Dietary and lifestysle factors associated with obesity among adolescents

NETRAVATI M. ULAVANNAVAR AND USHA MALAGI

The present investigation was carried out to assess the eating habits of 60 obese adolescents. The subjects were selected by purposive random sampling method from 2 villages of Dharwad taluk. A self structured questionnaire was developed to elicit the information about obese adolescents on various aspects including general information and dietary intake. The results revealed that About 40 per cent of subjects belonged to 13-14 years of age. Almost equal percentage of subjects had vegetarian and non-vegetarian food habits (38.33 % and 36.67 %, respectively) and only 25 per cent of the subjects belonged to eggetarian category. Majority of the adolescents had the habit of eating out side foods (88.33 %). Cereals, fats and oils, sugar and jaggery were consumed by all the adolescents (100 %) every day. Pulses, milk and milk products and other vegetables were consumed by 76 per cent of adolescents every day, Majority of them consumed roots and tubers (83.33 %) every day. Per cent adequacy of boys and girls in case of pulses (99.61 vs 94.05), fats and oils (98.42 vs 100.83) were at par with the SDA. Per cent adequacy of nutrients for boys and girls in case of protein (108.87 vs 120.77), fat (104.87 vs 105.74) were higher than the RDA. Per cent adequacy of iron, β carotene, riboflavin, ascorbic acid, niacin, vit B_6 were lower than the RDA (64.05 vs 84.84, 17.56 vs 28.34, 44.46 vs 50.88, 41.22 vs 46.67, 81.01 vs 90.03 and 7.77 vs 8.13, respectively). The duration of the light activities were higher than moderate activities (21.10 vs 2.90 hr, respectively). Majority of the subjects were belonged to overweight category (66.67%), followed by likely to be obese (21.67%) and obese category (11.66%). various unhealthy dietary and life style factors and physical in activity found to contribute obesity among adolescents.

Key Words : BMI, Dietary habits, Life style, Adolescents, Obesity, Food, Physical activity

How to cite this article : Ulavannavar, Netravati M. and Malagi, Usha (2017). Dietary and lifestysle factors associated with obesity among adolescents. *Food Sci. Res. J.,* **8**(2): 332-339, **DOI : 10.15740/HAS/FSRJ/8.2/332-339**.

INTRODUCTION

Over the past three decades the prevalence of overweight and obesity have increased substantially. Obesity in children and adolescents is gradually becoming a major public health problem in many developing countries, including India. WHO (Anonymous, 2013) reported that, more than 42 million children are overweight. In Karnataka (Davanagere), the prevalence of overweight was 6.5 per cent and obesity was 1.1 per cent among 13 to 16 year old adolescents (Subraya, 2011). The prevalence of overweight among adolescent girls was similar in both rural and urban areas (1.63 and 1.69%, respectively). Whereas, obesity was higher in urban girls compared to rural girls (1.69% vs. 0.41% Ballolli, 2013). Childhood obesity is an important predictor of adult obesity. About one third of obese pre-school children and one half of obese school-age children become obese adults

━━━━━ ● MEMBERS OF RESEARCH FORUM ● ━━━━━

Author for correspondence :
NETRAVATI M. ULAVANNAVAR, Department of Food Science and Nutrition, College of Rural Home Science, University of Agricultural Sciences, DHARWAD (KARNATAKA) INDIA
Email : netravatimu@gmail.com

Associate Authors' :
USHA MALAGI, Department of Food Science and Nutrition, College of Rural Home Science, University of Agricultural Sciences, DHARWAD (KARNATAKA) INDIA
Email : ushamalagi10@gmail.com

(Friedman and Brownell, 2000). Ebbeling *et al.* (2003) reported that approximately 60-85 per cent of obese pre-school children will remain obese during adulthood, and comorbidities represent a major health problem. Obese children and adolescents suffer from both short term and long term health consequences and can pose a serious health and economic burden on the society. Medical conditions associated with obesity include, sleep apnea, Type 2 diabetes, asthma, hepatic steatosis (fatty liver disease), cardiovascular disease, high cholesterol, cholelithiasis (gallstones), glucose intolerance and insulin resistance, skin conditions, menstrual abnormalities, impaired balance, and orthopedic problems (Niehoff, 2009). According to Popkin (2001). The cause of increasing childhood overweight and obesity in developing countries is attributed to transition towards western diet or changes in eating behaviour. The rise in obesity is primarily due to altered sedentary lifestyles, energy-dense diets and low-levels of physical activity and replacing family meals with unhealthy foods and also they do not consume enough fruits and vegetables. Therefore the aim of this research was to investigate dietary habits of rural obese adolescents.

METHODOLOGY

The study was carried out during 2014-2015, the 2 villages from Dharwad Taluk were selected for the study. About 30 obese, overweight and likely to be overweight children from classes 8th, 9th and 10th were selected purposively from one village by using WHO growth charts (Anonymous, 2007). Age and gender matched controls were selected from other village. A detailed questionnaire was developed to elicit the information about obese adolescents on various aspects including general information, nutritional status *viz.,* dietary intake, anthropometric and lipid profile was analysed. Anthropometric measurements *viz.,* height, weight, waist circumference (WC) and hip circumference (HC) were recorded as per the guidelines suggested by Jelliffe (1966). Dietary intake was assessed by using food frequency questionnaire and 24 hour recall method using a set of pre standardized vessels. The nutrients present in the food were computed using nutritive value book (Gopalan *et al.,* 2004). Recommended Dietary Allowance (RDA) for Indian adolescents was considered for computing percent adequacy of food (Anonymous, 2010 a) and nutrients (Anonymous, 2010 b). Mean and Standard

deviation was used to interprete the data, Independent t test was used to test the significance of difference between food intake of both girls and boys.

OBSERVATIONS AND ASSESSMENT

Distribution of subjects based on the demographic profile is presented in Table 1. About 40 per cent of subjects belonged to 13-14 years of age followed by 14-15 years (31.66 %) and 15-16 years of age (1.67 %). It was observed that half the (50%) subjects were living in a nuclear family set up. Equal and one fourth of the subjects (25 %) lived in a joint and extended family set up. Similar trend was observed in case of girls. In case of boys 45.84 per cent of the subjects lived in a nuclear family, followed by extended family (33.33%) and joint family setup (20.83 %). About 46.66 per cent of the subjects fathers had Agricultural labour as profession, followed by non-agricultural labour (31.67 %), farming (20%), with very few in a private or government sector (1.67 %). Similar trend was observed in case of girls. In case of boys 41.67 per cent of the fathers were non-agricultural labours, followed by agricultural labour (33.34%), farming (20.83%), with least in the service sector (4.16%). Similarly 56.66 per cent of the boys mothers were house wives, followed by non-agricultural labour (23.34%), agricultural labour (16.66%) and only 3.34 per cent were farm women. Similar trend was observed in case of girls. In case of boys 62.5 per cent of the mothers were house wives, followed by agricultural labour (12.51%) and only 4.16 per cent were farm women. About 38 per cent of the obese adolescent parents had annual income between 30,000-60,000 Rs. followed by 60,000-90,000 Rs. (35%), 10,000-30,000 Rs. (25%) and very few (1.67 %) had annual income of more than Rs. 90,000. Socio-economic status of families of obese adolescents showed that majority of the adolescents belonged to the upper middle class families (56.66%), followed by lower class families (26.66%), High class families (13.33%) and very few belonged to upper high class families (3.34 %).

Meal pattern of obese adolescents is presented in Table 2. Almost equal percentage of subjects had vegetarian and non-vegetarian food habits (38.33 % and 36.67 %, respectively) and only 25 per cent of the subjects belonged to eggetarian category. Similar trend was observed among the adolescent girls, where as in case of boys 41.66 per cent of the boys belonged to non-

vegetarian category, followed by vegetarian (37.51 %) and few subjects belonged to eggetarian category (20.83 %). Majority of the subjects consumed 4 meals per day (63.33 %), followed by 3 meals (36.66 %). Similar trend was observed among both boys and girls.

Frequency of consumption of foods outside the home is presented in Table 3. Majority of the adolescents had the habit of eating out side foods (88.33 %), higher percentage of girls consumed outside foods when compared to boys (94.44 % vs 79.17%, respectively). Almost one third of the adolescents visited hotels once in a month or occasionally (31.66 % and 36.66 %,

respectively), followed by once in a week (13.33 %) and least visited hotels daily (1.67 %).Almost equal number of subjects visited roadside eatery once in a week and daily (31.67 and 28.32 %, respectively), followed by once in month and occasionally (6.67 % and 5 %, respectively). Maximum percentage of the subjects visited bakery once in a week (65 %), followed by daily, once in a month and occasionally (13.34 %, 5%, and 3.33%, respectively), least percentage of the subjects had never visited hotels, road side eatery and bakeries (5 %, 16.66 % and 6.66 %, respectively). Modernization in food technology and processing has led to the availability of soft drinks, ready

Table 1 : Demographic profile of the obese adolescents (n=60)

Particulars		Boys		Girls		Total	
		n	%	n	%	n	%
Age (Year)	13-14	6	25.00	18	50.00	24	40.00
	14-15	5	20.83	14	38.88	19	31.66
	15-16	12	50.00	4	11.12	16	26.67
	16-17	1	4.17	0	0	1	1.67
Type of family	Nuclear	11	45.84	19	52.78	30	50.00
	Joint	5	20.83	10	27.78	15	25.00
	Extended	8	33.33	7	19.44	15	25.00
Fathers occupation	Agricultural labourers	8	33.34	20	55.55	28	46.66
	Non- Agricultural labourers	10	41.67	9	25	19	31.67
	Farming	5	20.83	7	19.45	12	20.00
	Service	1	4.16	0	0	1	1.67
Mothers occupation	House wife	15	62.5	19	52.78	34	56.66
	Agricultural labourers	5	20.83	5	13.88	10	16.66
	Non- Agricultural labourers	3	12.51	11	30.56	14	23.34
	Farming	1	4.16	1	2.78	2	3.34
Annual income (Rs.)	10,000 – 30,000	6	25.00	9	25.00	15	25
	30,000 – 60,000	11	45.84	12	33.34	23	38.33
	60,000 – 90,000	6	25.00	15	41.66	21	35.00
	>90,000	1	4.16	0	0	1	1.67
Socio-economic status	Upper high	1	4.18	1	2.78	2	3.34
	High	7	29.16	1	2.78	8	13.34
	Upper middle	9	37.50	25	69.44	34	56.66
	Lower middle	7	29.16	9	25.00	16	26.66

Table 2 : Meal pattern of selected obese adolescents (n=60)

Particulars		Boys (24)		Girls (36)		Total	
		N	%	N	%	N	%
Type of diet	Vegetarian	9	37.51	14	38.88	23	38.33
	Non veg.	10	41.66	12	33.34	22	36.67
	Eggetarian	5	20.83	10	27.78	15	25.00
No. of meals	4	13	54.17	25	69.45	38	63.34
	3	11	45.83	11	30.55	22	36.66
	2	0	0.00	0.00	0.00	0.00	0.00

to eat foods and other processed readymade sweets, chips and chocolates in the close vicinity of the schools and children were given pocket money and purchased these foods. This has led to eating of all these foods in place of traditional foods, this may be the cause for overweight and obesity. Several studies showed that the risk of obesity was related to high intake of soft drinks (Collision *et al*., 2010 and Gortmaker *et al*., 2003) and in some studies they have attributed the cause of obesity to consumption of fast foods (Niemeier *et al.,* 2006).

Musaiger *et al.* (2012) have reported that trend of increasing obesity with the high consumption of fast foods and high portion size. In the present study the children consumed chocolates, ready to eat foods like chips and soft drinks and not fast foods.

Frequency of consumption of foods is presented in Table 4. Cereals, fats and oils, sugar and jaggery were consumed by all the adolescents (100 %) every day, Majority of them consumed roots and tubers (83.33 %) every day, followed by weekly (13.33 %) and only one

Table 3 : Frequency of consumption foods outside the home (n=60)

Eating outside food		Boys (n=24)		Girls (n=36)		Total	
		N	%	N	%	N	%
Yes		19	79.17	34	94.44	53	88.33
No		5	20.83	2	5.56	7	11.67
If yes		Boys (24)		Girls (36)		Total (60)	
	Frequency of visit						
Hotels	Daily	1	4.17	0	0.00	1	1.67
`	Once in week	5	20.83	3	8.33	8	13.33
	Once in month	3	12.50	16	44.44	19	31.66
	Occasionally	9	37.50	13	36.11	22	36.67
	Never	1	4.17	2	5.56	3	5.00
Road side	Daily	7	29.17	10	27.78	17	28.32
eatery	Once in week	7	29.17	12	33.33	19	31.67
	Once in month	1	4.17	3	8.33	4	6.67
	Occasionally	2	8.33	1	2.78	3	5.00
	Never	2	8.33	8	22.22	10	16.67
Bakery	Daily	2	8.33	6	16.66	8	13.34
	Once in week	16	66.67	23	63.88	39	65
	Once in month	1	4.17	2	5.56	3	5.00
	Occasionally	0	0.00	2	5.56	2	3.33
	Never	0	0.00	1	2.78	1	1.66

Table 4 : Frequency of consumption of foods by rural obese adolescents (n=60)

Food groups	Daily N (%)	Weekly N (%)	Fortnightly N (%)	Monthly N (%)	Occasionally N (%)	Never N (%)
Cereals	60 (100.00)	0 (0)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Pulses	46 (76.66)	10 (16.67)	3 (5.00)	1 (1.67)	0 (0.00)	0 (0.00)
Fats and oils	60 (100.00)	0 (0)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Sugar and jaggary	60 (100.00)	0 (0)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Egg, fish, meat and meat products	0 (0.00)	0 (0.00)	20 (33.33)	10 (16.67)	7 (11.67)	23 (38.33)
Nuts and oil	5 (8.33)	23 (38.33)	13 (21.67)	4 (6.67)	11 (18.33)	4 (6.67)
Milk and milk products	46 (76.67)	11 (18.33)	3 (5.00)	0 (0.00)	0 (0.00)	0 (0.00)
Fruits	9 (15.00)	44 (73.33)	0 (0.00)	1 (1.67)	6 (10.00)	0 (0.00)
Green leafy vegetables	35 (58.32)	19 (31.67)	1 (1.67)	0 (0.00)	1 (1.67)	4 (6.67)
Other vegetables	46 (76.67)	12 (20.00)	2 (3.33)	0 (0.00)	0 (0.00)	0 (0.00)
Roots and tubers	50 (83.33)	8 (13.33)	1 (1.67)	0 (0.00)	1 (1.67)	0 (0.00)

Figures in parenthesis indicates percentages

subject each consumed fortnightly and occasionally (1.67 %). Pulses, milk and milk products and other vegetables were consumed by 76 per cent of adolescents every day, followed by weekly consumption of all the foods (from 16-20%), and fortnightly consumption (5 % each for pulses and milk and milk products. About 58.3 per cent adolescents consumed green leafy vegetables every day, followed by weekly consumption (31.1 %) and one subject (1.67 % each) consumed fortnightly and occasionally. Maximum subjects consumed fruits and nuts and oil seeds weekly once (73.3 % and 38.3 %, respectively), 21.67 per cent of the subjects consumed nuts and oil seeds fortnightly followed by occasionally and daily (18.3 % and 8.3 %, respectively), about 15 per cent of the adolescents consumed fruits daily, followed by occasionally and monthly (10 % and 1.7%, respectively). Higher percentage of the subjects consumed egg/fish, meat and meat products fortnightly (33.33 %), followed by monthly (16.66 %) and occasionally (11.67 %), where as 38.33 per cent of the subjects had never consumed the egg/fish, meat and meat products as they were vegetarian.

Per cent adequacy of foods for both boys and girls is presented in Fig. 1. Per cent adequacy of boys and girls in case of pulses (99.61 vs 94.05), fats and oils (98.42 vs 100.83) were on par with the SDA. The per cent adequacy of cereals (109.15 vs 102.0), sugar and jaggery (111.25 vs 104.77) for girls and boys were higher than the SDA, However green leafy vegetables, other vegetables, roots and tubers, fruits, fleshy foods and milk and milk products were lower than the SDA (22.16 vs 49, 49.82 vs 30.90, 31.63 vs 53.88, 25.30 vs 20.86, 47.91 vs 35.18 and 39.46 vs 32.58 g, respectively).
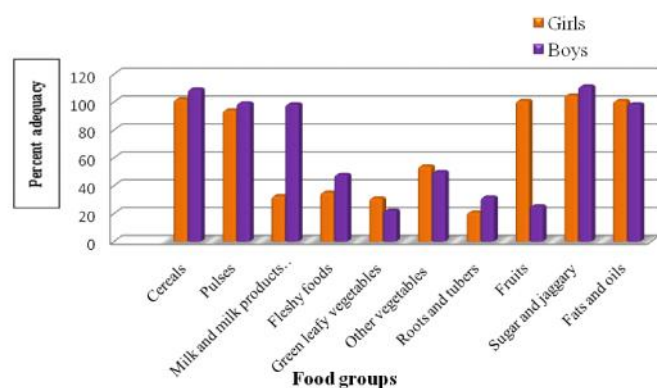
Per cent adequacy of nutrients for both boys and

girls is presented in Fig. 2. Per cent adequacy of nutrients for boys and girls in case of protein (108.87 vs 120.77), fat (104.87 vs 105.74) were higher than the RDA. Per cent adequacy of energy for girls and boys was (97.67 vs 99.61) were at par with the RDA. However iron, β carotene, riboflavin, ascorbic acid, niacin, vit B_6 were lower than the RDA (64.05 vs 84.84, 17.56 vs 28.34, 44.46 vs 50.88, 41.22 vs 46.67, 81.01 vs 90.03 and 7.77 vs 8.13, respectively). Per cent adequacy of calcium and thiamine were higher in girls (119.70 vs 87.71 and 99.85 vs 87.24, respectively) compared to boys. Where as in boys per cent adequacy of folic acid were higher compared to girls (102.15 vs 92.87). This may be due to poor purchasing capacity, lack of availability of protective foods in rural area, lack of awareness of the families regarding use of protective and micro nutrient rich foods. Therefore, there is a need to make them aware of healthy balanced diet and micro nutrient rich foods. Several scientists working with adolescents have reported lower intake of protective foods in comparison with suggested balance diet (Deepa, 2002; Koodagi and Yenagi, 2007). This may be due to poor purchasing capacity, lack of awareness of the families regarding use of protective foods. It can be concluded that various unhealthy dietary and life style factors, physical in activity and family traditions found to contribute obesity among adolescents.

Classification of adolescents based on BMI, WHR and WHtR were presented in Table 5. When adolescents were classified into different categories of obesity based on BMI, majority of the subjects were belonged to overweight category (66.67%), followed by likely to be obese (21.67%) and obese category (11.66%). Similarly maximum boys and girls belonged to overweight category (62.5% and 69.45%, respectively). On the other hand
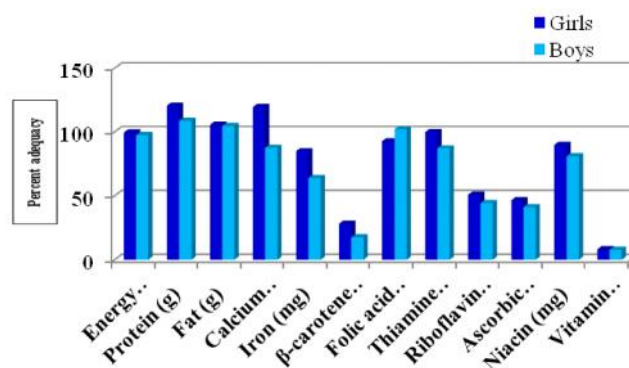

Fig. 1 : Per cent adequacy of foods for obese girls and boys

Fig. 2 : Per cent adequacy of nutrients for obese girls and boys

Table 5 : Activity pattern of obese adolescents (n=60)

Activities	Gender	Experimental	Control	Mean		Group	Gender	Group x Gender
Light activity (hr)								
Personal activity	Girls	3.11 ± 0.58	5.00 ± 0.54	4.05 ± 0.58	F value	3.01		
	Boys	2.85 ± 0.61	2.82 ± 0.61	2.83 ± 0.31	S.E. ±	0.075	32.11 [NS]	0.065 [NS]
	Mean	2.98 ± 0.59	3.91 ± 0.58	3.44 ± 0.86				
Attending class	Girls	7.11 ± 0.32	7 ± 0	7.05 ± 0.16	F value	1.96[NS]		
	Boys	7.66 ± 0.49	7 ± 0	7.33 ± 0.24	S.E. ±	0.048	1.10[NS]	14.00**
	Mean	7.38 ± 0.40	7 ± 0	7.19 ± 0.19				
Tuition and	Girls	2.27 ± 0.57	1.96 ± 0.54	2.11 ± 0.83	F value	0.47 [NS]		
homework	Boys	2.44 ± 0.74	2.5 ± 1.08	2.47 ±0.91	S.E. ±	0.09	3.15 [NS]	0.95 [NS]
	Mean	2.35 ± 0.66	2.23 ± 0.81	2.29 ± 0.24				
T.V watching	Girls	0.97 ± 0.48	1.43 ± 0.48	1.20 ± 0.63	F value	0.44 [NS]		
	Boys	1.43 ± 1.86	1.34 ± 0.78	1.38 ± 1.32	S.E. ±	0.12	0.44 [NS]	1.38 [NS]
	Mean	1.20 ± 1.17	1.38 ± 0.63	1.29 ± 0.12				
Total light	Girls	13.48 ± 0.70	13.4 ± 0.89	13.44 ± 0.79	F value			
activities	Boys	14.39 ± 2.10	13.66 ± 0.73	14.02 ± 1.42	S.E. ±			
	Mean	13.93 ± 1.40	13.53 ± 0.81	13.73 ± 0.41				
Sleeping	Girls	7.72 ± 0.57	7.58 ± 0.69	7.65 ± 0.67	F value	0.57 [NS]		
	Boys	6.58 ± 2.03	7.60 ± 0.77	7.09 ± 1.40	S.E. ±	0.14	0.91 [NS]	4.11*
	Mean	7.15 ± 1.30	7.59 ± 0.73	7.37 ± 0.39				
Moderate activities (hr)								
School play	Girls	1.45 ± 0.56	1.10 ± 0.34	1.28 ± 0.60	F value	17.81 [NS]		
	Boys	1.47 ± 0.41	1.26 ± 0.64	1.36 ± 0.52	S.E. ±	0.06	1.78 [NS]	0.61 [NS]
	Mean	1.46 ± 0.48	1.18 ± 0.49	1.32 ± 0.06				
Exercises	Girls	0.43 ± 0.37	0.78 ± 0.41	0.60 ± 0.40	F value	0.19 [NS]		
	Boys	0.70 ± 0.69	0.52 ± 0.43	0.61 ± 0.56	S.E. ±	0.006	0.002 [NS]	4.39*
	Mean	0.57 ± 0.53	0.65 ± 0.42	0.61 ± 0.007				
House hold chores	Girls	0.90 ± 0.42	2.08 ± 0.37	1.49 ± 0.47	F value	5.86 [NS]		
	Boys	0.84 ± 0.55	0.93 ± 0.53	0.88 ± 0.54	S.E. ±	0.06	3.95 [NS]	0.30 [NS]
	Mean	0.87 ± 0.48	1.51 ± 0.45	1.19 ± 0.42				
Total moderate	Girls	2.79 ± 0.54	3.02 ± 0.56	2.91 ± 0.72	F value			
activities	Boys	3.02 ± 1.02	2.72 ± 0.90	2.87 ± 0.96	S.E. ±			
	Mean	2.91 ± 0.78	2.87 ± 0.73	2.89 ± 0.02				
Total grand total	Girls	24 ± 0	24.00 ± 0.11	24 ± 0.00	F value			
	Boys	24.00 ± 0.36	24 ± 1.80	24.00 ± 1.09	S.E. ±			
	Mean	24 ± 0.18	24.00 ± 0.11	24 ± 0.002				

* and ** indicate significance of values at P=0.05 and 0.01, respectively   NS=Non-significant

Table 6 : Classification of adolescents based on BMI (n=60)

Classification		Boys (n=24)		Girls (n=36)		Total	
		N	%	N	%	N	%
Likely to be obese (75-85th percentile)		8	33.34	5	13.89	13	21.67
Over weight (85-95th percentile)		15	62.5	25	69.45	40	66.67
Obese >95th percentile		1	4.16	6	16.66	7	11.66
WHR	Non obese	17	70.84	2	5.56	19	31.67
	Abdominally obese	7	29.16	34	94.44	41	68.33
WHtRs	Non obese	6	25.00	2	5.56	8	13.34
	Abdominally obese	18	75.00	34	94.44	52	86.66

more girls were in obese category compared to boys (16.66 % vs 4.16 %) and more boys were in category of likely to be overweight compared to girls (33.34 % vs 13.89 %). When both boys and girls were classified according to waist to hip ratio, majority of the boys belonged to non-obese category compared to girls (70.84 % vs 5.56 %) and more of girls were abdominally obese compared to boys (94.44 % vs 29.16 %). When WHtR was considered, similar trend as that of WHR was followed, majority of the boys were belonged to non-obese category compared to girls (25% vs 5.56 %), and more of girls were belonged to abdominally obese category compared to boys (75 % vs 94.44%) was observed. Impaired endocrine secretions especially sex hormones along with low levels of growth hormone may be the reasons for visceral fat deposition. Shah *et al.* (2008) in Bhavnagar registered a higher abdominal obesity among girls compared to their gender counterparts. WHR was found to be high among girls in the present study compared to boys. Impaired endocrine secretions especially sex hormones along with low levels of growth hormone may be the reasons for visceral fat deposition as reported by Bjorntorp and Rosmond (2000).

The activity pattern of obese adolescents is presented in Table 6. The daily activity pattern of obese school children were classified as light and moderate activities. The duration of the light activities were higher than moderate activities (13.73 vs 2.89 hr, respectively). Among the light activities, maximum time was spent for attending classes (7.19 hr), followed by personal activity (3.44 hr), tuition and home work (2.29 hr) and T.V. watching (1.29 hr). When moderate activities of adolescents were considered, they spent maximum time in school play (1.32 hr), followed by performing household chores (1.19 hr) and exercise (0.61 hr). When compared between experimental and control groups the adolescents in the control group spent maximum time in personal activity (3.91 vs 2.98 hr), followed by T.V. watching (1.38 vs 1.20 hr), exercise (0.65 vs 0.57) and house hold chores (1.51 vs 0.87 hr), on the other hand experimental subjects spent more time in attending classes (7.38 vs 7 hr), tuition and home work (2.35 vs 2.23 hr), school play (1.46 vs 1.18 hr). When compared between experimental and control groups the subjects in control group spent maximum time in sleeping, when compared to experimental groups (7.59 vs 7.15, respectively). When compared between the girls and boys girls spent higher time in sleeping compared to boys (7.65 vs 7.09, respectively). Statistical test were applied when interaction between group and gender were considered attending classes were found to be significant at 1 per cent level and also significant difference were found in case of sleeping and exercise (p<0.05). Frequent consumption of energy rich foods and sedentary activity among the school children is the reason for overweight and obesity. Similarly the different workers *viz.,* Sun *et al*. (2009) reported that excessive eating, physical inactivity and long hours of TV watching was positively associated with obesity.

LITERATURE CITED

Anonymous (2007). Growth charts for children, World Health Organization.

Anonymous (2010a). Dietary Guidelines for Indians: A manual, National Institute of Nutrition, Hyderabad, p. 89.

Anonymous (2010b). Nutrient requirements and recommended dietary allowances for Indians-A report of the expert group of the Indian Council of Medical Research, p. 332.

Anonymous (2013). Prevalence of obesity in India, World Health Organization, Gineva.

Ballolli, U. (2013). Prevalence and management of adolescent Obesity through millet based foods. Ph.D. Thesis, University of Agricultural Sciences, Karnataka, Dharwad (India).

Bjorntorp, P. and Rosmond, R. (2000). The metabolic syndrome-a neuro endocrine disorder. *British J. Nutr.*, **83**: S49–S57.

Collison, K.S., Zaidi, M.Z., Subhani, S.N., Al-Rubeaan, K., Shoukari, M. and Al-Mohanna, F.A. (2010). Sugar-sweetened carbonated beverage consumption correlates with BMI, waist circumference, and poor dietary choices in school children. *BMC Public Health,* **10**: 234-246.

Deepa, K.S. (2002). Nutritional and health profile during menarche and seasonal variations in iron status of adolescent girls. M.H.Sc. Thesis*,* University of Agricultural Sciences, Karnataka, Dharwad (India).

Ebbeling, B.C., Leidig, M. Michael., Sinclair, B.K., Hangen, P.J. and Ludwig, S.D. (2003). A reduced – Glycemic load diet in the treatment of adolescent obesity. *Arch. Pediatr. Adolesc. Med.*, **157** : 773- 779.

Friedman, M. and Brownell, K. (2000). Psychological correlates of obesity: moving to the next research generation. *Psychological Bulletin.,* **117** : 3-20.

Gopalan, C., Ramashastri, B.V. and Balasubramanian, S.

(2004). Nutritive value of Indian foods. National Institute of Nutrition, Indian Council of Medical Research, Hyderabad, India.

Gortmaker, S.L., Peterson, K. and Weicha, J. (2003). Reducing obesity via a schoolbased interdisciplinary intervention among youth. *Arch. Pediatric., Adolesc.Med.,* **153**: 409-418.

Jelliffe, D.B. (1966). The assessment of nutritional status of community, WHO, Monograph series, WHO, Geneva.

Koodagi, K.B. and Yenagi, N.B. (2007). Nutritional status and physical fitness of high school of Dharwad city. *Mysore J. Agric. Sci.,* **41**(4): 433-540.

Musaiger, A.O., Takuri, H.R., Hasan, A.S. and Abu-Tarboush, H. (2012). Foodbased dietary guidelines for the Arab Gulf countries. *J. Nutri. Metabolism,* **12**: 45-50.

Niehoff, V. (2009). Childhood obesity : A call to action. *Bariatric Nursing Surgical Patient Care*., **4** (1):18-22.

Niemeier, H.M., Raynor, H.A., Lloyd-Richardson, E.E., Rogers, M.L. and Wing, R.R. (2006). Fast food consumption and breakfast skipping. Predictors of weight gain from adolescence to adulthood in nationally representative sample. *J. Adolescent Health,* **39**: 842–849.

Popkin, B.M. (2001). The nutrition transition and obesity in the developing world. *J. Nutr.,* **131** (Suppl): 871–873.

Shah, C., Diwan, J., Rao, P., Bhabhor, M., Gokhle, P. and Mehta, H. (2008). Assessment of obesity in school children. *Calicut Medical J.*, **6**(3): 1- 8.

Subraya, H. (2011). Study of prevalence and predictors of overweight and obesity in high school children of Davangere city. M.D. Thesis in Paediatrics, Rajiv Gandhi University of Health Sciences, Karnataka, Bangalore.

Sun, Y., Sekine, M. and Kagamimori, S. (2009). Lifestyle and overweight among Japanese adolescents: the Toyama birth cohort study. *J. Epidemiol*., **19**(6): 303-310.