4.1 SUBJECTS

Table 4.1 :Distribution of subjects

Variables	Age Group	Boys (N=718) N (%)	Girls (N=749) N (%)
Age	10 years	68 (9.5)	79 (10.5)
	11 years	75 (10.4)	106 (14.2)
	12 years	63 (8.8)	110 (14.7)
	13 years	112 (15.6)	90 (12)
	14 years	102 (14.2)	75 (10)
	15 years	131 (18.2)	89 (11.9)
	16 years	100 (13.9)	112 (15)
	17 years	67 (9.3)	88 (11.7)
Adolescent Stage	Early (10-14 years)	420 (58.5)	460 (61.4)
	Late (15-17 years)	298 (41.5)	289 (38.6)

The distribution of subjects is presented in the Table 4.1.Among a total of 1467 subjects,718 (48.9%) were boys and 749 (51.1%) were girls.A total of 420 (58.5%) of the boys and 460 (61.4%) of the girls belongs to early adolescent, and 298 (41.5%) of boys and 289 (38.6%) of the girls belongs to late adolescent group.

4.2 PHYSICAL CHARACTERISTICS OF THE SUBJECTS

4.2.1 HEIGHT OF THE SUBJECTS

Table 4.2 :Descriptive summary and comparison of height among boys and girls across different age groups.

Age (year)	Boys			Girls			Mean Dif.	t	p
	N	Mean	SD	N	Mean	SD			
10	68	136.8	5.78	79	139.4	6.45	-2.60	2.56	.012
11	75	140.9	6.08	106	142.1	7.79	-1.30	1.21	.229
12	63	146.6	7.33	110	148.1	7.53	-1.50	1.27	.205
13	112	156.4	9.14	90	153.4	5.93	3.00	2.69	.008
14	102	160.9	7.42	75	154.1	5.24	6.80	6.79	.000
15	131	167.2	7.01	89	155.4	5.28	11.8	13.5	.000
16	100	168.3	6.13	112	156.1	5.06	12.2	15.86	.000

Age (year)	Boys			Girls			Mean Dif.	t	p
	N	Mean	SD	N	Mean	SD			
17	67	168.8	5.84	88	156.6	5.48	12.2	13.3	.000
Total	718	155.7	13.28	749	150.7	8.76	6.90	11.7	.000
Early	420	148.3		460	147.4		0.9		
Late	298	168.1		289	156.0		12.1		

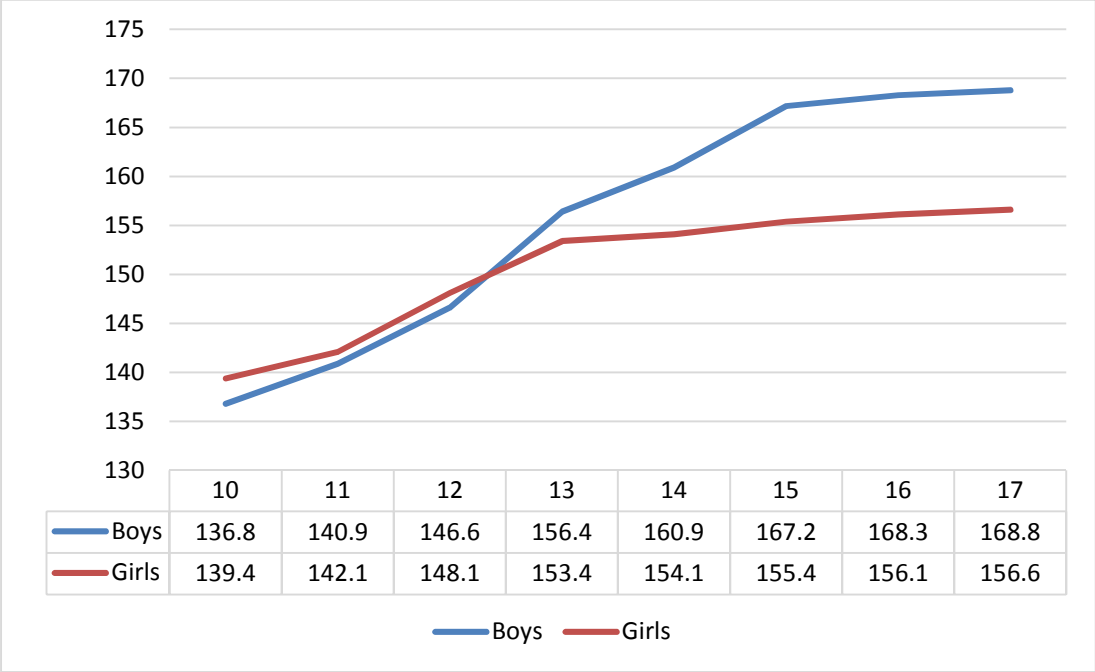
Descriptive summary of height of boys and girls at different age groups is presented in Table4.2. The mean height of the boys is 155.7 ± 13.3 cm and mean height of the girls is 150.7 ± 8.8 cm. The results showed a progressive increase in the mean height with age from 10 to 17 years for both the boys and girls. The height of the boys increased from 136.8 cm at 10 years to 168.8 cm at 17 years. Similarly, for the girlsheight increased from 139.4 cm at 10 years to 156.6 cm at 17 years.The total increase in mean height from 10-17 years for boys was 32 cm and 17.2 cm for the girls.

Major gain in height for the boys was 5.7 cm between 11 to 12 years, 9.8 cm between 12-13 years, 4.5 cm between 13 to 14 years and 6.3 cmbetween 14 to 15 years. From 15 to 17years the gain in height was negligible.

Major gain in height for the girls was 6 cm was between 11-12 years and 5.3 cm between 12 to 13 years. For other age groups the gain in height was negligible.

When the mean height of boys and girls at different age groups werecompared it was found that at 10 years, thegirls were 2.6 cm taller than the boys and this difference was statistically significant (p= .012). However, from 13 years onwards theboys become taller than girls and at each age group the difference in height between boys and girls were highly statistically significant.

Acomparative representation ofthe mean height of boys and girls at different age groupsis presented in Figure 4.1.



	10	11	12	13	14	15	16	17
Boys	136.8	140.9	146.6	156.4	160.9	167.2	168.3	168.8
Girls	139.4	142.1	148.1	153.4	154.1	155.4	156.1	156.6

Fig. 4.1 :Representation of mean height of boys (N= 718) and girls (N=749)

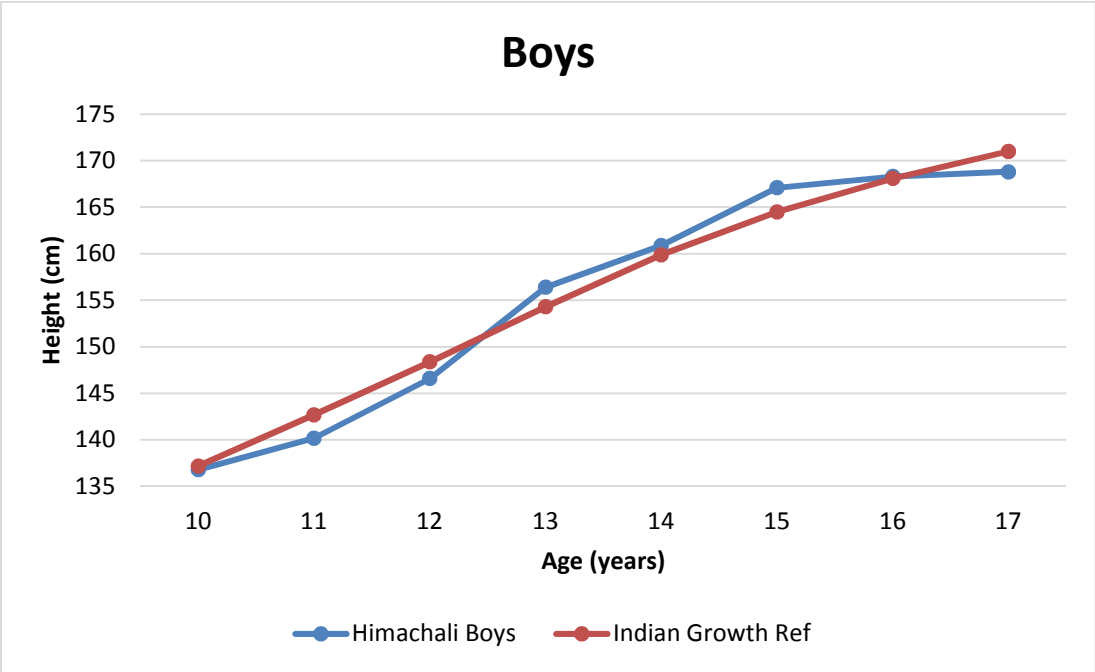


Fig.4.2 :Mean height of the boys at different age groups compared to the corresponding 50th percentile values of Indian growth standard

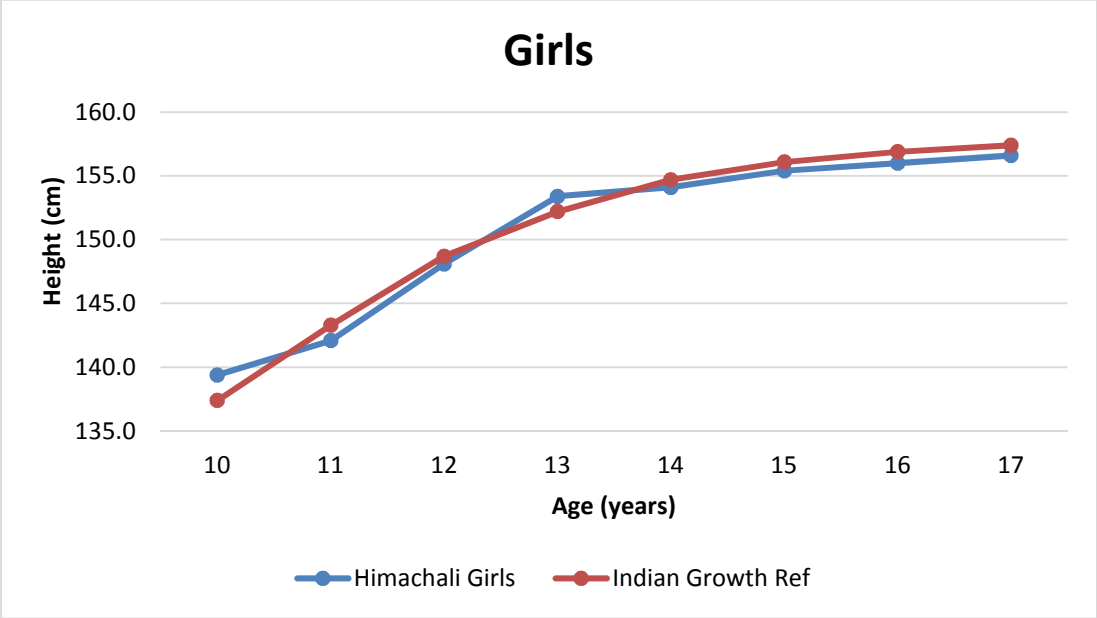


Fig.4.3 :Mean height of the girls at different age groups compared to the corresponding 50th percentile values of Indian growth standard

The mean height of Himachali boys and girls at 10 years of age was slightly lower and slightly higher than the 50th percentile of Indian growth reference standard respectively. At the age of 11 years and 12 years, the mean height of both sexes was lower than the 50th percentile. The mean height of the boys at 13 years to 15 years were higher than 50th percentile while the mean values of height for the girls at higher age groups (from 14 to 17 years) were lower than the 50th percentile. In summary, the mean height of the boys and girls differ differently when compared to the 50th percentile values of the Indian growth reference height of children[1]. (Figure 4.2 & Figure 4.3).

4.2.2 WEIGHT OF THE SUBJECTS

Table 4.3 :Descriptive summary and comparison of weight among boys and girls across different age group

Age (year)	Boys			Girls			Mean Dif.	t	p
	N	Mean	SD	N	Mean	SD			
10	68	28.8	5.52	79	29.3	4.85	-0.50	0.585	.560
11	75	32.4	6.85	106	32.2	6.51	0.20	0.199	.842
12	63	35.5	6.23	110	37.8	7.46	-2.30	2.068	.040
13	112	42.0	8.69	90	41.4	7.95	0.60	0.507	.613
14	102	46.8	8.01	75	43.5	7.39	3.30	2.80	.006

Age (year)	Boys			Girls			Mean Dif.	t	p
	N	Mean	SD	N	Mean	SD			
15	131	52.4	10.18	89	43.9	5.75	8.50	7.14	.000
16	100	53.6	8.78	112	46.2	8.65	7.4	6.17	.000
17	67	56.1	7.02	88	46.5	6.45	9.6	8.83	.000
Total	718	44.7	12.19	749	40.1	9.20	4.60	8.18	.000

Descriptive summary of weight of boys and girls at different age groups is presented in Table 4.3. The mean weight of the boys was 44.7 ± 12.2 kg and mean weight of the girls was40.1 ± 9.20 kg. The results showed a progressive increase in the mean weightwith age from 10 to 17 years for both the boys and girls. The weight of the boys increased from 28.8 kg at 10 years up to 56.1 kg at 17 years, resulting in a total gain of 27.3 kg. Similarly, for the girls, the weight increased from 29.3 kg at 10 years up to 46.5 kg at 17 years with a total gain of 17.2 kg.

Major gain in weight for the boys was 6.5kgfrom 12 to 13 years, 4.8 kg from 13 to 14 years and 5.6 kg between 14 to 15 years. Major gain in weight for the girls was 5.8 kg between 11-12 years and3.6 kg between 12 to 13 years.

Comparison of mean weight of boys and girls at different age groups showed that the 12 years old girls were 2.3 kg heavier as compared to the boys and this difference appeared to be statistically significant (p= .04).However, 14 to 17 years old boys were heavier and the differences of mean weight between boys and girls at these age groups appeared to be highly statistically significant.

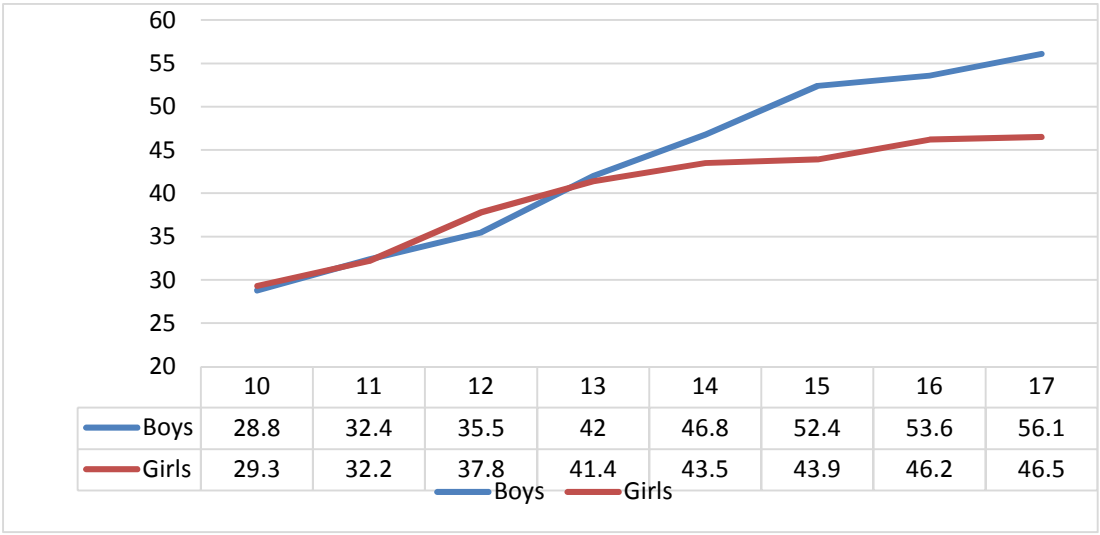


Fig. 4.4 :Representation of mean weight of boys (N= 718) and girls (N=749)

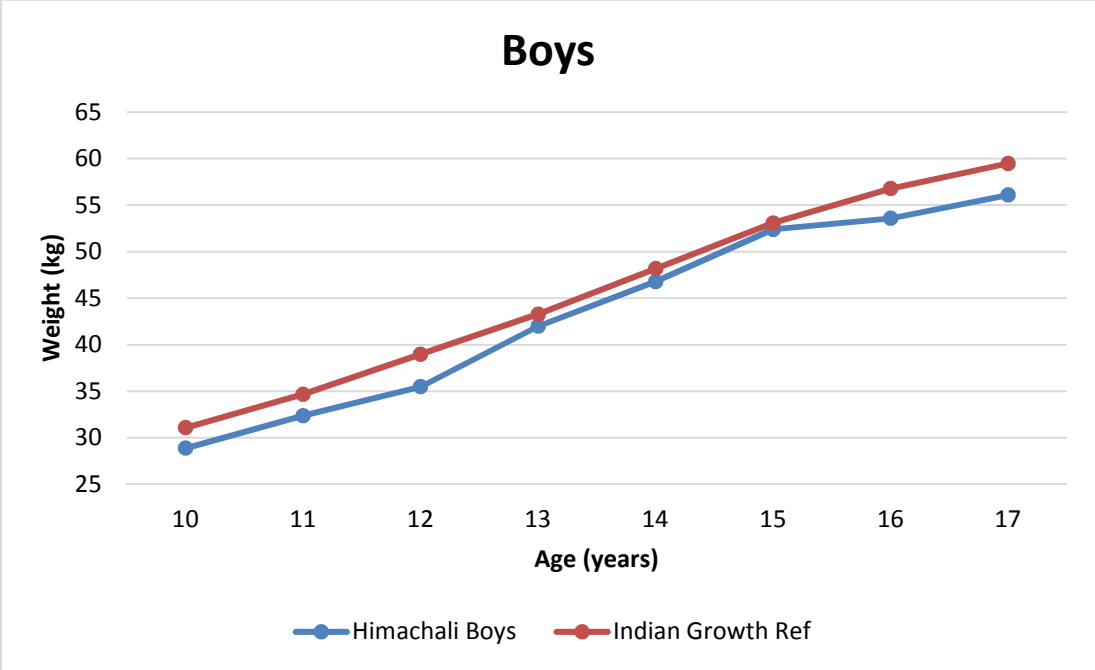


Fig. 4.5 :Mean weight of the boys at different age groups compared to the corresponding 50th percentile values of Indian growth standard

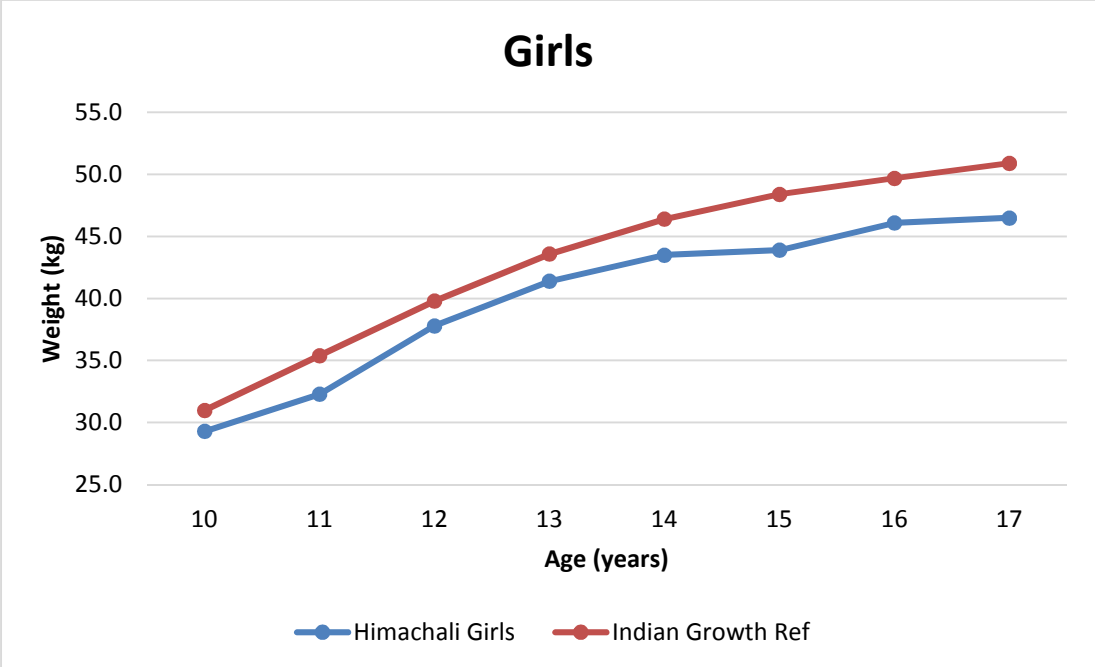


Fig. 4.6 :Mean weight of the girls at different age groups compared to the corresponding 50th percentile values of Indian growth standard

The mean weight of Himachali boys and girls at all age groups were lower than the 50th percentile of Indian growth reference standard. At 13, 14 and 15 years of age groups, the weight of the boys were just around the 50th percentile values. (Figure 4.5 & figure 4.6)

4.2.3 BODY MASS INDEX (BMI) OF THE SUBJECTS

Descriptive summary of the BMI of boys and girls at different age groups is presented in Table 4.4. The result showed that there is a progressive increase in the mean BMI with age for both boys and girls. The BMI of the boys increases from 15.3 at 10 years to 19.7 at 17 years. The BMI of the girlswas 14.9 at 10 years, which progressively increases to19.0 at 17 years.

No statistically significant differences in the BMI scores were observed between boys and girls across different age groups.

Table 4.4 :Descriptive summary and comparison of BMI among boys and girls across different age group

Age (year)	Boys			Girls			Mean Dif.	t	p
	N	Mean	SD	N	Mean	SD			
10	68	15.3	2.22	79	14.9	1.74	0.40	1.22	.22
11	75	16.3	2.68	106	15.9	2.45	0.40	1.041	.30
12	63	16.4	2.14	110	17.2	2.90	-0.80	1.911	.058
13	112	17.1	2.62	90	17.5	2.67	-0.40	1.07	.286
14	102	18.1	2.72	75	18.3	2.79	-0.20	0.476	.634
15	131	18.7	3.21	89	18.2	2.19	0.50	1.28	.202
16	100	18.9	2.70	112	18.9	3.37	0.00	0.00	1.00
17	67	19.7	1.95	88	19.0	2.36	0.70	1.97	.051
Total	718	17.7	2.94	749	17.5	2.94	0.20	1.30	.193

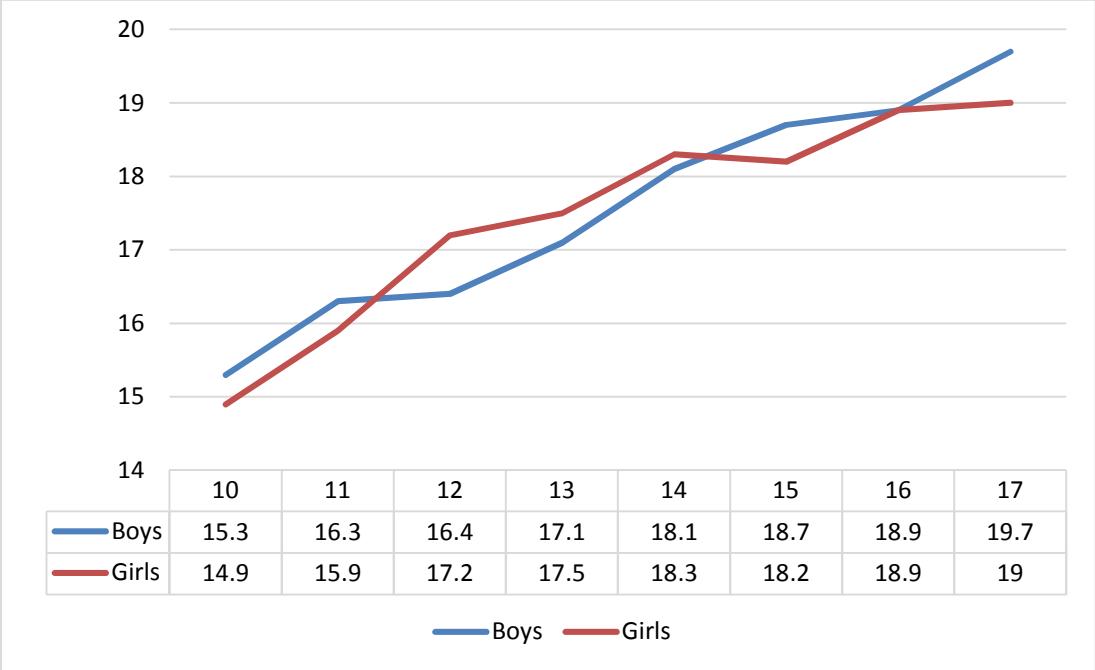


Fig. 4.7 :Representation of mean BMI of boys (N= 718) and girls (N=749)

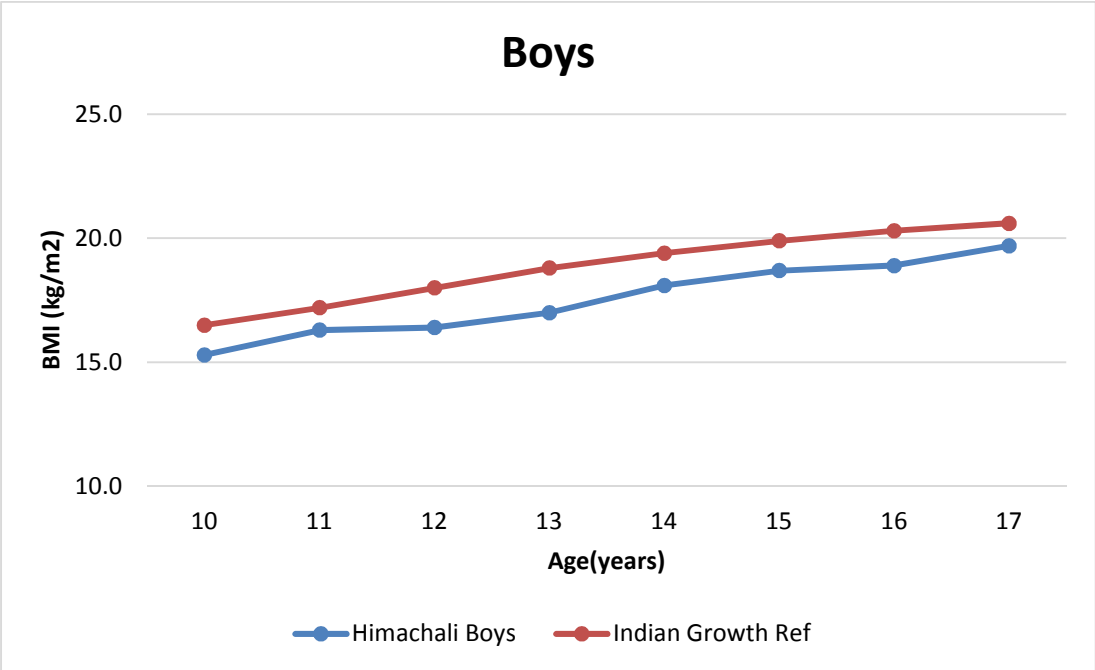


Fig. 4.8 :Mean BMI of the boys at different age groups compared to the corresponding 50th percentile values of Indian growth standard

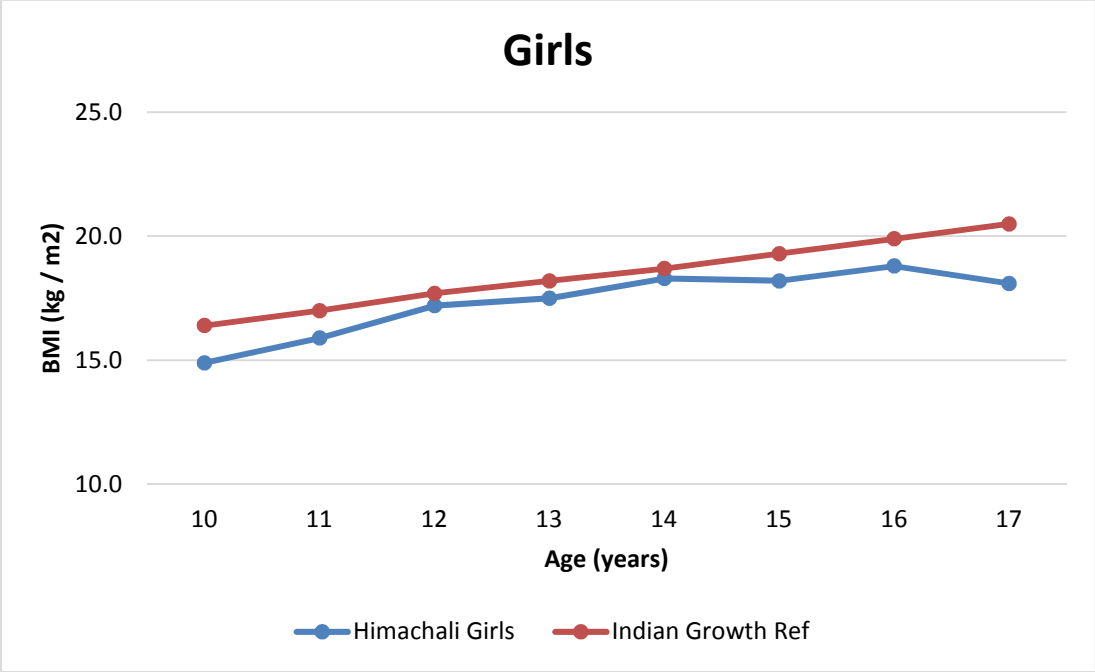


Fig. 4.9 :Mean BMI of the girls at different age groups compared to the corresponding 50th percentile values of Indian growth standard

Themean BMI of Himachali boys and girls at all age groups wereslightly lower than the corresponding 50th percentile values of Indian growth reference standard. (Figure 4.9 & Figure 4.9).

4.3 PREVALENCE OF MALNUTRITION

4.3.1 PREVALENCE OF STUNTING

Table 4.5 :Prevalence of stunting in boys and girls across different age groups. Values are presented as N (%)

Age Group (year)	Boys				Girls			
	N	Moderate Stunting	Severe Stunting	Total stunting	N	Moderate Stunting	Severe Stunting	Total stunting
10	68	6 (8.8)	0 (0)	6 (8.8)	79	2 (2.5)	0 (0)	2 (2.5)
11	75	5 (6.7)	0 (0)	5 (6.7)	106	19 (17.9)	0 (0)	19 (17.9)
12	63	5 (7.9)	1 (1.6)	6 (9.5)	110	11 (10)	3 (2.7)	14 (12.7)
13	112	10 (8.9)	1 (0.9)	11(9.8)	90	8 (8.9)	0 (0)	8 (8.9)
14	102	9 (8.8)	0 (0)	9 (8.8)	75	7 (9.3)	0 (0)	7 (9.3)
15	131	8 (6.1)	0 (0)	8 (6.1)	89	8 (9.0)	1 (1.1)	9 (10.1)
16	100	5 (5)	0 (0)	5 (5)	112	5 (4.5)	0 (0)	5 (4.5)
17	67	4 (6)	0 (0)	4 (6)	88	4 (4.5)	0 (0)	4 (4.5)
All age	718	52 (7.2)	2 (0.3)	54 (7.5)	749	64 (8.5)	4 (0.5)	68 (9)

The prevalence of stunting in boys and girls at different age groups is presented in Table 4.5. Majority of the boys and girls at all age groups were normal.

The rate of moderate stunting among the boys at different age groupsvaried from 5% to 9%. The rate of moderate stunting was maximum at 13 years (8.9%) and minimum (5%) at 16 years.The prevalence of severe stunting was negligeable, only one subject each in 12 and 13 years were found to be severely stunted. No age-related trend was observed in the rate of moderate stunting. The overall prevalence of stunting among boys was 7.5%.

Among the girls, the rate of moderate stunting varied from 2.5% at 10 years to 17.9% at 11 years. Intermediate rates of stunting were observed among other age groups. Severe stunting was observed in 12 years (2.7%) and at 15 years (1.1%), which is slightly higher than the boys. Like the boys, the rate of moderate stunting did not show any age-related trend. The overall rate of stunting among girls was 9% which is slightly higher than the boys (7.5%).

Table 4.6 :Mean and standard deviations of *Height - for - age* Z-scores for different stunted and not- stunted categories among boys and girls across different age groups

Age Gr	Nutritional Category	Boys			Girls		
		n	Mean	sd	n	Mean	sd
10 yrs	Not stunted	62	-0.40	0.78	77	-0.27	0.87
	Stunted	6	-2.16	0.16	2	-2.12	0.08
	Severe stunted	0					
11yrs	Not stunted	70	-0.54	0.80	87	-0.46	0.87
	Stunted	5	-2.49	0.23	19	-2.36	0.27
	Severe stunted	0					
12yrs	Not stunted	57	-0.64	0.77	96	-0.56	0.75
	Stunted	5	-2.47	0.20	11	-2.44	0.34
	Severe stunted	1	-3.04	.	3	-3.44	0.28
13yrs	Not stunted	101	-0.15	0.96	82	-0.54	0.71
	Stunted	10	-2.39	0.28	8	-2.30	0.27
	Severe stunted	1	-4.12	.			

Age Gr	Nutritional Category	Boys			Girls		
		n	Mean	sd	n	Mean	sd
14yrs	Not stunted	93	-0.51	0.78	68	-0.85	0.64
	Stunted	9	-2.48	0.27	7	-2.23	0.28
	Severe stunted	0					
15yrs	Not stunted	123	-0.36	0.77	80	-0.81	0.59
	Stunted	8	-2.35	0.28	8	-2.38	0.27
	Severe stunted	0			1	-3.48	.
16yrs	Not stunted	95	-0.63	0.71	107	-0.90	0.69
	Stunted	5	-2.48	0.20	5	-2.45	0.25
	Severe stunted	0					
17yrs	Not stunted	63	-0.76	0.73	84	-0.90	0.79
	Stunted	4	-2.29	0.20	4	-2.41	0.36
	Severe stunted	0					
Total	Not stunted	664	-0.47	0.81	681	-0.67	0.77
	Stunted	52	-2.39	0.25	64	-2.36	0.28
	Severe stunted	2	-3.58	0.77	4	-3.45	0.23

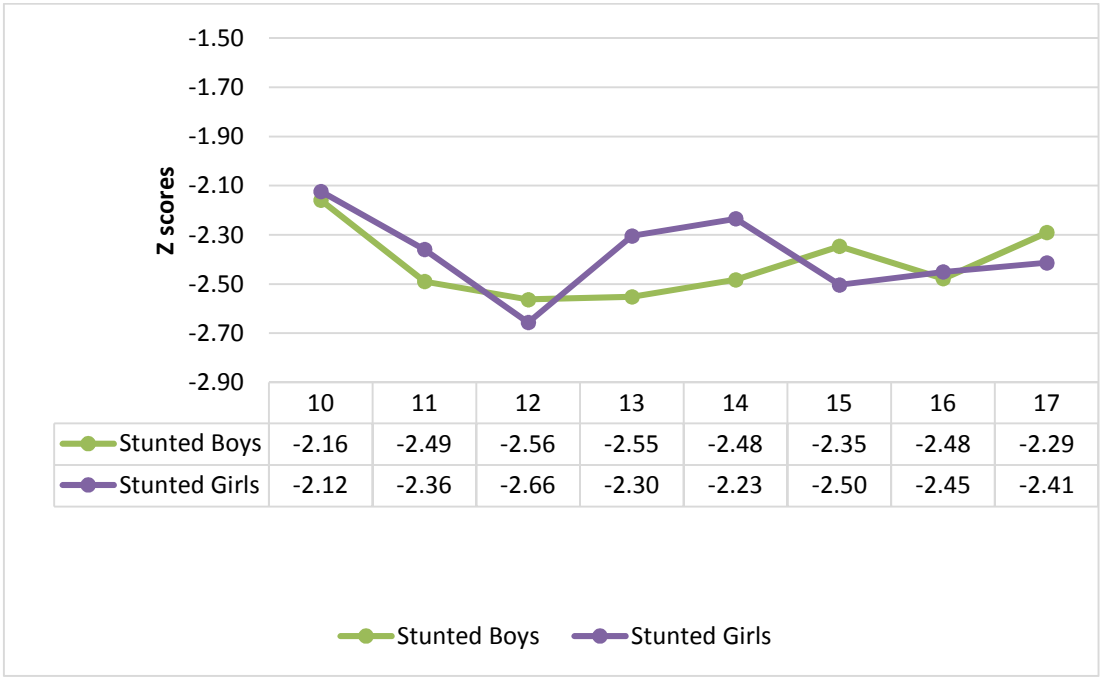


Fig. 4.10 : Z-scores of *Height - for - age* for normal and stunterd boys and girls across different age groups

The Z-scores of non-stunted, stunted, and severely stunted boys and girls at different age groups is summarized in Table 4.6. The paired representation of the Z-scoresof stunting for boys and girls in different age groups is presented in figure 4.10.It appeared that the Z-scores of stunting obtained for boys and girls at in most of the age groups except at 13 and 14 years,were almost similar.

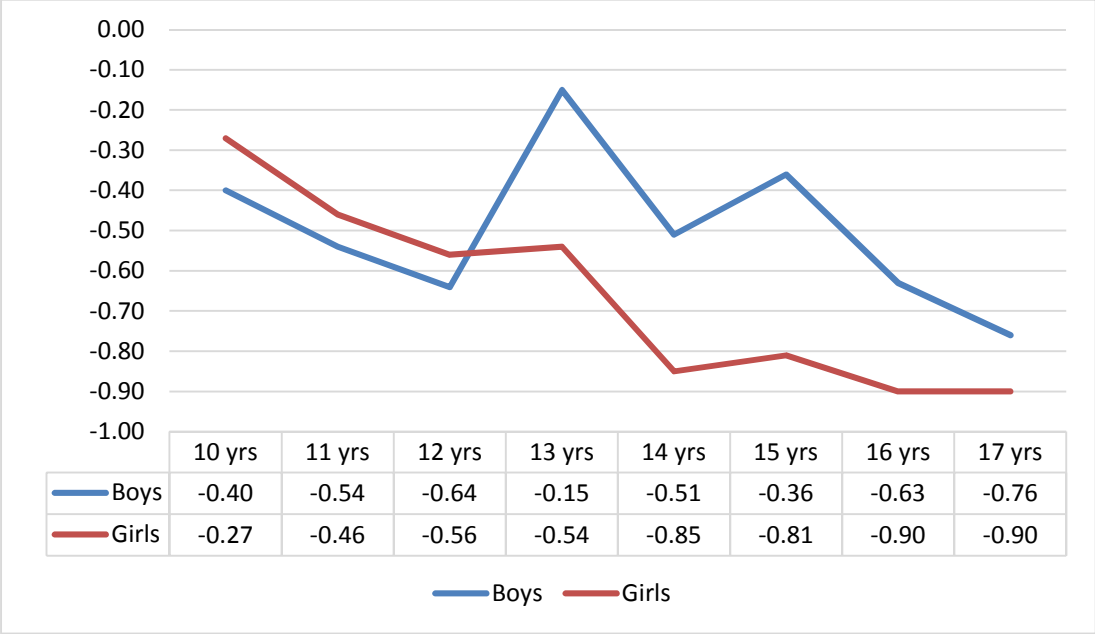


Fig. 4.11 : Z-scores of *Height - for - age* for non- stunted boys and girls across different age groups

The z-scores of the non-stunted categories of boys and girls at different age groups is depicted in Figure 4.11. The Z-score was observed from 13 to 16 years showed a wide difference among the boys and girls which reflect somewhat retarded growth of girls as compared to the boys in these age groups.

Table 4.7 :Prevalence of stunting in boys and girls across early (10-14 years) and late (15-17 years) adolescent groups

Gender	Adolescent Groups	Non-stunted N (%)	Moderate Stunted N (%)	Severe Stunted N (%)	χ^2	P value
Boys	Early (N= 420)	383 (91.2)	35 (8.3)	2 (0.5)	2.42	.30
	Late (N=298)	281 (94.3)	17 (5.7)	0 (0)		
Girls	Early (N= 460)	420 (91.3)	37 (8.0)	3 (0.7)	0.68	.71
	Late (N=289)	261 (90.3)	27 (9.3)	1 (0.3)		

The prevalence of stunting in boys and girls across early and late adolescent groups is presented in Table no 4.7. The relationship between the nutritional categories across the adolescent groups for both the boys and girls appeared to be non-significant.

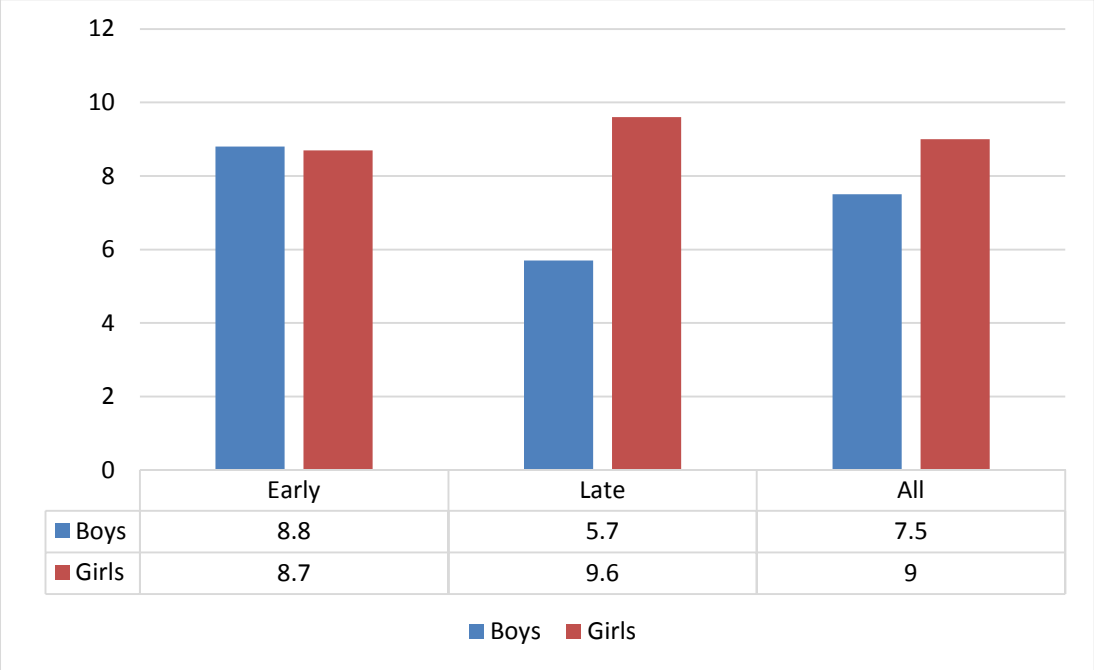


Fig. 4.12 :Prevalence of stunting among boys and girls across adolescent groups

The prevalence of total stunting in boys and girls across early and late adolescent groupsas represented in the Figure 4.12.The condition of being stunted among the boys and girls did not differ significantly by adolescent categories (χ^2 =1.215, df 1, p=.270).

Table 4.8 :Prevalence of thinness, overweight and obesity in boys and girls cross different age groups. Values are presented as N (%)

Age(yrs)	Boys					Girls				
	N	Moderate Thinness	Severe Thinness	Over Weight	Obese	N	Moderate Thinness	Severe Thinness	Over Weight	Obese
10	68	17(25)	3 (4.4)	3 (4.4)	2 (2.9)	79	16 (20.3)	5 (6.3)	1 (1.3)	0 (0)
11	75	10 (13.3)	4(5.3)	5 (6.7)	3 (4.0)	106	15 (14.2)	9 (8.5)	6 (5.7)	0 (0)
12	63	9 (14.3)	3 (4.8)	2 (3.2)	0 (0)	110	9 (8.5)	5 (4.5)	5 (4.5)	4 (3.6)

13	112	19 (17)	11 (9.8)	6 (5.4)	1 (0.9)	90	13 (14.4)	4 (4.4)	1 (1.1)	1 (1.1)
14	102	15 (14.7)	1 (1)	11 (10.8)	0 (0)	75	8 (10.7)	2 (2.7)	2 (2.7)	1 (1.3)
15	131	19 (14.5)	7(0.5)	9 (6.9)	4 (3.1)	89	8 (9.0)	3 (3.4)	2 (2.2)	0 (0)
16	100	15 (15.0)	1 (1.0)	5 (5.0)	1 (1.0)	112	13 (11.6)	6 (5.4)	8 (7.1)	1 (0.9)
17	67	5 (7.5)	0(0)	2 (3.0)	0 (0)	88	11 (12.5)	5 (5.7)	0 (0)	0 (0)
Total	718	139 (19)	30 (4.2)	44 (6)	11 (2)	749	93 (12)	39 (5)	25 (3)	7 (1)

The prevalence of thinness in boys and girls(Table 4.8) depicts a differential prevalence rate across the age groups with gender.Among the boy's moderate thinness was minimum at 17 years (7.5%) and maximum at 10 years (25%). Among the girls, moderate thinness was minimum at 12 years (8.5%) and maximum at 10 years (20.3 %).The overall prevalence of moderate thinness was more among the boys (19%) as compared to the girls (12%).

Rates of severe thinness among boys were more in the age groups of 10 to 14 years with maximum prevalence at 13 years group (9.8%). Severe thinness among girls was maximum in 11 years (8.5 %) and minimum in 14 years (2.7%). For the other age groups the rates of severe thinness varied from 3.4% to 6.3%.The overall rates of severe thinness were almost similar in boys (4.2%) and girls (5%).

In both boys and girls, the prevalence rates of overweight across all the age groups were more as compared to the prevalence rates of the obesity. Overweight was more among boys as compared to the girlsand varied from 3% at 12 and 17 years to a maximum of 10.8 % at 14 years. Among the girl'smaximum prevalence of overweight was observed at 16 years (7.1%). The overall prevalence rate of overweight was more in boys (6%) as compared to girls (5%).

More obese boyswere found at 10 years (2.9%), 11years (4%) and 15 years (3%) with an overall prevalence of 2%. While maximum obese girls were found at 12 years of age (3.6%).

Table4.9 :Mean and standard deviations of *BMI - for - age* Z-scores for different nutritional categories in boys and girls across different age groups

Age Groop	Nutritional Category	Boys				Girls			
		N	n	Mean	sd	N	n	Mean	sd
10 yrs	Normal	68	43	-0.75	0.85	79	57	-0.82	0.78
	Overweight	68	3	1.44	0.45	79	1	1.02	.
	Obese	68	2	2.03	0.00		0		
	Thin	68	17	-2.46	0.25	79	16	-2.42	0.31
	Severe Thin	68	3	-3.26	0.30	79	5	-3.36	0.14
11yrs	Normal	75	53	-0.65	0.78	106	76	-0.66	0.83
	Overweight	75	5	1.59	0.32	106	6	1.33	0.19
	Obese	75	3	2.17	0.21		0		
	Thin	75	10	-2.38	0.29	106	15	-2.47	0.28
	Severe Thin	75	4	-3.42	0.53	106	9	-4.24	1.78
12yrs	Normal	63	49	-0.66	0.81	110	87	-0.72	0.79
	Overweight	63	2	1.57	0.59	110	5	1.51	0.23
	Obese	63	0			110	4	2.03	0.41
	Thin	63	9	-2.38	0.17	110	9	-2.31	0.18
	Severe Thin	63	3	-3.28	0.07	110	5	-3.36	0.23
13yrs	Normal	112	75	-0.60	0.81	90	71	-0.59	0.83
	Overweight	112	6	1.42	0.27	90	1	1.16	.
	Obese	112	1	2.45	.	90	1	2.51	.
	Thin	112	19	-2.34	0.24	90	13	-2.39	0.20
	Severe Thin	112	11	-3.44	0.30	90	4	-3.49	0.44
14yrs	Normal	102	75	-0.77	0.83	75	62	-0.66	0.75
	Overweight	102	11	1.43	0.20	75	2	1.76	0.07
	Obese		0			75	1	2.20	.
	Thin	102	15	-2.39	0.28	75	8	-2.46	0.29
	Severe Thin	102	1	-3.76	.	75	2	-3.27	0.24
15yrs	Normal	92	92	-0.72	0.71	89	76	-0.82	0.66
	Overweight	92	9	1.42	0.28	89	2	1.42	0.05

Age Groop	Nutritional Category	Boys				Girls			
		N	n	Mean	sd	N	n	Mean	sd
	Obese	92	4	2.34	0.13		0		
	Thin	92	19	-2.44	0.29	89	8	-2.26	0.12
	Severe Thin	92	7	-3.34	0.34	89	3	-3.74	0.57
16yrs	Normal	100	78	-0.85	0.81	112	84	-0.82	0.71
	Overweight	100	5	1.41	0.27	112	8	1.57	0.40
	Obese	100	1	2.26	.	112	1	2.41	.
	Thin	100	15	-2.40	0.36	112	13	-2.42	0.28
	Severe Thin	100	1	-3.30	.	112	6	-3.19	0.11
17yrs	Normal	67	60	-0.65	0.59	88	72	-0.59	0.75
	Overweight	67	2	1.35	0.40		0		
	Obese		0				0		
	Thin	67	5	-2.18	0.20	88	11	-2.40	0.26
	Severe Thin		0			88	5	-3.68	0.43
Total	Normal	718	525	-0.71	0.77	749	585	-0.71	0.77
	Overweight	718	43	1.44	0.27	749	25	1.47	0.30
	Obese	718	11	2.24	0.18	749	7	2.18	0.36
	Thin	718	109	-2.39	0.27	749	93	-2.40	0.25
	Severe Thin	718	30	-3.38	0.32	749	39	-3.62	0.94

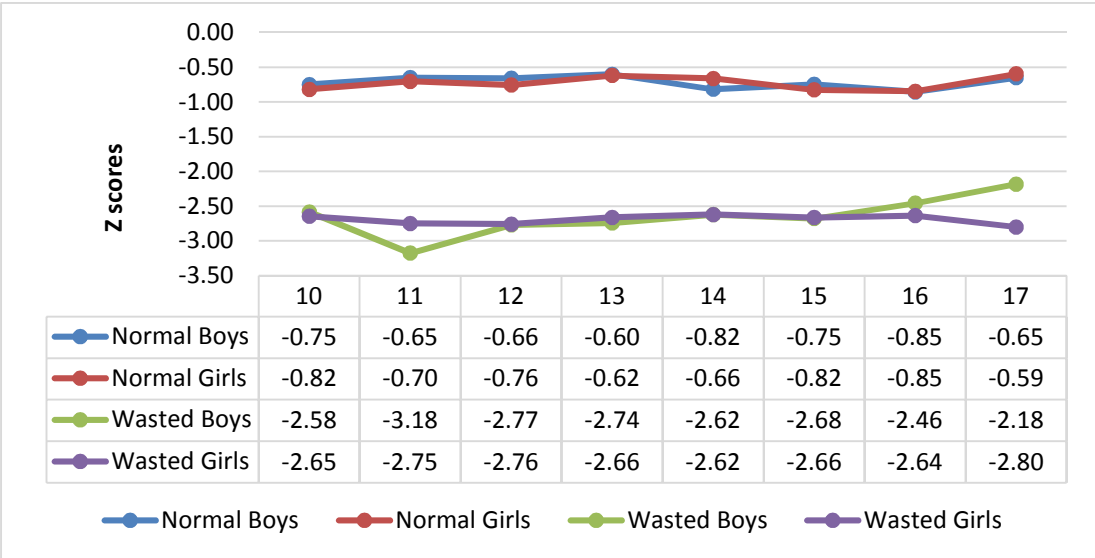
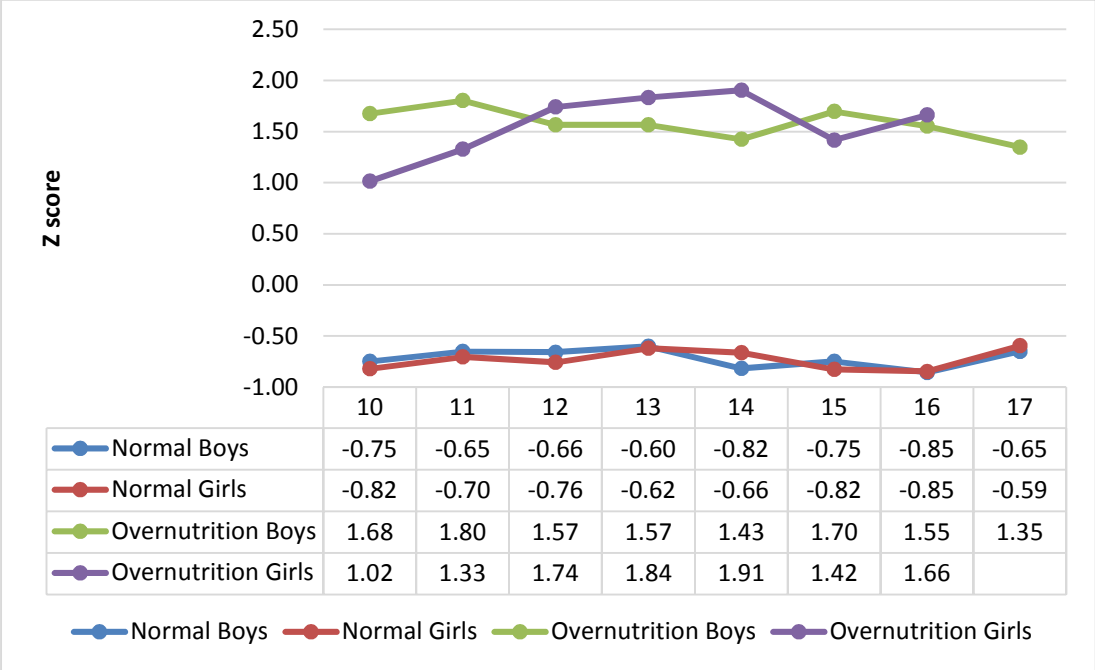


Fig. 4.13 : Z-scores of *BMI - for - age* for nomal and thin boys and girls across different age group



	10	11	12	13	14	15	16	17
Normal Boys	-0.75	-0.65	-0.66	-0.60	-0.82	-0.75	-0.85	-0.65
Normal Girls	-0.82	-0.70	-0.76	-0.62	-0.66	-0.82	-0.85	-0.59
Overnutrition Boys	1.68	1.80	1.57	1.57	1.43	1.70	1.55	1.35
Overnutrition Girls	1.02	1.33	1.74	1.84	1.91	1.42	1.66	

Fig. 4.14 : Z-scores of *BMI - for - age* for nomal and overnutrition boys and girls across different age group

The Z-score of normal, moderatethinness, severe thinness, overweight and obesity among boys and girls at different age group is summarized in Table no.4.9.

Thepaired representation of the Z-score for normal and thinness and normal and overnutrition between boys and girlsat different age groups is depicted in Figure 4.13 and Figure 4.14 respectively.

From the figure 4.13 it appeared that the mean Z-score for thinness were conspicuously different between boys and girls at 11 and 17 years. However, for the other age groups the mean Z-scores were almost similar. Major difference in mean Z scores for overnutrition was observed at 10, 11 and 14 years of age (Figure 4.14).

BMIAZ Z-scores for normal category of boys and girls at different age groups were obtained to be almost similar.

Table 4.10:Prevalence of thinness, overweight and obesity across early (10-14 years) and late (15-17 years) adolescent groups in boys and girls

Gender	Adolescent Groups	Normal N (%)	Thin N (%)	Severely Thin N (%)	Overweight	Obese	χ^2	P value
Boys	Early (N=420)	294 (70.0)	70 (16.7)	22(5.2)	28 (6.7)	6 (1.4)	5.17	.16
	Late (N=298)	230 (77.2)	39 (13.1)	8 (2.7)	16 (5.4)	5 (1.7)		
Girls	Early (N=460)	349 (75.9)	57 (12.4)	28 (6.1)	21 (4.6)	5 (1.1)	8.21	.08
	Late (N=289)	236 (81.7)	36 (12.5)	11 (3.8)	4 (1.4)	2 (0.7)		

The comparison of prevalence rates of different categories of malnutrition between early and late adolescent groups revealed no significant association in boys (χ^2 (3) = 5.17, p= .16), and girls (χ^2 (4) = 8.21, p= 0.08). (Table 4.10)

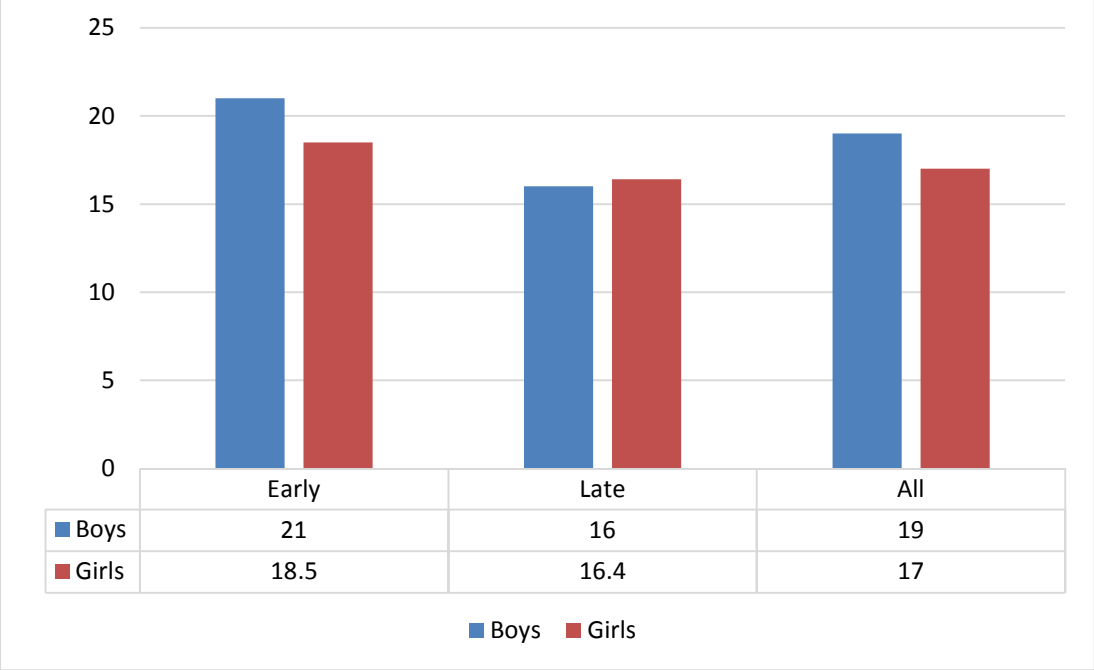


Fig.: 4.15. Prevalence of thinness among boys and girls across adolescent groups

The proportion of boys and girls who were reported to be thin across early and late adolescent categories is represented in the Figure 4.15.A chi-square test of independence showed that the condition of being thindid not differ significantly by adolescent categories,χ^2(1, N=271)= 0.0961, p=0.756 among boys and girls.

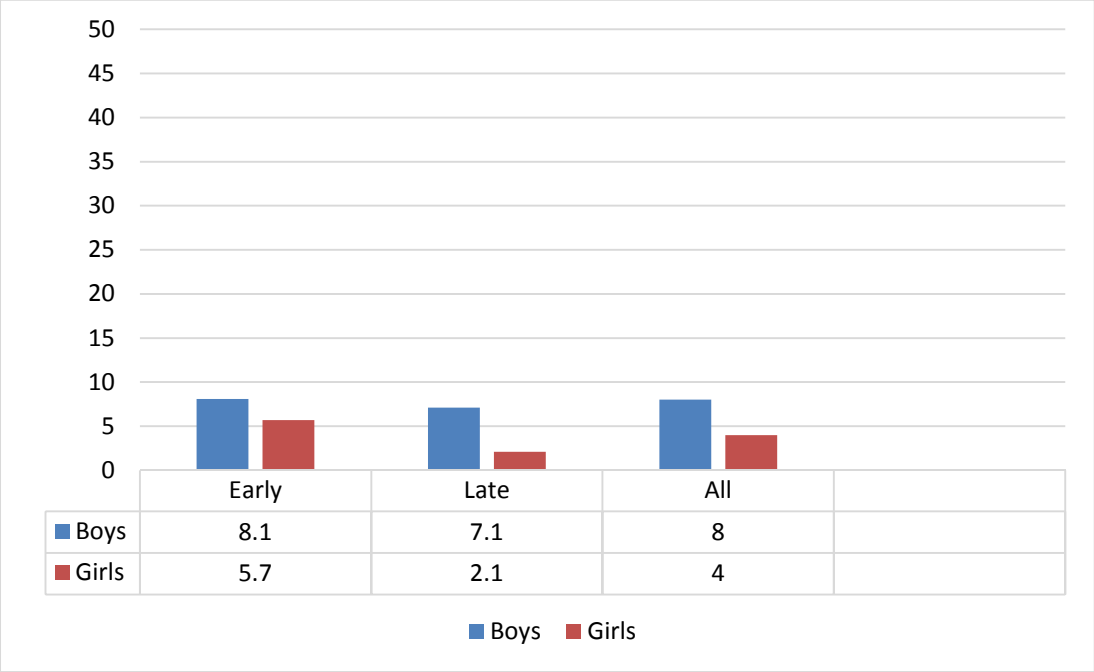


Fig. 4.16 :Prevalence of over-nutrition among boys and girls across different age groups

The proportion of boys and girls within the overnutrition category (combining overweight and obese) across early and late adolescent groups is represented in the Figure 4.16.A chi-square test of independence showed that overnutrition statusamong boys and girls did not show any statistically significant difference across adolescent groups (χ^2 are (1), N=87)= 3.569, p<0.06).

4.3.2 OVERALL PREVALENCE OF DIFFERENT CATEGORIES OF MALNUTRITION

Combining the nutritional categories obtained from height-for- age and BMI- for- age, four different categories of malnutrition were considered in the present study, viz, stunted, thinness, co-existence of stunted and thinness and overnutrition (by combining overweight and obese).

4.3.2.1 OVERALL PREVALENCE OF DIFFERENT CATEGORIES OF MALNUTRITION IN BOYS AND GIRLS AT DIFFERENT AGE GROUP.

The different categories of malnutrition in boys and girls at different age group is presented in Table no. 4.11

Table4.11 :Prevalence of different categories of malnutrition across the different age groups among boys and girls. Values are presented as N (%)

Age(yrs)	Boys					Girls				
	Nomal N (%)	Stunted N (%)	Thin N(%)	Stunted/ Thin N (%)	O/Ob N (%)	Normal N (%)	Stunted N (%)	Thin N (%)	Stunted/Thin N (%)	O/Ob N (%)
10	39 (57.4)	3 (4.4)	17 (25.0)	3 (4.4)	6 (8.8)	55 (69.6)	2 (2.5)	21 (26.6)	0 (0)	1 (1.3)
11	48 (64.0)	5 (6.7)	14 (18.7)	0 (0)	8 (10.7)	60 (56.6)	16 (15.1)	21 (19.8)	3 (2.8)	6 (5.7)
12	46 (73.0)	3 (4.8)	9 (14.3)	3 (4.8)	2 (3.2)	78 (70.9)	9 (8.2)	10 (9.1)	4 (3.6)	9 (8.2)
13	68 60.7)	7 (6.2)	26 (23.2)	4 (3.6)	7 (6.2)	65 (72.2)	6 (6.7)	16 (17.8)	1 (1.1)	2 (2.2)
14	67 (65.7)	8 (7.8)	15 (14.7)	1 (1.0)	11 (10.8)	55 (73.3)	7 (9.3)	10 (13.3)	0 (0)	3 (4.0)
15	86 65.6)	6 (4.6)	24 (18.3)	2 (1.5)	13 (9.9)	69 (77.5)	7 (7.9)	9 (10.1)	2 (2.2)	2 (2.2)
16	73 (73.0)	5 (5.0)	16 (16.0)	0 (0)	6 (6.0)	80 (71.4)	4 (3.6)	18 (16.1)	1 (0.9)	9 (8.0)
17	56 (83.6)	4 (6.0)	5 (7.5)	0 (0)	2 (3.0)	68 (77.3)	4 (4.5)	16 (18.2)	0 (0)	0 (0)

For the boys the rate of prevalence of stunting varied between 4.4% (at 10 years) to7.8% (at 14 years). For the girl's minimum rate of stunting (2.5%) was found at 10 years and maximum rate (15.1%) was obtained at 11 years. While intermediate values of prevalence were obtained at other age groups.

Like stunting the prevalence rates of thinness did not show any age-related pattern. Maximum rate of thinness (25%) was obtained at 10 years followed by (23.2%) at 13 years and minimum thinness (7.5%) was obtained among 17 years' boys.

For the girls the highest rate of thinness (26.6%) was also obtained at 10 years like the boys followed by (19.8%) at 11 years and minimum prevalence of thinness (9%) was seen in the age group 12 years. The prevalence of thinness from 13 to 17 years were obtained between 10 to 18%.

The coexistence of stunting and thinness was obtained at the age of 10,12,13,14 and 15 years for boys which varied between 1% at 14 years, 3.6% at 13 years, 4.4%at 10 years and 4.8% at 12 years. among the girls the stunting-thinness category of malnutrition was obtained at 11 years (2.8%), 12 years (3.6%), 13 years (1.1%), 15years (2.2%) and 16 years (0.9%).

Overnutrition was obtained at all age groups for boys which varied between 3 to 10.8%, and in all age groups except 17 years among the girls which varied between 1.3 to 8%.

4.3.2.2 :OVERALL PREVALENCE OF DIFFERENT CATEGORIES OF MALNUTRITION ACROSS THE ADOLESCENT CATEGORIES IN BOYS AND GIRLS

Prevalence of different categories of malnutrition and whole group of boys and is summarized in Table 4.12.

Table 4.12 :Prevalence of different categories of malnutrition across the different adolescent groups among boys and Girls. Values are presented as N (%)

Group (age)	Boys					Girls					χ^2	p
	N N (%)	S N (%)	W N (%)	S/W N (%)	O/Ob N (%)	N N (%)	S N (%)	W N (%)	S/W N (%)	O/Ob N (%)		
Early (10-14)	268 (63.8)	26 (6.2)	81 (19.3)	11 (2.6)	34 (8.1)	316 (68.7)	33 (7.2)	77 (16.7)	9 (2.0)	25 (5.4)	4.64	.33
Late (15-17)	215 (72.1)	15 (5.0)	45 (15.1)	2 (0.7)	21 (7.0)	214 (74.0)	22 (7.6)	44 (15.2)	2 (0.7)	7 (2.4)	8.20	.08
All	483 (67.3)	41 (5.7)	126 (17.5)	13 (1.8)	55 (7.7)	530 (70.8)	55 (7.3)	121 (16.2)	11 (1.5)	32 (4.3)	9.92	.04

Comparative prevalence of malnutrition among early and late adolescent boys showed higher prevalence of different malnutrition categories among the early adolescent boys as compared to their late counterpart. Similarly, findings were also obtained among early and late adolescent girls, except for the prevalence of stunting, which was almost similar in early and late adolescent girls.

Comparison of prevalence between early boys and girls showed that stunting was slightly higher among girls (6.2 % in boysvs 7.2 % in girls) and thinness is higher among boys (19.3 % in boys vs 16.7 % in girls). Prevalence of stunting – thinness is

almost similar in boys and girls. However, overnutrition was higher in boys (8.1 %) as compared to the girls (5.4 %). The difference in prevalence rates among early boys and girls appeared to be statistically non – significant, chi square (4, N= 1467) = 4.64, p=0.33.

Comparison of prevalence between late boys and girls showed that stunting was higher among girls (7.6 % in girlsvs 5.0 % in boys) and thinness and stunted – thinness is similar in both sexes. Overnutrition is higher among boys than girls (7.0 % in boysvs 2.4 % in girls). The difference in prevalence rates among late boys and girls appeared to be statistically non – significant, chi square (4, N= 1467) = 8.20, p=0.08.

Comparative prevalence of malnutrition among the whole group of boys and girls showed that stunting was higher in girls as compared to boys (7.3 % in girlsvs 5.7% in boys). Thinness was slightly higher among boys (17.5 % in boysvs 16.2 % in girls). The stunted- thinness was almost similar in both sexes. Overnutrition is higher among boys (7.7 %) than girls (4.3 %).The difference appeared to be statistically significant. Chi square (4, N= 1467) = 9.92, p=0.041.

Diagrammatic representation of the prevalence rates of different malnutrition categories in the whole groupof is presented in Figure 4.3.3.1.

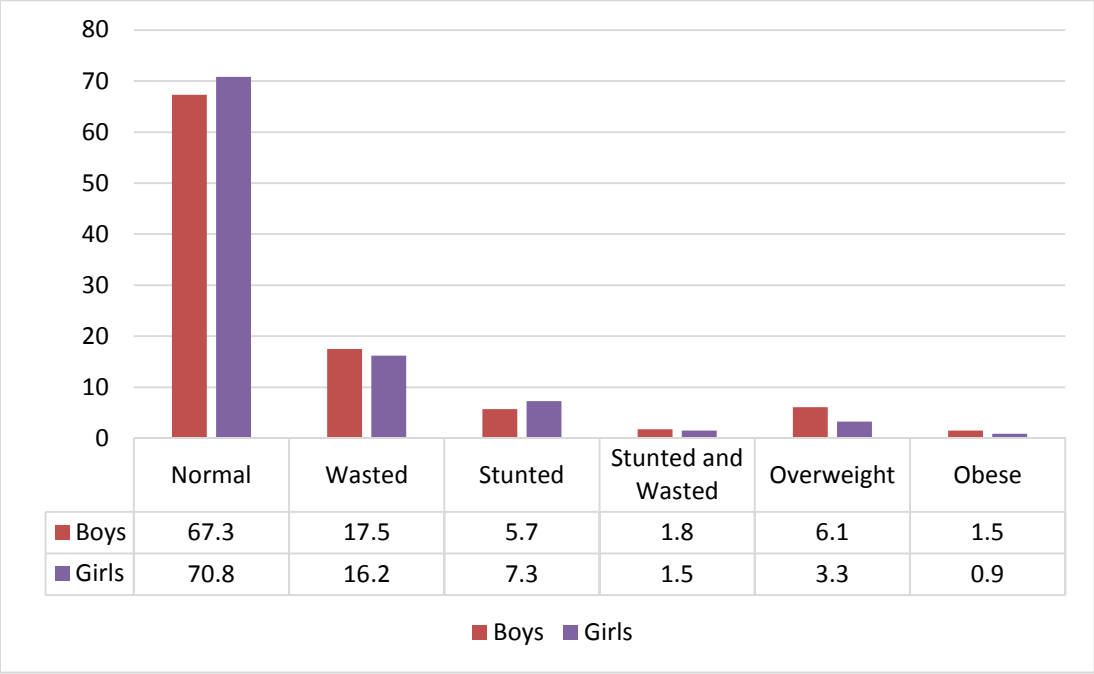


Fig. 4.17 : Prevalence of different categories of nutrition status for boys and girls

4.4 RESULTS ON DIETARY PATTERN

4.4.1 BREAKFAST HABIT OF THE HIMACHALI CHILDREN

Table4.13 :Breakfast habit among boys and girls

Gender	Adolescent category	N	Frequent consumption		Infrequent consumption		χ^2	p
			Daily	Most days a week	Few days a week	Never		
Boy	Early	420	420 (100)	0 (0)	1 (0)	0 (0)	14.41	.000
	Late	298	210 (70.5)	69 (23.2)	19 (6.4)	0 (0)		
	All	718	630 (87.7)	69 (9.6)	19 (2.6)	0 (0)		
Girl	Early	460	394 (85.7)	31 (6.7)	33 (7.2)	2 (0.4)	76.45	.000
	Late	289	167 (57.8)	74 (25.6)	45 (15.6)	3 (1.0)		
	All	749	561 (74.9)	105 (14.0)	78 (10.4)	5 (0.7)		

Analysis of breakfast habit of the Himachali childrenshowed that (88%) of the boys and (75%)to the girls had regular habit of breakfast.Having regular breakfast was more common in early adolescent period and decreased in late adolescent in both the sexes. 100 % of the early adolescent boys had regular breakfast as compared to 70% of the late adolescent boys, and 86% of the early adolescent girls had regular breakfast, as compared to 58% of late adolescent girls (Table 4.13). The relation between frequent and infrequent breakfast consumption patterns with adolescent groups in both sexes appear to be highly statistically significant.

4.4.2 CONSUMPTION PATTERN OF HEALTHY FOOD ITEMS

Table 4.14 : Consumption pattern of healthy foods by the boys and girls

Food	Gender	N	Daily		Most days a week		Few days a week		Never	
			F	%	F	%	F	%	F	%
Fruit	Boy	718	198	27.6	277	38.6	240	33.4	3	0.4
	Girl	749	217	29.0	303	40.5	229	30.6	0	0.0
	Total	1467	415	28.3	580	39.5	469	32.0	3	0.2
Milk	Boy	718	279	38.9	289	40.3	88	12.3	62	8.6
	Girl	749	337	45.0	301	40.2	20	2.7	91	12.1
	Total	1467	616	42.0	590	40.2	108	7.4	153	10.4
Dairy	Boy	718	76	10.6	99	13.8	517	72.0	26	3.6
	Girl	749	364	48.6	160	21.4	202	27.0	23	3.1
	Total	1467	440	30.0	259	17.7	719	49.0	49	3.3
Cooked Vegetable	Boy	718	347	48.3	242	33.7	125	17.4	4	0.6
	Girl	749	401	53.5	203	27.1	145	19.4	0	0.0
	Total	1467	748	51.0	445	30.3	270	18.4	4	0.3
Green Leafy vegetables	Boy	718	0	0.0	7	1.0	579	80.6	132	18.4
	Girl	749	0	0.0	46	6.1	662	88.4	41	5.5
	Total	1467	0	0.0	53	3.6	1241	84.6	173	11.8
Salad	Boy	718	260	36.2	189	26.3	197	27.4	72	10.0
	Girl	749	350	46.7	198	26.4	201	26.8	0	0.0
	Total	1467	610	41.6	387	26.4	398	27.1	72	4.9
Pulses	Boy	718	437	60.9	182	25.3	99	13.8	0	0.0
	Girl	749	513	68.5	135	18.0	101	13.5	0	0.0
	Total	1467	950	64.8	317	21.6	200	13.6	0	0.0

The pooled estimate (combining allthe age groups) of the consumption pattern of different healthy food items by the boys and girls is presented in Table 4.14. Majority of the boys and girls (almost 90 percent or more) mentioned that they had consumed the different food items “at least once a week”, and only a minor percentage of children reported that they had “never” consumed the item.

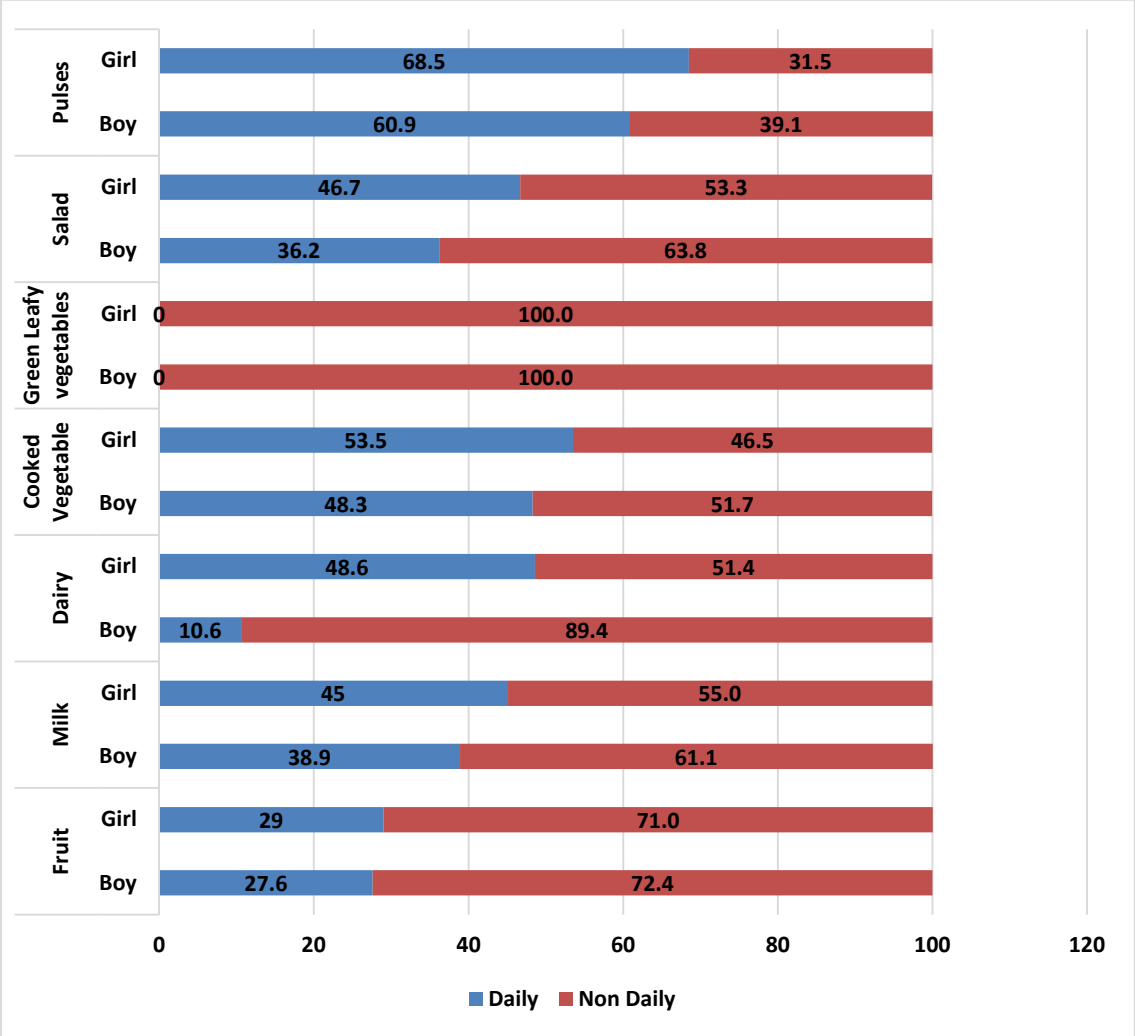


Fig.4.18 :Daily and non-daily consumption pattern of different healthy food items by the boys and girls

Percentages of boys and girls having daily and non-daily patterns of consumption for different healthy foods is represented in Figure 4.18. On a daily basis, none of the boys or girls consumed green leafy vegetables, while maximum number of boys and girls were found to consume pulses. All food items were consumed by higher percentages of girls daily as compared to the boys. The maximum difference in the percentages of boys and girls was observed in the consumption pattern of dairy products; 48.6% of girls reported consumption of dairy products as compared to only 10.6% of boys.

Table 4.15 :Dichotomized consumption pattern of healthy foods by boys and girls

Food	Group	Total	High Consumption		Low Consumption		χ^2	p
			Daily	Most days a week	Few days a week	Never		
Fruit	Boy	718	475	66.2	243	33.8	1.786	.18
	Girl	749	520	69.4	229	30.6		
	All	1467	995	67.8	472	32.2		
Milk	Boy	718	568	79.1	150	20.9	9.24	.002
	Girl	749	638	85.2	111	14.8		
	All	1467	1206	82.2	261	17.8		
Dairy	Boy	718	175	24.4	543	75.6	30.54	.000
	Girl	749	524	70.0	225	30.0		
	All	1467	699	47.6	768	52.4		
Cooked Vegetables	Boy	718	589	82.0	129	18.0	0.468	.494
	Girl	749	604	80.6	145	19.4		
	All	1467	1193	81.3	274	18.7		
Green leafy vegetables	Boy	718	7	1.0	711	99.0	28.1	.000
	Girl	749	46	6.1	703	93.9		
	All	1467	53	3.6	1414	96.4		
Salad	Boy	718	449	62.5	269	37.5	19.02	.000
	Girl	749	548	73.2	201	26.8		
	All	1467	997	68.0	470	32.0		
Pulses	Boy	718	619	86.2	99	13.8	0.029	.865
	Girl	749	648	86.5	101	13.5		
	All	1467	1267	86.4	200	13.6		

More number of boys and girls have higher or frequent intake of fruit (boys 66 %, girls 69 %), milk (boys 79 %, girls 85 %), cooked vegetables (boys 82 %, girls 81 %), salad (boys 63%, girls 73 %) and pulses (boys 86%, girls 87%). Green leafy vegetables were the least consumed item; about 99 % of the boys and 94 % of girls reported infrequent consumption of green leafy vegetables. A higher percentage of

girls (70%) and a comparatively much lower percentage of boys (24%) reported frequent consumption of dairy products.

The consumption patterns for milk, dairy products, green leafy vegetables and salads have statistically significant association with gender.The percentages of the boys and girls showed significant statistical variations in their consumption pattern for milk ($\chi^2$9.24, df = 1, p = 0.002), dairy products ($\chi^2$30.54, df = 1, p = 0.000), green leafy vegetables ($\chi^2$28.1, df = 1, p = 0.000) and salad ($\chi^2$19.02, df = 1, p = 0.000) (Table 4.15).

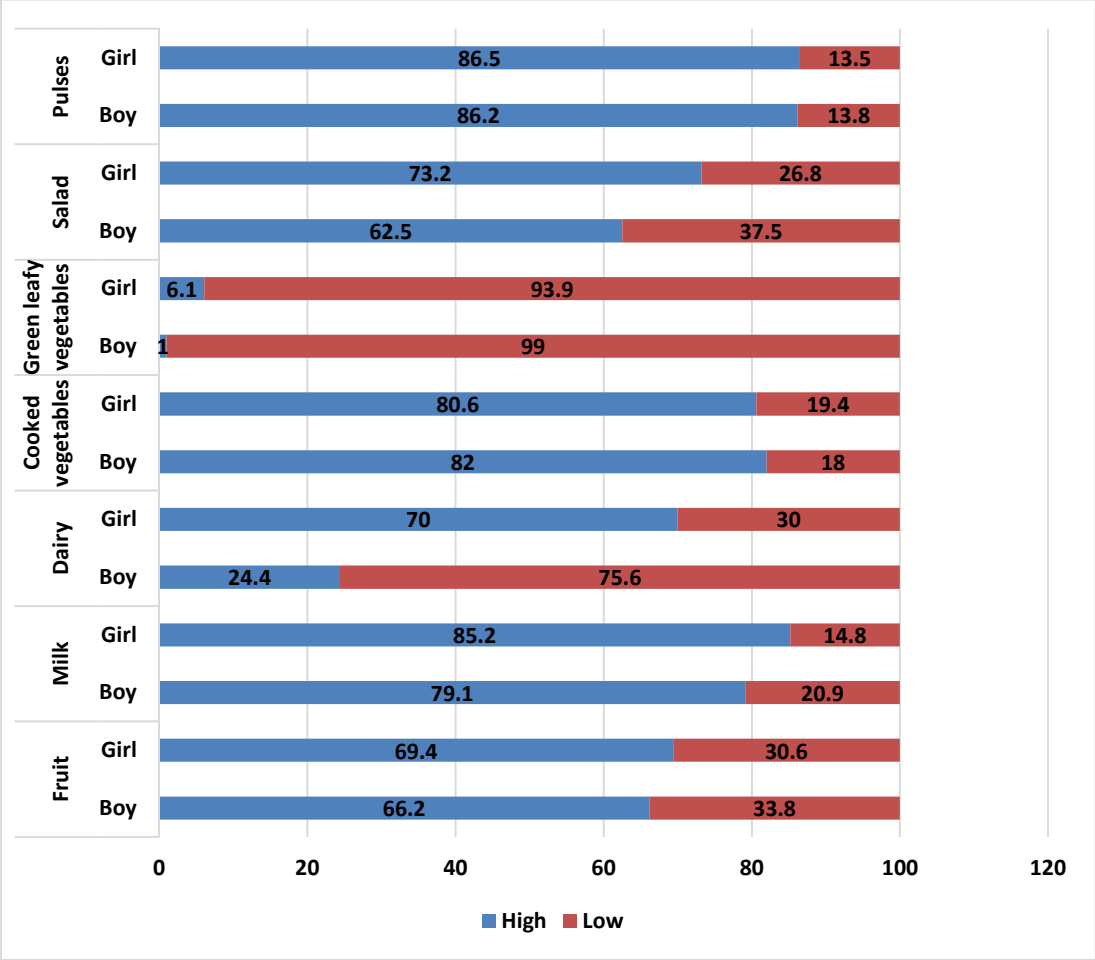


Fig.4.19 :Dichotomized consumption pattern of healthy foods by boys and girls.

Table 4.16 :Dichotomized consumption pattern of healthy foods by early and late adolescent boys

Food Groups	Adolescent category	Total	Frequent consumption		Infrequent consumption		χ^2	p
			N	%	N	%		
Fruit	Early	420	236	56.2	184	43.8	44.88	.000
	Late	298	239	80.2	59	19.8		
Milk	Early	420	346	82.4	74	17.6	6.56	.01
	Late	298	222	74.5	76	25.5		
Dairy	Early	420	65	15.5	355	84.5	43.45	.000
	Late	298	110	36.9	188	63.1		
Cooked vegetables	Early	420	352	83.8	68	16.2	2.167	.141
	Late	298	237	79.5	61	20.5		
Green leafy vegetables	Early	420	0	0.0	420	100.0	9.96	.002
	Late	298	7	2.3	291	97.7		
Salad	Early	420	206	49.0	214	51.0	78.57	.000
	Late	298	243	81.5	55	18.5		
Pulses	Early	420	367	87.4	53	12.6	1.16	.281
	Late	298	252	84.6	46	15.4		

The Table 4.16 showed that significantly higher percentages of boys in the late adolescent group consumed fruit, diary products, green leafy vegetables and salad as compared to the early adolescent boys. Frequent consumption of fruit was reported by 80 % of the late adolescent boys as compared to 56 % of the early adolescents and this difference was statistically significant (χ^2 = 44.88, df = 1, p = 0.000). Similar increase in consumption frequency from early to late adolescent period was observed for the consumption pattern of dairy products (15,5 % early adolescent's vs 37 % late adolescents) and this difference was also statistically significant (χ^2 = 43.45, df = 1, p = 0.000). Similar statistically significant increases were observed for the consumption patterns of green leafy vegetables (0 % early adolescent's vs 2.3% late adolescents, (χ^2 = 9.96, df = 1, p = 0.002) and salads (49 % early adolescent's vs 82% late adolescents, χ^2 = 78.6, df = 1, p = 0.000).

In contrast, the consumption of milk was reported by a significantly a greater number of early boys as compared to their late counterpart (82 % early adolescents vs 75% late adolescents, ($\chi^2 = 6.56$, df = 1, p = 0.01).

The percentages of boys having frequent consumption of cooked vegetables and pulses show a slight decline when early and late adolescents were compared; 84 % early adolescent vs 80 % late adolescent for cooked vegetables, and 87% early adolescent vs 84 % late adolescent for pulse consumption, however, these differences did not appear to be statistically significant.

Table 4.17 :Dichotomized consumption pattern of healthy foods by early and late adolescent girls

Food Groups	Adolescent category	N	High Consumption		Low Consumption		χ^2	p
			N	%	N	%		
Fruit	Early	460	282	61.3	178	38.7	37.05	.000
	Late	289	238	82.4	51	17.6		
Milk	Early	460	397	86.3	63	13.7	1.19	.275
	Late	289	241	83.4	48	16.6		
Dairy	Early	460	327	71.1	133	28.9	0.721	.396
	Late	289	197	68.2	92	31.8		
Cooked vegetables	Early	460	373	81.1	87	18.9	0.152	.697
	Late	289	231	79.9	58	20.1		
Green leafy vegetables	Early	460	0	0.0	460	100.0	78.01	.000
	Late	289	46	15.9	243	84.1		
Salad	Early	460	307	66.7	153	33.3	25.07	.000
	Late	289	241	83.4	48	16.6		
Pulses	Early	460	407	88.5	53	11.5	2.94	.05
	Late	289	241	83.4	48	16.6		

The dichotomized pattern of consumption frequency of different healthy food items by early and late adolescent girls is presented in Table 4.17.It was observed that significantlya greater number of late adolescent girls consumed fruit, green leafy vegetables and salad as compared to the early adolescent group; 61 % early

adolescent's vs 82% late adolescents for fruit, (χ^2 = 37.05, df = 1, p = 0.000), 0 % early adolescent's vs 16% late adolescents for green leafy vegetables, (χ^2 = 25.07, df = 1, p = 0.000) and by 67 % early adolescent vs 83 % late adolescent for salads (χ^2 = 25.07, df = 1, p = 0.000).

The frequencies of consumption of other food items like milk dairy product and cooked vegetables did not show any significant differences. These consumptions were slightly higher in early adolescent group. A higher percentage of early adolescent girls also reported frequent consumption of pulses, (88.5 % early vs 83.4% late) and this difference was statistically significant (χ^2 = 2.94, df = 1, p = 0.05).

4.4.3 :CONSUMPTION PATTERN OF UNHEALTHY FOOD ITEMS

Table 4.18 :Consumption pattern of unhealthy foods by boys and girls

Food	Gender	N	Daily		Most days a week		Few days a week		Never	
			F	%	F	%	F	%	F	%
SavorySnacks	Boys	718	14	1.9	79	11.0	625	87.0	0	0.0
	Girls	749	59	7.9	240	32.0	436	58.2	14	1.9
	All	1467	73	5.0	319	21.7	1061	72.3	14	1.0
Fast Foods	Boys	718	0	0.0	56	7.8	614	85.5	48	6.7
	Girls	749	0	0.0	87	11.6	588	78.5	74	9.9
	All	1467	0	0.0	143	9.7	1202	81.9	122	8/0
Sweet	Boys	718	33	4.6	96	13.4	513	71.4	76	10.6
	Girls	749	30	4.0	72	9.6	560	74.8	87	11.6
	All	1467	63	4.3	168	11.5	1073	73.1	163	11.1
Cake and Pastries	Boys	718	35	4.9	101	14.1	514	71.6	68	9.5
	Girls	749	45	6.0	99	13.2	529	70.6	76	10.1
	All	1467	80	5.5	200	13.6	1043	71.1	144	10.0
Candy and Chocolate	Boys	718	0	0.0	67	9.30	611	85.1	40	5.6
	Girls	749	7	0.9	186	24.8	541	72.2	15	2.0
	All	1467	7	0.5	253	17.2	1152	78.5	55	3.7
Soft Drink	Boys	718	13	1.8	121	16.9	454	63.2	130	18.1
	Girls	749	0	0.0	70	9.3	617	82.4	62	8.3
	All	1467	13	0.9	191	13.0	1071	73.0	192	13.1

The pooled estimate (combining all the age groups) of the consumption pattern of different unhealthy food items by the boys and girls is presented in table 4.18. Majority of the boys and girls (70.6 – 87.0%) reported to consume the different unhealthy food items "few days a week" only followed by most days a week (7.80 – 32.0%), and only a minor percentage(0 – 7.9) of children reported that they have not consumed the item "daily". Also, very small percentage of children (0- 18.1%) reported that they have "never" consumed the items.

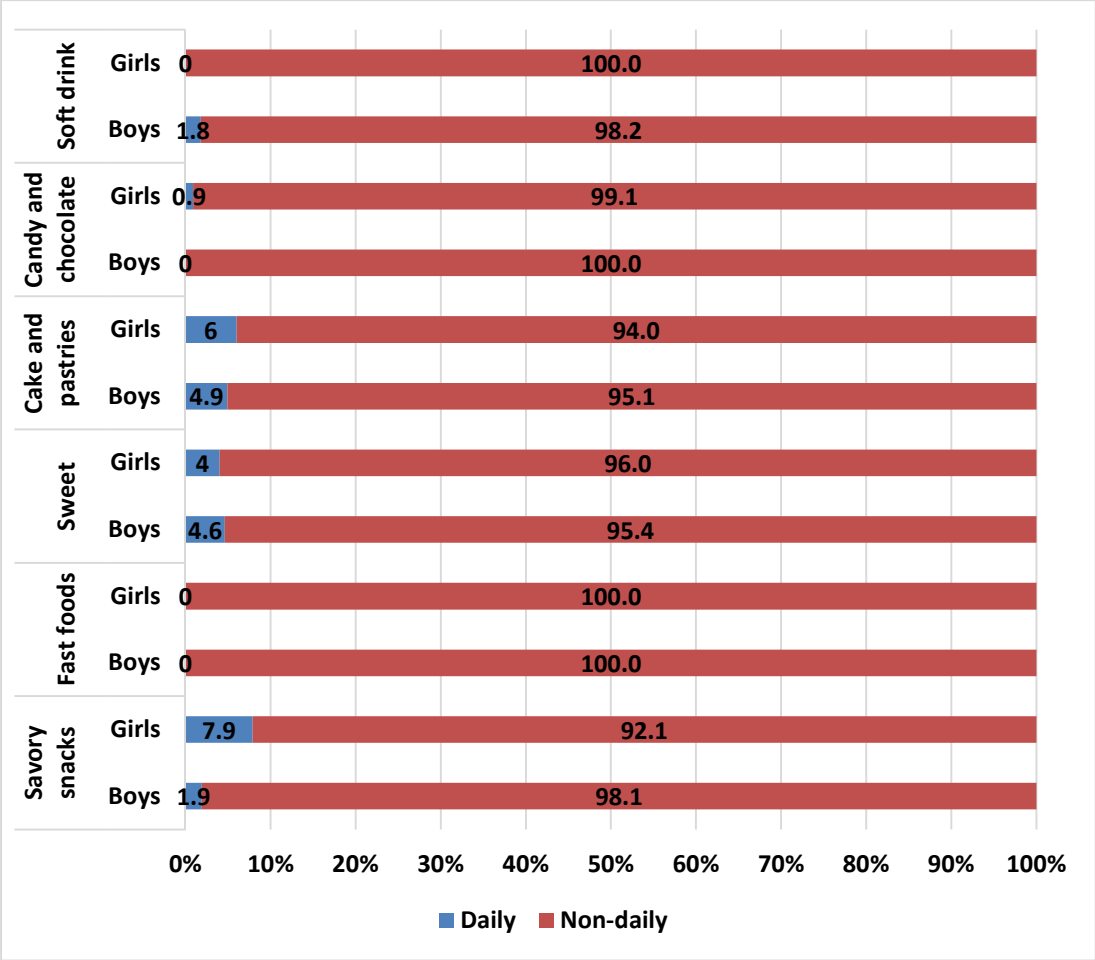


Fig. 4.20 :Daily and Non- daily consumption pattern of unhealthy foods by the boys and girls

Percentages of boys and girls having daily and non-daily patterns of consumption for different unhealthy foods is represented in Figure 4.20.Almost equal percentagesof girls and boys (30-33% respectively) consumed sweetsdaily.None of the boys or girls consumed fast food daily. None of the boys consumed candy and chocolate on daily basis, and none of the girls consumed soft drinks on daily basis. A much higher

percentage of girls (59%) consumed savory snacks dailyas compared to much lower percentage (14%) of boys.

Table 4.19 :Dichotomized consumption pattern of unhealthy foods by boys and girls

Food type	Gender	High Consumption		Low Consumption		χ^2	p
		N	%	N	%		
Savory Snacks	Boys	93	13.0	625	87.0	1.36	.000
	Girls	299	39.9	450	60.1		
	All	392	26.7	1075	73.3		
Fast foods	Boys	56	7.8	662	92.2	6.068	.014
	Girls	87	11.6	662	88.4		
	All	143	9.7	1324	90.3		
Sweet	Boys	129	18.0	589	82.0	37.94	.000
	Girls	102	13.6	647	86.4		
	All	231	15.7	1236	84.3		
Cake and pastries	Boys	136	18.9	582	81.1	0.019	.89
	Girls	144	19.2	605	80.8		
	All	280	19.1	1187	80.9		
Candy and chocolate	Boys	67	9.3	651	90.7	67.91	.0001
	Girls	193	25.8	556	74.2		
	All	260	17.7	1207	82.3		
Soft drink	Boys	134	18.7	584	81.3	26.58	.0000
	Girls	70	9.3	679	90.7		
	All	204	13.9	1263	86.1		

From the Table 4.19. it can be observed that most of the boys and girls had low consumption of all the unhealthy foods, viz.,savory snacks (boys 87 %, girls 60.1 %), fast foods (boys 92.2 %, girls 88.4 %), sweets (boys 82 %, girls 86.4 %), cake and pastries (boys 81.1%, girls 80.8 %), candy and chocolates (boys 90.7%, girls 74.2%) and soft drinks (boys 81.3%,girls90.7%).

A higher percentage of girls reported high consumption of savory snacks (39.9%), candy and chocolates (25.8%), and fast foods (11.6%), while more boys reported high consumption for sweets (18%), and soft drinks (18.7%) as compared to girls.

The consumption patterns for savory snacks, sweets, candy and chocolates and soft drinks have highly statistically significant association with gender. The percentages of

the boys and girls showed significant statistical variations in their consumption pattern for savory snacks (χ^2 = 1.36, df = 1, p = 0.000), sweets (χ^2 = 37.94, df = 1, p = 0.000), candy and chocolates (χ^2 = 67.91, df = 1, p = 0.0001) and soft drink (χ^2 = 26.58, df = 1, p = 0.000).

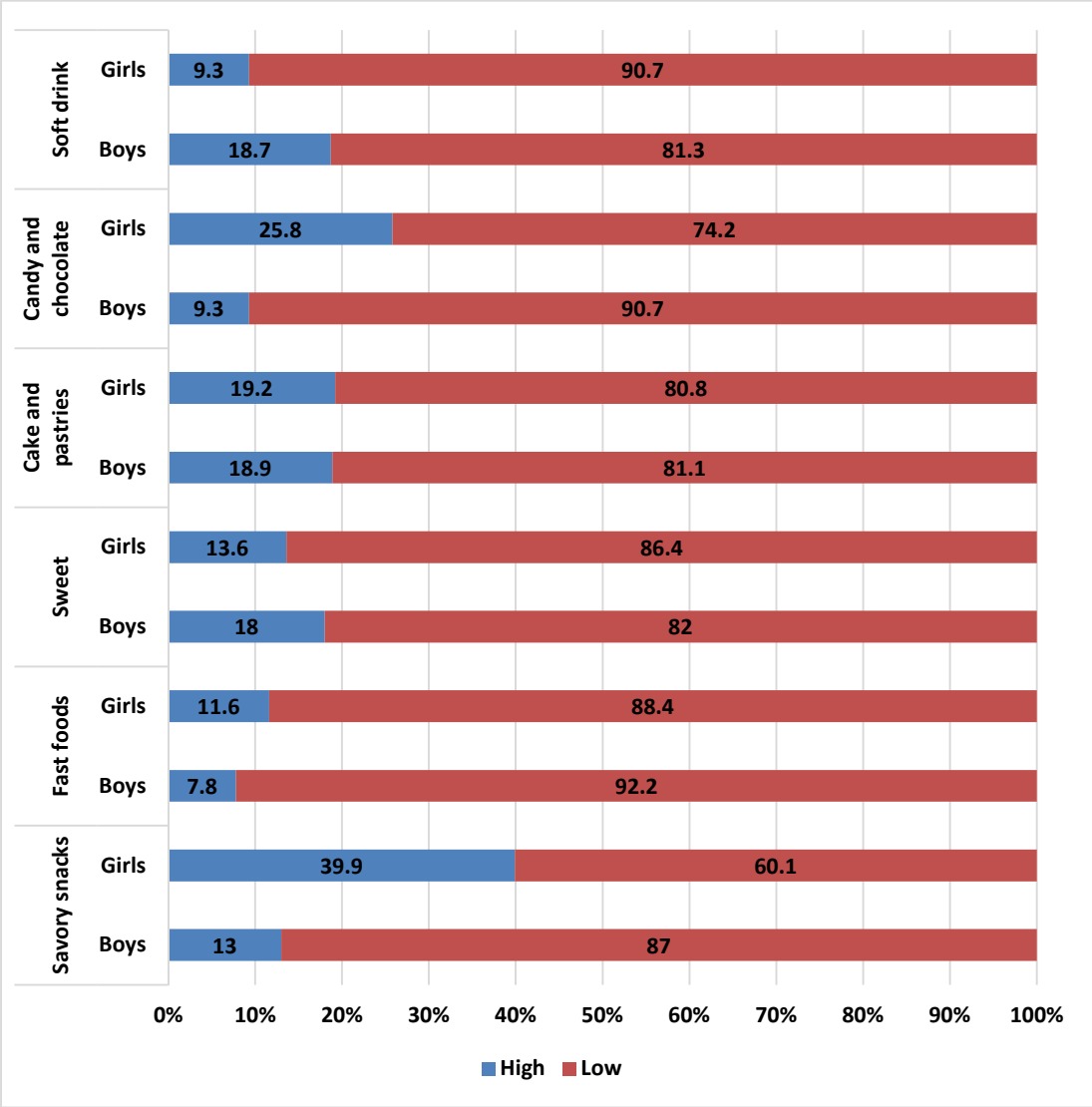


Fig.4.21 :Dichotomized consumption pattern of unhealthy foods by boys and girls

Table 4.20 :Dichotomized consumption pattern of unhealthy foods by the early and late adolescent boys

Food Items	Adolescent group	Total N	High Consumption		Low Consumption		χ^2	p
			N	%	N	%		
Savory snacks	Early	420	77	18.3	343	81.7	25.98	.00
	Late	298	16	5.4	282	94.6		
Fast foods	Early	420	27	6.4	393	93.6	2.64	.104
	Late	298	29	9.7	269	90.3		
Sweet	Early	420	234	55.7	186	44.3	59.03	.000
	Late	298	80	26.8	218	73.2		
Cake and pastries	Early	420	93	22.1	327	77.9	6.755	.009
	Late	298	43	14.4	255	85.6		
Candy and chocolate	Early	420	40	9.5	380	90.5	0.044	.833
	Late	298	27	9.1	271	90.9		
Soft drink	Early	420	45	10.7	375	89.3	42.11	.000
	Late	298	89	29.9	209	70.1		

The Table 4.20 showed that the consumption pattern decreases from early to late adolescent for majority of the food items (savory snacks, sweets, cake/ pastries and candy / chocolates) except for the fast food and the soft drinks.

Significantly higher percentage of early adolescent boys as compared to their late counterpart, reported frequent consumption of savoury snacks (18.3 %) vs 5.4%, χ^2 = 25.98, p = .000), sweets (55.7 % vs 26.8 %, χ^2 = 59.03, p = 0.000), and cake and pastries (22.1 % vs 14.4%, χ^2 = 6.75, p = 0.009).

Significantly higher percentage of late adolescent boys as compared to their early counterpart, reported frequent consumption of soft drinks (29.9% vs 10.7%, χ^2 = 42.11,p = .000)

Table 4.21 :Dichotomized consumption pattern of unhealthy foods by the early and late adolescent girls

Food items	Adolescent group	Total N	High Consumption		Low Consumption		χ^2	p
			N	%	N	%		
SavorySnacks	Early	460	202	43.9	258	56.1	7.93	.005
	Late	289	97	33.6	192	66.4		
Fast foods	Early	460	58	12.6	402	87.4	1.15	.284
	Late	289	29	10.0	260	90.0		
Sweet	Early	460	159	34.6	301	65.4	23.03	.000
	Late	289	53	18.3	236	81.7		
Cake and pastries	Early	460	89	19.3	371	80.7	0.011	.915
	Late	289	55	19.0	234	81.0		
Candy andchocolate	Early	460	118	25.7	342	74.3	0.008	.927
	Late	289	75	26.0	214	74.0		
Soft Drink	Early	460	13	2.8	447	97.2	59.81	.000
	Late	289	57	19.7	232	80.3		

Analysis of dichotomized consumption pattern of unhealthy foods by early and late adolescent girls (Table 4.21), showed that significantly higher percentage of early adolescent girls as compared to their late counterpart, had frequent consumption of savoury snacks (43.9% vs 33.6%, $\chi^2 = 7.93$, p = .005), and sweets (34.6 % vs 18.3 %, $\chi^2 = 23.03$, p = .000).)

A significantly higher percentages of late adolescent girls as compared to their early counterpart reported frequent consumption of soft drinks (19.7% vs 2.8%, $\chi^2 = 59.81$, p = .000).

4.4.4 VEG AND NON- VEG FOOD CONSUMPTION BY THE HIMACHALI ADOLESCENT POPULATION

The distribution of vegetarian and non-vegetarian meal pattern revealed that among the boys (N = 718) half of the boys are vegetarian (n = 361, 50.3 %) and the remaining half are non-vegetarian (N = 357, 49.7%).

Girls, in contrast were mostly vegetarian. Among the girls (N = 749), a total of 492 girls (65.7%) were vegetarian and 257 girls (34.3 %) were non-vegetarian. The

distribution of meal pattern among the boys and girls appeared to be highly statistically significant (χ^2 (1) = 35.17, p < .001)

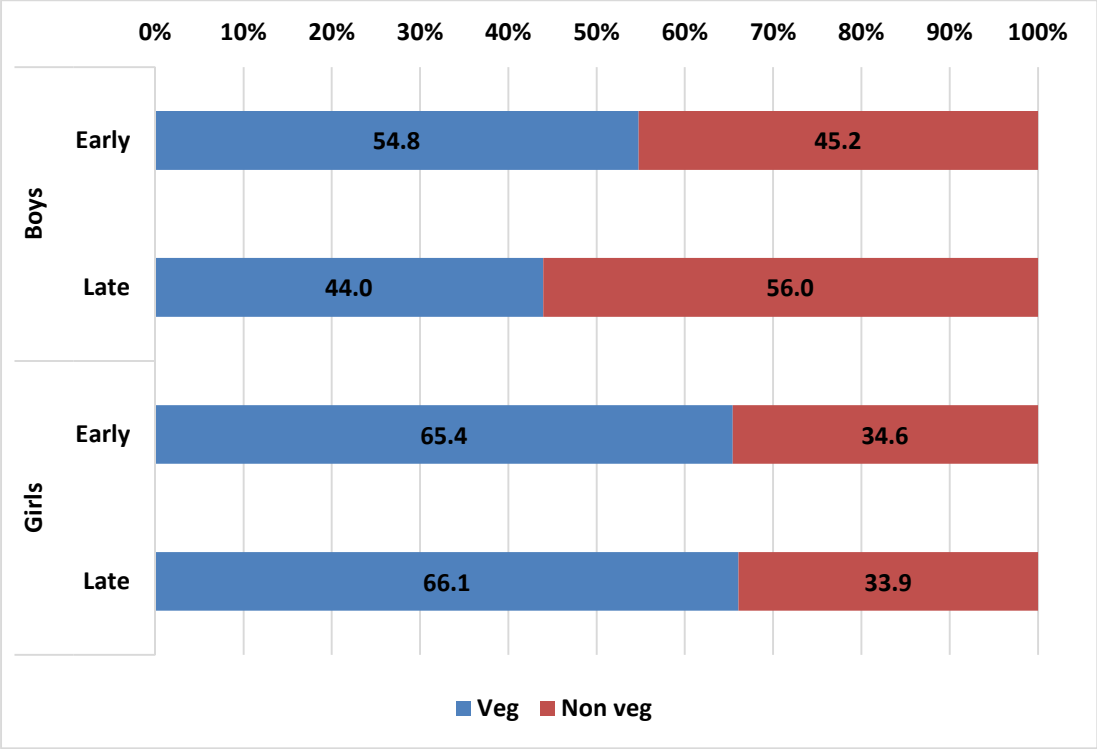
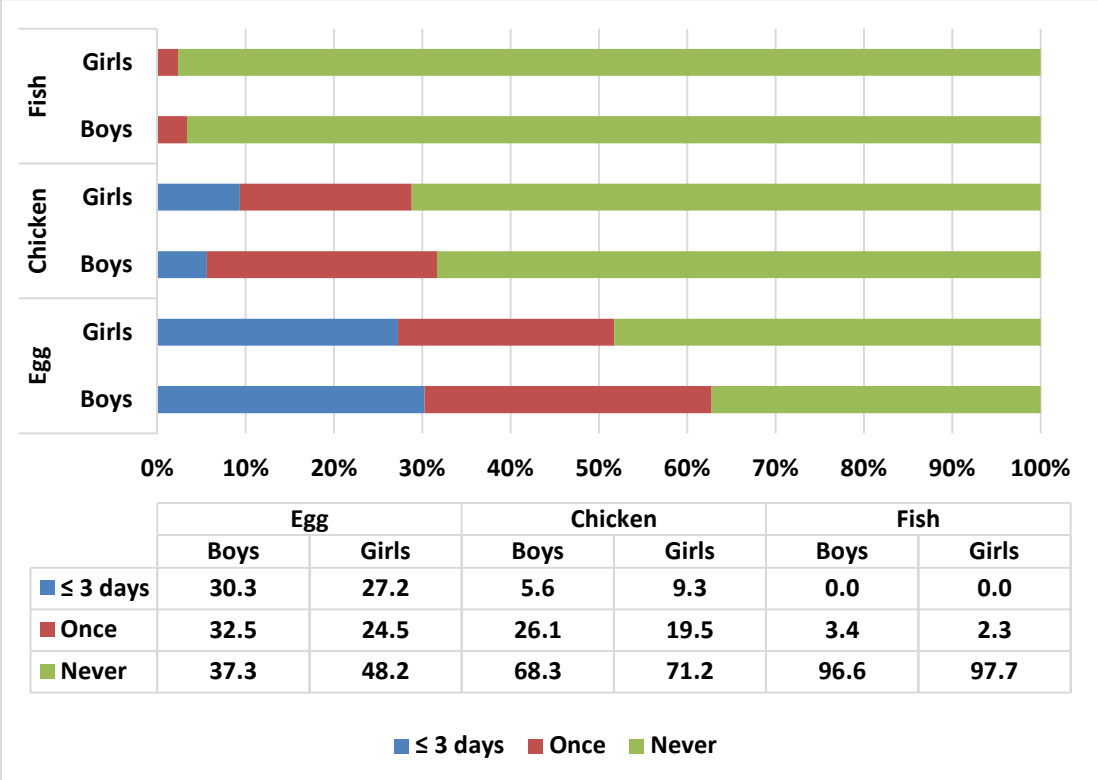


Fig. 4.22 :Vegetarian and non-vegetarian diet pattern of the boys and girls in relation to adolescent category



	Egg		Chicken		Fish	
	Boys	Girls	Boys	Girls	Boys	Girls
≤ 3 days	30.3	27.2	5.6	9.3	0.0	0.0
Once	32.5	24.5	26.1	19.5	3.4	2.3
Never	37.3	48.2	68.3	71.2	96.6	97.7

Fig.4.23 :Consumption frequencies of non-vegetarian items by boys and girls

Egg, chicken and meat and fish were the non-vegetarian items consumed. All the items were reported to be consumed less frequently, i.e, either ≤ 3 days a week, or once or never over the last two weeks prior to the study. Figure 4.23 depicts the frequency of consumption of different non-vegetarian foods. Fish was the least consumed item and consumed only by 3.4 % of boys (n =12) and 2.3 % (n =6) girls. Overall consumption of chicken was reported by 31.7 % of the boys (n = 113) and 28.8 % of the girls (N = 74). Percentages of boys and girls reporting the consumption of eggs were highest. 224 boys (62.7) and 133 girls (51.8%) reported egg consumption.

4.5 RESULTS ON ASSOCIATION BETWEEN DIETARY PATTERN AND NUTRITIONAL STATUS

4.5.1 DIETARY PATTERN AND STUNTING

Diet and Stunting status in Boys

Table 4.22 :Dietary pattern and stunting status in boys

Dietary Variables	Pattern	Stunting Status		χ^2	p
		Yes (N=54) F (%)	No (N=664) F (%)		
Breakfast	Regular (617)	32(5.2)	585(94.8)	34.369	.000
	Irregular (101)	22(21.8)	79(78.2)		
Fruit	High (475)	35(7.4)	440(92.6)	0.047	.829
	Low (243)	19(7.8)	224(92.2)		
Milk	High (568)	44(7.8)	524(92.2)	0.199	.656
	Low (150)	10(6.7)	140(93.3)		
Diary	High (175)	13(7.4)	162(92.6)	0.003	.958
	Low (543)	41(7.6)	502(92.4)		
Cooked Veg.	High (589)	43(7.3)	546(92.7)	0.229	.632
	Low (129)	11(8.6)	118(91.4)		
Green leafy	High (7)	1(14.3)	6(85.7)	0.465	.495
	Low (711)	53(7.4)	658(92.6)		
Salad	High (449)	32(7.1)	417(92.9)	0.267	.605
	Low (269)	22(8.1)	247(91.9)		

Dietary Variables	Pattern	Stunting Status		χ^2	p
		Yes (N=54) F (%)	No (N=664) F (%)		
Pulses	High (619)	45(7.3)	574(92.7)	0.407	.524
	Low (99)	9(9)	90(91)		
Savory snack	High (93)	20(21.5)	73(78.5)	30.041	.000
	Low (625)	34(5.4)	591(94.6)		
Fast food	High (56)	10(17.9)	46(82.1)	9.330	.002
	Low (662)	44(6.6)	618(93.4)		
Sweet	High (314)	17(5.4)	297(94.6)	3.562	.059
	Low (404)	37(9.1)	367(90.9)		
Cake/pastries	High (136)	12(8.8)	124(91.2)	0.409	.522
	Low (582)	42(7.2)	540(92.8)		
Candy / Chocolate	High (67)	6(9)	61(91)	0.219	.640
	Low (651)	48(7.4)	603(92.6)		
Soft Drinks	High (134)	18(13.4)	116(86.6)	8.279	.004
	Low (584)	36(6.2)	548(93.8)		

Analysis of dietary pattern and stunting in boys (Table 4.22)showed significant association of stunting with irregular breakfast pattern (22% stunted in irregular group vs 5% stunted in regular group), χ^2 =34.37, p < .001.

Stunting in boys is also significantly associated with high consumption of savory snacks (22% stunted in high consumption group vs 5% stunted in low consumption group), χ^2 30.04, df 1, p < 0.001, and soft drinks consumption (13.4% stunted in high consumption group vs 6% stunted in low consumption group), χ^2 8.28, df 1, p < 0.01.

Diet and Stunting status in Girls

Table 4.23 :Dietary pattern and stunting status in girls

Dietary Variables	Pattern	Stunting Status		χ^2	p
		Yes (N=66) N (%)	No (N=683) N (%)		
Breakfast	Regular (559)	31 (5.5)	528 (94.5)	29.25	.000
	Irregular (190)	35 (18.4)	155 (81.6)		
Fruit	High (520)	9 (1.7)	511 (98.3)	1.06	.000

Dietary Variables	Pattern	Stunting Status		χ^2	p
		Yes (N=66) N (%)	No (N=683) N (%)		
	Low (229)	57 (24.9)	172 (75.1)		
Milk	High (638)	52 (8.1)	586 (91.9)	2.34	.126
	Low (111)	14 (12.6)	97 (87.4)		
Diary	High (542)	45 (8.3)	497 (91.7)	0.109	.741
	Low (225)	21 (9.3)	204 (90.7)		
Cooked Veg.	High (604)	34 (5.6)	570 (94.4)	46.94	.000
	Low (144)	31 (21.5)	113 (78.5)		
Green leafy	High (46)	1 (2.2)	45 (97.8)	2.68	.101
	Low (703)	65 (9.2)	638 (90.8)		
Salad	High (548)	47 (8.6)	501 (91.4)	0.140	.708
	Low (201)	19 (9.5)	182 (90.5)		
Pulses	High (648)	56 (8.6)	592 (91.4)	0.172	.678
	Low (101)	10 (9.9)	91 (90.1)		
Savory snack	High (299)	22 (7.4)	277 (92.6)	1.309	.253
	Low (450)	44 (9.8)	406 (90.2)		
Fast food	High (87)	8 (9.2)	79 (90.8)	0.018	.893
	Low (662)	58(8.8)	604 (91.2)		
Sweet	High (112)	15 (13.4)	97(86.6)	1.109	.292
	Low (537)	51 (9.5)	486 (90.5)		
Cake/pastries	High (144)	17 (11.8)	127 (88.2)	1.989	.158
	Low (605)	49 (8.1)	556 (91.9)		
Candy / Chocolate	High (193)	15 (7.8)	178 (92.2)	0.350	.554
	Low (556)	51 (9.2)	505 (90.8)		
Soft Drinks	High (70)	4 (5.7)	66 (94.3)	0.922	.337
	Low (679)	62 (9.1)	617 (90.9)		

Stunting in girls was associated with breakfast frequency and consumption patterns of fruit and cooked vegetables. Self-reported intake of unhealthy foods did not reveal any relation with stunting status.

Among the irregular breakfast group statistically significant higher percentage of girls (18%) were stunted as compared to 6% of the girls in the regular breakfast group, (χ^2 29.25, df 1, $p < 0.001$).

Stunting was reported by 25% of the girls with low consumption of fruit as compared to only 1.7% of the girls with high fruit consumption (χ^2 10.06, df 1, $p < 0.01$). Again, stunting was reported by 22% of girls with low cooked vegetable consumption as compared to 6% of the girls with low consumption (χ^2 46.94, df 1, $p < 0.01$).

4.5.2 DIETARY PATTERN AND THINNESS

Diet and Thinness status in Boys

Table 4.24 :Dietary pattern and thinnessin Boys

Dietary Variables	Pattern	Stunting Status		χ^2	p
		Yes (N=139) F (%)	No (N=579) F (%)		
Breakfast	Regular (617)	98 (15.9)	519 (84.1)	33.95	.000
	Irregular (101)	41 (40.6)	60 (59.4)		
Fruit	High (475)	79(16.6)	396(83.4)	6.689	.010
	Low (243)	60(24.7)	183(75.3)		
Milk	High (568)	114(20.1)	454(79.9)	0.881	.348
	Low (150)	25(16.7)	125(83.3)		
Diary	High (175)	33(18.9)	142(81.1)	0.037	.847
	Low (543)	106(19.6)	437(80.47)		
Cooked Veg.	High (589)	111(18.9)	478(81.2)	0.554	.457
	Low (129)	28(20.7)	101(78.29)		
Green leafy	High (7)	1(14.2)	6(85.7)	0.117	.733
	Low (711)	138(19.4)	573(80.59)		
Salad	High (449)	79(17.6)	370(82.4)	2.391	.122
	Low (269)	60(22.3)	209(77.7)		
Pulses	High (619)	125(20.1)	494(79.9)	2.003	.157
	Low (99)	14(14.1)	85(85.9)		
Savory snack	High (93)	26(27.9)	67(72.0)	5.06	.025
	Low (625)	113(18.08)	512(81.9)		
Fast food	High (56)	20(35.71)	36(64.3)	10.407	.0001

Dietary Variables	Pattern	Stunting Status		χ^2	p
		Yes (N=139) F (%)	No (N=579) F (%)		
	Low (662)	119(17.9)	543(82)		
Sweet	High (314)	57(18.1)	257(81.9)	0.520	.471
	Low (404)	82(20.2)	322(79.7)		
Cake/pastries	High (136)	26(19.1)	110(80.9)	0.006	.937
	Low (582)	113(19.4)	469(80.5)		
Candy / Chocolate	High (67)	12(17.9)	55(82)	0.099	.753
	Low (651)	127(19.5)	524(80.4)		
Soft Drinks	High (584	132(22.6)	452(77.3)	21.086	.000
	Low) (134)	7(5.2)	127(94.7)		

Analysis of dietary pattern and thinness in boys (Table 4.24)showed significant association of thinness with irregular breakfast pattern (41% stunted in irregular group vs16% stunted in regular group), χ^2 =33.95, p < .000.

Significantly higher prevalence of thinness was also reported among the boys who had low consumption of fruit, (25 % thin) as compared to17% of the thin boys with high consumption (χ^2 =6.69, df 1, p = .010).

Thinness in boys was also significantly associated with high consumption of savory snacks (28% thin in high consumption group vs 18% thin in low consumption group),χ^2 5.06, df 1, p < .025,fast food consumption (36% thin in high consumption group vs 18% stunted in low consumption group), χ^2 10.41, df 1, p < .000, and soft drinks (23% thin in high consumption group vs 5%thin in low consumption group) χ^2 =21.09, df 1, p < .001).

Diet and Thinness status in Girls

Table 4.25 :Dietary pattern and thinness status in girls

Dietary Variables	Pattern	Wasting Status		χ^2	p
		Yes (N=132) N (%)	No (N=617) N (%)		
Breakfast	Regular (559)	72 (12.9)	487 (87.1)	34.15	.000
	Irregular (190)	60 (31.6)	130 (68.4)		
Fruit	High (520)	40 (7.7)	480 (92.3)	11.55	.000
	Low (229)	92 (40.2)	137 (59.8)		
Milk	High (638)	114 (17.9)	524 (82.1)	0.178	.673

Dietary Variables	Pattern	Wasting Status		χ^2	p
		Yes (N=132) N (%)	No (N=617) N (%)		
	Low (111)	18 (16.2)	93(83.8)		
Diary	High (524)	80 (15.3)	444 (84.7)	6.671	.010
	Low (225)	52 (23.1)	173 (76.9)		
Cooked Veg.	High (604)	83 (13.7)	521 (86.3)	33.17	.000
	Low (144)	49 (34)	95 (66)		
Green leafy	High (46)	6 (13)	40 (87)	0.708	.400
	Low (703)	126 (17.9)	577 (82.1)		
Salad	High (548)	97 (17.7)	451 (82.3)	0.008	.927
	Low (201)	35 (17.4)	166 (82.6)		
Pulses	High (648)	107 (16.5)	541 (83.5)	4.087	.043
	Low (101)	25 (24.8)	76 (75.2)		
Savory snack	High (299)	53 (17.7)	246 (82.3)	0.004	.952
	Low (450)	79 (17.6)	371 (82.4)		
Fast food	High (87)	16 (18.4)	71 (81.6)	0.040	.842
	Low (662)	116 (17.5)	546 (82.5)		
Sweet	High (212)	32 (15.1)	180 (84.9)	1.303	.254
	Low (537)	100 (18.6)	437 (81.4)		
Cake/pastries	High (144)	25 (17.4)	119 (82.6)	0.0080	.927
	Low (605)	107 (17.7)	498 (82.3)		
Candy / Chocolate	High (193)	29 (15)	164 (85)	1.208	.272
	Low (556)	103 (18.5)	453 (81.5)		
Soft Drinks	High (70)	8 (11.4)	62 (88.6)	2.041	.153
	Low (679)	124 (18.3)	555 (81.7)		

Dietary pattern and thinness among girls (Table4.25**)** revealed that breakfast habit has a significant effect on thinness. The data revealed that a higher percentage (32%) of the girls in the irregular breakfast group were thin as compared to only 13% of the girls who took regular breakfast, and this difference appeared to be significant (χ^2 34.15, df 1, p <0.001).

Analysis of healthy food consumption pattern showed statistically significant association between thinness and fruit consumption (40 % in low consumption group

vs 8% in high consumption group, χ^2 1.15, df 1, p <0.001), diary product consumption (23 % in low consumption group vs 15% in high consumption group, χ^2 6.67, df 1, p =0.01), cooked vegetable (34% % in low consumption group vs 14% in high consumption group, chi square 33.17, df 1, p < 0.001) and pulses (25% in low consumption group vs 17% in high consumption group, chi square 4.09, df 1, p =0.05). However, snacking pattern or consumption of unhealthy type of foods did not reveal any significant association with the thinness.

4.5.3 DIETARY PATTERN AND OVER-NUTRITION (OVERWEIGHT AND OBESITY)

DIET AND OVER-NUTRITION AMONG BOYS

Table 4.26 :Dietary pattern and over-nutrition status in boys

Dietary Variables	Pattern	Over-nutrition Status		χ^2	p
		Yes (N=55) F (%)	No (N=663) F (%)		
Breakfast	Regular (617)	39(6.3)	578(93.7)	11.122	.001
	Irregular (101)	16(15.8)	85(84.2)		
Fruit	High (475)	38(8)	437(92)	0.229	.632
	Low (243)	17(7)	226(93)		
Milk	High (568)	45(7.9)	523(92.1)	0.265	.607
	Low (150)	10(6.7)	140(93.3)		
Diary	High (175)	9(5.1)	166(94.9)	2.073	.150
	Low (543)	46(8.5)	497(91.5)		
Cooked Veg.	High (589)	47(8)	542(92)	0.473	.492
	Low (129)	8(6.2)	121(93.8)		
Green leafy	High (7)	0(0)	7(100)	0.586	.444
	Low (711)	55(7.7)	656(92.3)		
Salad	High (449)	38(8.5)	411(91.5)	1.093	.296
	Low (269)	17(6.3)	252(93.7)		
Pulses	High (619)	48(7.8)	571(92.2)	0.056	.812
	Low (99)	7(7)	92(93)		
Savory snack	High (93)	22(23.7)	71(76.3)	38.646	.000
	Low (625)	33(5.3)	592(94.7)		
Fast food	High (56)	20(35.7)	36(64.3)	67.580	.000
	Low (662)	35(5.3)	627(94.7)		

Dietary Variables	Pattern	Over-nutrition Status		χ^2	p
		Yes (N=55) F (%)	No (N=663) F (%)		
Sweet	High (314)	35(11.1)	279(88.9)	9.589	.002
	Low (404)	20(5)	384(95)		
Cake/pastries	High (136)	10(7.3)	126(92.7)	0.022	.881
	Low (582)	45(7.7)	537(92.3)		
Candy / Chocolate	High (67)	7(10.4)	60(89.6)	0.812	.368
	Low (651)	48(7.3)	603(92.7)		
Soft Drinks	High (134)	18(13.4)	116(86.6)	7.761	.005
	Low (584)	37(6.3)	547(93.7)		

Analysis of dietary pattern and over nutritional status in boys (Table 4.26) showed statistically significant association of over-nutrition with irregular breakfast consumption pattern (16% overweight in irregular group vs 6%overweight in regular group),$\chi^2$11.12, df 1, $p < 0.001$.

Overweight in boys is significantly associated with high consumption of savory snacks (24% overweight in high consumption group vs 5% overweight in low consumption group), χ^2 38.65, df 1, $p < 0.001$, fast food (36% overweight in high consumption group vs 5% overweight in low consumption group) χ^2 67.58, df 1, $p < 0.001$, sweets (11% overweight in high consumption group vs 5% overweight in low consumption group) χ^2 9.58, df 1, $p < 0.002$, and soft drinks consumption (13% overweight in high consumption group vs 6% overweight in low consumption group) χ^2 7.76, df 1, $p < 0.005$.

Diet and Over-nutrition among girls

Table 4.27 :Dietary pattern and over-nutrition status in girls

Dietary Variables	Pattern	Over-nutrition Status		χ^2	p
		Yes (N=32) F (%)	No N=717) F (%)		
Breakfast	Regular (559)	16 (2.9)	543 (97.1)	10.71	.001
	Irregular (190)	16 (8.4)	174 (91.6)		
Fruit	High (520)	2 (0.4)	518 (99.6)	62.86	.000
	Low (229)	30 (13.1)	199 (86.9)		

Dietary Variables	Pattern	Over-nutrition Status		χ^2	p
		Yes (N=32) F (%)	No N=717) F (%)		
Milk	High (638)	27 (4.2)	611 (95.8)	0.017	.90
	Low (111)	5 (4.5)	106 (95.5)		
Diary	High (524)	24 (4.6)	500 (95.4)	0.404	.525
	Low (225)	8 (3.6)	217 (96.4)		
Cooked Veg.	High (604)	26 (4.3)	578 (95.7)	0.050	.975
	Low (144)	6 (4.2)	138 (95.8)		
Green leafy	High (49)	3 (6.5)	43 (93.5)	0.606	.436
	Low (703)	29 (4.1)	674 (95.9)		
Salad	High (548)	25 (4.6)	523 95.4)	0.419	.517
	Low (201)	7 (3.5)	194 (96.5)		
Pulses	High (648)	30 (4.6)	618 (95.4)	1.50	.221
	Low (101)	2 (2.0)	99 (98.0)		
Savory snack	High (299)	17 (5.7)	282 (94.3)	2.43	.119
	Low (450)	15 (3.3)	435 (96.7)		
Fast food	High (87)	9 (10.3)	78 (89.7)	8.87	.003
	Low (662)	23 (3.5)	639 (96.5)		
Sweet	High (212)	11 (5.2)	201 (94.8)	0.607	.436
	Low (537)	21 (3.9)	516 (96.1)		
Cake/pastries	High (144)	3 (2.1)	141 (97.9)	2.089	.148
	Low (605)	29 (4.8)	576 (95.2)		
Candy / Chocolate	High (193)	7(3.6)	186 (96.4)	0.265	.607
	Low (556)	25 (4.5)	531(95.5)		
Soft Drinks	High (70)	6(8.6)	64(91.4)	3.49	.062
	Low (679)	26(3.8)	653(96.2)		

Analysis of over nutritional status and dietary pattern in girls (Table 4.27)showed statistically significant association of breakfast consumption pattern with over-nutrition. Among the irregular breakfast group 8% girls were overweight as compared to 3% of the girls having regular breakfast consumption (χ^2 10.71, df 1, $p < 0.001$).

Statistically significant association was observed between low fruit consumption and over-nutrition, 13% of the girls with low fruit consumption were overweight as compared to only 0.4% of the girls with high fruit consumption. (χ^2 62.86, df 1, $p < .001$).

Similar highly significant statistical relations were obtained with the consumption of fast food.10% of the girls with high fastfood consumption were found to be in overweight and obese as compared to only 4% girls with low consumption (χ^2 8.87, df 1, $p < 0.01$).

REFERENCES OF RESULTS

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