television viewing associated with a 167 kcal increment in calorie intake providing support for this (Wiecha *et al*. 2006). However, until recently sedentary behaviours have been measured using subjective, self-report proxy techniques and are therefore liable to recall bias. Average viewing times of children in both the USA and Europe exceed the recommended limit of 2 hours/day with additional time spent using other forms of sedentary media such as video games (teVelde *et al*. 2007; Laurson *et al*. 2008). In addition sedentary pursuits are modifiable behaviours and should therefore be targeted by public health interventions with focus not just on increasing physical activity but reducing sedentary time. As such children tend to snack while sitting and playing which adds to their energy consumption (Fontvieille *et. al*. 1993.) Several studies have demonstrated that changing television viewing time alone can lead to weight loss, without any changes in physical activity (Gortmaker *et al*. 1996; Epstein *et al*. 2000; Robinson, 2001). A television viewing in the child's bedroom is an even stronger marker of increased risk of being overweight (Dennison *et al*. 2002).

CONCLUSIONS

It can be concluded from the above discussion that of all the covariates affecting overweight and obesity among affluent Hindu Khatri boys and girls of the present study, eating while watching television (OR= 2.83; 95%

CI= 2.06-2.91; p= 0.000), consumption of Junk foods (OR=2.65; 95% CI=1.84-3.83), consumption of ≤3 meals (OR=2.42; 95% CI=1.84-3.19), buying eatables from school canteen instead of packed lunch (OR: 2.2; 95% CI: 1.64-2.99), non-vegetarianism (OR=1.84; 95% CI=1.41-2.41), breakfast skipping (OR=1.63; 95% CI=1.25-2.13; p= .000***), TV viewing for more than two hours (OR: 1.54; 95% CI :1.12-2.11), visit to restaurant more than once a week (OR=1.30; 95% CI=.99-1.71), family history of obesity (OR=.62; 95% CI=.44-.89); were positively associated with likelihood of being overweight and obese and indulgence in physical activity and outdoor games (OR=4.2; 95% CI=3.04-5.74) decreased obesity. In addition to these factors, increased frequency of fast foods like pizza/burger/samosa (OR = 3.8; 95% CI= 2.61-5.72), non-vegetarian foods (OR= 1.86; 95 CI= 1.27-2.75), pastries/ Ice Creams (OR=1.72; 95% CI=1.28-2.3), soft Drinks/ juices (OR=1.62; 95% CI=1.19-2.23), potato Chips/pop corns/packed foods (OR=1.62; 95% CI=1.20-2.2), chocolates/ sweets (OR=1.58; 95% CI=1.10-2.26) were found to be the positive contributors of obesity whereas on the contrary higher consumption of milk (OR= .86; 95% CI= .63-1.19) and fruits (OR= .78 ; 95% CI= .59-1.03) decreased obesity.

REFERENCES

- Abu-Rmeileh NME, Hart CL, McConnachie A, Upton MN, Lean MEJ, Watt GCM. Contribution of midparental BMI and other determinants of obesity in adult offspring. Obesity. 2008; 16:1388–1393.
- Affenito SG. Breakfast: a missed opportunity. J Am Diet Assoc. 2007; 107: 565-568.
- Aggarwal T, Bhatia RC, Singh D, Sobti PC. Prevalence of obesity and overweight in affluent adolescents from Ludhiana, Punjab. Indian Pediatr. 2008; 45:500–502.
- Andersen RE, Crespo CJ, Bartlett SJ, Cheskin LJ, Pratt M. Relationship of physical activity and television watching with body weight and level of fatness among children: Results from the Third National Health and Nutrition Examination Survey. JAMA. 1998; 279:938–942.
- Angelopoulos PD, Milionis HJ, Moschonis G, Manios Y. Relations between obesity and hypertension: preliminary data from a cross-sectional study in primary schoolchildren: the children study. Eur J ClinNutr. 2006; 60: 1226–1234.
- Baecke J, Burema J, Frijters J. A short questionnaire for the measurement of habitual physical activity in epidemiological studies. Am J ClinNutr. 1982; 36:936–942.
- Barba G, Troiano E, Russo P, Strazzullo P, Siani A. Body mass, fat distribution and blood pressure in Southern Italian children: Results of the ARCA project. NutrMetabCardiovasc Dis. 2006; 16:239-248.
- Birch L & Fisher J. Development of eating behaviours among children and adolescents. Pediatrics.1998; 101 (Suppl).593–594.
- Blass EM, Anderson DR, Kirkorian HL, Pempek TA, Price I, Koleini MF. On the road to obesity: television viewing increases intake of high-density foods. PhysiolBehav. 2006; 88:597– 604.
- Blundell JE, Burley VJ, Cotton JR, Lawton CL. Dietary fat and the control of energy intake: evaluating the effects of fat on meal size and postmeal satiety. Am J ClinNutr. 1993; 57(suppl):772S–778S.
- Burke V, Beilin LJ, Dunbar D. Family lifestyle and parental body mass index as predictors of body mass index in Australian children: a longitudinal study. Int J Obes. 2001; 25:147–157.
- Bhuvaneswari, J. and Nazni, P., Impact of Breakfast Bar Supplementation on Nutritional And Academic Performance of Adolescence, International Journal of Development Research Vol. 1, Issue, 3, pp.018-021, June, 2011 ISSN: 2230-9926
- Carvalhal MM, Padez MC, Moreira PA, Rosado VM. Overweight and obesity related to activities in Portuguese children, 7–9 years. Eur J Public Health. 2006; 17:42–46.
- Cason KL. Family mealtimes: more than just eating together. J Am Diet Assoc. 2006; 106: 532-533.
- Caspersen CJ, Pereira MA, Curran KM. Changes in physical activity patterns in the United States, by sex and cross-sectional age. 2000; 32 (9):1601-1609.
- Centers for Disease Control and Prevention. Guidelines for school health programs to promote lifelong healthy eating.. Morb Mortal Wkly Rep. 1996; 45:1-37.
- Charney E, Goadman HC, Mcbride M, Lyon B, Praltt R. Childhood antecedents of adult obesity. Do chubby infants become obese adults? N Engl J Med. 1976; 295: 6-9.
- Claessens A, BeunenG, Malina R. Anthropometry, physique, body composition and maturity. In: Amstrong N, Van Mechelen W, editors. Paediatric exercise science and medicine. Oxford: Oxford University Press. 2000; 11–22.
- Coulson NS, Eiser C, Eiser JR. Nutrition education in the National Curriculum. Health Education Journal. 1998; 57: 81–88.
- Croll JK, Neumark-Sztainer D, Story M. Healthy eating: what does it meanto adolescents? Journal of Nutrition Education. 2001; 33:193–198.
- Crossman A, Sullivan DA, Benin M. The family environment and American adolescents' risk of obesity as young adults. SocSci Med. 2006; 63:2255–2267.

- Davey Smith G, Steer C, Leary S, Ness A. Is there an intrauterine influence on obesity? Evidence from parent child associations in the Avon Longitudinal Study of Parents and Children (ALSPAC). Arch Dis Child. 2007; 92:876–880.
- Dencker M, Thorsson O, Karlsson MK, Linde C, Svensson J, Wollmer P, Andersen LB. Daily physical activity in Swedish children aged 8–11 years. Scand J Med Sci Sports. 2006; 16:252–257.
- Dennison BA, Erb TA, Jenkins PL. Television viewing and television in bedroom associated with overweight risk among low-income preschool children. Pediatrics. 2002; 109: 1028-1035.
- Dietz WH, Gortmaker SL. Do we fatten our children at the television set? Obesity and television viewing in children and adolescents. Pediatrics. 1985; 75:807-812.
- Eisenmann JC, Bartee RT, Wang MQ. Physical Activity, TV Viewing, and Weight in U.S. Youth: 1999 Youth Risk Behavior Survey. Obesity Res. 2002; 10(5):379-385.
- Epstein LH, Saelens BE. Behavioral economics of obesity: food intake and energy expenditure. In: Bickel WK, Vuchinich RE, editors. Reframing Health Behavior Change with Behavioral Economics. Mahwah, NJ: Lawrence Erlbaum. 2000; 293–311.
- Fontvieille AM, Kriska A, Ravussin E. Decreased physical activity in Pima Indian compared with Caucasian children. Int J ObesRelatMetabDisord.1993; **17**:445–52.
- Freedman DS, Khan LK, Serdula MK, Dietz WH, Srinivasan SR, Berenson GS. The relation of childhood BMI to adult adiposity: The Bogalusa Heart Study. Pediatrics. 2005; 115:22–27.
- French SA, Story M, Jeffery RW. Environmental influences on eating and physical activity. Annu Rev Public Health. 2001; 22:309–335.
- Gleason P, Suitor C. Children's diets in the mid-1990s: dietary intake and its relationship with school meal participation. Special nutrition programs; report no. CN-01-CD1. Alexandria, VA: US Department of Agriculture, Food and Nutrition Service. 2001.
- Goldberg GR. Plants: Diet and Health. The Report of a British Nutrition Foundation Task Force. Blackwell Publishing, Oxford, UK. 2003.
- Gortmaker SL, Must A, Sobol AM, Peterson K, Colditz GA, Dietz WH. Television viewing as a cause of increasing obesity among children in the United States, 1986–1990. Arch PediatrAdolesc Med. 1996; 150:356–366.
- Goyal Ramesh K, Shah Vitthaldas N, Saboo Banshi D, PhatakSanjiv R, Shah Navneet N, Gohel Mukesh C, RavalPrashad B, Pate Snehal S. Prevalence of Overweight and Obesity in Indian Adolescent School Going Children : Its Relationship with Socioeconomic Status and Associated Lifestyle Factors. Journal of the association of physicians of India. 2010; 58.
- Griffiths LJ, Dezateux C, Cole TJ, TheMillenium Cohort Study Child Health Group. Differential parental weight and height contributions to offspring birthweight and weight gain in infancy. Int J Epid. 2007; 36:104–107.
- Guillaume M, Lapidus L, Bjorntorp P, Lambert A. Physical activity, obesity, and cardiovascular risk factors in children. The Belgian Luxembourg Child Study II. Obes Res. 1997; 5:549 –556.
- Guy JA, Micheli LJ. Strength training for children and adolescents. J Am AcadOrthopSurg. 2001; 9:29–36.
- Haste H. My Body, My Self. Young People's Values and Motives about Healthy Living. Nestle Social Research Programme, London. 2004.
- Hebbelnick M, Clarys P, deMalsche A. Growth, development, and physical fitness of Flemish vegetarian children, adolescents, and young adults. American Journal of Clinical Nutrition. 1999; 70:579S–585S.
- Hernandez B, Gortmaker SL, Colditz GA, Peterson KE, Laird NM, Parra- Cabrera S. Association of obesity with physical activity, television programs and other forms of video viewing among children in Mexico City. Int J Obes. 1999; 23:845–854.
- Hill JO, et al. Obesity and the environment: where do we go from here? Science. 2003; 299(5608):853–55.
- Hill L, Casswell S, Maskill C, Jones S, Wyllie A. Fruit and vegetables as adolescent food choices in New Zealand. Health Promotion International.1998; 13:55–65.
- Jahns L, Siega-RizAM, Popkin BM. The increasing prevalence of snacking among US children from 1977 to 1996. J Pediatr. 2001; 138(4):493-498.
- Johansson L, Thelle DS, Solvoll K, Bjorneboe GE, Drevon CA. Healthy dietary habits in relation to social determinants and lifestyle factors. Br J Nutr.1999; 81: 211 – 220.
- Jotangia D, Moody A, Stamatakis E, Wardle H. Obesity among children under 11. London: Office for National Statistics. 2005.
- Kalpana CA, Narayanan Aruna , Thangarathi T. Effect of medicinal iron supplementation and nutrition education on anaemic adolescent girls of low income families. The Indian J. Nutr. andDietet. 2007; 44: 551-559.

- Kaur J, Mehta P. A study of prevalence of overweight and underweight among girls from different socioeconomic status in Ludhiana (Punjab). Human Biology Review. 2012; 1(2): 197-206.
- Kaur S, Sachdev HP, Dwivedi SN, Lakshmy R, Kapil U. Prevalence of overweight and obesity amongst school children in Delhi, India. Asia Pac J ClinNutr. 2008; 7(4): 592-596.
- Key TJ, Appleby PN, Rosell MS. Health effects of vegetarian and vegan diets. Proc Nutr Soc. 2006 Feb; 65(1):35-41.
- Khadilkar VV, Khadilkar AV, Cole TJ, Sayyad MG. Cross-sectional growth curves for height weight and body mass index for affluent Indian children, 2007. Indian Pediatr. 2009; 46:477–489.
- Kivima¨ki M, Lawlor DA, Smith GD, Elovainio M, Jokela M, Keltikangas-Ja¨rvinen L, Viikari JSA, Raitakari OT. Substantial intergenerational increases in body mass index are not explained by the fetal overnutrition hypothesis: the Cardiovascular Risk in Young Finns Study. Am J ClinNutr. 2007; 86:1509–1514.
- Kleinman RE, Hall S, Green H, Korzec-Ramirez D, Patton K, Pagano ME, Murphy JM. Diet, breakfast and academic performance in children. Ann NutrMetab. 2002; 46: 24-30.
- Kotian MS, Kumar G, Kotian SS. Prevalence and determinants of overweight and obesity among adolescent school children of South Karnataka, India. Indian J Community Medicine. 2010; 35:176-178.
- Kumar S, Mahabalaraju DK, Anuroopa MS. Prevalence obesity and its influencing factor among affluent school children of Devangre city. Indian J Community Medicine. 2007; 32(1):15-17.
- Kuriyan R, Bhat S, Thomas T, Vaz M, Kurpad AV. Television viewing and sleep are associated with overweight among urban and semi-urban South Indian children. Nutr J. 2007; 6:25–28.
- Lake JK, Power C, Cole TJ. Child to adult body mass index in the 1958 British birth cohort: associations with parental obesity. Arch Dis Child. 1997; 77:376–381.
- Laurson KR, Eisenmann JC, Welk GJ, Wickel EE, Gentile DA, Walsh DA. Combined Influence of Physical Activity and Screen Time Recommendations on Childhood Overweight. The Journal of Pediatrics. 2008; 153(2):209-214.
- Lawlor DA, Davey Smith G, O'Callaghan M, Alati R, Mamun AA, Williams GM, Najman JM. Epidemiologic evidence for the fetal overnutrition hypothesis: findings from the Mater-University study of pregnancy and its outcomes. Am J Epidemiol. 2007; 165:418–424.
- Leonard HE, Rocco AP, Constance CG, Joan D. Decreasing Sedentary Behaviors in Treating Pediatric Obesity. Arch PediatrAdolesc Med. 2000; 154:220-226.
- Lien N, Lytle LA, Klepp KI. Stability in consumption of fruit, vegetables, and sugary foods in a cohort from age 14 to age 21. Preventive Medicine. 2001; 33: 217–226.
- Lima F, De FV, Baima J, Carazzato JG, Pereira RM. Effects of impact load and active load on bone metabolism and body composition of adolescent athletes. Med Sci Sports Exer. 2001; 33:1318–1323.
- Lin BH, Guthrie J, Blaylock J. The diets of America's children: influences of dining out, household characteristics, and nutrition knowledge US Department of Agriculture Economic Report Number. 1996; 746 (AER-746).
- Maffeis C, Provera S, Filippi L, Sidoti G, Schena S, Pinelli L, Tato L. Distribution of food intake as a risk factor for childhood obesity. Int J ObesRelatMetabDisord. 2000; 24:75–80.
- Maffeis C, Talamini G, Tato` L. Influence of diet, physical activity and parents' obesity on children's adiposity: a four-year longitudinal study. Int J Obes. 1998; 22:758–764.
- Magalhães L, Maia J, Silva R, Seabra A. Padrão de actividadefísica. Estudoemcrianças de ambos ossexos do 4_ ano de escolaridade. Rev Port CienDesp. 2002; 2:47–57.
- Manolio TA, Collins FS, Cox NJ, Goldstein DB, Hindorff LA, Hunter DJ, McCarthy MI, Ramos EM, et al. Finding the missing heritability of complex diseases. Nature. 2009; 461:747–753.
- Margetts BM, Thompson RL, Speller V, McVey D. Factors which influence 'healthy' eating patterns: results from the 1993 Health Education Authority health and lifestyle survey in England. Public Health Nutr.1998; 1:193 – 198.
- Marshall SJ, Biddle SJ, Gorely T, Cameron N, Murdey I. Relationships between media use, body fatness and physical activity in children and youth: A meta-analysis. Int J ObesRelatMetabDisord. 2004; 28:1238–1246.
- Marwaha RK, Tandon N, Ganie MA, Kanwar R, Shivaprasad C, Sabharwal A, et al. Nationwide reference data for height, weight and body mass index of Indian school children. Natl Med J India. 2011; 24:269–77.
- Mohan V, Radhika G, Vijayalakshmi P, SudhaCan V. The diabetes/cardiovascular disease epidemic in India be explained, at least in part, by excess refined grain (rice) intake. Indian J Med Res. 2010; 131:369-372.

- Mota J, Fidalgo F, Silva R, Ribeiro JC, Santos R, Carvalho J, Santos MP. Relationships between physical activity, obesity and meal frequency in adolescents. Annals of Human Biology. 2008; 35(1): 1–10.
- Moy FM, Gan CY, Siti Zaleha MK. Eating patterns of school children and adolescents in Kuala Lumpur. Mal J Nutr. 2006; 12: 1-10.
- National Health and Nutrition Examination Survey. Centers for disease control and prevention. 2005-06.
- Nicklas TA, Baranowski T, Cullen KW, Berenson G. Eating patterns, dietary quality and obesity. J Am College Nutr. 2001; 20: 599-608.
- Nicklas TA, Myers L, Reger C, Beech B, Berenson GS. Impact of breakfast consumption on nutritional adequacy of the diets of young adults in Bogalusa, Louisiana: ethnic and gender contrasts. J Am Diet Assoc. 1998; 98(12):1432-1438.
- Nazni.P and Bhuvaneswari, J, Optimization of mixture flakes and nuts to formulate ready to eat breakfast bar using Response Surface Methodology, International Journal of Current Research, Vol. 33, Issue, 3, pp.029-038, March, 2011, ISSN: 0975-833X
- Padez C, Mourao I, Moreira P, Rosado V. Prevalence and risk factors for overweight and obesity in Portuguese children. ActaPaediatr. 2005; 94:1550–1557.
- Parfitt G, Pavey T, Rowlands AV. Children's physical activity and psychological health: The relevance of intensity. ActaPaediatr. 2009; 98:1037–1043.
- Parsons TJ, Power C, Logan S, Summerbell CD. Childhood predictors of adult obesity: a systematic review. Int J Obes. 1999; 23(8):S1–S107.
- Pearson Natalie, Ball Kylie, CrawfordDavid. Mediators of longitudinal associations between television viewing and eating behaviours in adolescents. International Journal of Behavioral Nutrition and Physical Activity. 2011; 8:23.
- Pereira Sofia A, Seabra André T, Silva Rui G, Katzmarzyk Peter T, Beunen Gaston P, Maia José A. Prevalence of overweight, obesity and physical activity levels in children from Azores Islands. Annals of Human Biology. 2010; 37(5): 682–691.
- Pollitt E, Mathews R. Breakfast and cognition: an integrative summary. Am J Clin Nutr. . 1998; 67: 804S-13S.
- Poppitt SD. Energy density of diets and obesity. Int J Obes. 1995; 19:S20-S26.
- Prabhjot. Assessment of obesity and associated factors among the school childen of Amritsar (Punjab). Ph. D. thesis submitted to Guru Nanak Dev University. Amritsar. 2009.
- Reilly JJ, Armstrong J, Dorosty AR, Emmett PM, Ness A, Rogers I, Steer C, Sherriff A, and for the Avon Longitudinal Study of parents and children study team. Early life risk factors for obesity in childhood: cohort study. Br Med J. 2005; 330:1357.
- Riddoch CJ, Andersen LB, Wedderkkop N, Harro M, Klasson-Heggebo L, Sardinha LB, Cooper AR, Ekelund U. Physical activity levels and patterns of 9 and 15-yr-old European children. Med Sci Sports Exerc. 2004; 36:86–92.
- Robinson TN. Television viewing and childhood obesity. PediatrClin North Am. 2001; 48: 1017- 1025.
- Rolls BJ, Kim-Harris S, Fischman MW, Foltin RW, Moran TH, Stoner SA. Satiety after preloads with different amounts of fat and carbohydrate: implications for obesity. Am J ClinNutr. 1994; 60: 476–487.
- Saakslahti A, Numminen P, Varstala V, Helenius H, Tammi A, Viikari J, Välimäki I. Physical activity as a preventive measure for coronary heart disease risk factors in early childhood. Scand J Med Sci Sports. 2004; 14: 143–149.
- Sallis J. A behavioral perspective on children's physical activity. In: Cheung L, Richmond J, editors. Child health, nutrition, and physical activity. Champaign, IL: Human Kinetics.1995; 125–138.
- Sardinha L, Andersen LB, Anderssen SA, Quitério AL, Ornelas R, Froberg K, Riddoch CJ, Ekelund U. Objectively measured time spent sedentary is associated with insulin resistance independent of overall and central body fat in 9- to 10–year-old Portuguese children. Diabetes Care. 2008; 31: 569–575.
- Siega-Riz AM, Carson T, Popkin B. Three squares or mostly snacks—what do teens really eat? A sociodemographic study of meal patterns. J Adolesc Health. 1998; 22: 29– 36.
- Srivastava SP, Kumar A, Bharati LK, Sharma VK. Dietary Practices and Beliefs in Adolescent Girls. Indian Pediatrics. 1997; 34.
- Stang J, Kong A, Story M, Eisenberg ME, Neumark-Sztainer D. Food and weight-related patterns and behaviors of Hmong adolescents. J Am Diet Assoc. 2007; 107: 936-941.
- Strong WB, Malina RM, Blimkie CJR, Daniels SR, Dishman RK, Gutin B, Hergenroeder AC, Must A, Nixon PA, Pivarnik JM, Rowland T, Trost S, Trudeau F. Evidence based physical activity for school-age youth. J Pediatr. 2005; 146:732–737.
- Subar AF, Krebs-Smith SM, Cook A, Kahle LL. Dietary sources of nutrients among US children, 1989-1991. Pediatrics. 1998; 102(4 Pt 1):913-923.

- Sweeting H. Gendered dimensions of obesity in childhood and adolescence. Nutr J. 2008; 7:1–14.
- Swinburn BA, Ley SJ, Plank LD. Body size and composition in Polynesians. Int J Obes.1999; 23**:** 1178-1183.
- Tanasescu M, Ferris AM, Himmelgreen DA, Rodriguez N, Perez-Escamilla R. Biobehavioral Factors Are Associated with Obesity in Puerto Rican Children. J Nutr. 2000; 130:1734-1742.
- teVelde SJ, De Bourdeaudhuij I, Thorsdottir I, Rasmussen M, Hagstromer M, et al. Patterns in sedentary and exercise behaviors and associations with overweight in 9–14-year-old boys and girls–a cross-sectional study. BMC Public Health. 2007; 7: 16.
- Trost SG, Pate RR, Sallis JF, Freedson PS, Taylor WC, Dowda M, Sirard J. Age and gender differences in objectively measured physical activity in youth. Med Sci Sports Exerc. 2002; 34:350–355.
- Van Mechelen W, Twisk JWR, Post GB, Snel J, Kemper HCG. Physical activity of young people: The Amsterdam longitudinal growth and healthy study. Med Sci Sports Exerc. 2000; 32:1610–1616.
- Vereecken C, Ojala K, Delgrande J. Eating habits. In: Currie C, Roberts C, Morgan A, Smith R, Setterobulte W, Samdel O, Rasmussen VB,editors. Young People's Health in Context: Health Behaviour in School-aged Children (HSBC) Study: International Report From the 2001/2002 Survey. Health Policy for Children and Adolescents No. 4. WHO Regional Office for Europe, Copenhagen. 2004; 110–119.
- Veugelers PJ, Fitzgerald AL. Prevalence of and risk factors for childhood overweight and obesity. CAMJ. 2005; 173(6): 607-613.
- Videon TM, Manning CK. Influences on adolescent eating patterns: the importance of family meals. J AdolescHealth. 2003; 32: 365-373.
- Wardle J, HaaseAM, Steptoe A, Nillapun M, Jonwutiwes K, Bellisle F. Gender differences in food choice: the contribution of health beliefs and dieting. Annals of Behavioural Medicine. 2004; 27:107–116.
- Weiner JS, Lourie. Practical Human Biology. Academic Press Inc. Ltd., London.1981.
- Whitaker RC, Wright JA, Pepe MS, Seidel KD, Dietz WH. Predicting obesity in young adulthood from childhood and parental obesity. New Engl J Med. 1997; 337:869–873.
- WHO. Obesity: preventing and managing the global epidemic. Report of a WHO consultation on obesity. World Health Organization Technical Report Series WHO/NUT/NCD/981. Geneva: WHO 1997. The Lancet. 2004; 363: 157-163.
- Wiecha JL, Peterson KE, Ludwig DS, Kim J, Gortmaker SL. When children eat what they watch: impact of television viewing on dietary intake in youth. Arch Pediatr Adoles Med. 2006; 160:436–442.
- Williams S. Overweight at age 21: the association with body mass index in childhood and adolescence and parents' body mass index. A cohort study of New Zealanders born in 1972–1973. Int J Obes. 2001; 25: 158–163.
- Wolfe WS, Campbell CC, Frongillo EA, Haas JD, Melnik TA. Overweight schoolchildren in New York State: Prevalence and characteristics. Am J Public Health. 1994; 84: 807-813.
- Wyshak G. Teenage girls, carbonated beverage consumption, and bone fractures. Arch Pediatr Adolesc Med. 2000; 154(6):610-613.