



Original Research Article

Health Status of Adolescents in Selected Districts of Tamil Nadu

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ABSTRACT

Objective: To assess the health status of the adolescents in selected districts of Tamil Nadu.

Material and Methods: The study was carried out in 6000 adolescents of 12 to 17 years of age in five districts (Coimbatore, Madurai, Salem, Tiruchirappalli, and Tirunelveli) of Tamil Nadu. The obesity and overweight were assessed using an updated Body Mass Index (BMI) reference chart developed by Centre for Disease Control (CDC), 2000. Details on demographic profile, food consumption pattern and lifestyle habits of adolescents were determined using pre-tested questionnaire.

Results: Coimbatore showed a higher prevalence of obesity (23 percent) while compared with other districts [Madurai (17 percent), Salem (22 percent), Tiruchirappalli (20 percent), and Tirunelveli (18 percent)]. The prevalence of obesity was 29 percent in boys and 32 percent in girls. The prevalence of underweight was 34 percent in boys and 26 percent in girls. Girls had a higher prevalence rate of overweight and obesity while compared with boys of the same age.

Conclusion: The study suggests that the prevalence of overweight and obesity varies remarkably with socioeconomic status, food consumption pattern and lifestyle habits. It is concluded that proper nutrition is essential to keep teens healthy and able to grow and develop properly. Eating right helps teens participate better in school and athletic activities. Individually targeted obesity prevention education programme will produce beneficial effects on dietary habits and lifestyle pattern.

Key words: Health status, Body Mass index, Adolescent Obesity, Tamil Nadu

INTRODUCTION

Obesity is a major public health concern with a highly increasing prevalence in adolescents and childhood population. Obesity increased dramatically, particularly

since 1980's throughout the world. This trend prompted the World Health Organization in 1998 to recognize a "global epidemic of obesity". According to newly established national criteria, about 25

percent of adolescents and children are overweight or obese. These teens are at significant risk for becoming obese adults. The nutritional status and health of children and adolescents has declined in recent years. Government surveys have currently shown that at least 16 percent of children and adolescents, aged 6 to 19 years are considered overweight and at least 11 percent of adolescents are classified as obese. World Health Organization estimates that approximately 1.6 million adult (age 15+) were overweight and at least 400 million adult were obese globally in 2005. By 2015, approximately 2.3 billion adults will be overweight and more than 700 million will be obese. ⁽¹⁾ Obese adolescents are at increased risk of discrimination, less likely to be married, less likely to have life satisfaction and achieve the future life aspirations of young women. This may be because girls are judged specifically on shape more than boys. ⁽²⁾ Obesity has become a public health concern with an over increasing prevalence in adolescent and childhood populations. ⁽³⁾ The developing world now confirms the dual challenge of competing chronic under nutrition characterized by short stature and over nutrition reflected by a high weight for height, in the same persons. Childhood obesity may result from a number of underlying causes including less healthy eating patterns, engaging in less physical activity, more sedentary behavior, and cultural attitudes about body weight. ⁽⁴⁾ Obesity is a monumental dilemma affecting the health and well-being of the world's population. ⁽⁵⁾ This is not a new problem, but rather a rapidly increasing one among children, adolescents and adults. ⁽⁶⁻⁸⁾ The reasons for this escalation are multi-factorial; each must be appreciated and precisely addressed before solutions to obesity are practical. In recent years, the occurrence of obesity has increased in

developing countries also, and now even replacing more traditional public health concerns, including under nutrition and infectious diseases. Though, it is not a recent phenomenon. However, the prevalence of obesity has never before reached up to such epidemic proportion as today. ⁽⁹⁾ In Tamil Nadu, main emphasis has been placed on under nutrition but over nutrition, the other side of the coin has not been investigated specifically at the beginning age of adolescence from 12 years of age. This stage of life is of great importance and development of obesity at this period may have adverse effect on their health and personal achievements. Psychological and dietary factors can be either the cause or the effect of obesity. Considering all these points, the present research work was undertaken to assess the health status of adolescents between the age group of 12 to 17 years in selected districts namely Coimbatore, Madurai, Salem, Tiruchirappalli, and Tirunelveli from Tamil Nadu.

Objectives

- Asses the health status of the adolescents in the selected districts of Tamil Nadu.
- Study the socio economic status of selected school children.
- Assess the dietary pattern and lifestyle habits of the adolescents.
- Impart nutrition intervention programme to the adolescents.

MATERIALS AND METHODS

Selection of area:

Tamil Nadu is one of the 28 states of India. The state of Tamil Nadu, in southeastern India is divided into 32 districts. Based on convenience sampling technique, the investigator chosen five districts (15 percent of total districts) of Tamil Nadu (Coimbatore, Madurai, Salem,

Tiruchirappalli, and Tirunelveli). The schools were selected with the official permission from the inspectors of matriculation schools. Hence based on purposive sampling technique, the investigator conducted the study in 25 matriculation higher secondary schools.

Selection of samples:

The samples were selected based on the following inclusion criteria –

- adolescents aged between 12 to 17 years.
- adolescents who are not included in any similar researches.

Only those adolescents who fulfilled the above mentioned criteria and those who consented to participate were included in the study. A stratified random sampling technique was adopted to select the samples to get an equal distribution of adolescents from each age group. The total sampling unit comprises of 6000 adolescents. One thousand and two hundred samples were selected from each district (600 boys and 600 girls). One hundred boys and one hundred girls were selected from each age group.

Conduct of the study

Demographic profile, food consumption pattern and lifestyle habits of adolescents:

School authorities were requested by the investigator to provide a list of children attending classes from standard seven to standard twelve. Consent letters were obtained from the school authorities and parents to take anthropometric measurements (height, weight, waist and hip circumference) and also to collect data regarding the samples through the questionnaire. Questionnaire assessed the socioeconomic status, participation in sports, physical exercise, sleeping habit during day time, diet (vegetarian or non vegetarian), junk food consumption, meal pattern, frequency of visiting restaurants and other factors that influence physical health of

representative samples of adolescents. Food frequency questionnaires are commonly used to assess habitual food intake. A self administered food frequency questionnaire was designed to assess the food consumption pattern of adolescents. The present study also assessed family history of diabetes and obesity. The investigator distributed the questionnaires to all the adolescents who attended the school on the day of survey. Self perception of the samples regarding their own current body weight was assessed on the basis of five categories (normal, slightly less than normal, much less than normal, slightly higher than normal and much higher than normal).

Anthropometric measurements:

The measurement of height is a standard component of most fitness assessments. The measurement was made and the result was recorded in the student health record and data log. The body weight was recorded using a standard balance scale. The weight was read on the scale and recorded immediately on the student's health record and data log. Body Mass Index (BMI) is defined as the ratio of body weight to body height squared, expressed as kg/ m². BMI was classified using CDC percentiles (Centre for Disease Control, 2000). Adolescents with BMI more than or equal to 95th percentile with respect to age and gender were considered as obese, between 85th percentile and less than 95th percentile were considered as overweight and between 5th percentile and less than 85th percentile were considered as healthy weight and less than 5th percentile were considered as under nourished.

BMI Classification for Children 2-20 Years Old.

BMI for Age Percentiles	Weight Classification
<5th	Underweight
5th to <85th	Healthy Weight
85th to <95th	Overweight
≥95th	Obese

* Centre for Disease Control, 2000

Awareness on obesity and promoting healthy eating habits and positive lifestyle practices:

School-based nutrition education programme involved interventional components (classroom instruction by teachers, nutrition intervention integrated across curricula, peer training), environmental components (school menus, classroom snacks and special treats), and/or other components (physical activity, family intervention and community involvement).

The nutrition education programme in this study focused on the following major eight components:

- Dissemination of health-related information through lectures and focused group discussions
- Quizzes

- Individual counseling of students
- Promotion of physical activity
- Family intervention and community involvement
- Change in menu for healthy eating
- Health camps for parents and teachers, and
- Training of student volunteers for sustainability of the health related programme in school.

Statistical analysis and interpretation:

Mean and standard deviation were calculated for the statistical analysis. Student's t test was used to compare the mean results of the analyzed variables and chi - square was used for the comparison of frequencies. ANOVA was employed to test the statistical significances of the differences between the BMI of boys and girls.

RESULTS

Age and gender wise distribution of adolescents: The total sampling unit comprises of 6000 adolescents. The number of adolescents selected from each age group of a single district is presented in Table I-A.

Table I -A: Age and gender wise distribution of adolescents

Age	Boys	Girls	Total
12	100	100	200
13	100	100	200
14	100	100	200
15	100	100	200
16	100	100	200
17	100	100	200
Total	600	600	1200

Table I-B: Number of adolescents as per district

Districts	Number
Coimbatore	1200
Madurai	1200
Salem	1200
Tiruchirappalli	1200
Tirunelveli	1200
Total	6000

It is noted from the Table I-A that one hundred boys and one hundred girls were

selected from each age group. One thousand and two hundred samples were selected from each district (600 boys and 600 girls).

Number of adolescents as per district: A total number of 6000 adolescents in the age group between 12 to 17 years from 25 matriculation schools in five districts of Tamil Nadu (Coimbatore, Madurai, Salem, Thirchirappalli, and Tirunelveli) were selected for the study and it is depicted in Table I-B.

The Table I-B shows that one thousand and two hundred adolescents were selected from each district which comprises the total number of 6000 adolescents. Out of 6000 adolescents, 3000 (50 percent) were boys and 3000 (50 percent) were girls.

Mean height of the adolescents: The height of the adolescents was measured and result was recorded in the student health record and data log. The mean height of the adolescents were elicited and presented in Table II.

Table II: Mean height of the adolescents

Age	Coimbatore		Madurai		Salem		Tiruchirappalli		Tirunelveli	
	Boys (N=600)	Girls (N=600)	Boys (N=600)	Girls (N=600)	Boys (N=600)	Girls (N=600)	Boys (N=600)	Girls (N=600)	Boys (N=600)	Girls (N=600)
12	1.46±0.08	1.54±0.10	1.41±0.08	1.44±0.06	1.48±0.08	1.50±0.07	1.44±0.08	1.51±0.10	1.44±0.09	1.52±0.10
13	1.60±0.09	1.51±0.05	1.49±0.08	1.48±0.08	1.53±0.07	1.52±0.05	1.52±0.07	1.51±0.07	1.58±0.09	1.53±0.07
14	1.71±0.11	1.62±0.08	1.58±0.09	1.53±0.08	1.60±0.07	1.53±0.08	1.57±0.09	1.56±0.06	1.61±0.11	1.57±0.06
15	1.64±0.09	1.54±0.05	1.60±0.08	1.56±0.05	1.65±0.07	1.57±0.05	1.62±0.12	1.54±0.06	1.62±0.10	1.54±0.05
16	1.77±0.06	1.60±0.05	1.68±0.07	1.57±0.05	1.68±0.08	1.58±0.06	1.69±0.07	1.56±0.05	1.72±0.09	1.57±0.04
17	1.70±0.07	1.54±0.08	1.68±0.04	1.54±0.10	1.69±0.05	1.54±0.06	1.70±0.08	1.58±0.04	1.70±0.08	1.58±0.04

The Table II shows that the height of the adolescents gradually increases as per the age increases by. The beginning of the increase in growth velocity is about age 11 in boys and 9 in girls but varies widely from individual to individual. The peak height velocity occurs at a mean of 13.5 years in boys and 11.5 years in girls. ⁽¹⁰⁾

Table III: Mean weight of the adolescents

Age	Coimbatore		Madurai		Salem		Tiruchirappalli		Tirunelveli	
	Boys (N=600)	Girls (N=600)	Boys (N=600)	Girls (N=600)	Boys (N=600)	Girls (N=600)	Boys (N=600)	Girls (N=600)	Boys (N=600)	Girls (N=600)
12	49.9±10.6	56.9±16.3	41.2±13.8	42.8±12.2	48.4±12.0	52.0±12.2	44.2±13.9	53.6±17.6	43.9±15.3	49.8±15.0
13	60.7±16.3	55.1±10.4	44.5±12.8	45.4±14.6	52.5±12.5	55.5±13.7	50.1±14.4	54.1±15.4	53.8±21.6	49.7±14.4
14	66.7±19.4	64.3±14.8	50.3±17.5	50.7±14.3	56.3±15.2	54.9±13.7	54.6±19.2	57.8±20.4	56.5±22.1	53.7±17.4
15	61.0±17.2	62.5±17.2	51.9±18.7	55.2±22.0	60.4±17.5	64.1±20.9	56.3±18.0	56.6±16.4	54.0±15.7	57.7±21.3
16	72.3±21.6	68.0±21.2	60.9±21.2	52.2±17.4	63.8±22.2	59.3±16.4	63.6±19.9	57.0±19.2	62.7±19.2	57.4±20.1
17	67.6±20.0	58.0±15.9	58.8±18.9	51.3±16.4	65.6±19.6	55.5±13.7	64.7±21.2	58.0±18.4	61.9±19.8	58.0±16.2

Mean weight of the adolescents: The body weight of the adolescents was measured using a standard balance scale and the result was recorded in the student health record and data log. The Table III shows the mean weight of the adolescents.

The Table III shows that weight of the adolescents increases as per the age increases. Weight velocity increases and peaks during the adolescent growth spurt. Pubertal weight gain accounts for about 50 percent of an individual's ideal adult body weight. As we age, a decrease in our physical abilities leads to a decrease in our metabolic rate (amount of energy used in a given period), which in turn contributes to weight gain. ^(10,11)

Mean BMI of the adolescents: BMI is a useful tool to identify possible weight problems; it screens children and teens for being obese, overweight, healthy weight and underweight. The BMI of the adolescents were assessed and the results are presented in Table IV.

Table IV: Mean BMI of the adolescents

Age	Coimbatore			Madurai			Salem			Tiruchirappalli			Tirunelveli		
	Boys (N=600)	Girls (N=600)	't' value	Boys (N=600)	Girls (N=600)	't' value	Boys (N=600)	Girls (N=600)	't' value	Boys (N=600)	Girls (N=600)	't' value	Boys (N=600)	Girls (N=600)	't' value
12	23±3.4	24±4.5	0.802 ^{ns}	21±6.5	21±5.7	0.2579 ^{ns}	22±4.6	23±4.4	1.1578 ^{ns}	21±5.5	23±6.1	2.2995*	21±5.8	22±6.1	0.9142 ^{ns}
13	23±4.9	24±4.4	1.2473 ^{ns}	20±5.6	21±5.6	0.4615 ^{ns}	22±5.2	24±5.1	1.7308*	21±5.3	23±6.2	2.5748*	21±6.4	21±5.5	0.2244 ^{ns}
14	23±4.8	24±4.1	2.6405*	20±6.3	22±6.0	1.8785*	22±5.5	23±5.5	1.9267*	22±6.3	23±7.2	1.8301*	21±6.9	22±6.1	0.2382 ^{ns}
15	23±5.7	25±5.8	4.0544*	20±6.4	23±8.7	2.2631*	22±5.8	26±8.1	4.1403*	21±5.5	24±6.7	2.747*	20±8.5	24±8.1	3.5674*
16	23±6.5	26±7.1	3.5267*	21±6.8	21±7.1	0.351 ^{ns}	22±6.6	24±6.8	1.775*	22±6.6	23±7.3	1.1087 ^{ns}	21±6.3	23±7.8	1.9167*
17	23±7.0	25±8.1	1.1098 ^{ns}	21±6.5	22±8.0	1.1997 ^{ns}	23±7.0	24±6.1	0.5891 ^{ns}	22±7.4	23±7.3	0.8292 ^{ns}	22±7.1	23±6.8	1.3049 ^{ns}

Values are mean ± SD (n=100)

* - significant at (t<0.05)

ns – Not significant

The Table IV shows that Girls had a higher BMI while compared with boys of the same age. BMI is a measure of body fat and it can be used for anyone from two to 20 years of age. (12) Recent studies in Britain have indicated that female between the ages 12 and 16 have a higher BMI than males of the same age by 1.0 kg/m² on average. (13)

Prevalence of obesity among adolescents: BMI is a reliable indicator of body mass fatness for most children and teens. BMI was classified using CDC percentiles (Centre for Disease Control, 2000). Table V shows the prevalence of obesity among the selected adolescents.

It is evident from the Table V, among the selected adolescents, boys and girls with normal BMI were 16 percent and 19 percent respectively. The prevalence of overweight was 21 percent among boys and 23 percent among girls. The prevalence of obesity was 29 percent in boys and 32 percent in girls. The prevalence of underweight was 34 percent in boys and 26 percent in girls. Girls had a higher prevalence rate of overweight and obesity while compared with boys of the same age. The F-value was significant at one percent level. Although there was no

increase in the mean height of children and young adults between 1995 and 2002, weight and BMI increased year by year for all age and sex groups. As a result, there was a steady upward trend in the prevalence of overweight and obesity during these years. (14)

District wise prevalence of obesity: Body Mass Index (BMI) calculation is used to assess the health status of the adolescents in five districts (Coimbatore, Madurai, Salem, Tiruchirappalli, and Tirunelveli) of Tamil Nadu and the results are presented in Table VI.

It is evident from the Table VI that Coimbatore showed a higher prevalence of obesity (23 percent) while compared with other districts [Madurai (17 percent), Salem (22percent), Tiruchirappalli (20 percent), and Tirunelveli (18 percent)]. The value of chi square was significant at 5 percent level. India is following a trend of other developing countries that are steadily becoming more obese. According to the National Family Health Survey (2007), Tamil Nadu ranks fourth among the States in obesity.

Table V: Prevalence of obesity among adolescents

Health status	Boys (N=3000)		Girls (N=3000)		F value
	No	%	No	%	
Underweight (<5 th percentile)	1021	34	777	26	21.82*
Healthy weight (5 th to <85 th percentile)	473	16	568	19	
Overweight (85 th to <95 th percentile)	620	21	699	23	
Obese (≥95 th percentile)	886	29	956	32	
Total	3000	100	3000	100	

* - Significant at one percent (p<0.01)

Table VI: District wise prevalence of obesity

Districts	Obese samples		Chi ² value
	No	%	
Coimbatore	426	23	4.39*
Madurai	306	17	
Salem	405	22	
Tiruchirappalli	374	20	
Tirunelveli	331	18	
Total	1842	100	

* - Significant at five percent

Self perception of the health status by the adolescents: Self perception of the samples regarding their own current body weight was assessed and the results are shown in Table VII.

The Table VII shows that the actual prevalence of obesity was 29 percent in boys and 32 percent in girls. But only 22 percent of obese boys and 25 percent of obese girls could correctly perceive that they are above the normal weight. However, rest of the obese adolescents had the wrong concept that they themselves were of normal body weight. There was a tendency of teenagers to underestimate their weight status. More than half of the girls and about one third of the boys expressed discontentment with their body weight. (15)

Table VII: Self perception of the health status by the adolescents

Health status	Boys				t value	Girls				t value
	SP		AR			SP		AR		
	No	%	No	%		No	%	No	%	
Underweight	1021	34	1021	34	-	777	26	777	26	-
Healthy weight	692	23	473	16	12.67*	798	27	568	19	18.53*
Overweight	617	21	620	21	0.84 ^{ns}	663	22	699	23	7.12*
Obese	670	22	886	29	20.64*	762	25	956	32	13.48*
Total	3000	100	3000	100		3000	100	3000	100	

SP- Self perception, AR- Actual results; * - Significant at one percent (p<0.01)

DISCUSSION

A total number of 6000 adolescents in the age group between 12 to 17 years from 25 matriculation schools in five districts of Tamil Nadu (Coimbatore, Madurai, Salem, Thiruchirappalli, and Tirunelveli) were screened for their height, weight and body mass index. Out of 6000 adolescents, 3000 (50 percent) were boys and 3000 (50 percent)

were girls. Among the selected adolescents, boys and girls with normal BMI were 16 percent and 19 percent respectively. The prevalence of overweight was 21 percent among boys and 23 percent among girls. The prevalence of obesity was 29 percent in boys and 32 percent in girls. The prevalence of underweight was 34 percent in boys and 26 percent in girls. Girls had a higher

prevalence rate of overweight and obesity while compared with boys of the same age. The prevalence of obesity among boys and girls were 20 percent and 21 percent respectively in Coimbatore district. Coimbatore showed a higher prevalence of obesity (23 percent) while compared with other districts [Madurai (17 percent), Salem (22 percent), Tiruchirappalli (20 percent), and Tirunelveli (18 percent)]. The value of chi square is significant at 5 percent level. The adolescents in the age of 12 years showed a higher prevalence of obesity (19 percent) while compared to other age groups. Eighty one percent of adolescents who belonged to the higher socioeconomic status were found to be obese. Out of 1842 obese samples, 783 (43 percent) reported a family history of obesity. Consumption of potato, rice, bread, biscuits, syrups, squashes, chocolates, soft drinks, coffee, pastries, fast foods and ice creams was found to be on weekly basis by the obese samples. The frequency of consumption of items like cheese, butter, jams and jellies was less but relatively higher by those having more than desirable body weight. Obese and overweight samples participated in sports less often than normal-weight and underweight samples, similarly obese and overweight samples participated in physical exercise less often than normal-weight and underweight samples. Self perception of the samples regarding their own current body weight was assessed. The actual prevalence of obesity was 29 percent in boys and 32 percent in girls. But only 22 percent of obese boys and 25 percent of obese girls could correctly perceive that they are above the normal weight. However, rest of the obese adolescents had the wrong concept that they themselves were of normal body weight. There was a tendency of teenagers to underestimate their weight status. The impact of nutrition education was assessed through a questionnaire and the mean scores

showed that the adolescents were more aware of the positive aspects of health and nutrition.

CONCLUSION

The present study was carried out to assess the health status of the adolescents in selected districts of Tamil Nadu and to modify the food consumption pattern and their sedentary lifestyle habits through imparting nutrition education. A total of 3000 boys and 3000 girls between the age group of 12–17 years were screened for the height and weight. BMI was calculated by using BMI reference chart developed by CDC, 2000. The study showed that adolescent obesity varies from each district with respect to family income, family history, dietary pattern, and lifestyle habits. Nutrition education was imparted to the samples and parents in the Parents Teachers Association meeting. This session involved power point presentation on obesity, causes, risk factors, signs and symptoms, complications, dietary management, treatment and prevention. Pamphlets and compact disks containing information on obesity were distributed to the samples. The impact of nutrition education showed that the adolescents were more aware of the positive aspects of health and nutrition. It was concluded that inspite of the knowledge of nutritious food and complications of obesity among adolescents, obesity was more prevalent in them. Individually targeted obesity prevention education programme will produce beneficial effects on dietary pattern and lifestyle habits.

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