Results and Discussion

4. RESULTS AND DISCUSSION

The results of the study entitled **"Diet and Lifestyle of Obese Children in the Selected Districts of Kerala and Tamil Nadu and the Impact of Medical Nutrition Therapy"** are discussed under the following headings.

A. Demographic Profile of the subjects
B. Lifestyle practices of the selected obese children
C. Dietary pattern of the obese subjects
D. Infant nutrition and maternal health status during pregnancy
E. Assessment of risk factors for childhood obesity
F. Prevalence of childhood obesity among the selected tribal population of Kerala and Tamil Nadu
G. Impact of Medical Nutrition Therapy

A. DEMOGRAPHIC PROFILE OF THE SUBJECTS

The demographic profile embraces age, gender, education details of the subjects, religion, education of parents, occupation, family income, family type, family size and number of children.

1. Age of the Subjects

Age denotes the effect of time on a person. Table I shows the classification of children on the basis of their age.

TABLE I

AGE OF THE SUBJECTS

States	Districts	Age In Years									
		6		7		8		9		10	
		No.	%	No.	%	No.	%	No.	%	No.	%
Tamil Nadu	Coimbatore	110	22	49	10	134	27	109	21	98	20
	Erode	107	21	126	25	103	21	93	19	71	14
	Tirupur	63	13	94	19	127	25	97	19	119	24
	Salem	118	24	91	18	49	10	110	22	132	26
Kerala	Kottayam	97	20	119	24	132	26	66	13	86	17
	Pathanamthitta	103	21	97	19	32	16	106	22	112	22
	Allepey	69	14	82	16	70	14	136	27	143	29
	Thrissur	112	22	76	16	95	19	121	24	96	19

The subjects selected were grouped into five categories on the basis of their age. In Coimbatore, 27 per cent of the subjects were eight years and ten per cent were seven years of age. In Erode district, 25 per cent were seven years and 21 per cent each were of six years and eight years respectively. Only 14 per cent belonged to ten years age category. The agewise distribution of obese population in Tirupur district was in the order of 13 per cent under six years of age, 19 per cent each under seven years and nine years respectively and 24 per cent under ten years. In Salem, 24 per cent were six years old and 25 per cent were ten years old.

The details on age classification of the subjects in various districts of Kerala are discussed below. In Kottayam, 26 per cent were eight years old and 24 per cent were seven years old, whereas 13 per cent of the obese subjects were nine years old. In Pathanamthitta, 16 per cent were eight years, 21 per cent were six years, 19 per cent were seven years and 22 per cent each were of nine years and ten years of age respectively. In Allepey district, fourteen per cent each were six years and eight years of age respectively.

Twenty nine per cent were ten years old. In Thrissur district, 24 per cent were nine years old, 22 per cent were six years.

Nearly 22 million children under the age of five are estimated to be overweight worldwide. The calculated global prevalence of overweight (including obesity) in children aged 5-17 years is 10 per cent and the prevalence varies from over 30 per cent in America to less than two per cent in sub Saharan Africa. Recent trends in Indian population indicate a rise in obesity both in children as well as adults (Balistreri, 2009).

Obesity has reached epidemic proportion globally, with more than one billion adults overweight – at last 3000 million of them clinically obese – and is a major contributor to the global burden of chronic disease and disability. Often coexisting in developing countries with under-nutrition, obesity is a complex condition, with serious social and psychological dimensions, affecting virtually all ages and socioeconomic groups (Beckfield, 2009).

2. Gender Classification of the Selected Subjects

The gender classification of the selected obese population in various districts of Tamil Nadu and Kerala is depicted in Table II. Gender is a range of characteristics distinguishing between male and female, particularly in case of men and women. A total of 500 obese children from each district in both the sexes were selected for the present research work. Table II and Figure III reveal the gender wise classification of the selected subjects.

TABLE II

GENDER CLASSIFICATION

States	Districts	GENDER			
		Boys		Girls	
		No.	%	No.	%
Tamil Nadu	Coimbatore	217	43	283	57
	Erode	209	42	291	50
	Tirupur	251	50	249	50
	Salem	226	45	274	55
Kerala	Kottayam	284	57	216	43
	Pathanamthitta	212	42	288	58
	Allepey	271	54	229	46
	Thrissur	236	47	264	53

In Coimbatore, 57 per cent were girls and 43 per cent were boys. The percentage of boys in the districts of Erode, Tirupur and Salem were in the order of 42, 50 and 45 per cent respectively. The percentage of girls in the districts of Tamil Nadu was 50 per cent each in Erode and Tirupur and 55 per cent in Salem. In Kerala, 57 per cent were boys in Kottayam district and the rest were girls (43 per cent). In Pathanamthitta, 58 per cent were girls and 42 per cent were boys, while in Allepey district the percentage was 54 and 46 for boys and girls respectively. In Thrissur district, 53 per cent were girls and 47 per cent were boys.

Many of the studies from India showed that females have more obesity and metabolic syndrome as compared to males. Obese adolescent girls are more likely to suffer from Poly Cystic Ovarian Sysndrome (PCOS), a syndrome of variable combinations of menstrual irregularity, hirsutism or acne, with obesity and insulin resistance (Harris, 2009).

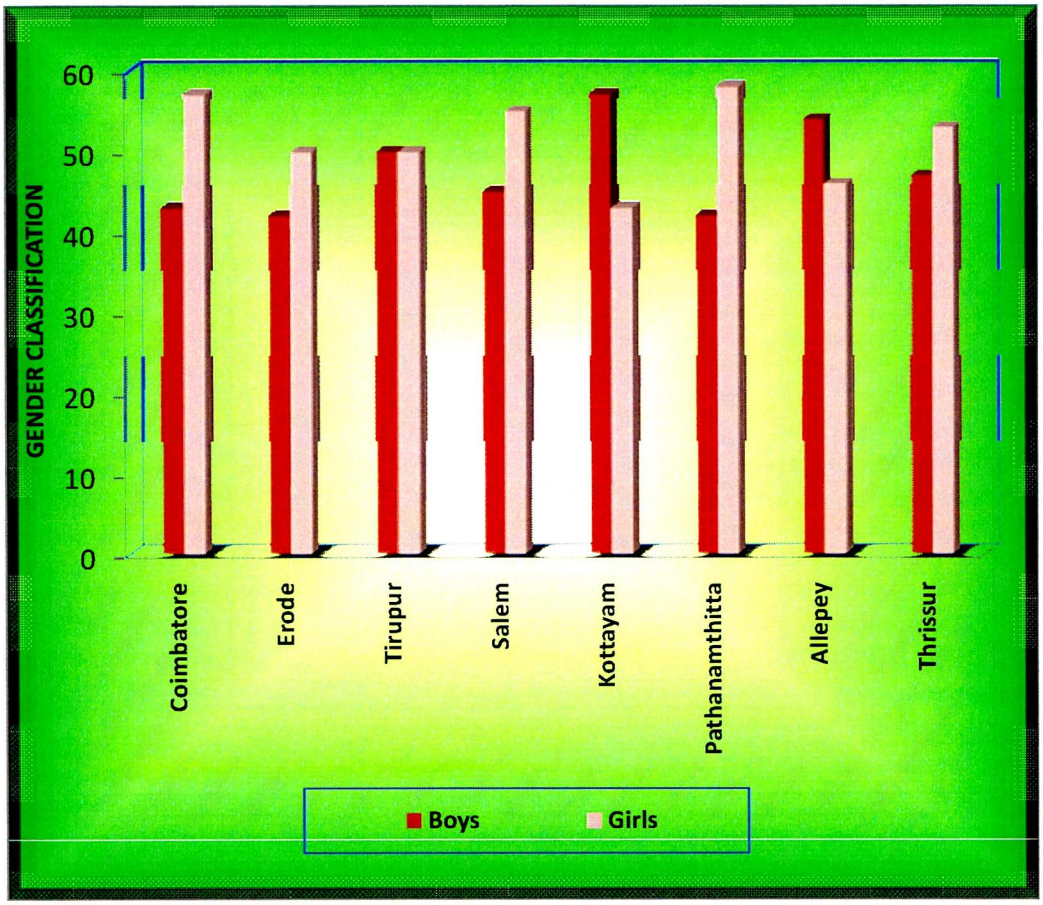


FIGURE III

GENDER CLASSIFICATION

According to Ramachandran *et al.* (2002) in Chennai 17.8 per cent boys were overweight and it was 15.8 per cent with girls.

As per figures revealed in the National Family Health Survey III conducted by 18 research organizations between December 2005 and August 2006, over 32.9 per cent women and 24 per cent men are obese, while those with a Body Mass Index below normal stand at 10.6 per cent in women and 10.4 per cent in men (Shankar, 2009).

3. Religion of the subjects

Religion is a collection of cultural systems, belief systems and world views that establishes symbols that relates humanity to spirituality and moral values. The children selected for the present study belonged to four different

religions like Christianity, Islam, Hinduism and Jainism. The details regarding the religion of the subjects in various districts were elicited and is presented in Table III.

TABLE III

RELIGION

States	Districts	RELIGION							
		Hindu		Christian		Islam		Jain	
		No.	%	No.	%	No.	%	No.	%
Tamil Nadu	Coimbatore	245	49	71	14	118	24	66	13
	Erode	361	72	52	10	72	15	15	3
	Tirupur	283	57	30	6	187	37	-	-
	Salem	406	81	31	6	45	9	18	4
	ChiSquare – 283.25; df – 9; Sig - **								
Kerala	Kottayam	57	12	361	72	82	16	-	-
	Pathanamthitta	42	8	414	83	44	9	-	-
	Allepey	261	52	124	25	115	23	-	-
	Thrissur	312	63	116	23	72	14	-	-
	Chi Square – 663.34; df – 6; Sig - **								

It was noted that in Coimbatore, 49 per cent were Hindus and 24 per cent were Muslims. The percentage of Christians and Jains in Coimbatore were 14 per cent and 13 per cent respectively. In Erode, 72 per cent were Hindus and 10 per cent were Christians, whereas in Tirupur 37 per cent believed in Islam religion and 57 per cent believed in Hinduism, whereas in Salem, 81 per cent were Hindus of which a majority was gounders (community) and only eight per cent were Christians.

In Kerala, 72 per cent of the subjects in the district of Kottayam were Christians and 12 per cent were Hindus and 16 per cent were muslims. In Pathanamthitta, 83 per cent were Christians and eight per cent were Hindus and in Allepey district, 52 per cent were Hindus and 23 per cent were Muslims and 25 per cent were Christians. Sixty three per cent of the subjects in

Thrissur were Hindus and 23 per cent were Christians and 14 per cent were Muslims. It was also noted that none of the selected subjects from Kerala followed Jainism.

Chi square test was applied to find out the association of childhood obesity with religion. The calculated value of chi square was found to be 283.25 in the districts of Tamil Nadu and 663.34 in the districts of Kerala. The calculated value of chi square was greater than the table value of 21.666 at one per cent level. Since the calculated value was greater than the table value it was inferred that there is significant relationship between childhood obesity in both the states and religion.

4. Education details of the parents

Education is one act or experience that has a formative effect on the mind, character and physical ability of an individual.

TABLE IV

EDUCATION DETAILS OF PARENTS

States	Districts	QUALIFICATION					
		Higher Secondary		Under Graduation		Post Graduate	
		No.	%	No.	%	No.	%
Tamil Nadu	Coimbatore	97	19	324	65	79	16
	Erode	267	53	214	43	19	4
	Tirupur	120	24	342	68	38	8
	Salem	79	16	324	65	97	19
Kerala	Kottayam	28	6	406	81	66	13
	Pathanamthitta	42	8	379	79	79	16
	Allepey	103	21	311	62	86	17
	Thrissur	129	26	347	69	24	5

The educational qualifications of the selected subjects's parents in the selected districts of Kerala and Tamil Nadu were also elicited. In Coimbatore, 65 per cent of the parents were undergraduates and 16 per cent were post

graduates. In Erode, it was noted that 53 per cent of the parents passed higher secondary and 19 per cent were undergraduates. Sixty eight per cent of the subjects' parents in Tirupur were undergraduates and eight per cent were post graduate. In Salem, 65 per cent were undergraduates and 19 per cent were postgraduate.

It was observed that in Kottayam district of Kerala, 81 per cent were undergraduates and 13 per cent were postgraduates, whereas in Pathanamthitta where 76 per cent had completed their graduation, 16 per cent had completed post graduation. In Allepey, 21 per cent passed higher secondary level and 62 per cent were graduates. In Thrissur district, 69 per cent were graduates and five per cent were post graduates.

5. Occupation Details of the Parents

Occupation is that which occupies or engages the time, attention and the principal business of one's life. The parents of the selected children in both the states were employed in various fields. The job designation of the parents were categorized as business, professionals, which included doctors and engineers, teaching, banking and planters who depend on agriculture as a source of income. The occupational details of parents are depicted in Table V.

TABLE V

OCCUPATION DETAILS OF THE PARENTS

States	Districts	OCCUPATION									
		Business		Professionals		Teaching		Banking		Agriculture	
		No.	%	No.	%	No.	%	No.	%	No.	%
Tamil Nadu	Coimbatore	117	23	92	19	117	23	96	19	78	16
	Erode	56	11	49	10	46	9	203	41	146	29
	Tirupur	232	46	42	8	74	15	49	10	103	21
	Salem	104	21	82	16	123	25	79	16	112	22
Kerala	Kottayam	88	18	64	13	143	27	126	25	79	16
	Pathanamthitta	174	35	116	23	25	5	102	20	83	17
	Allepey	127	25	15	3	67	13	48	10	243	49
	Thrissur	141	28	79	16	123	25	109	22	48	9

In Coimbatore, the occupation of the parents was business and teaching which was 23 per cent each respectively and 19 per cent each for professionals and bank employees. In Erode, 29 per cent were planters and nine per cent were teachers. It was observed that in Tirupur, 46 per cent were businessmen and eight per cent were professionals. Twenty two per cent of the parents in Salem were agriculturists and 16 per cent each were professionals and bank employees respectively.

In Kottayam, 28 per cent were teachers and 25 per cent were working in banks. In Pathanamthitta, 35 per cent were business personals and 17 per cent were planters. In Allepey, a majority of 49 per cent depend on agriculture as a main source of income. Only three per cent from this district were professionals. In Thrissur district, 28 per cent were business men, 16 per cent were professionals, 25 per cent were teachers, 22 per cent were bank employees and nine per cent were planters.

High female labor participation rates lead to high obesity rates in children. Working mothers, particularly the highly educated are more likely to have obese children (Anderson, 2001).

6. Family Income of the Subjects

Income is the consumption and savings opportunity gained by an individual within a specified time frame, generally expressed in monetary terms. On the basis of family income, the subjects in both the states were grouped into three categories, namely, the rich, consuming class and climbers (National Council of Applied Economic Research, 2007). The rich had an annual income range greater than Rs.2,15.000. The consuming class had an annual income range between Rs. 45,000 and Rs.2,15,000. The climbers had an annual income range between Rs. 22,000 and 2,45,000. These details are shown in Table VI and Figure IV.

ANNUAL ?

TABLE VIII

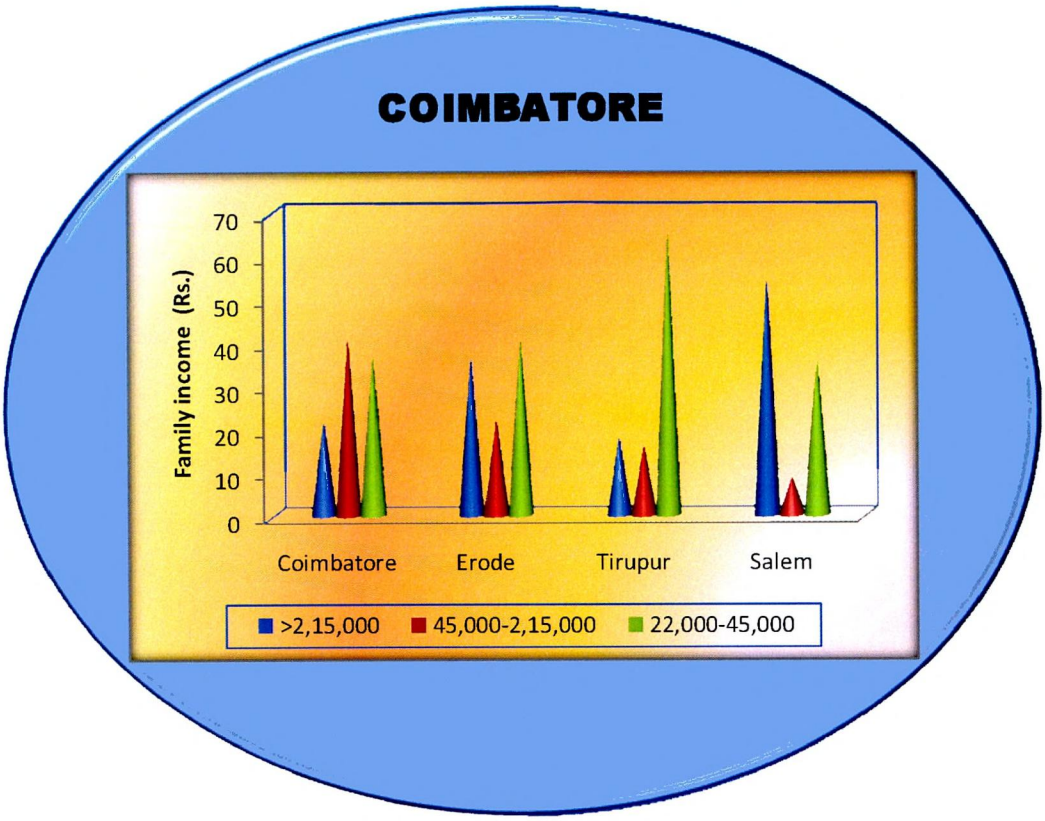
FAMILY INCOME

States	Districts	INCOME RANGE (Rs.)*					
		>2,15,000		45,000-2,15,000		22,000-45,000	
		No.	%	No.	%	No.	%
Tamil Nadu	Coimbatore	109	22	207	41	184	37
	Erode	186	37	111	22	203	41
	Tirupur	92	18	76	16	332	66
	Salem	274	55	47	9	179	36
	Chi Square – 327.69; df – 6; Sig – **						
Kerala	Kottayam	166	33	141	28	193	39
	Pathanamthitta	199	40	70	14	231	46
	Allepey	212	42	152	31	136	27
	Thrissur	263	53	80	16	157	31
	Chi Square – 99.54; df – 6; Sig – **						

**** - Significant at one per cent level (*Source : NCAER, 2007)**

It was clear from the table that 22 per cent of the subjects from Coimbatore, 37 per cent from Erode, 18 per cent from Tirupur, 55 per cent from Salem, 33 per cent from Kottayam, 40 per cent from Pathanamthitta, 42 per cent from Allepey and 53 per cent from Thrissur had an annual income range greater than Rs.2,15,000 and were categorized as rich.

Forty one per cent from Coimbatore, 22 per cent from Erode, 16 per cent from Tirupur, nine per cent from Salem, 28 per cent from Kottayam, 14 per cent from Pathanamthitta, 31 per cent from Allepey and 16 per cent from Thrissur belonged to the consuming class category with an annual income range of Rs.45,000 to Rs.2,15,000. Twenty two thousand rupees to Rs.45,000 was the annual income of 37 per cent from Coimbatore, 41 per cent from Erode, 66 per cent from Tirupur, 36 per cent from Salem, 39 per cent from Kottayam, 46 per cent from Pathanamthitta, 27 per cent from Allepey and 31 per cent from Thrissur district. This income range was named as the climber.



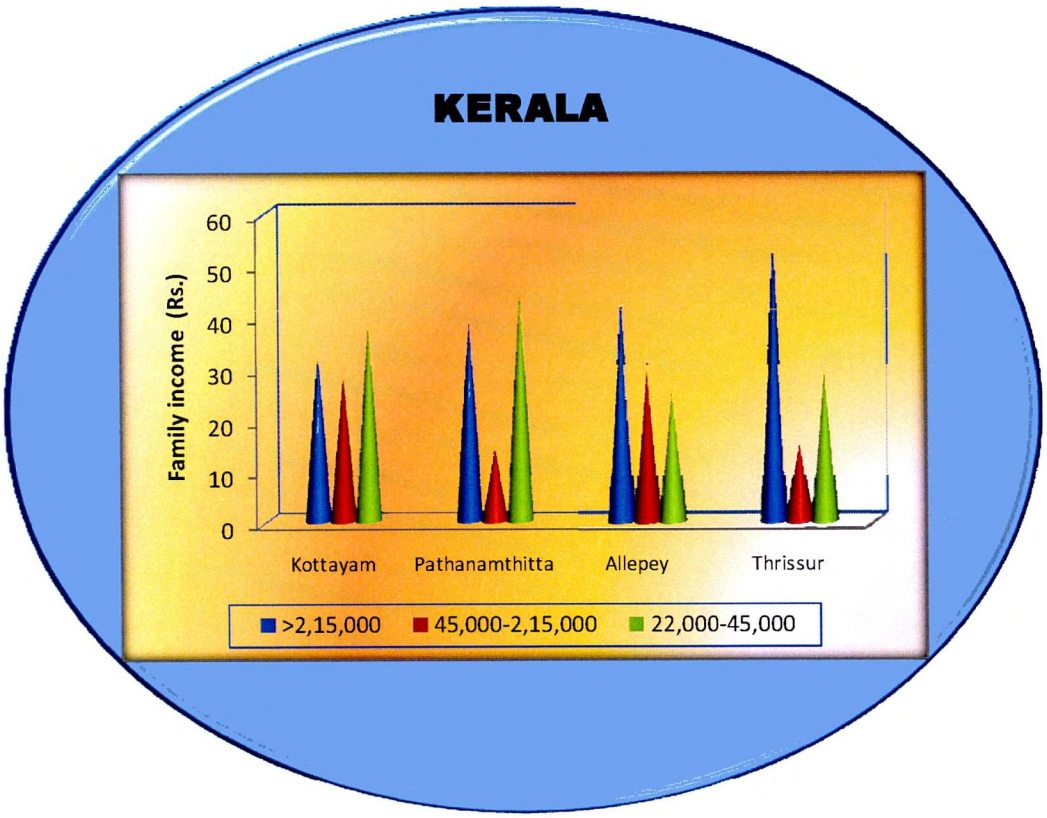


FIGURE IV

FAMILY INCOME

Chi square test was applied to find out the association of childhood obesity with the income. The calculated value of chi square was found to be 327.69 in the districts of Tamil Nadu and 99.54 in the districts of Kerala. The calculated value of chi square was greater than the table value of 16.812 at one per cent level. Since the calculated value was greater than the table value it was inferred that there is significant relationship between childhood obesity in both the states and income.

Child obesity is becoming a public health problem worldwide, but the prevalence of obesity varies remarkably across countries with different socioeconomic development levels. Different socioeconomic status groups are at different risks and the relationship between obesity and SocioEconomic Status (SES) varies across countries (Vanhook, 2009).

7. Type of Family

Family is a group of people afflicted by consanguinity, affinity and co-residence. It is the principle institution for the socialization of children. The details on the type of family of the selected subjects were found out and are presented in Table VII and Figure V.

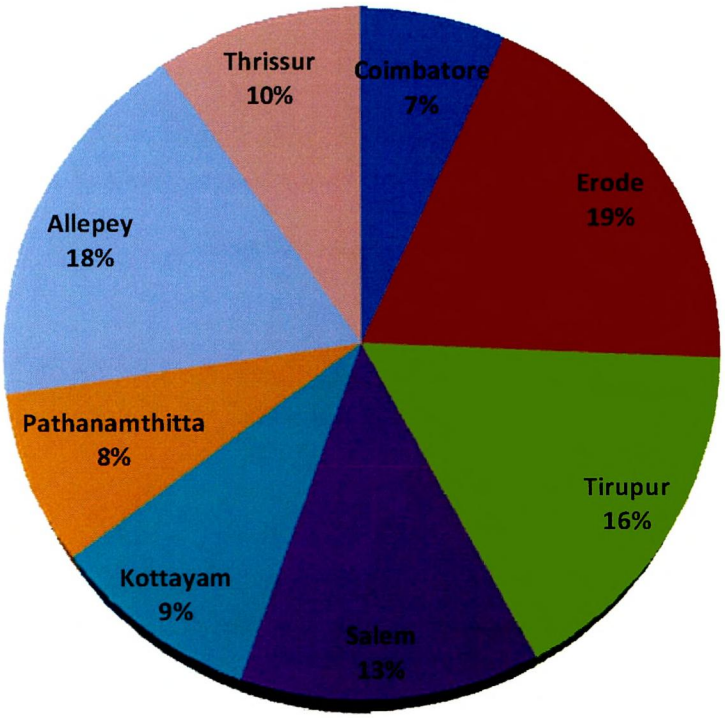
TABLE VII

TYPE OF FAMILY

States	Districts	FAMILY TYPE			
		Joint Family		Nuclear Family	
		No.	%	No.	%
Tamil Nadu	Coimbatore	84	17	416	83
	Erode	237	47	263	53
	Tirupur	203	41	297	59
	Salem	164	33	336	67
	Chi Square – 115.16; df – 3; Sig – **				
Kerala	Kottayam	116	23	384	77
	Pathanamthitta	99	20	401	80
	Allepey	219	44	281	56
	Thrissur	121	24	379	76
	Chi Square – 88.31; df – 3; Sig – **				

**** - Significant at one per cent level**

Joint Family



Nuclear Family

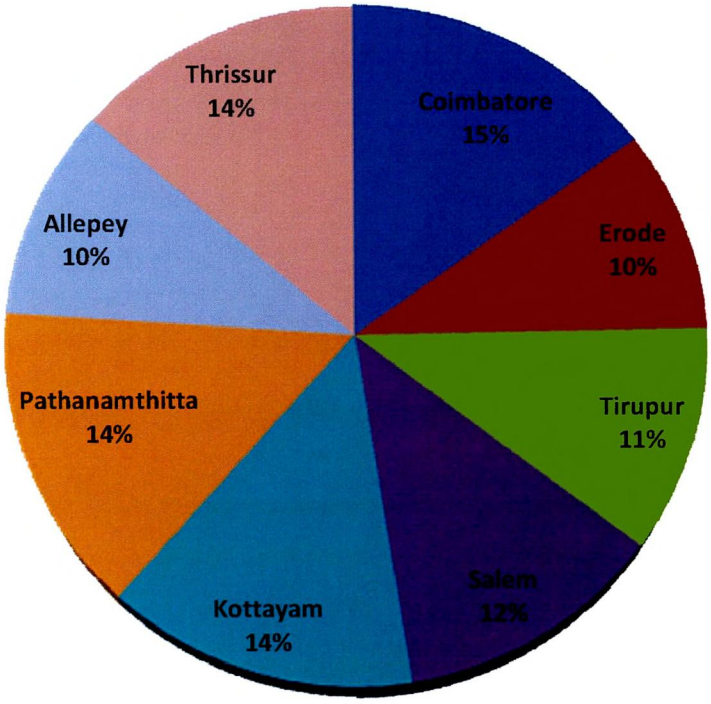


FIGURE V

TYPE OF FAMILY

It was observed that in Coimbatore, 83 per cent were from nuclear family and the rest 17 per cent came from a joint family setup. The percentage of children coming from nuclear family in the districts of Erode, Tirupur and Salem were in the order of 53 per cent, 59 per cent and 67 per cent respectively. The joint family system persists among 47 per cent subjects in Erode, 41 per cent in Tirupur and 33 per cent of the subjects in Salem.

It was noted that when 77 per cent of the subjects in Kottayam came from nuclear family only 23 per cent were from joint family. In Pathanamthitta, only a minority of 20 per cent were living in joint family setup and the rest 80 per cent came from nuclear family. In Allepey, 44 per cent were from joint family and 56 per cent were from nuclear family. It was clear that in Thrissur district, 76 per cent were from nuclear family and the rest 24 per cent came from joint family setup. In both the states, nuclear family systems were more prevalent.

Chi square test was applied to find out the association of childhood obesity with the type of family. The calculated value of chi square was found to be 115.16 in the districts of Tamil Nadu and 88.31 in the districts of Kerala. The calculated value of chi square was greater than the table value of 11.345 at one per cent level. Since the calculated value was greater than the table value it was inferred that there is significant relationship between childhood obesity in both the states and type of family.

The results of a survey in the UK published in 2010 imply that children raised by their grandparents are more likely to be obese as adults than those raised by their parents (Mohan, 2011).

8. Family Size

Human reproduction is the basis for individual existence. The details regarding the size of the family are presented in Table VIII.

TABLE VIII

FAMILY SIZE

States	Districts	FAMILY SIZE							
		3		4		5		>5	
		No.	%	No.	%	No.	%	No.	%
Tamil Nadu	Coimbatore	182	36	142	29	92	18	84	17
	Erode	118	24	39	8	106	21	237	47
	Tirupur	120	24	88	18	89	18	203	40
	Salem	96	19	144	23	126	25	164	33
Kerala	Kottayam	147	29	123	25	114	23	116	23
	Pathanamthitta	211	42	107	21	83	17	99	20
	Allepey	77	15	93	19	111	22	219	44
	Thrissur	96	20	216	43	67	13	121	24

In Coimbatore, 36 per cent had only three members in the family and 17 per cent had more than five members. In Erode district, 47 per cent were categorized under more than five members and 21 per cent had five members in the family. In Tirupur district, 18 per cent each had four and five members in the family. Twenty four per cent in the present district had three members and 40 per cent had more than five members in the family. Twenty five per cent of the subjects in Salem had five members in the family and 19 per cent had only three members.

In Kottayam, 29 per cent had three members in family and 25 per cent had four family members. Forty two per cent from Pathanamthitta had three members in the family and 17 per cent had five members. The family size of children from Allepey district was in the order of 15 per cent for three members, 19 per cent for four members, 22 per cent for five members and 44 per cent for more than five members. In Thrissur, 43 per cent had four members in their family, 24 per cent had more than five members in the family and 20 per cent had three members in the family.

9. Number of Children in the Family

All children go through stages of social development. More number of children in the family influences the social development of the child to a great extent. The details regarding the number of children in a family in the selected districts of Kerala and Tamil Nadu were elicited and are presented in Table IX and Figure VI.

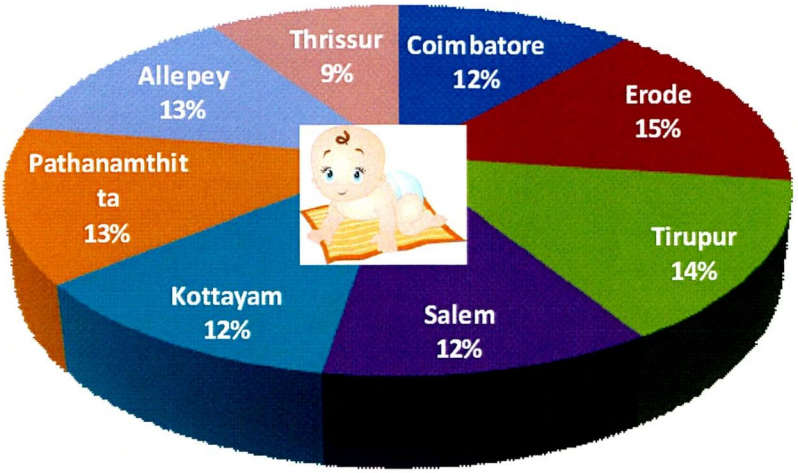
TABLE IX

NUMBER OF CHILDREN

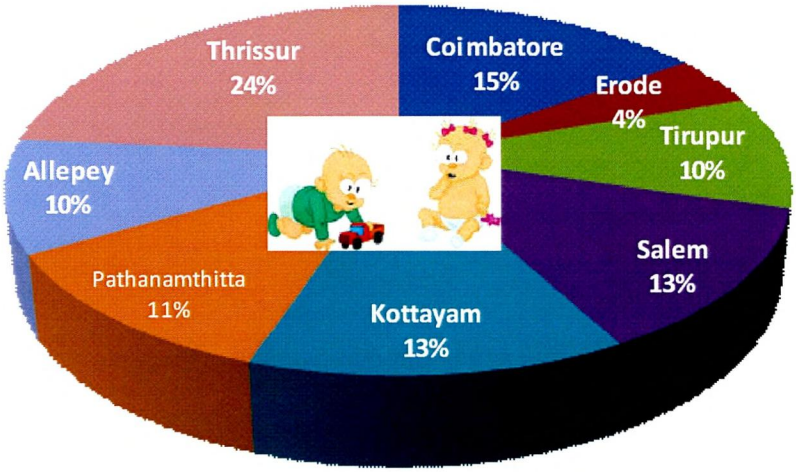
States	Districts	NUMBER OF CHILDREN					
		ONE		TWO		THREE	
		No.	%	No.	%	No.	%
Tamil Nadu	Coimbatore	266	54	142	28	92	18
	Erode	355	71	39	8	106	21
	Tirupur	323	64	88	18	89	18
	Salem	260	53	114	23	126	26
	Chi Square – 214.06; df – 6; Sig – **						
Kerala	Kottayam	263	53	123	24	114	23
	Pathanamthitta	310	62	107	21	83	17
	Allepey	296	60	93	18	111	22
	Thrissur	217	43	216	43	67	14
	Chi Square – 237.31; df – 6; Sig – **						

**** - Significant at one per cent level**

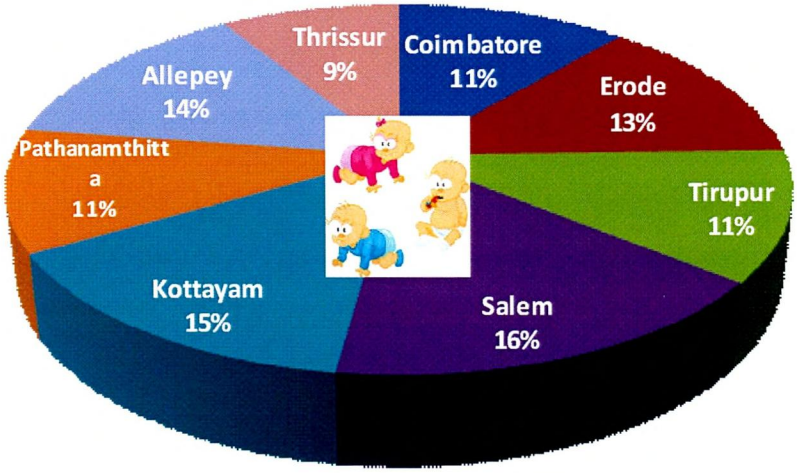
Fifty four per cent in Coimbatore were a single child families and 18 per cent had three children. In Erode, eight per cent had two children and 71 per cent had single child in the family. In Tirupur, 64 per cent had single child, 18 per cent each had two and three children respectively in the family. The number of children in Salem district was in the order of 53 per cent for single child, 26 per cent for three children and 23 per cent for two children.



(a) One Child



(b) Two Children



(c) Three Children

FIGURE VI

NUMBER OF CHILDREN

In Kottayam, 53 per cent had only one child in the family and 23 per cent had three children. Same way sixty two per cent from Pathanamthitta had only one child in the family and 21 per cent had two children. In Allepey, 60 per cent had single child, 18 per cent had two children and 22 per cent had three children in the family. The number of children present in the selected families of Thrissur district was in the order of 43 per cent each for single child and two children respectively and 14 per cent for three children. It was also noted that in both the states, no families had more than three children.

Chi square test was applied to find out the association of childhood obesity with the number of children. The calculated value of chi square was found to be 214.06 in the districts of Tamil Nadu and 237.31 in the districts of Kerala. The calculated value of chi square was greater than the table value of 16.812 at one per cent level. Since the calculated value was greater than the table value it was inferred that there is significant relationship between childhood obesity in both the states and the number of children.

B. LIFESTYLE PRACTICES OF THE SELECTED OBESE CHILDREN

The lifestyle practices of the subjects in the selected districts of Kerala and Tamil Nadu were studied. The details comprised of skipping breakfast, type of screen time at home, duration of screen time, habit of snaking during screen time, subjects interest in play, place of play, type of play, duration of outdoor games, mode of transport to school, duration of Physical Training (PT) classes in school, details on receiving pocket money, mode of spending pocket money, frequency of having meals with parents, frequency of dining out, parents interaction with the subjects and the duration of sleep.

1. Skipping of Breakfast

Breakfast is the first meal taken after rising from a night's sleep, most often eaten in the early morning before undertaking the days work. Skipping the main and first meal of the day has much ill effects in the overall development of the children. The details on skipping breakfast by the selected subjects are presented in Table X and Figure VII.

TABLE X

DETAILS ON SKIPPING BREAKFAST

States	Districts	SKIPPING BREAKFAST			
		Do Skip		Do Not Skip	
		No.	%	No.	%
Tamil Nadu	Coimbatore	276	55	224	45
	Erode	247	49	253	51
	Tirupur	281	56	219	44
	Salem	203	41	297	59
	Chi Square – 30.74; df – 3; Sig – **				
Kerala	Kottayam	106	21	394	79
	Pathanamthitta	224	45	276	55
	Allepey	179	36	321	64
	Thrissur	211	42	289	58
	Chi Square – 72.69; df – 3; Sig – **				

**** - Significant at one per cent level**

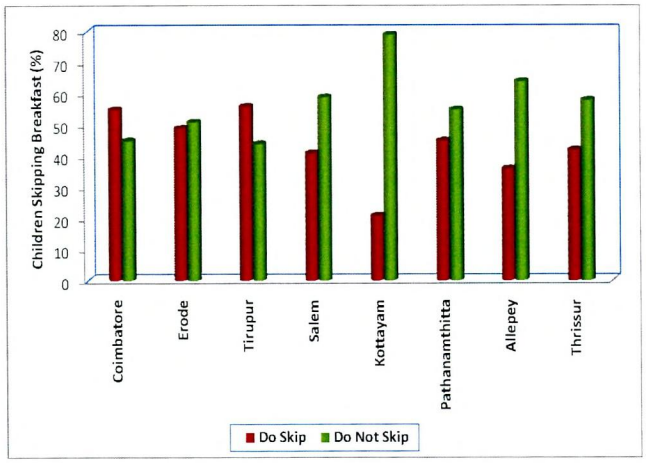


FIGURE VII

DETAILS ON SKIPPING BREAKFAST

It was noted that in Coimbatore, 55 per cent skipped the breakfast. The details on skipping breakfast in the districts of Erode, Tirupur and Salem were in the order of 49 per cent, 56 per cent and 41 per cent respectively. In Erode, 51 per cent of the subjects in Tirupur, 44 per cent of the subjects and in Salem 59 per cent of the subjects had their breakfast regularly.

In the state of Kerala, it was observed that 79 per cent in Kottayam, 55 per cent in Pathanamthitta, 64 per cent in Allepey and 58 per cent in Thrissur did not skip the first meal of the day - the breakfast. In Kottayam 21 per cent, in Pathanamthitta, 45 per cent in Allepey 36 per cent and in Thrissur 42 per cent of the subjects skipped the breakfast. The main reasons for skipping breakfast listed by the subjects in both the states were lack of hunger and time.

Chi square test was applied to find out the association of childhood obesity with the habit of skipping breakfast. The calculated value of chi square was found to be 30.74 in the districts of Tamil Nadu and 72.69 in the districts of Kerala. The calculated value of chi square was greater than the table value of 11.345 at one per cent level. Since the calculated value was greater than the table value it was inferred that there is significant relationship between childhood obesity in both the states and the habit of skipping breakfast.

According to Benton (2009) eating breakfast helps children to do better in school by improving memory, alertness, concentration, problem-solving ability, test scores, school attendance and mood. Research suggests that breakfast skippers are at greater risk for obesity and weight gain while breakfast eaters tend to have healthier weight (Pereira, 2005).

2. Type of Screen Time at Home

Entertainment is an activity which provides a diversion and permits people to amuse themselves in leisure time. It is generally passive. The type of screen time at home included watching television, video games and computer. Subjects spend their leisure time in various activities. Watching television, playing video games and computers were the prime interests of the

children. The details on the type of screen time at home are presented in Table XI.

TABLE XI

TYPE OF SCREEN TIME AT HOME

States	Districts	TYPE OF SCREEN					
		Television		Video Games		Computer	
		No.	%	No.	%	No.	%
Tamil Nadu	Coimbatore	119	24	132	26	249	50
	Erode	78	16	146	29	276	55
	Tirupur	188	38	169	34	143	28
	Salem	29	6	144	29	327	65
Kerala	Kottayam	20	4	79	16	401	80
	Pathanamthitta	42	8	173	35	285	59
	Allepey	37	7	169	34	294	59
	Thrissur	109	22	124	25	267	53

It was observed that 50 per cent of the subjects in Coimbatore were interested in computer, 26 per cent showed interest in video games and 24 per cent on television. In Erode, 55 per cent were interested in computers, while only 16 per cent watched television during leisure. Thirty eight per cent from Tirupur watched television and 34 per cent showed interest in video games. In Salem, 65 per cent used computers regularly and 29 per cent played video games.

In Kottayam, 80 per cent used computers regularly and only four per cent watched television. Fifty seven per cent of the subjects in Pathanamthitta showed interest in computers and 35 per cent were interested in video games. The type of screen time at home by the subjects of Allepey district was in the order of 59 per cent for computers, 34 per cent for video games and seven per cent for television. In Thrissur, 53 per cent used computers regularly and 25 per cent played video games during leisure time. Cartoon channels in television were preferred by the subjects in both the states.

According to Cyrers (2008) children spend more time in front of television and computers at the expense of sports and physical activity. Children were 21.5 per cent more likely to be overweight when watching 4+ hours of television per day, 4.5 per cent more likely to be overweight when using a computer one or more hours per day and unaffected by potential weight gain from playing video games.

3. Duration of Screen Time

Entertainment provides fun, enjoyment and laughter. Puppets, clowns and cartoons tend to appeal children and the subjects spend a lot of time on screen. Duration of screen time on weekends and weekdays is depicted in Table XII and Figure VIII.

TABLE XII

DURATION OF SCREEN TIME

States	Districts	Weekdays						Weekends					
		½ Hour		1 Hour		> 1 Hour		2 Hours		2-4 Hours		> 4 Hours	
		No	%	No	%	No	%	No	%	No	%	No	%
Tamil Nadu	Coimbatore	42	8	52	10	406	82	36	7	200	40	264	53
	Erode	36	6	70	15	394	79	49	10	193	39	258	51
	Tirupur	56	11	120	24	324	65	92	18	17	3	391	79
	Salem	92	18	92	18	316	64	77	15	217	43	206	42
	Chi Square – 265.21; df – 6; Sig – **												
Kerala	Kottayam	64	13	189	38	247	49	49	10	87	17	364	73
	Pathanamthitta	78	16	213	42	209	42	63	13	108	22	329	65
	Allepey	66	13	120	24	314	63	58	12	41	8	401	80
	Thrissur	47	9	247	50	206	41	62	12	141	28	297	60
	Chi Square – 75.27; df – 6; Sig – **												

** - Significant at one per cent level

It was observed that in Coimbatore, 82 per cent of the children spend more than one hour on screen during weekdays and 53 per cent spend more than four hours on weekends. In Erode, only six per cent spend half an hour on screen and 9 per cent spend more than one hour during weekdays. On weekends, 39 per cent spend two to four hours and 51 per cent spend more than four hours. Sixty five per cent of the subjects in Tirupur spend more than

one hour on screen during weekdays and 79 per cent spend more than four hours on weekends. In Salem, the duration of screen time during weekdays was in the order of 18 per cent each for half an hour and one hour respectively and 64 per cent for more than one hour. On weekends it was 15 per cent for two hours, 43 per cent for two to four hours and 42 per cent for more than four hours.

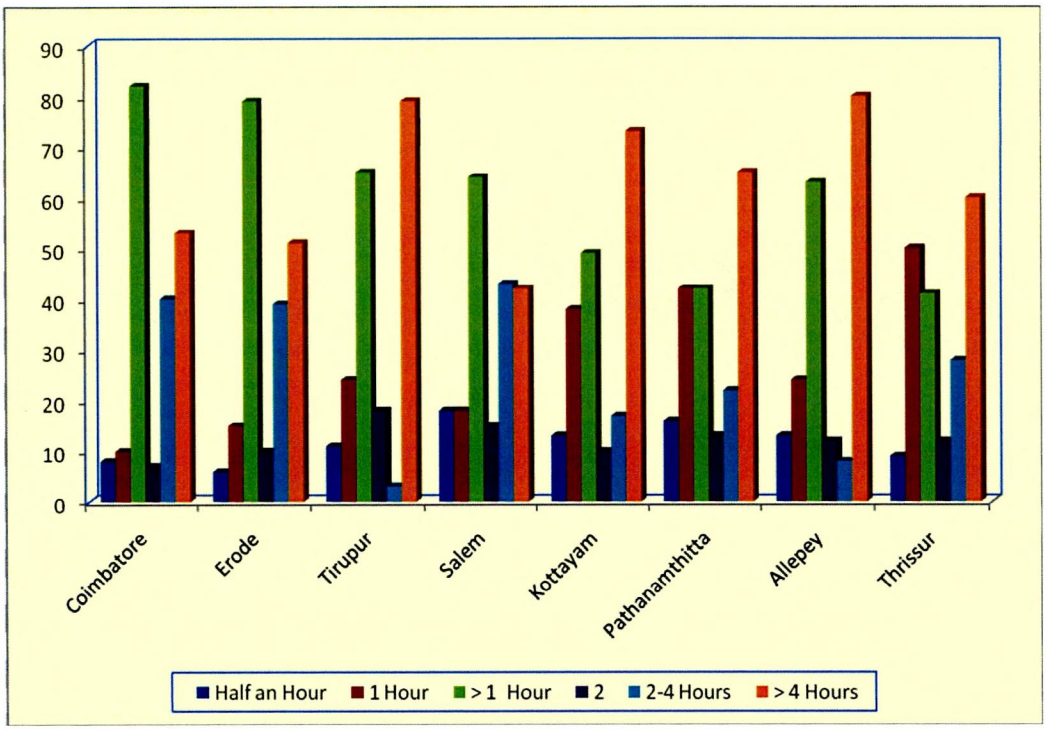


FIGURE VIII

DURATION OF SCREEN TIME

In Kerala, 49 per cent of the subjects in Kottayam watched screen for more than one hour on weekdays. On weekends, 73 per cent spend more than four hours in front of the screen. In Pathanamthitta during weekdays, 42 per cent each spend one hour and more than one hour on screen. During weekends, 65 per cent of the subjects spend more than four hours and only 13 per cent spend two hours on screen. The duration of screen times during weekdays in Allepey district was in the order of 13 per cent for half an hour, 24 per cent for one hour and 63 per cent for more than one hour. During weekends, it was in the order of 12 per cent for two hours, eight per cent for two to four hours and 80 per cent for more than four hours. In Thrissur, only

than one hour during weekdays. On weekends, 60 per cent spend more than four hours and only 12 per cent spend two hours on screen.

Chi square test was applied to find out the association of childhood obesity with the duration of screen time. The calculated value of chi square was found to be 265.21 in the districts of Tamil Nadu and 75.27 in the districts of Kerala. The calculated value of chi square was greater than the table value of 16.812 at one per cent level. Since the calculated value was greater than the table value it was inferred that there is significant relationship between childhood obesity in both the states and the duration of screen time.

The obese children were 35 per cent less active on school days and 65 per cent less active on weekends compared to non-obese children. By the time average American children graduated from high school, they have watched 15,000 hours of television and spent 11,000 hours in the classroom. School age children watched television on an average of 23 hours or more per week, whereas pre-school children watched an average about 27 hours per week. The hours of television viewing, as a marker of sedentary behaviour, has been the most consistent risk factor for childhood obesity (Jackson, 2004).

4. Habit of Snaking during Screen Time

Snacking refers to the food or drink eatern between main meals. Children had the habit of snaking during leisure time. The details regarding the habit of snacking during screen time is presented in Table XIII and Figure IX.

TABLE XIII

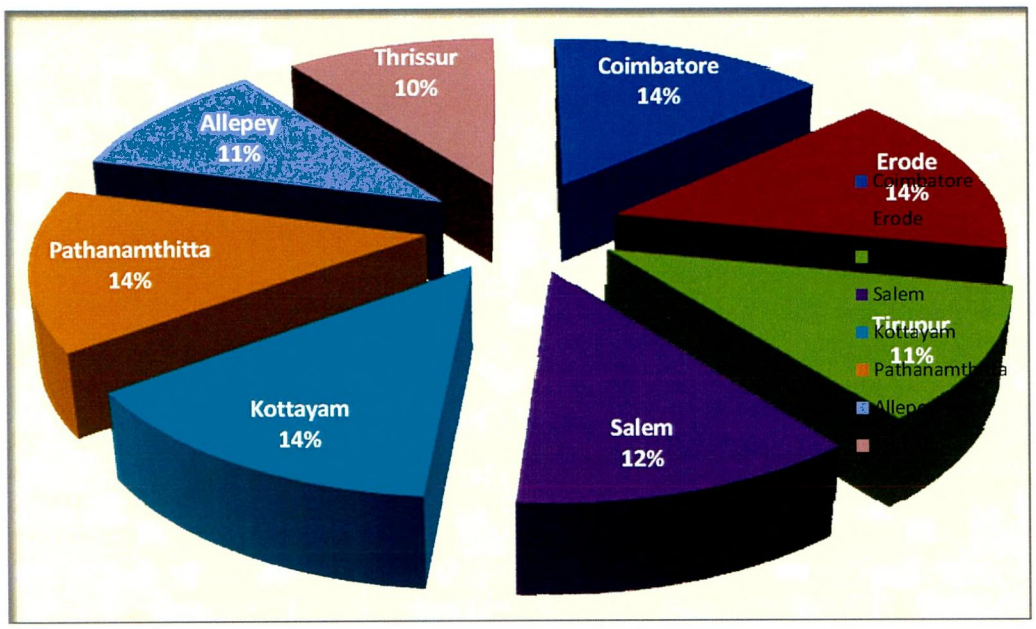
HABIT OF SNACKING DURING SCREEN TIME

States	Districts	Habit of Snacking			
		Yes		No	
		No.	%	No.	%
Tamil Nadu	Coimbatore	396	79	104	21
	Erode	418	84	82	16
	Tirupur	329	66	171	34
	Salem	343	69	157	31
	Chi Square – 56.36; df – 3; Sig – **				
Kerala	Kottayam	401	80	99	20
	Pathanamthitta	407	81	93	19
	Allepey	305	61	195	39
	Thrissur	299	60	201	40
	Chi Square – 100.60; df – 3; Sig – **				

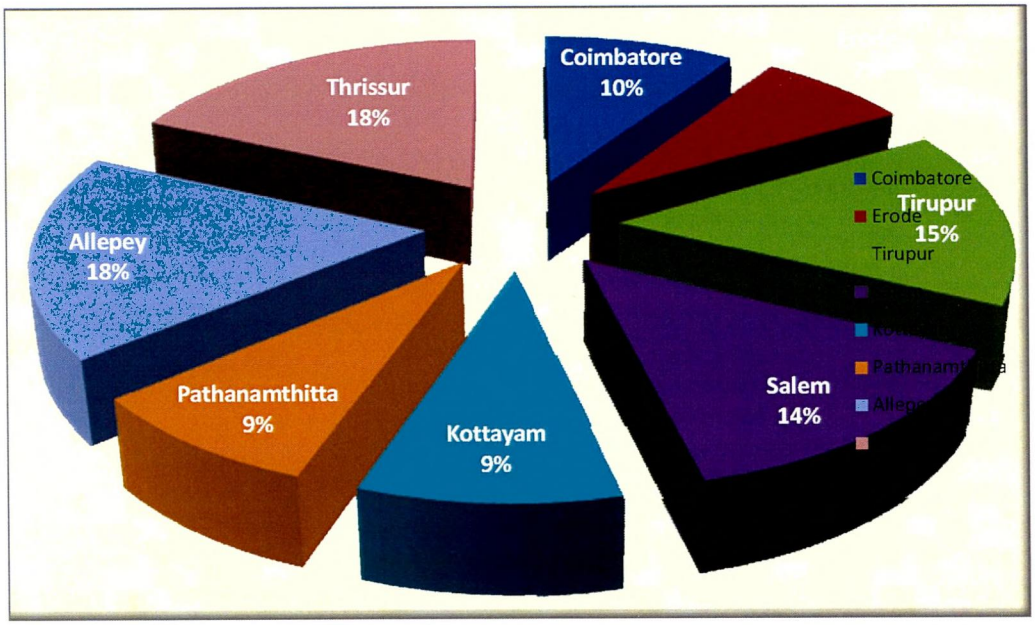
**** - Significant at one per cent level**

It was observed that 79 per cent from Coimbatore, 84 per cent from Erode, 66 per cent from Tirupur and 69 per cent from Salem had the habit of snacking during screen time. In Kerala, it was noted that 20 per cent of the subjects from Kottayam, 19 per cent from Pathanamthitta, 39 per cent from Allepey and 40 per cent from Thrissur did not snack during screen time. A good percentage had the habit of snacking during screen time. It was in the order of 80 per cent in Kottayam, 81 per cent in Pathanamthitta, 61 per cent in Allepey and 60 per cent in Thrissur. It was also noted that the subjects preferred calorie dense foods for snacking such as pizza, burger, hotdog, pastries and chips.

Chi square test was applied to find out the association of childhood obesity with the habit of snacking during screen time. The calculated value of chi square was found to be 56.36 in the districts of Tamil Nadu and 100.60 in the districts of Kerala. The calculated value of chi square was greater than the table value of 11.345 at one per cent level. Since the calculated value was greater than the table value it was inferred that there is significant relationship between childhood obesity in both the states and habit of snacking during screen time.



(a) YES



(b) NO

FIGURE IX

HABIT OF SNACKING DURING SCREEN TIME

It was reported that children who viewed television consumed high fat food and fast food drink more soft drinks and consumed fewer fruits and vegetables. A randomized trial showed that reducing television viewing and computer use can decrease age-adjusted BMI; reduced calorie intake was thought to be the greatest contributor to the BMI decrease (Netto, 2008).

Children who received the television reduction intervention reduced the number of meals consumed during television viewing and trend towards lower intake of high fat food was observed (Robinson, 2001).

5. Play

Play refers to the activity that is done for enjoyment. Physical activity is involved in the play. The details regarding the subjects' interest in play is depicted in Table XIV.

TABLE XIV

PLAY

States	Districts	Play			
		Do Play		Do Not Play	
		No.	%	No.	%
Tamil Nadu	Coimbatore	246	49	254	51
	Erode	316	63	184	37
	Tirupur	254	51	246	49
	Salem	176	35	324	65
Kerala	Kottayam	326	65	174	35
	Pathanamthitta	321	64	179	36
	Allepey	297	59	206	41
	Thrissur	276	55	224	45

It was observed that 49 per cent in Coimbatore do play and 51 per cent do not play. In Erode, when 63 per cent played, 37 had no interest in playing. In Tirupur and Salem, the percentage of subjects interested in play was in the order of 51 per cent and 35 per cent respectively.

In Kottayam, when 65 per cent played daily, 35 per cent showed no interest to play. When 36 per cent of the subjects in Pathanamthitta do not play regularly, 64 per cent were regular in play. In Allepey, 59 per cent were interested in play and 41 per cent were not interested. Fifty five per cent of the subjects in Thrissur do play and 45 per cent do not play. The main problem which deprived the children in both the state from play was the heavy body weight.

Many children fail to exercise because they are spending time doing stationary activities such as computer usage, playing video games or watching television. Television and other technology may be large factors of physically inactive children (Kadhai, 2010).

6. Place of Play

Some children play only at school, some only at home and a few played both at school and home. Table XV shows the details on place of play of the selected children in the state of Kerala and Tamil Nadu.

TABLE XV

PLACE OF PLAY

States	Districts	Place					
		School		Home		Both	
		No.	%	No.	%	No.	%
Tamil Nadu	Coimbatore	123	50	42	17	81	33
	Erode	134	42	26	8	156	50
	Tirupur	112	44	30	12	112	44
	Salem	97	55	67	38	12	7
Kerala	Kottayam	86	26	63	19	177	55
	Pathanamthitta	114	36	37	12	170	52
	Allepey	124	42	72	24	98	34
	Thrissur	109	39	47	17	120	44

In Coimbatore, 50 per cent the subjects played at school and 33 per cent played both at school and home. When 50 per cent of the subjects in Erode played both at school and home, only eight per cent played while at home. In Tirupur, 44 per cent each played at school and both places (i.e., school and home). In Salem, 55 per cent played at school and seven per cent played both at school and home.

In Kottayam, 55 per cent played both at school and home and 19 per cent played at home ony. In Pathanamthitta, 52 per cent played both in school and home and 36 per cent played only at school. Forty two per cent of the subjects from Allepey played only at school and 24 per cent played only at home. In Thrissur, it was in the order of 39 per cent for playing only at school, 17 per cent for playing only at home and 44 per cent for playing both at school and home.

7. Type of Play

Play is a serious business which in the preschool years is the leading source of development. Play can be either indoor or outdoor. The subjects' preference for indoor and outdoor games was elicited and is depicted in Table XVI and Figure X.

TABLE XVI

TYPE OF PLAY

States	Districts	Type of Play			
		Indoor Games		Outdoor Games	
		No.	%	No.	%
Tamil Nadu	Coimbatore	367	73	133	27
	Erode	427	85	73	15
	Tirupur	249	50	251	50
	Salem	278	56	222	44
Kerala	Kottayam	312	62	188	38
	Pathanamthitta	344	69	156	31
	Allepey	320	64	180	36
	Thrissur	403	81	97	19

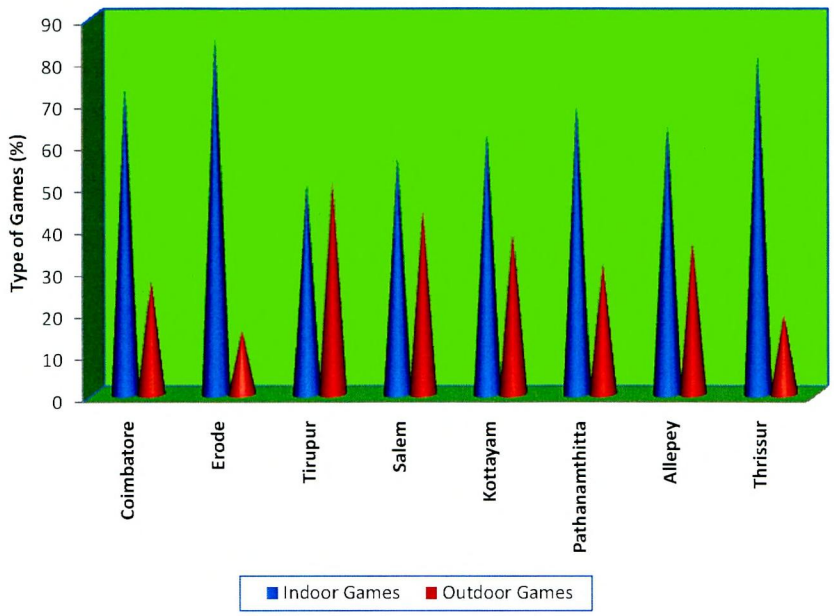


FIGURE X

TYPE OF PLAY

It was observed that in Coimbatore, 73 per cent played indoor games and 27 per cent played outdoor games. In Erode, when 85 per cent preferred indoor games, only 15 per cent went for outdoor games. Equal per cent of subjects in Tirupur (50 per cent) played indoor and outdoor games. In Salem, 56 per cent were interested in indoor games and 44 per cent were interested in outdoor games.

The percentage of subjects interested in outdoor games in Kerala was in the order of 38 per cent in Kottayam, 31 per cent in Pathanamthitta, 36 per cent in Allepey and 19 per cent in Thrissur. It was observed that 62 per cent in Kottayam, 69 per cent in Pathanamthitta, 64 per cent in Allepey and 81 per cent in Thrissur were interested in indoor games. The indoor games preferred by the subjects in both the states were building blocks, snake and ladder and playing cards which involve no physical activity.

Reilly *et al.* (2004) reported that young children spent considerable time in sedentary activities. Children aged six to eight years preferred to

spend most of their time to modern activities like computer games particularly on weekends.

8. Duration of Outdoor Games

Outdoor games have a very important role to play in the growth and development of the mind and body. It was clear from the Table XVII that only a minority from both the states were interested in outdoor games, which involve physical activity. The details regarding the duration of outdoor games is depicted in Table XVII.

TABLE XVII

DURATION OF OUTDOOR GAMES

States	Districts	Duration in Minutes					
		<30		30-60		>60	
		No.	%	No.	%	No.	%
Tamil Nadu	Coimbatore	97	73	24	18	12	9
	Erode	42	58	25	34	6	8
	Tirupur	140	56	65	26	46	18
	Salem	143	64	18	8	61	28
Kerala	Kottayam	124	66	55	30	9	4
	Pathanamthitta	97	62	37	24	22	14
	Allepey	69	38	93	52	18	10
	Thrissur	44	45	42	43	11	12

It was noted that 73 per cent of the subjects from Coimbatore played outdoor for less than 30 minutes and only 18 per cent played for 30 to 60 minutes. In Erode, 58 per cent played less than 30 minutes and only eight per cent played for more than an hour. In Tirupur, 18 per cent played for more than one hour and 26 per cent played for about 30 to 60 minutes. In Salem, it was in the order of 64 per cent for less than 30 minutes, eight per cent for 30 to 60 minutes and 28 per cent for more than one hour.

In Kottayam, when 66 per cent played for less than 30 minutes outdoor, only four per cent played for more than one hour. Sixty two per cent of the subjects in Pathanamthitta played for less than 30 minutes and 24 per cent played 30 to 60 minutes daily. In Allepey, it was in the order of 38 per cent for less than 30 minutes, 52 per cent for 30 to 60 minutes and ten per cent to more than one hour. Forty five per cent from Thrissur played outdoor for less than 30 minutes daily and only 12 per cent played more than one hour

9. Mode of Transport to School

Transport refers to the movement of people from one location to another. Children of the selected districts used two wheelers, four wheelers and cycle to reach the school. Some of the children walked to school. Table XVIII reveals the details on the mode of transport used by the subjects to school.

TABLE XVIII

MODE OF TRANSPORT TO SCHOOL

States	Districts	Mode of Transport to School							
		By Walk		Two Wheeler		Four Wheeler		Cycling	
		No.	%	No.	%	No.	%	No.	%
Tamil Nadu	Coimbatore	26	5	164	33	288	58	22	4
	Erode	47	9	129	26	287	57	37	8
	Tirupur	69	14	147	29	258	52	26	5
	Salem	12	2	121	24	349	70	18	4
Kerala	Kottayam	46	9	156	31	286	57	12	3
	Pathanamthitta	-	-	114	23	352	70	34	7
	Allepey	42	8	106	21	323	65	29	6
	Thrissur	37	7	174	35	248	50	41	8

In Coimbatore, when 58 per cent used four wheelers, it was 57 per cent in Erode, 52 per cent in Tirupur and 70 per cent in Salem. Cycle was used as a mode of transport to school only by a minor percentage. It was four

per cent in Coimbatore, eight per cent in Erode, five per cent in Tirupur and four per cent in Salem. Thirty three per cent from Coimbatore, 26 per cent from Erode, 29 per cent from Tirupur and 24 per cent from Salem used two wheelers to reach the school. Only five per cent from Coimbatore, nine per cent from Erode, 14 per cent from Tirupur and two per cent from Salem reached school by walk.

In Kottayam, when 57 per cent used four wheelers to each reach school, it was 70 per cent in Pathanamthitta, 65 per cent in Allepey and 50 per cent in Thirssur. In Pathanamthitta none went to school by walk, whereas in Kottayam nine per cent, Allepey eight per cent and Thrissur seven per cent reached school by walk. Two wheelers was used as a mode of transport by 31 per cent in Kottayam, 23 per cent in Pathanamthitta, 21 per cent in Allepey and 35 per cent in Thrissur. Three per cent from Kottayam, seven per cent from Pathanamthitta, six per cent from Allepey and eight per cent from Thrissur cycled to school.

10. Duration of Physical Education Classes

Physical education promotes psychomotor development in the play and movement exploration setting. Table XIX reveals the details on the duration of physical training classes rendered by the school authorities in various districts.

TABLE XIX

DURATION OF PHYSICAL EDUCATION

States	Districts	Duration of Physical Education/Week			
		45 Minutes		60 Minutes	
		No.	%	No.	%
Tamil Nadu	Coimbatore	460	92	40	8
	Erode	480	96	20	4
	Tirupur	500	100	-	-
	Salem	400	80	100	20
Kerala	Kottayam	422	84	78	16
	Pathanamthitta	460	92	40	8
	Allepey	500	100	-	-
	Thrissur	420	84	80	16

In Coimbatore, 92 per cent had physical training classes for 45 minutes and eight per cent had for one hour. In Erode, 96 per cent had physical training class for 45 minutes. Cent per cent in Tirupur had physical training. classes for 45 minutes. Twenty per cent in Salem had physical training for one hour and the rest 80 per cent had for 45 minutes.

In Kottayam, 84 per cent had drill period for 45 minutes and in Pathanamthitta it was 92 per cent. Cent per cent from Allepey had physical training class for 45 minutes. Only 16 per cent from Thrissur had drill period for one hour and the rest 84 per cent had it for 45 minutes. The frequency of physical training class in both the states was similar and was found to be one period per week. But it was also observed that this physical training classes was not regular in some districts of Kerala because of climatic changes. In some districts physical training classes were substituted by regular classes whenever portions are to be covered.

Studies have shown that increasing access to physical activity in an organized, structured and supervised manner is effective for children, youth and adults (Sohan, 2006).

11. Details on Receiving Pocket Money

Pocket money is the money given to children to take care of petty expenses. The details on receiving pocket money by the subjects in Kerala and Tamil Nadu were elicited and are presented in Table XX.

TABLE XX

DETAILS ON RECEIVING POCKET MONEY

States	Districts	Receive Pocket Money			
		Yes		No	
		No.	%	No.	%
Tamil Nadu	Coimbatore	296	59	204	41
	Erode	203	41	297	59
	Tirupur	227	45	273	55
	Salem	316	63	184	37
Kerala	Kottayam	344	69	156	31
	Pathanamthitta	209	42	291	58
	Allepey	321	64	179	36
	Thrissur	324	65	176	35

It was noted that a good percentage receive pocket money from parents, grandparents and relatives. It was in the order of 59 per cent in Coimbatore, 41 per cent in Erode, 45 per cent in Tirupur and 68 per cent in Salem.

In Kerala, 31 per cent from Kottayam, 58 per cent from Pathanamthitta, 36 per cent from Allepey and 35 per cent from Thrissur do not get any pocket money, while 69 per cent from Kottayam, 42 per cent from Pathanamthitta, 64 per cent from Allepey and 65 per cent from Thrissur receive pocket money from the above listed sources.

12. Mode of Spending Pocket Money

As long as the child has the freedom to spend the pocket money, there will be a loss of control on where children spend the money and for what purpose. The mode of spending pocket money was analyzed and is presented in Table XXI.

TABLE XXI

MODE OF SPENDING POCKET MONEY

States	Districts	Mode of Spending							
		Sweets		Ice Cream		Toys		Savings	
		No.	%	No.	%	No.	%	No.	%
Tamil Nadu	Coimbatore	117	23	260	52	97	19	26	6
	Erode	123	25	291	58	69	14	17	3
	Tirupur	97	19	319	65	42	8	42	8
	Salem	86	17	305	61	76	15	33	7
Kerala	Kottayam	114	23	278	56	83	16	25	5
	Pathanamthitta	93	19	319	64	72	14	16	3
	Allepey	127	25	292	58	69	14	12	3
	Thrissur	149	30	270	54	47	9	34	7

From Table XXI, it was clear that a good per cent of the subjects in both the states received pocket money. It was noted that 52 per cent from Coimbatore, 58 per cent from Erode, 65 per cent from Tirupur and 61 per cent from Salem spend the pocket money for ice cream. Nineteen per cent from Coimbatore, 14 per cent from Erode, eight per cent from Tirupur and 15 per cent from Salem were interested to buy toys with the pocket money they receive. A very few had interest in savings, which was in order of six per cent in Coimbatore, three per cent in Erode, eight per cent in Tirupur and seven per cent in Salem. Twenty three per cent from Coimbatore, 25 per cent from Erode, 19 per cent from Tirupur and 17 per cent from Salem bought sweets with the pocket money.

In Kerala, a good per cent were interested to buy ice creams with the pocket money they receive. It was in the order of 56 per cent in Kottayam, 64 per cent in Pathanamthitta, 58 per cent in Allepey and 54 per cent in Thrissur. Twenty three per cent from Kottayam, 19 per cent from Pathanamthitta, 25 per cent from Allepey and 30 per cent from Thrissur bought sweets with the pocket money. Toys were preferred by 16 per cent of subjects in Kottayam, 14 per cent each in Pathanamthitta and Allepey and nine per cent from Thrissur. Five per cent from Kottayam, three per cent each from Pathanamthitta and Allepey and seven per cent from Thrissur saved the pocket money for future use. It was observed that a good per cent of subjects in both the states spend the pocket money on food items.

Children's food choices are also influenced by family meals. Researchers provided a householdeating questionnaire to 18,177 children, ranging in ages 11-21 and discovered that four out of five parents let their children make their own food decisions (Mishen, 2010).

13. Frequency of having Meals with Parents

A meal is one instance of eating, specifically one that takes place at a specification and includes specific prepared food. The school time prevents the children from having all the three meals together. The details regarding the frequency of having meals with parents are presented in Table XXII.

TABLE XXII

FREQUENCY OF HAVING MEALS WITH PARENTS

States	Districts	Frequency per Day							
		Two Meals		Only Dinner		On Weekends		Never	
		No.	%	No.	%	No.	%	No.	%
Tamil Nadu	Coimbatore	92	18	92	18	316	64	-	-
	Erode	95	19	197	39	208	42	-	-
	Tirupur	103	21	76	15	321	64	-	-
	Salem	151	30	112	22	237	48	-	-
Kerala	Kottayam	67	13	210	43	200	40	23	4
	Pathanamthitta	49	10	107	21	344	69	-	-
	Allepey	49	10	89	18	362	72	-	-
	Thrissur	35	7	164	33	301	60	-	-

In Coimbatore, 18 per cent had two meals together with parents and 64 per cent had meals with parents only on weekends. Forty two per cent from Erode had meals with parents on weekends and 39 per cent had dinner with family. In Tirupur, it was in the order of 21 per cent for two meals together, 15 per cent for dinner together and 64 per cent for having meals with family on weekends. In Salem, 48 per cent had meals with parents on weekends and 30 per cent had two meals together with family.

In Kottayam, 40 per cent had meals together on weekends and 43 per cent had only dinner with parents as the parents were busy with the work schedule. It was shocking to note that four per cent never had any meals with parents. In Pathanamthitta it was in the order of ten per cent for two meals together, 21 per cent for dinner together and 69 per cent for meals together with family only on weekends. Seventy two per cent in Allepey had meals with parents only on weekends and 21 per cent had only dinner together. In Thrissur, 60 per cent had meals together on weekends and seven per cent often had two meals together. In all districts except Kottayam, parents will have atleast a meal of the day with children.

14. Frequency of Dining Out

People prefer outside food for a various reasons such as time saving, taste and for enjoyment or celebration. The details on frequency of dining out by the subjects in the selected districts of Kerala and Tamil Nadu are presented in Table XXIII and Figure XI.

TABLE XXIII

FREQUENCY OF DINING OUT

States	Districts	Frequency									
		Every Day		Weekly Once		Weekly Twice		Rarely		Never	
		No.	%	No.	%	No.	%	No.	%	No.	%
Tamil Nadu	Coimbatore	21	4	290	58	172	35	17	3	-	-
	Erode	-	-	346	69	104	21	23	5	27	5
	Tirupur	-	-	378	76	106	21	16	3	-	-
	Salem	13	3	359	72	114	23	14	2	-	-
	Chi Square – 159.09; df – 12; Sig – **										
Kerala	Kottayam	12	2	264	53	180	36	44	9	-	-
	Pathanamthitta	-	-	356	71	102	20	42	9	-	-
	Allepey	-	-	309	62	132	26	37	8	22	4
	Thrissur	17	3	344	69	118	24	21	4	-	-
	Chi Square – 147.39; df – 12; Sig – **										

**** - Significant at one per cent level**

In Coimbatore, 58 per cent went out for food once in a week and 35 per cent dined out weekly twice. Five per cent from Erode never had hotel food and 69 per cent went out once in a week for food. In Tirupur, 76 per cent and 21 per cent dined out once and twice a week respectively. In Salem, it was in the order of three per cent for dining out daily, 72 per cent for once a week, 23 per cent for weekly twice and two per cent for dining out rarely.

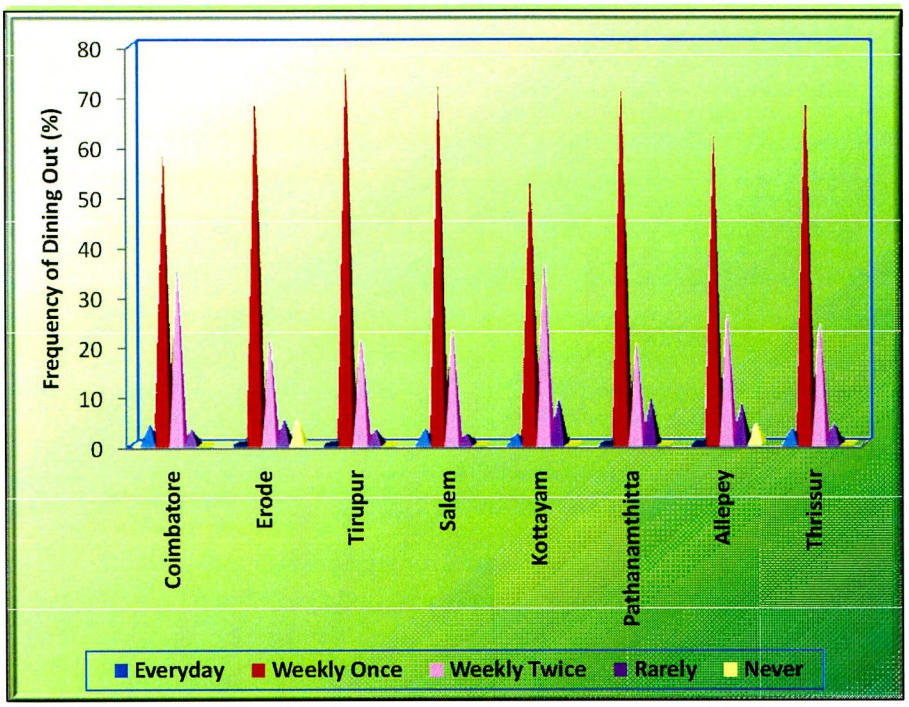


FIGURE XI

FREQUENCY OF DINING OUT

In Kottayam, when 53 per cent dined out weekly once only, nine per cent went out for food rarely. In Pathanamthitta, it was in the order of 71 per cent for dining out weekly once, 20 per cent for twice a week and nine per cent for rarely having food from hotels. Sixty two per cent of subjects from Allepey dined out every week and 26 per cent went out twice a week for food. In Thrissur, 69 per cent had outside food once a week and only four per cent rarely had hotel food. It was surprising to note that four per cent from Coimbatore, three per cent each from Salem and Thrissur and two per cent from Kottayam had hotel food (mostly dinner) daily. The reason was majority of these subjects' mothers were working for evening shifts and it was convenient for the mothers to get parcel from hotels daily.

Chi square test was applied to find out the association of childhood obesity with the frequency of dining out. The calculated value of chi square was found to be 159.09 in the districts of Tamil Nadu and 147.39 in the

districts of Kerala. The calculated value of chi square was greater than the table value of 26.212 at one per cent level. Since the calculated value was greater than the table value it was inferred that there is significant relationship between childhood obesity in both the states and frequency of dining out.

The key causes for obesity are increased consumption of energy-dense foods high in saturated fats and sugars and reduced physical activity (Cyril, 2010). A study which found that fast food restaurants near schools increases the risk of obesity among the student population (Sadha, 2001).

15. Duration of Parents Interaction with the Subjects

Interaction is a kind of action that occurs as two or more objects have an effect on one another. Parents interact with children on various aspects. The details regarding the duration of parents' interaction with the subjects other than studies were elicited and is presented in Table XXIV.

TABLE XXIV

DURATION OF PARENT'S INTERACTION WITH SUBJECTS

States	Districts	DURATION IN MINUTES					
		15-30		30-60		>60	
		No.	%	No.	%	No.	%
Tamil Nadu	Coimbatore	396	79	104	21	-	-
	Erode	374	75	126	25	-	-
	Tirupur	416	83	72	14	12	3
	Salem	295	59	205	41	-	-
Kerala	Kottayam	276	55	224	45	-	-
	Pathanamthitta	315	63	119	24	66	13
	Allepey	324	65	176	35	-	-
	Thrissur	296	59	204	41	-	-

It was noted that a good per cent of the parents' interact only for about 15 to 30 minutes with the children on topics other than studies. It was 79 per cent in Coimbatore, 75 per cent in Erode, 83 per cent in Tirupur and 59 per cent in Salem. Twenty one per cent from Coimbatore, 25 per cent from Erode,

14 per cent from Tirupur and 41 per cent of the parents from Salem intereacted for a duration of 30 to 60 minutes daily on topics other than studies. Only three per cent from Tirupur spend more than an hour to talk with subjects on topics other than studies.

In Kottayam, 55 per cent parents spend 15 to 30 minutes and 45 per cent spend 30 to 60 minutes for personal interaction with subjects. It was in the order of 63 per cent for 15 to 30 minutes, 24 per cent for 30 to 60 minutes and 13 per cent for more than an hour personal interaction in the district of Pathanamthitta. Sixty five per cent and 59 per cent from Allepey and Thrissur respectively spend only 15 to 30 minutes for personal interaction. It was also noted that none from Kottayam, Allepey and Thrissur spend more than one hour for personal interaction with the children, which was one among the good ways to bind the child to the family.

16. Duration of Sleep

Sleep is a naturally recurring state characterized by reduced consciousness, suspended sensory activity and inactivity of all voluntary muscles. Sound sleep ensures healthy mind and body. Table XXV gives a clear idea of the subjects' duration of sleep.

TABLE XXV

DURATION OF SLEEP

States	Districts	DURATION IN HOURS							
		8-9		7-8		6-7		<6	
		No.	%	No.	%	No.	%	No.	%
Tamil Nadu	Coimbatore	97	19	63	13	224	45	116	23
	Erode	82	16	79	16	313	63	26	5
	Tirupur	47	9	42	8	337	67	74	16
	Salem	86	17	68	14	281	56	65	13
Kerala	Kottayam	74	15	65	13	288	57	73	15
	Pathanamthitta	42	8	47	9	284	57	127	26
	Allepey	63	13	82	16	241	48	114	23
	Thrissur	79	16	97	19	188	38	136	27

It was noted that a good per cent of the subjects in Tamil Nadu slept for 6 to 7 hours daily. It was in the order of 45 per cent in Coimbatore, 63 per cent in Erode, 67 per cent in Tirupur and 56 per cent in Salem. It was also understood that 23 per cent from Coimbatore, five per cent from Erode, 16 per cent from Tirupur and 13 per cent from Salem slept for less than six hours daily. The percentage of subjects sleeping for 8 to 9 hours was in the order of 19 per cent in Coimbatore, 16 per cent in erode, nine per cent in Tirupur and 17 per cent in Salem. Thirteen per cent from Coimbatore, 16 per cent from Erode, eight per cent from Tirupur and 14 per cent fro Salem slept for 7 to 8 hours daily.

Fifty seven per cent each in Kottayam and Pathanamthitta, 48 per cent in Allepey and 38 per cent in Thrissur slept for 6 to 7 hours daily. The duration of sleep was less than six hours for 15 per cent in Kottayam, 26 per cent in Pathanamthitta, 23 per cent in Allepey and 27 per cent in Thrissur. Few per cent slept for 8 to 9 hours daily. It was in the order of 15 per cent in Kottayam eight per cent in Pathanamthitta, 13 per cent in Allepey and 16 per cent in Thrissur. Thirteen per cent from Kottayam, nine per cent from Pathanamthitta, 16 per cent from Allepey and 19 per cent from Thrissur district slept for a duration of 7 to 8 hours daily.

A Northwestern University study indicates that inadequate sleep has a negative impact on a child's performance in school, their emotional and social welfare and increases their risk of being overweight. This study was the first nationally represented, longitudinal investigation of the correlation between sleep, Body Mass Index (BMI) and overnight status in children between the ages of three and 18. The study found that an extra hour of sleep lowered the children's risk of being overweight from 36 per cent to 30 per cent, while it lessened older children's risk from 34 per cent to 30 per cent (Nelson, 2008).

C. DIETARY PATTERN OF THE OBESE SUBJECTS

The dietary pattern of obese children in the selected districts of Kerala and Tamil Nadu was elicited. The details included food habit of the subject, frequency of consuming non-vegetarian food stuff, form of fleshy food

preferred, favourite non-vegetarian food stuffs of the subjects, common breakfast food preferred by the subjects, similarity in the diet preference of parents and subjects, details on mood and food choices, preference for fruits and vegetables, frequency of milk consumption, fluid consumption per day, favourite outside food stuff, favourite commercial drink, frequency of consuming commercial food and drink, commonly preferred ready to eat food stuff, the details on food allergy and mean nutrient intake of selected subsamples.

1. Food Habit

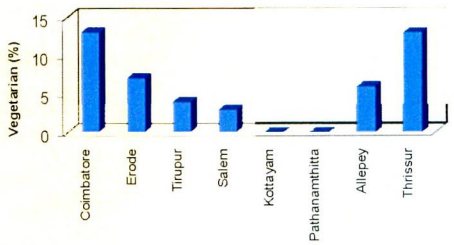
Food is any substance consumed to provide nutritional support for the body. The selected children had different food habits, some were vegetarians, some were non-vegetarians and even some were ova-vegetarians. Table XXVI and Figure XII describes the details of food habits of the subjects in selected districts of Kerala and Tamil Nadu.

TABLE XXVI

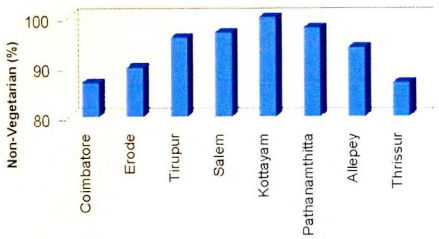
FOOD HABIT

States	Districts	Food Habit					
		Vegetarian		Non-Vegetarian		Ova-Vegetarian	
		No.	%	No.	%	No.	%
Tamil Nadu	Coimbatore	66	13	434	87	-	-
	Erode	36	7	448	90	16	3
	Tirupur	22	4	478	96	-	-
	Salem	18	3	482	97	-	-
	Chi Square – 91.50; df – 6; Sig – **						
Kerala	Kottayam	-	-	500	100	-	-
	Pathanamthitta	-	-	488	98	12	2
	Allepey	32	6	468	94	-	-
	Thrissur	63	13	437	87	-	-
	Chi Square – 156.04; df – 6; Sig – **						

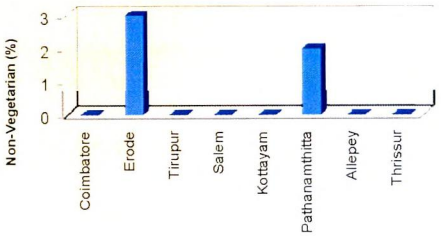
** - Significant at one per cent level



(A) VEGETARIAN



(B) NON-VEGETARIAN



(C) OVA-VEGETARIAN

FIGURE XII

FOOD HABIT

It was noted that in Coimbatore, when 87 per cent were non-vegetarians, only 13 per cent were vegetarians. In Erode, seven per cent were vegetarians, 90 per cent were non-vegetarians and three per cent were ova-vegetarians. In Tirupur, four per cent were vegetarians whereas 96 per cent where non-vegetarians. Ninety seven per cent of the subjects in Salem were non-vegetarians and the rest, three per cent, were vegetarians.

In Kottayam, all the subjects were non-vegetarians. In Pathanamthitta, when 98 per cent consumed non-vegetarian food stuffs, only two per cent had ova-vegetarian food items. It was observed that in Allepey, six per cent were vegetarians and the rest 94 per cent were non-vegetarians. While 13 per cent of the subjects in Thrissur were vegetarians, 87 per cent consumed non-vegetarian food stuffs.

Chi square test was applied to find out the association of childhood obesity with the food habit. The calculated value of chi square was found to be 91.50 in the districts of Tamil Nadu and 156.04 in the districts of Kerala. The calculated value of chi square was greater than the table value of 16.812 at one per cent level. Since the calculated value was greater than the table value it was inferred that there is significant relationship between childhood obesity in both the states and food habit.

2. Frequency of Consuming Non-Vegetarian Food Stuff

Non-vegetarian foods are rich in protein of high biological value and in vitamin B complex. Obesity and high cholesterol levels are found to be greater among non-vegetarians (www.seniorindian.com). The frequency of consuming non-vegetarian food by the subjects is depicted in Table XXVII.

TABLE XXVII

FREQUENCY OF CONSUMING NON-VEGETARIAN FOODS

States	Districts	Frequency							
		Everyday		Weekly Once		Weekly Twice		Rarely	
		No.	%	No.	%	No.	%	No.	%
Tamil Nadu	Coimbatore	74	17	83	19	277	64	-	-
	Erode	96	21	73	16	279	63	-	-
	Tirupur	107	22	49	10	322	68	-	-
	Salem	92	19	43	9	347	72	-	-
Kerala	Kottayam	112	22	92	18	296	60	-	-
	Pathanamthitta	95	19	12	3	381	78	-	-
	Allepey	69	15	55	12	344	73	-	-
	Thrissur	31	7	39	9	367	84	-	-

In Coimbatore, 64 per cent of the subjects had non-vegetarian food twice a week and 19 per cent had the same weekly once. In Erode, 21 per cent had non-vegetarian food items daily and 63 per cent had weekly twice. In Tirupur, the frequency of consuming non-vegetarian food stuff was in the order of 22 per cent for daily consumption, ten per cent for once in a week and 68 per cent for weekly twice. Seventy two per cent of the subjects in Salem had non-vegetarian food items weekly twice and 19 per cent had the same daily.

In Kottayam, when 22 per cent consumed non-vegetarian food items daily, 60 per cent had it twice a week. Seventy eight per cent of the subjects in Pathanamthitta consumed non-vegetarian food items weekly twice and 19 per cent had the same everyday. In Allepey, 12 per cent consumed non-vegetarian items once in a week and 73 per cent had the same weekly twice. In Thrissur, the frequency of non-vegetarian food consumption was in the order of seven per cent for daily consumption, nine per cent for having once a week and 84 per cent for weekly twice. It was also noted that none of the

subjects in all the selected districts consumed non-vegetarian food stuff rarely.

Calorie-dense, snacks are available in many locations which are frequented by children. As childhood obesity has become more prevalent, snack vending machines in school settings have been reduced by law in a small number of localities. Eating at fast food restaurants is very common among young people with 75 per cent of 7^{th} to 12^{th} grade students consuming fast food in a given week (Laxman, 2011).

3. Form of Fleshy Food Preferred

Cooking is the process of preparing food by the use of heat. In deep fat frying, food is submerged in hot oil or fat. Shallow frying is the cooking of food in small quantity of fat. Boiling is the method of cooking food in water, stock or milk. The details regarding the form of fleshy food preferred by the subjects are given in Table XXVIII and Figure XIII.

TABLE XXVIII

FORM OF FLESHY FOOD PREFERRED

States	Districts	Food Habit					
		Deep Fried		Shallow Fried		Boiled	
		No.	%	No.	%	No.	%
Tamil Nadu	Coimbatore	262	60	149	34	23	6
	Erode	326	73	106	24	16	3
	Tirupur	239	50	197	41	42	9
	Salem	267	55	148	31	67	14
Kerala	Kottayam	319	64	135	27	46	9
	Pathanamthitta	321	66	120	25	47	9
	Allepey	407	87	29	6	32	7
	Thrissur	368	84	8	2	61	14

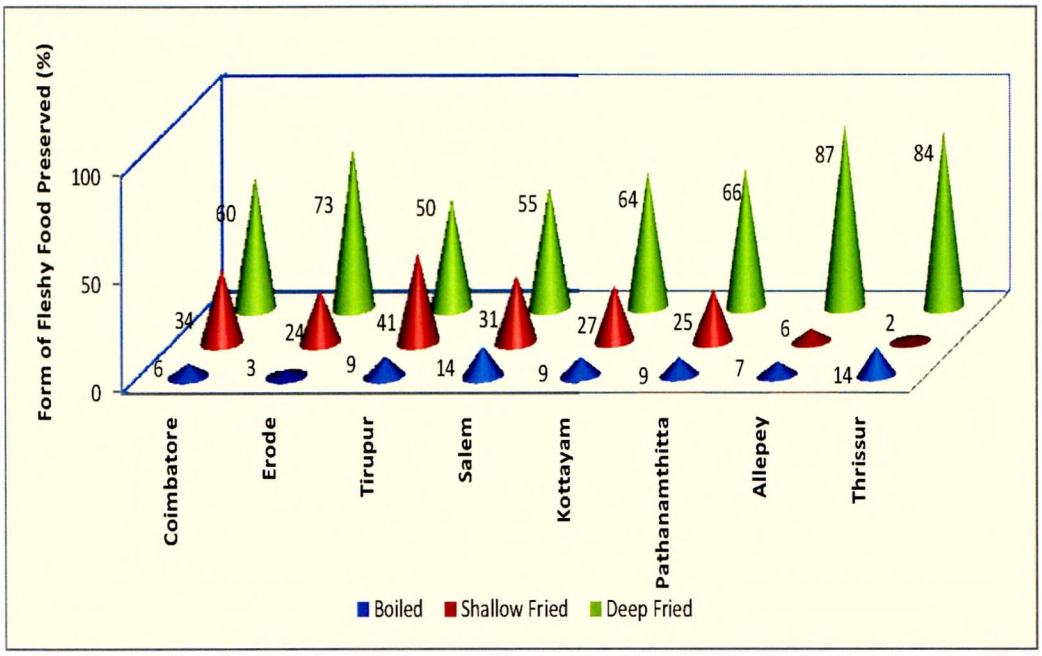


FIGURE XIII

FORM OF FLESHY FOOD PREFERRED

It was clear that 60 per cent in Coimbatore preferred deep fat fried food stuff and only six per cent preferred fleshy food in boiled form. In Erode, 24 per cent preferred shallow fried fleshy food and 73 per cent liked deep fried. When 50 per cent of subjects in Tirupur preferred deep fried fleshy food, nine per cent opted for boiled form. In Salem, 14 per cent preferred boiled form of non-vegetarian food, while 55 per cent like deep fried fleshy food.

In Kerala, 64 per cent of subjects in Kottayam liked non-vegetarian foods in the deep fried form and nine per cent preferred boiled form. Twenty five per cent of the subjects in Pathanamthitta like fleshy food in shallow fried form and 66 per cent preferred the same as deep fried. In Allepey, 87 per cent like fleshy food in deep fat fried form and only seven preferred curry form. The order of preference in Thrissur was 84 per cent for deep fat fried, two per cent for shallow fat fried and 14 per cent for boiled form.

4. Favourite Non-Vegetarian Food Stuff of the Subjects

The children had varying preference for fish, chicken, meat and egg. Some of the children prefer all the above listed food stuff. The favourite non-

vegetarian food stuff from subjects was elicited and is presented in Table XXIX.

TABLE XXIX

FAVOURITE NON-VEGETARIAN FOOD STUFF OF THE SUBJECTS

States	Districts	Food Stuff									
		Chicken		Fish		Meat		Egg		All the Above	
		No.	%	No.	%	No.	%	No.	%	No.	%
Tamil Nadu	Coimbatore	23	5	37	8	37	8	-	-	376	79
	Erode	23	5	23	5	37	8	16	4	349	78
	Tirupur	93	19	31	6	26	6	-	-	328	69
	Salem	6	1	47	10	13	3	-	-	416	86
Kerala	Kottayam	37	7	42	8	74	16	-	-	347	69
	Pathanamthitta	12	2	19	4	63	13	12	2	382	79
	Allepey	10	2	112	24	12	3	-	-	334	71
	Thrissur	36	8	106	24	46	11	-	-	249	57

All good per cent of the subjects in the selected districts had all the commonly consumed non-vegetarian food items like chicken, fish, meat and egg as their favourite. It was in the order of 79 per cent in Coimbatore, 78 per cent in Erode, 69 per cent in Tirupur, 86 per cent in Salem, 69 per cent in Kottayam, 79 per cent in Pathanamthitta, 71 per cent in Allepey and 57 per cent in Thrissur. Five per cent each from Coimbatore and Erode respectively had chicken as the favourite food items. Six per cent each from Tirupur had fish and egg as the favourite food. When ten per cent from Salem had fish as the favourite food items only one per cent from the same place go for the chicken.

In Kottayam, seven per cent opted chicken, 16 per cent opted meat and eight per cent opted fish as the favourite non-vegetarian food stuff. Thirteen per cent had meat as the favourite non-vegetarian food in Pathanamthitta. In Allepey, 24 per cent subjects' favourite non-vegetarian

food items were fish and only two per cent opted for chicken. In Thrissur, it was in the order of eight per cent for chicken, 24 per cent for fish and 11 per cent opted meat as the favourite non-vegetarian food items.

5. Common Breakfast Preferred by the Subjects

Mainly South Indian dishes like idli, dosai, appam, adai, upuma and steam cake (puttu) were on the top as the breakfast items preferred by the subjects. Table XXX gives a detailed description of the common breakfast food items preferred by the subjects. Idli is a savory cake of South Indian original popular throughout India. It is usually two to three inches in diameter and is made by steaming a batter consisting of fermented black lentils and rice. Dosaiis a fermented pan cake made from rice batter and black lentils. Upuma and adai are popular South Indian breakfast dishes. Upuma is usually made with semolina. Puttu is a South Indian and Srilankan breakfast dish made of ground rice layered with coconut.

TABLE XXX

COMMON BREAKFAST PREFERRED BY THE SUBJECTS

States	Districts	Food Stuff													
		Chapathi		Dosai/Idli		Steam Cake		Appam		Adai		Sandwich		Upuma	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Tamil Nadu	Coimbatore	55	11	242	48	-	-	-	-	-	-	174	35	29	6
	Erode	79	16	266	53	-	-	62	12	-	-	37	8	56	11
	Tirupur	122	24	284	57	-	-	16	3	-	-	59	12	19	4
	Salem	96	19	103	21	-	-	42	8	-	-	235	47	24	5
Kerala	Kottayam	129	26	76	15	112	22	49	10	24	5	79	16	31	6
	Pathanamthitta	147	29	56	11	68	14	43	9	67	13	107	22	12	2
	Allepey	105	21	63	13	75	15	121	24	72	14	45	9	19	4
	Thrissur	122	24	81	16	56	12	78	16	52	10	69	14	42	8

In Coimbatore and Erode, 48 per cent and 53 per cent respectivbely preferred idli or dosai for breakfast. Thirty five per cent in Coimbatore and 12 per cent in Tirupur preferred sandwich with a non-vegetarian stuffing. In Salem, when 47 per cent sandwich for breakfast, only five per cent preferred upuma.

In Kottayam, 26 per cent preferred chapathi, 15 per cent preferred dosai or idli, 22 per cent preferred steam cake and ten per cent preferred appam for breakfast. In Pathanamthitta, 29 per cent and 22 per cent respectively preferred chapathi and sandwich for breakfast. In Allepey, steam cake and appam were preferred for breakfast by 15 per cent and 24 per cent respectively. Ten per cent from Thrissur preferred adai for breakfast with a non-vegetarian stuffing and 14 per cent from the same district preferred sandwich as breakfast. Upuma was preferred as breakfast by a minority in all the districts. It was in the order of six per cent each in Coimbatore and Kottayam, 11 per cent in Erode, four per cent in Tirupur, five per cent in Salem, two per cent in Pathanamthitta, four per cent in Allepey and eight per cent in Thrissur. Rice, wheat and sugi were the commonly used food stuff for breakfast. It was also noted that fibre and iron rich ragi was not at all included in any form for breakfast.

6. Similarity in the Diet Preference of Parents and Subjects

Some of the subjects had a similar taste with the parents, while the others did not share any similarity in the diet preference. Parents' food choice had a positive effect on the subject's choice. Similarity in the diet preference of subjects with the parents was studied and is presented in Table XXXI.

TABLE XXXI

DIET PREFERENCE

States	Districts	Diet preference			
		Similar		Not Similar	
		No.	%	No.	%
Tamil Nadu	Coimbatore	394	79	106	21
	Erode	409	82	91	18
	Tirupur	396	79	104	21
	Salem	327	65	173	35
Kerala	Kottayam	440	88	60	12
	Pathanamthitta	369	74	131	26
	Allepey	394	79	106	21
	Thrissur	340	68	160	32

It was noted that 79 per cent in Coimbatore, 82 per cent in Erode, 79 per cent in Tirupur and 65 per cent of the subjects in Salem had diet preference similar to the parents. Twelve per cent of the subjects from Kottayam, 26 per cent from Pathanamthitta, 21 per cent from Allepey and 32 per cent from Thrissur did not show any similarity in the diet preference with parents. But a majority of 88 per cent of the subjects in Kottayam, 74 per cent in Pathanamthitta, 79 per cent in Allepey and 68 per cent in Thrissur had same preferred for diet like the parents. When the parents take energy dense food and carbonated beverages to home the subjects are also prone to consume these foods at an early stage.

Family eating habits contribute to childhood obesity. Eighty per cent of children born to two obese parents become obese themselves since they are fed too much. Family members model eating and activity behavior for each other and might provide social support for weight-control efforts. In this context, parent-child influences and interaction appear to be bi-directional (Waring, 2008).

7. Mood and Food Choice

Emotions are the complex psycho-physiological experience of an individual's state of mind as interacting with internal and external influences. The details on mood and food choice were studied and are presented in Table XXXII and Figure XIV.

TABLE XXXII

MOOD AND FOOD CHOICES

States	Districts	Moods			
		Do Affect		Do Not Affect	
		No.	%	No.	%
Tamil Nadu	Coimbatore	394	79	106	21
	Erode	402	80	98	20
	Tirupur	340	68	160	32
	Salem	341	69	153	31
	Chi Square – 31.58; df – 3; Sig – **				
Kerala	Kottayam	421	84	79	16
	Pathanamthitta	327	65	173	35
	Allepey	410	82	90	18
	Thrissur	411	82	89	18
	Chi Square – 68.03; df – 3; Sig – **				

**** - Significant at one per cent level**

It was clear that 79 per cent of the subjects in Coimbatore, 80 per cent in Erode, 68 per cent in Tirupur and 69 per cent Salem agreed that the emotions affected the food choices to a greater extent. The subjects agreed that they eat more when they are happy or sad. Eighty four per cent from Kottayam, 65 per cent from Pathanamthitta, 82 per cent each from Allepey and Thrissur accepted that the mood affect the food choice. It was also noted that some of the subjects depend on snacking to get rid of tensions. Failures in leisure time games also resulted in snacking.

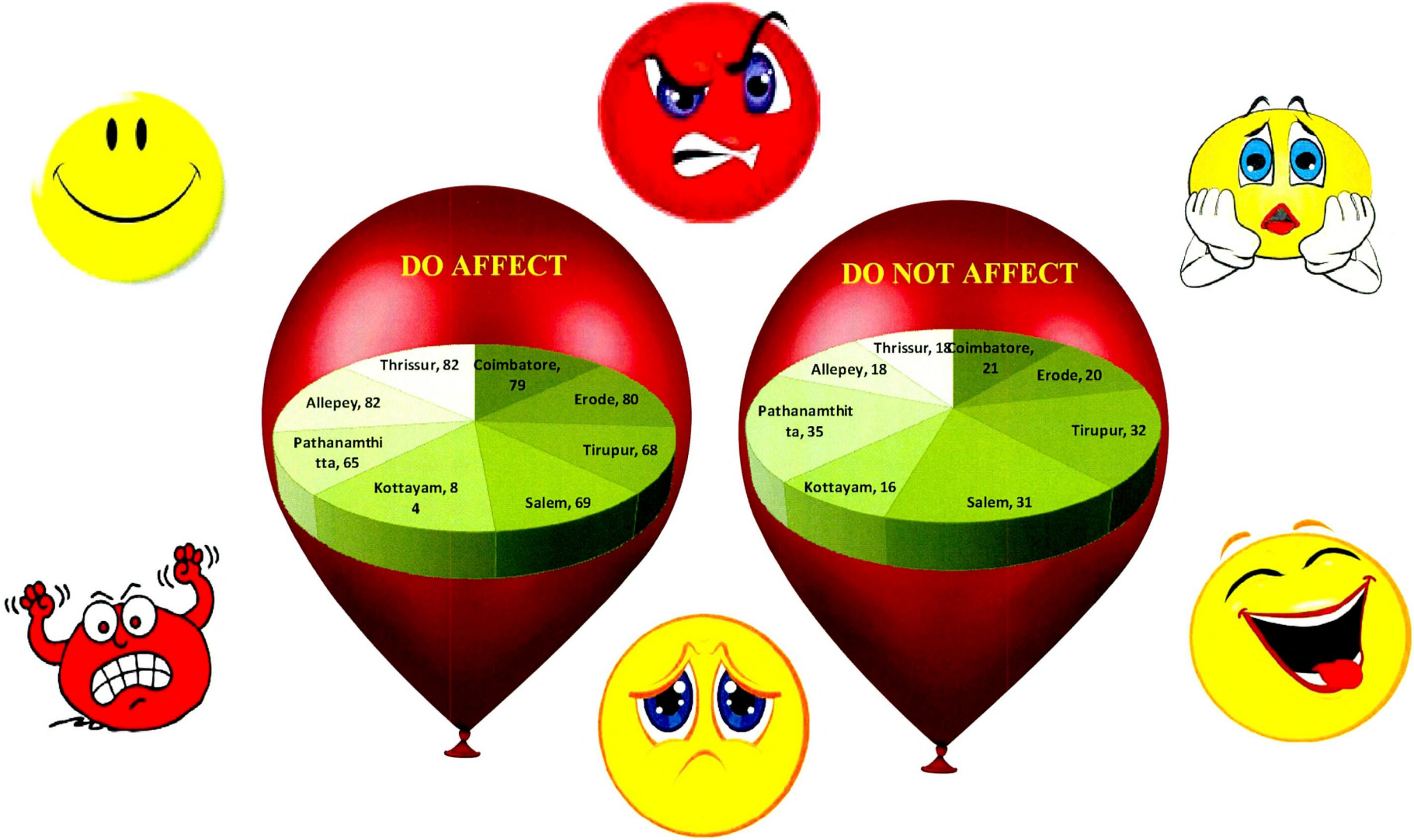


FIGURE XIV
MOOD AND FOOD CHOICES

Chi square test was applied to find out the association of childhood obesity with mood. The calculated value of chi square was found to be 31.58 in the districts of Tamil Nadu and 68.03 in the districts of Kerala. The calculated value of chi square was greater than the table value of 11.435 at one per cent level. Since the calculated value was greater than the table value it was inferred that there is significant relationship between childhood obesity in both the states and mood.

Stress can influence a child's eating habits. Feelings of depression can cause a child to overeat (Lipsky, 2008).

8. Preference for Fruits and Vegetables

The health benefits of a diet rich in fruits and vegetables is well established. The preference of the subjects for fruits and vegetables were assessed. The preference for fruits and vegetables of the subjects was studied and are presented in Table XXXIII.

TABLE XXXIII

PREFERENCE FOR FRUITS AND VEGETABLES

States	Districts	Preference			
		Do Prefer		Do Not Prefer	
		No.	%	No.	%
Tamil Nadu	Coimbatore	177	35	323	65
	Erode	156	31	344	69
	Tirupur	137	27	363	73
	Salem	226	45	274	55
Kerala	Kottayam	181	36	319	64
	Pathanamthitta	172	34	328	66
	Allepey	203	41	297	59
	Thrissur	216	43	284	57

In Coimbatore, when 35 per cent preferred fruits and vegetables, 65 per cent did not prefer the same. When 69 per cent in Erode disliked fruits

and vegetables, only 31 per cent liked it. In Tirupur, 73 per cent did not prefer fruits and vegetables and the rest 27 per cent preferred the same. Forty five per cent of the subjects from Salem preferred fruits and vegetables.

The order of preference for fruits and vegetables in various districts of Kerala was 36 per cent in Kottayam, 34 per cent in Pathanamthitta, 41 per cent in Allepey and 43 per cent in Thrissur. Among the preferred subjects the form of preference for fruits was mainly in the juice form with added sugar.

It was discovered that when compared to adolescents who ate three or four meals per week, those who ate four to five family meals per week were 19 per cent less likely to report poor consumption of vegetables, 22 per cent less likely to report poor consumption of fruits and 19 per cent less likely to report poor consumption of dairy foods (Patternson, 2008).

9. Frequency of Milk Consumption

Milk contains significant amount of saturated fat, protein, calcium and vitamin C. It is referred to as a complete food. The frequency of milk consumption by the subjects is depicted in Table XXXIV.

TABLE XXXIV

FREQUENCY OF MILK CONSUMPTION

States	Districts	Frequency per Day							
		Once (100ml)		Twice (200ml)		Thrice (300ml)		Never	
		No.	%	No.	%	No.	%	No.	%
Tamil Nadu	Coimbatore	78	16	76	15	346	69	-	-
	Erode	129	26	102	20	269	54	-	-
	Tirupur	105	21	83	17	312	62	-	-
	Salem	21	4	61	12	416	84	2	-
Kerala	Kottayam	36	1	97	19	367	74	-	-
	Pathanamthitta	48	10	69	14	383	76	-	-
	Allepey	51	10	43	9	406	81	-	-
	Thrissur	27	5	76	15	397	80	-	-

In Coimbatore, 16 per cent had milk only once a day and 69 per cent had thrice a day. Fifty four per cent in Erode consumed milk thrice a day while 20 per cent had the same twice a day. In Tirupur, 62 per cent had milk three times a day and 21 per cent had milk only once. Eighty four per cent of the subjects in Salem drank milk three times a day.

In Kottayam, 74 per cent consumed milk thrice a day and seven per cent had the same only once. Fourteen per cent of the subjects in Pathanamthitta drank milk twice a day and 76 per cent had the same thrice. In Alleypey the frequency of milk consumption was in the order of 10 per cent for once a day, nine per cent for twice a day and 81 per cent for thrice a day. Eighty per cent of the subjects in Thrissur had milk three times a day, that is, in the morning, evening and at night.

According to Dunn (2009), whole milk consumption verses two per cent milk consumption in children of one to two years of age had no effect on weight, height or body fat percentage. Therefore, whole milk continues to be recommended for this age group. However, the trend of substituting sweetened drink for milk has been found to lead to excess weight gain.

10. Fluid Consumption per Day

Fluid has to be taken liberously for the proper functioning of the body. Fluid constitutes all the liquid food stuff consumed by the subjects. Milk, water, coffee, tea, carbonated beverages, juices and shakes enhance the fluid consumption. The details regarding the fluid consumption per day was elicited and is presented in Table XXXV.

TABLE XXXV

FLUID CONSUMPTION PER DAY

States	Districts	Amount in Milliliter					
		< 250		250-600		>600	
		No.	%	No.	%	No.	%
Tamil Nadu	Coimbatore	77	15	196	39	227	46
	Erode	143	28	235	47	122	25
	Tirupur	126	25	95	19	279	56
	Salem	183	37	164	33	153	30
Kerala	Kottayam	139	28	114	23	247	49
	Pathanamthitta	106	21	174	35	220	44
	Allepey	144	29	129	26	227	45
	Thrissur	260	52	112	22	128	26

It was noted that more than 600 ml of fluid was consumed by 46 per cent of subjects in Coimbatore, 25 per cent in Erode, 56 per cent in Tirupur and 30 per cent in Salem. Fifteen per cent from Coimbatore, 28 per cent from Erode, 25 per cent from Tirupur and 37 per cent from Salem consumed less than 250 ml of fluid per day. The fluid consumption was limited to 250 to 600 ml per day by 39 per cent of the subjects in Coimbatore, 47 per cent Erode, 18 per cent in Tirupur and 33 per cent in Salem.

In Kottayam 28 per cent, in Pathanamthitta 21 per cent, in Allepey 29 per cent and in Thrissur 52 per cent of the subjects consumed less than 250 ml of liquid per day. The fluid consumption was between 250 to 600 ml by 23 per cent of the subjects in Kottayam, 35 per cent in Pathanamthitta, 26 per cent in Allepey and 22 per cent in Thrissur. Forty nine per cent of the subjects in Kottayam, 44 per cent in Pathanamthitta, 45 per cent in Allepey and 26 per cent in Thrissur consumed fluid liberally, that is, more than 600 ml per day.

Calorie-rich drinks and foods are readily available to children. Sugar-laden soft drink consumption may contribute to childhood obesity. In a study

of 548 children over a 19 month period the likelihood of obesity increased by 1.6 for every additional soft drink consumed per day (Levin, 2008).

11. Favourite Outside Foods

Children had varying preference for outside food. Spiced food stuff in the gray or curry form were less preferred by the children while dining out. Noodles, pizza, chat items and all fast foods are on the top category of preference. The details regarding the favourite outside food stuff is presented in Table XXXVI.

TABLE XXXVI

FAVOURITE OUTSIDE FOODS

States	Districts	Food Stuff									
		KFC*		Noodles		Pizza		Chat Item		All Fast Foods	
		No.	%	No.	%	No.	%	No.	%	No.	%
Tamil Nadu	Coimbatore	76	15	64	13	18	4	216	43	126	25
	Erode	-	-	79	16	116	23	209	42	96	19
	Tirupur	22	4	112	22	90	18	134	27	142	29
	Salem	-	-	141	28	16	3	226	46	117	23
	Chi Square – 358.64; df – 12; Sig – **										
Kerala	Kottayam	27	5	123	25	215	43	12	2	123	25
	Pathanamthitta	46	9	107	21	193	39	41	8	113	23
	Allepey	38	8	110	22	210	42	36	7	106	21
	Thrissur	117	23	114	23	121	24	24	5	124	25
	Chi Square – 139.22; df – 12; Sig – **										

***Kentuky Fried Chicken**
**** - Significant at one per cent level**

Chat items were most preferred by the subjects in Tamil Nadu. It was in the order of 43 per cent in Coimbatore, 42 per cent in Erode, 27 per cent in Tirupur and 46 per cent in Salem. The preference for noodles was 13 per cent in Coimbatore, 16 per cent in Erode, 22 per cent in Tirupur and 28 per cent in Salem. All types of fast foods were preferred by 25 per cent in Coimbatore, 19

per cent in Erode, 29 per cent in Tirupur and 23 per cent in Salem. Pizza was the favourite outside recipe of four per cent subjects in Coimbatore, 23 per cent in Erode, 18 per cent in Tirupur and three per cent in Salem,

Pizza, noodles and all fast foods were more popular among the subjects of Kerala. Forty three per cent from Kottayam, 39 per cent from Pathanamthitta, 42 per cent from Allepey and 24 per cent from Thrissur preferred the former (pizza). Noodles were preferred by 25 per cent in Kottayam, 21 per cent in Pathanamthitta, 22 per cent in Allepey and 23 per cent of the subjects in Thrissur. Twenty five per cent each from Kottayam and Thrissur, 23 per cent from Pathanamthitta and 21 per cent from Allepey preferred the later (all fast foods) as the favourite outside food items.

Chat items were not popular among the subjects of Kerala. Kentuky Fried Chicken known called as KFC was preferred by 15 per cent of subjects in Coimbatore, four per cent from Tirupur, five per cent from Kottayam, nine per cent from Pathanamthitta, eight per cent from Allepey and 23 per cent of the subjects from Thrissur.

Chi square test was applied to find out the association of childhood obesity with junk food consumption. The calculated value of chi square was found to be 358.64 in the districts of Tamil Nadu and 139.22 in the districts of Kerala. The calculated value of chi square was greater than the table value of 26.212 at one per cent level. Since the calculated value was greater than the table value it was inferred that there is significant relationship between childhood obesity in both the states and junk food consumption.

12. Favourite Commercial Drink

Carbonated beverages that are available in the market are more preferred by children than fresh fruit juices. The details on the favourite commercial drinks of the subjects are elicited in Table XXXVII.

TABLE XXXVII

FAVOURITE COMMERCIAL DRINK

States	Districts	Drinks									
		Cola		Pepsi		Maaza		7 Up		All the Above	
		No.	%	No.	%	No.	%	No.	%	No.	%
Tamil Nadu	Coimbatore	36	7	106	21	48	10	72	14	238	48
	Erode	72	14	49	10	84	17	77	15	218	44
	Tirupur	73	15	89	18	47	9	64	13	227	45
	Salem	110	22	102	20	74	15	69	14	145	29
Kerala	Kottayam	92	18	96	19	97	19	48	10	167	34
	Pathanamthitta	76	15	42	8	66	13	78	16	238	48
	Allepey	101	20	174	35	102	20	39	8	84	17
	Thrissur	74	15	97	19	64	13	72	14	193	39

In Coimbatore, seven per cent preferred Cola, 21 per cent preferred Pepsi, ten per cent preferred Maaza, 14 per cent preferred seven up and 48 per cent preferred all the above listed drinks. Fourteen per cent from Erode preferred Cola, while 17 per cent preferred Mazza and 44 per cent liked all the marketed drinks. In Tirupur, 45 per cent opted for all commercial drinks while 18 per cent had Pepsi as the favourite drink. In Salem, 22 per cent preferred Cola and 14 per cent preferred 7Up as a favourite commercial drink.

In Kerala, 18 per cent the subjects in Kottayam preferred Cola, 19 per cent each preferred Pepsi and Maaza respectively. In Pathanamthitta, 48 per cent of the subjects had all the marketed drinks as the favourite and 16 per cent preferred 7Up. In Allepey, the favourite commercial drink of the subjects was in the order of 20 per cent for Cola, 35 per cent for Pepsi, 20 per cent for Maaza, eight per cent for 7Up and 17 per cent for all the commercially marketed drinks. In Thrissur, when 39 per cent had all the commercial drinks as favourite, 19 per cent had Pepsi and 15 per cent had Cola as the favourite commercial drinks.

13. Frequency of Consuming Commercial Food and Drinks

Some of the parents had the habit of storing carbonated beverages in the fridge which promotes the consumption of the child. The frequency of consuming commercial foods and drinks were studied and is presented in Table XXXVIII.

TABLE XXXVIII

FREQUENCY OF CONSUMING COMMERCIAL FOOD AND DRINKS

States	Districts	Frequency									
		Everyday		Weekly Once		Weekly Twice		Rarely		Never	
		No.	%	No.	%	No.	%	No.	%	No.	%
Tamil Nadu	Coimbatore	32	6	297	59	97	19	74	16	-	-
	Erode	17	3	366	73	41	8	76	16	-	-
	Tirupur	49	10	315	63	67	13	69	14	-	-
	Salem	16	3	373	75	64	13	47	9	-	-
Kerala	Kottayam	47	9	401	80	23	5	29	6	-	-
	Pathanamthitta	27	5	313	63	49	10	111	22	-	-
	Allepey	18	4	364	73	76	15	42	8	-	-
	Thrissur	42	8	300	60	91	18	67	14	-	-

In Coimbatore, when six per cent consumed commercial foods and drinks daily, 59 per cent consumed the same weekly once. In Erode, 73 per cent consumed weekly once and only 16 per cent consumed marketed food and drinks rarely. When 13 per cent of the subjects in Tirupur consumed the marketed foods and drinks twice in a week, 63 per cent consumed the same weekly once. In Salem, nine per cent consumed rarely while 75 per cent consumed the marketed products once in a week.

In Kottayam, the frequency of consumption of commercial foods and drinks was in the order of nine per cent for daily consumption, 80 per cent for weekly once, five per cent for weekly twice and six per cent for rare

consumption. In Pathanamthitta, when 63 per cent consumed the commercial food stuffs once in a week, only 22 per cent had the same rarely. In Allepey 73 per cent was of the habit of consuming marketed foods and drinks once in a week and 15 per cent had the same weekly twice. In Thrissur, the frequency of consumption was in the order of eight per cent for daily consumption, 60 per cent for consuming once in a week, 18 per cent for twice a week and 14 per cent for rare consumption of commercial food and drinks. It was also amazing that none of the selected subjects in the selected districts of Tamil Nadu and Kerala opted that 'Never' category as the subjects have tasted the commercial foods and drinks atleast once.

A changing lifestyle has certainly taken a tool on the health but children are not far behind as they too are now bearing the brunt of too much junk food consumption. A study on a sample group of school children by Delhi's Fortis Hospital found 28 per cent of kids were obese. There is an increasing trend of ready to eat foods eaten or purchased away from home (Singh, 2007).

14. Commonly Preferred Ready-to-Eat Foods

Ready-to-eat are self-contained, individual field ration in light weight packaging. Confectionary is a set of food items that are rich in sugar like lollipops, candy bars, chocolates and candy flours. Bakery products are flour based food baked in an oven such a bread cakes, pastries and pies. Table XXXIX gives an idea about the commonly preferred ready-to-eat items, by the subjects in the selected districts of Kerala and Tamil Nadu.

TABLE XXXIX

COMMONLY PREFERRED READY-TO-EAT FOODS

States	Districts	Items			
		Confectionary		Bakery	
		No.	%	No.	%
Tamil Nadu	Coimbatore	327	65	173	35
	Erode	251	50	249	50
	Tirupur	326	65	174	35
	Salem	163	33	337	67
Kerala	Kottayam	226	45	274	55
	Pathanamthitta	258	52	242	48
	Allepey	321	64	179	36
	Thrissur	135	27	365	73

In Coimbatore and Tirupur, 65 per cent each preferred confectionary items and 35 per cent preferred bakery items. Fifty per cent each preferred confectionary and bakery in Erode. When 67 per cent in Salem like bakery products, 33 per cent preferred confectionary items.

In Kerala, 55 per cent from Kottayam preferred bakery items and the rest 45 per cent opted confectionary items. In Pathanamthitta, the preference for ready-to-eat food stuffs was in the order of 52 per cent and 48 per cent for confectionary and bakery respectively. When 64 per cent of the subjects in Allepey preferred confectionary, 36 per cent liked bakery products. In Thrissur, 73 per cent of the subjects opted for bakery products while 27 per cent preferred confectionary items.

Consumption of junk food as well as the sedentary lifestyle among children is a main cause of concern. Also the dietary pattern includes pre-packaged fatty foods. Experts advice that adults themselves do not give up on fast food and quick-fix meals, there's only a slim chance that children may follow a healthy nutritive diet pattern (Wang, 2002).

15. Mean Nutrient intake of Selected Subsamples (Boys)

For sustaining healthy life, diet should be planned on sound nutritional principles. The details regarding mean nutrient intake of selected subsamples in various districts of Kerala and Tamil Nadu is depicted in Table XL.

TABLE XL

MEAN NUTRIENT INTAKE OF SELECTED SUBSAMPLES – 4-6 YEARS BOYS (N-400)

States	Districts	Energy (Kcal)			Protein (g)			Fat (g)			Iron (mg)			Calcium (mg)		
		RDA	Total	Diff	RDA	Total	Diff	RDA	Total	Diff	RDA	Total	Diff	RDA	Total	Diff
Tamil Nadu	Coimbatore	1350	1463	+113	20	16	-4	25	27	+2	13	10	-9	600	600	0
	Erode	1350	1524	+174	20	18	-2	25	31	+6	13	11	-2	600	480	-120
	Tirupur	1350	1379	+29	20	21	+1	25	32	+7	13	9	-4	600	550	-50
	Salem	1350	1443	+93	20	20	0	25	33	+8	13	9	-4	600	600	0
Kerala	Kottayam	1350	1628	+278	20	18	-2	25	29	+4	13	12	-1	600	400	-200
	Pathanamthitta	1350	1849	+499	20	17	-3	25	24	-1	13	14	+1	600	500	-100
	Allepey	1350	1471	+121	20	14	-6	25	28	+3	13	9	-4	600	600	0
	Thrissur	1350	1525	+175	20	21	+1	25	31	+6	13	11	-2	600	600	0

It was observed that in all the selected districts of Kerala and Tamil Nadu the energy requirement exceeded the Recommended Dietary Allowance (RDA, 2010). The mean energy scores were in the order of 1463 KCals in Coimbatore, 1524 KCals in Erode, 1379 KCals in Tirupur, 1443 KCals in Salem, 1628 KCals in Kottayam, 1849 KCals in Pathanamthitta, 1471 KCals in Allepey and 1525 KCals in Thrissur. The RDA for children in the age group of four to six years being 1350 KCals. Though the protein and fat requirement exceeded the RDA values in all the districts, the iron and calcium requirement did not meet the RDA values of 13mg.

16. Mean Nutrient intake of Selected Subsamples (Girls)

Life cannot be sustained without adequate nourishment. The mean nutrient intake of obese girls in the selected districts of Kerala and Tamil Nadu is depicted in Table XLI.

TABLE XLI

MEAN NUTRIENT INTAKE OF SELECTED SUBSAMPLES – 7-9 YEARS GIRLS (N-400)

States	Districts	Energy (Kcal)			Protein (g)			Fat (g)			Iron (mg)			Calcium (mg)		
		RDA	Total	Diff	RDA	Total	Diff	RDA	Total	Diff	RDA	Total	Diff	RDA	Total	Diff
Tamil Nadu	Coimbatore	1690	1970	+280	29.5	25	-4.5	30	32	+2	16	13	-3	600	600	0
	Erode	1690	1630	-60	29.5	23	-6.5	30	36	+6	16	12	-4	600	600	0
	Tirupur	1690	1742	+50	29.5	26	-3.5	30	35	+5	16	13	-3	600	500	-100
	Salem	1690	1761	+77	29.5	30	+0.5	30	33	+3	16	14	-2	600	600	0
Kerala	Kottayam	1690	1697	+7	29.5	23	-6.5	30	30	0	16	16	0	600	620	+20
	Pathanamthitta	1690	1701	+11	29.5	29	-0.5	30	31	-1	16	13	-3	600	550	-50
	Allepey	1690	1780	+90	29.5	27	-2.5	30	33	+3	16	12	-4	600	600	0
	Thrissur	1690	1761	+71	29.5	25	-405	30	27	-3	16	12	-4	600	600	0

It was clear from the above table that the mean energy intake of selected girl subsamples in the age group of seven to nine years exceeded the Recommended Dietary Allowance (RDA) value of 1691 KCals. It was in the order of 1970 KCal in Coimbatore, 1630 KCals in Erode, 1742 KCals in Tirupur, 1761 KCals in Salem, 1697 KCals in Kottayam, 1701 KCals in Pathanamthitta, 1780 KCals in Allepey and 1761 KCals in Thrissur. The calcium and fat requirement exceeded the RDA value of 600mg and 30g respectively in most of the districts in Kerala and Tamil Nadu. The mean iron intake did not meet the RDA values of 16mg indicating the chance of the subjects to be anaemic. The order of mean iron intake in the selected districts were in the order of 13mg in Coimbatore, 12mg in Erode, 13mg in Tirupur, 14mg in Salem, 16mg in Kottayam, 13mg in Pathanamthitta, 12mg in Allepey and 12mg in Thrissur.

17. Details on Food Allergy

Food allergy is an adverse immune response to a food protein. The details on food allergy were found out and are depicted in Table XLII.

TABLE XLII

DETAILS ON FOOD ALLERGY

States	Districts	Food Allergy			
		Allergic		Non-Allergic	
		No.	%	No.	%
Tamil Nadu	Coimbatore	21	4	479	96
	Erode	42	8	458	92
	Tirupur	27	5	473	95
	Salem	16	3	484	97
Kerala	Kottayam	49	10	451	90
	Pathanamthitta	35	7	465	93
	Allepey	23	5	477	95
	Thrissur	41	8	459	92

It was noted that in Tamil Nadu, four per cent from Coimbatore, eight per cent in Erode, five per cent in Tirupur and three per cent in Salem was allergic to certain food stuff. The common allergens were milk, prawn, crab and egg.

In Kerala, 90 per cent from Kottayam, 93 per cent from Pathanamthitta, 95 per cent from Allepey and 92 per cent from Thrissur did not exhibit any allergic reactions to food. A minor percentage of 10 per cent from Kottayam, seven per cent from Pathanamthitta, five per cent from Allepey and eight per cent Thrissur had food allergy. The allergens were similar in both the states.

D. INFANT NUTRITION AND MATERNAL HEALTH STATUS DURING PREGNANCY

The details regarding nutrition during infancy comprised of birth weight of the subject, birth order, details regarding feeding, duration of breastfeeding, initiation of weaning, duration of weaning, type of foods weaned on, growth pattern during infancy, weight loss during infancy, reasons for weight loss, immunization schedule, visit to a pediatrician and parents opinion on subjects' present nutritional status.

Adequate nutrition before and during pregnancy has a greater potential for a long term health impact. Maternal health is a complex, influenced by various genetic, social and economic factors, infections and environmental conditions, many of which may affect the foetal growth. Complications during pregnancy, weight gain during pregnancy and type of complication experienced was also analyzed.

1. Birth Weight of the Subjects

Birth weight is the body weight of the baby at birth. Table XLIII shows the birth weight of the subjects in selected districts of Kerala and Tamil Nadu.

TABLE XLIII

BIRTH WEIGHT

States	Districts	Birth Weight (kg)					
		< 2.5		2.5-3.5		>3.5	
		No.	%	No.	%	No.	%
Tamil Nadu	Coimbatore	42	8	215	43	243	49
	Erode	97	19	282	56	121	25
	Tirupur	74	15	353	71	73	14
	Salem	56	11	326	65	118	24
Kerala	Kottayam	122	24	257	51	121	25
	Pathanamthitta	62	12	300	60	138	28
	Allepey	111	22	293	59	96	19
	Thrissur	44	9	392	78	64	13

It was noted that in Coimbatore, eight per cent of the subjects had low birth weight (<2.5 kg) and 49 per cent had high birth weight (>3.5 kg). In Erode, 56 per cent of the subjects had normal birth weight. Seventy one per cent of the subjects in Tirupur had normal birth weight and 15 per cent were of low birth weight. In Salem, 24 per cent weighted above normal during birth and 65 per cent had normal weight.

In Kottayam, 51 per cent were of normal birth weight and 24 per cent had low birth weight. Sixty per cent of the subjects in Pathanamthitta had normal birth weight and 28 per cent were of high birth weight. In Allepey, 22 per cent had low birth weight and 59 per cent had normal weight during birth. In Thrissur only nine per cent had low birth weight while 78 per cent had normal birth weight.

Birth weight is positively associated with childhood obesity, with an increased risk of obesity for both the heaviest and highest babies, independent of socio-economic status and gestational age, but may be confounded by maternal weight (Power *et al.*, 2001).

A child's weight may be influenced when he or she is only an infant. Researchers did a cohort study on 10,397 babies, from their birth until age seven and discovered that fat babies at four months were 1.38 times more likely to be overweight at seven years old compared to normal weight babies. Fat babies at the age of one were 1.17 times more likely to be overweight at age seven compared to normal weight babies. High birth weight is associated with increased risk of later obesity (Oken *et al.*, 2003).

2. Birth Order of the Subjects

Birth order is a person's rank by age among his or her siblings. The details regarding the birth order of the subject is depicted in Table XLIV.

TABLE XLIV

BIRTH ORDER OF THE SUBJECTS

States	Districts	Birth Order					
		First		Second		Third	
		No.	%	No.	%	No.	%
Tamil Nadu	Coimbatore	216	43	197	39	87	18
	Erode	114	23	212	42	174	35
	Tirupur	246	49	148	30	106	21
	Salem	312	62	93	19	95	19
Kerala	Kottayam	236	48	167	33	97	19
	Pathanamthitta	224	45	139	28	137	27
	Allepey	96	19	243	49	161	32
	Thrissur	146	29	179	36	175	35

It was observed that in Coimbatore, 43 per cent were the first child in the family, while 18 per cent were the third child. In Erode, 23 per cent and 42 per cent were the first and second child respectively in the family. In Tirupur, the birth order was 49 per cent as first child, 30 per cent as the second one and 21 per cent as the third child in the family. In Salem, when 62 per cent were the first child in the family, 19 per cent each were the second and third child respectively.

In Kottayam, 19 per cent were the third in the family and 48 per cent were the first ones. When 45 per cent of the subjects were first born in the family, 33 per cent were second born. In Allepey, 49 per cent were the second child in the family and 32 per cent were the third child in the family. In Thrissur, 36 per cent and 35 per cent respectively were second and third born in the family.

It has been shown that the birth order of the child may have an effect on childhood obesity (Wang *et al.*, 2007).

3. Feeding Pattern during Infancy

Human breast milk is the healthiest form of milk for babies. Breastfeeding promotes health and helps to prevent diseases. The details regarding the feeding pattern of the new born are depicted in Table XLV and Figure XV.

TABLE XLV

FEEDING PATTERN DURING INFANCY

States	Districts	Feeding Pattern			
		Breast Fed		Bottle Fed	
		No.	%	No.	%
Tamil Nadu	Coimbatore	408	82	92	18
	Erode	484	97	16	3
	Tirupur	471	94	29	6
	Salem	488	98	12	2
	Chi Square – 120.52; df – 3; Sig – **				
Kerala	Kottayam	437	87	63	13
	Pathanamthitta	376	75	124	25
	Allepey	469	94	31	6
	Thrissur	448	89	52	11
	Chi Square – 81.95; df – 3; Sig – **				

**** - Significant at one per cent level**

It was found that when 82 per cent in Coimbatore were breastfed, 18 per cent were bottle fed. In Erode, a majority of 97 per cent were breastfed

and the rest three per cent were bottle fed. When six per cent of the subjects were bottle fed, 94 per cent in Tirupur were breast fed. In Salem, 98 per cent the subjects were breast fed.

In Kerala the percentage of breast fed infants was in the order of 87 per cent in Kottayam, 75 per cent in Pathanamthitta, 94 per cent in Alleypey and 89 per cent in Thrissur. The details regarding bottle fed infants in these districts are 13 per cent in Kottayam, 25 per cent in Pathanamthitta, six per cent in Allepey and 11 per cent in Thrissur. The reasons behind bottle feeding at an earlier state were lack of milk, diseases of mother and work schedule of the mother.

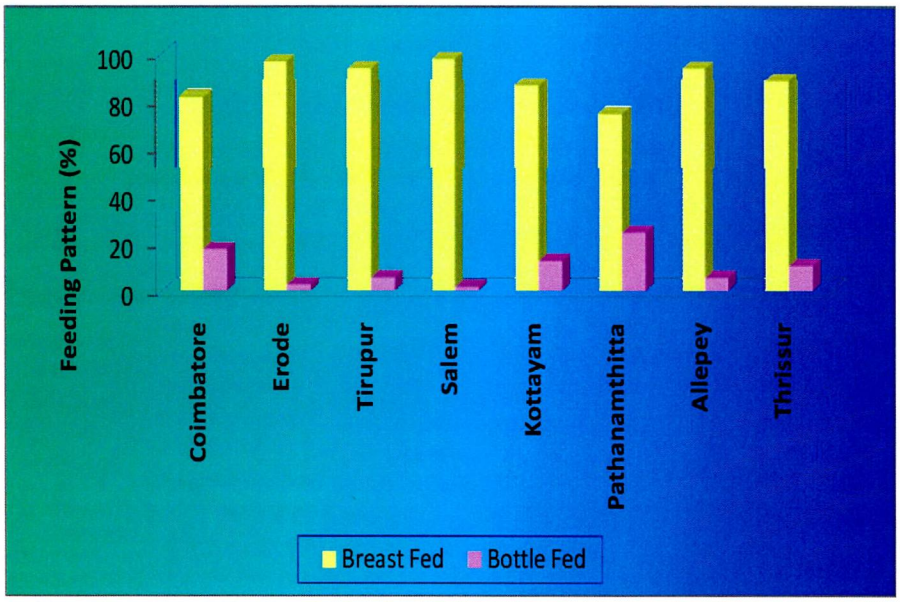


FIGURE XV

FEEDING PATTERN DURING INFANCY

Chi square test was applied to find out the association of childhood obesity with breast feeding. The calculated value of chi square was found to be 120.52 in the districts of Tamil Nadu and 81.95 in the districts of Kerala. The calculated value of chi square was greater than the table value of 11.345 at one per cent level. Since the calculated value was greater than the table

value it was inferred that there is significant relationship between childhood obesity in both the states and breast feeding.

Various developmental factors may affect rates of obesity. Breast-feeding may protect against obesity in later life with the duration of breast-feeding inversely associated with the risk of being overweight later on. Repeated and uncritical offering of a bottle as a method of dealing with a fretful or crying infant may establish a habit that leads the infant to seek food whenever experiencing frustration (Khaleel, 2004).

4. Duration of Breastfeeding

The World Health Organization (WHO) and the American Academy of Pediatrics (AAP) recommend exclusive breastfeeding for the first six months of life and then supplemented breastfeeding for atleast one year and upto two years or more. The details regarding the duration of breastfeeding is presented in Table XLVI and Figure XVI.

TABLE XLVI

DURATION OF BREAST FEEDING

States	Districts	Duration of Months					
		< 6		6-12		>12	
		No.	%	No.	%	No.	%
Tamil Nadu	Coimbatore	121	30	275	67	12	3
	Erode	243	50	169	35	72	15
	Tirupur	217	46	198	42	56	12
	Salem	288	47	148	30	112	23
	Chi Square – 186.04; df – 6; Sig – **						
Kerala	Kottayam	321	73	87	20	29	7
	Pathanamthitta	223	59	106	28	47	13
	Allepey	107	23	291	62	71	15
	Thrissur	149	33	245	55	54	12
	Chi Square – 299.99; df – 6; Sig – **						

**** - Significant at one per cent level**

It was noted that 30 per cent of the subjects in Coimbatore were breast fed only for a duration of less than six months and only three per cent were fed more than a year. In Erode, 35 per cent were breastfed for about six to twelve months, while 50 per cent were breastfed only less than six months. In Tirupur, 46 per cent were breast fed for a duration of less than six months whereas 12 per cent were fed more than a year. Thirty per cent of the subjects in Salem were breast fed for about six to 12 months.

In Kerala, the percentage of subjects who were breast fed for less than six months was 73 per cent in Kottayam, 59 per cent in Pathanamthitta, 23 per cent in Allepey and 33 per cent in Thrissur. Twenty per cent of the subjects in Kottayam, 28 per cent in Pathanamthitta, 62 per cent in Allepey and 55 per cent in Thrissur were breast fed for six to 12 months. A few percent who were breast fed for more than a year was seven per cent from Kottayam, 13 per cent from Pathanamthitta, 15 per cent from Allepey and 23 per cent from Thrissur.

Chi square test was applied to find out the association of childhood obesity with the duration of breast feeding. The calculated value of chi square was found to be 186.04 in the districts of Tamil Nadu and 299.99 in the districts of Kerala. The calculated value of chi square was greater than the table value of 16.812 at one per cent level. Since the calculated value was greater than the table value it was inferred that there is significant relationship between childhood obesity in both the states and the duration of breast feeding.

Exclusive breast-feeding is recommended in all newborn infants for its nutritional and other beneficial effects. It may also protect against obesity in later life. Mothers who breastfed their infants for six months or longer were less likely to restrict their child's food intake when they were one year old. There was no relationship between breastfeeding and mother's pressuring their one year old child to eat more. This may be one factor related to decreased obesity in later life in breastfed infants (Taveras, 2004).

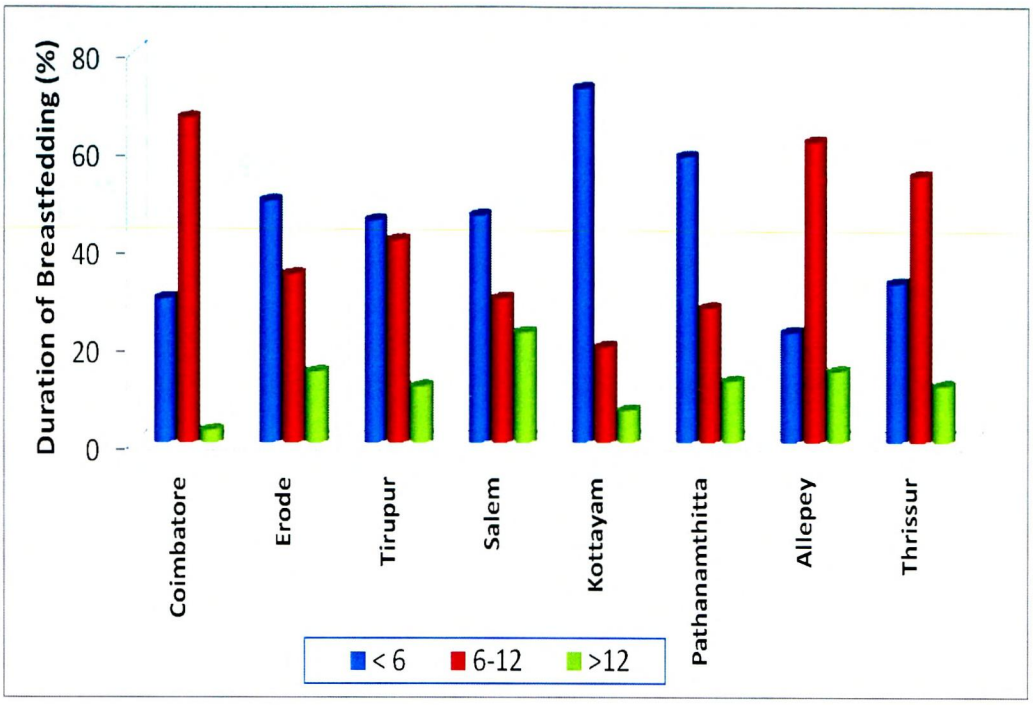


FIGURE XVI

DURATION OF BREAST FEEDING

5. Initiation of Weaning

Weaning is the process of gradually introducing an adult diet and reducing the supply of breast milk, at around six months. The details regarding the initiation of weaning are presented in Table XLVII.

TABLE XLVII

INITIATION OF WEANING

States	Districts	Initiation of Weaning in Months					
		< 4		4-6		>6	
		No.	%	No.	%	No.	%
Tamil Nadu	Coimbatore	226	45	76	15	198	40
	Erode	271	54	117	23	112	23
	Tirupur	122	24	72	14	306	62
	Salem	233	47	164	33	103	20
	Chi Square – 257.78; df – 6; Sig – **						
Kerala	Kottayam	264	53	83	17	153	30
	Pathanamthitta	312	62	126	25	62	13
	Allepey	156	31	103	21	241	48
	Thrissur	179	36	69	14	252	50
	Chi Square – 222.23; df – 6; Sig – **						

**** - Significant at one per cent level**

It was noted that 45 per cent from Coimbatore, 54 per cent in Erode, 24 per cent in Tirupur and 47 per cent in Salem were weaned when the subjects were less than four months. The weaning was started from the 6th month for 40 per cent of subjects in Coimbatore, 23 per cent Erode, 62 per cent in Tirupur and 20 per cent in Salem.

In Kerala, it was noted that for 17 per cent of the subjects in Kottayam, 25 per cent in Pathanamthitta, 21 per cent in Allepey and 14 per cent in Thrissur the weaned foods were introduced between the fourth and sixth months. It was also obvious that 53 per cent in Kottayam, 62 per cent in Pathanamthitta, 31 per cent in Allepey and 36 per cent in Thrissur initiated the weaning period in less than four months.

Chi square test was applied to find out the association of childhood obesity with the weaning period. The calculated value of chi square was found to be 257.78 in the districts of Tamil Nadu and 222.23 in the districts of Kerala. The calculated value of chi square was greater than the table value of

16.812 at one per cent level. Since the calculated value was greater than the table value it was inferred that there is significant relationship between childhood obesity in both the states and the weaning period.

First week of weaning should be from the sixth month of a child's life but unfortunately children are being weaned as early as 12 weeks (Paw, 2007).

6. Duration of Weaning

While weaning soft food is introduced to a baby's diet, along with breast milk. The duration of weaning process is depicted in Table XLVIII.

TABLE XLVIII

DURATION OF WEANING

States	Districts	Duration of Years					
		Till 1st Year		Till 1½ Years		Till 2 Year	
		No.	%	No.	%	No.	%
Tamil Nadu	Coimbatore	146	29	137	27	217	44
	Erode	158	32	166	33	176	35
	Tirupur	131	26	180	36	189	38
	Salem	127	25	230	46	143	29
Kerala	Kottayam	58	12	321	64	121	24
	Pathanamthitta	129	26	164	33	207	41
	Allepey	87	17	290	58	123	25
	Thrissur	121	24	271	54	108	22

It was clear that in Coimbatore, 29 per cent were weaned till one year and 44 per cent till two years. In Erode, 32 per cent and 33 per cent respectively were weaned till one year and one-and-a-half years. Thirty eight per cent from Tirupur were weaned till two years while 26 per cent were weaned till a year. In Salem, 46 per cent were weaned till one and a half years and 29 per cent were weaned till two years.

In Kottayam, 12 per cent were weaned till one year and 24 per cent till two years. The duration of weaning in Pathanamthitta district were in the order of 26 per cent till first year, 33 per cent till one and a half years and 41 per cent till two years. In Allepey, 58 per cent were weaned till one and a half years and 25 per cent were weaned till two years. In Thrissur, 54 per cent and 24 per cent were weaned for a duration of one and a half years and one year respectively.

7. Type of Food Weaned during Infancy

Soft food such as mashed fruits and vegetables or masticated foods is introduced to the babies at the early stage of weaning. The details regarding the type of food weaned during infancy is presented in Table XLIX.

TABLE XLIX

TYPE OF WEANING FOOD

States	Districts	Product							
		Commercial		Home made		Regular Home Diet		Special Feeds	
		No.	%	No.	%	No.	%	No.	%
Tamil Nadu	Coimbatore	316	63	111	22	73	15	-	-
	Erode	263	53	128	26	47	9	62	12
	Tirupur	291	58	103	21	59	12	47	9
	Salem	326	65	76	15	25	5	73	15
Kerala	Kottayam	417	83	29	6	54	11	-	-
	Pathanamthitta	407	81	38	8	55	11	-	-
	Allepey	312	63	47	9	62	12	79	16
	Thrissur	309	62	66	13	125	25	-	-

It was clear that 63 per cent from Coimbatore were weaned on commercial foods while 15 per cent were fed on regular home diets. Twenty six per cent from Erode were weaned on homemade cereal pulse products while 53 per cent were fed with marketed tin foods. In Tirupur, 12 per cent were weaned with regular home diets while nine per cent were fed with

special feeds. Sixty five per cent of the subjects in Salem were fed with commercial food stuff while 21 per cent were weaned on homemade products.

In Kottayam, 83 per cent were fed with commercial products while 11 per cent were weaned on regular home diets. Eighty one per cent in Pathanamthitta were fed on tinned food available in the market, while eight per cent were weaned on homemade products. In Allepey, 16 per cent were fed on special feeds during weaning and eight per cent were fed with homemade products. The type of weaned food used by the subjects of Thrissur district were 62 per cent on commercial food products, 13 per cent on homemade products and 25 per cent on regular home diets. The special feeds used for weaning were Amirtham food supplement.

Infants have a preference for sweet and salty tastes and concern has been expressed that early introduction of sweetened beverages and high fat or sweet foods to infants may be major contributors to childhood obesity (Sneddon, 2008).

8. Growth Pattern during Infancy

Variations from the usual pattern of growth will occur during childhood. The details regarding growth pattern during infancy is presented in Table L.

TABLE L

GROWTH PATTERN

States	Districts	Growth Pattern			
		Steady		Not Steady	
		No.	%	No.	%
Tamil Nadu	Coimbatore	133	27	367	73
	Erode	257	51	243	49
	Tirupur	324	65	176	35
	Salem	157	31	343	69
Kerala	Kottayam	394	79	106	21
	Pathanamthitta	61	12	439	88
	Allepey	124	25	376	75
	Thrissur	305	61	195	39

When 27 per cent of the subjects in Coimbatore had a steady growth pattern during infancy, 73 per cent did not had a steady growth. In Erode, 51 per cent had a good growth pattern while in Tirupur 65 per cent showed a steady growth pattern. In Salem, 31 per cent exhibited a steady growth while 69 per cent had a retarded growth during infancy.

In Kerala, 79 per cent from Kottayam, 12 per cent from Pathanamthitta, 25 per cent from Allepey and 61 per cent from Thrissur exhibited a steady growth pattern during infancy. The growth pattern was decelerated for 21 per cent in Kottayam, 88 per cent in Pathanamthitta, 75 per cent in Allepey and 39 per cent in Thrissur during infancy. Since the growth pattern was not steady during infancy the mothers of the subjects agreed that the subjects were fed on calorie dense foods with pressure.

9. Weight Loss During Infancy

Weight loss is the reduction in the total body mass. The details regarding weight loss during infancy were elicited from the mothers and are presented in Table LI.

TABLE LI

WEIGHT LOSS DURING INFANCY

States	Districts	Experienced any Weight Loss			
		Yes		No	
		No.	%	No.	%
Tamil Nadu	Coimbatore	312	62	188	38
	Erode	226	45	274	55
	Tirupur	179	36	321	64
	Salem	295	59	205	41
Kerala	Kottayam	276	55	224	45
	Pathanamthitta	244	49	256	51
	Allepey	127	25	373	75
	Thrissur	183	37	317	63

It was noted that 62 per cent from Coimbatore, 45 per cent from Erode, 36 per cent from Tirupur and 59 per cent from Salem lost the weight during infancy.

In Kerala, it was found that 55 per cent in Kottayam, 49 per cent in Pathanamthitta, 25 per cent in Allepey and 37 per cent in Thrissur experienced weight loss during infancy. The mothers recalled that the subjects were more prone to communicable diseases during infancy, which resulted in weight loss.

Post natal rapid weight gain has been suggested to as a risk factor for later obesity (Kamanika *et al.*, 2003).

10. Reasons for Weight Loss

Weight loss can occur due to an underlying disease. The reasons for weight loss were found to be infections, fever, measles and chicken pox. These details are presented in Table LII.

TABLE LII

REASON FOR WEIGHT LOSS

States	Districts	Reasons							
		Infections		Measies		Chicken Pox		Fever	
		No.	%	No.	%	No.	%	No.	%
Tamil Nadu	Coimbatore	76	24	48	15	26	8	163	53
	Erode	43	19	9	4	17	8	157	69
	Tirupur	36	20	-	-	31	17	112	63
	Salem	112	38	6	2	29	10	148	50
Kerala	Kottayam	47	17	-	-	56	20	173	63
	Pathanamthitta	109	45	2	-	27	11	106	44
	Allepey	56	44	-	-	32	25	39	31
	Thrissur	61	33	-	-	12	7	110	60

From Table LII, it was clear that many subjects experienced weight loss during infancy. It was noted that in Coimbatore 24 per cent claimed infections and 53 per cent claimed fever as the reason for weight loss. In Erode, 19 per cent had infections and eight per cent had chicken pox, which was believed to be the reasons for weight loss. The reasons for weight loss listed by the mothers of the Tirupur subjects were 20 per cent for infections, 17 per cent for chicken pox and 63 per cent for fever. In Salem, 50 per cent of the subjects experienced weight loss because of fever.

In Kottayam, 63 per cent claimed fever and 17 per cent claimed infections as the reason for weight loss during infancy. Forty five per cent and 44 per cent of the subjects in Pathanamthitta had infections and fever during infancy. The reasons for weight loss in Allepey district were found to be 44 per cent as a result of infections, chicken pox resulted in weight loss for 25 per cent and 31 per cent lost weight as the result of fever. Sixty per cent of the mothers in Thrissur claimed that the subjects lost weight during infancy because of fever. Since weight was loss during infancy a good effort was taken from the mother's side to make up the loss.

11. Immunization Schedule

Immunization is the process by which an individual's immune systems become fortified against an agent. Table LIII gives the immunization schedule of the subjects is selected districts of Kerala and Tamil Nadu.

TABLE LIII

IMMUNIZATION SCHEDULE

States	Districts	Immunization Schedule			
		Regular		Irregular	
		No.	%	No.	%
Tamil Nadu	Coimbatore	500	100	-	-
	Erode	491	98	9	2
	Tirupur	482	96	18	4
	Salem	500	100	-	-
Kerala	Kottayam	500	100	-	-
	Pathanamthitta	500	100	-	-
	Allepey	496	99	4	1
	Thrissur	500	100	-	-

All the subjects in Coimbatore, Salem, Kottayam, Pathanamthitta and Thrissur were immunized regularly. In Erode, two per cent and in Tirupur four per cent of the subjects missed certain vaccines. In Allepey, one per cent of the subjects were not immunized regularly. The vaccines missed were the oral polio vaccine and the booster dose of DPT vaccine. For two subjects in Tirupur the Nacillus Calmette Guerin (BGC) vaccine was not taken because of the very low birth weight.

12. Visit to Paediatrician

Paediatrics is a branch of medicine that deals with the medical care of infants, children and adolescents. A medical practitioner who specializes in this area is known as a pediatrician. The subjects' visits to a pediatrician were elicited and are presented in Table LIV.

TABLE LIV

VISIT TO A PAEDIATRICIAN

States	Districts	Occasion					
		Once in a Month		Once in Three Months		Only During Illness	
		No.	%	No.	%	No.	%
Tamil Nadu	Coimbatore	26	5	165	33	309	62
	Erode	217	43	155	31	128	26
	Tirupur	74	15	240	48	186	37
	Salem	63	13	110	22	327	65
Kerala	Kottayam	39	8	331	66	130	26
	Pathanamthitta	92	18	184	37	224	45
	Allepey	47	10	22	4	431	86
	Thrissur	85	17	158	32	257	51

A good percentage went to a doctor only during illness. It was in the order of 62 per cent in Coimbatore, 26 per cent in Erode, 37 per cent in Tirupur and 65 per cent in Salem. It was also interesting to note that five per cent from Coimbatore, 43 per cent from Erode, 15 per cent from Tirupur and 13 per cent from Salem visited a pediatrician once in every one month to ensure steady growth pattern. Thirty three per cent from Coimbatore, 31 per cent from Erode, 48 per cent from Tirupur and 22 per cent from Salem went to hospital once in every three months.

In Kottayam, eight per cent in Pathanamthitta, 18 per cent in Allepey, 10 per cent and in Thrissur 17 per cent of the subjects visited a pediatrician once in every month. Visits to hospital were during illness for 26 per cent of subjects in Kottayam, 45 per cent in Pathanamthitta, 86 per cent in Allepey and 51 per cent in Thrissur. Sixty six per cent from Kottayam, 37 per cent from Pathanamthitta, four per cent from Allepey and 32 per cent from Thrissur were regular to hospital in every three months.

13. Parents Opinion on the Subjects' Present Nutritional Status

In the earlier days fat and chubby child was only considered to be healthy. Some of the parents still had the same opinion. The parents were asked to rate the child on the basis of body fat. Only those children whose Body Mass Index (BMI) were greater than 95th percentile falling under obese category were selected for the present study. Still the parent's opinion on the subjects' present nutritional status was analyzed and is presented in Table LV.

TABLE LV

PARENTS OPINION ON SUBJECTS PRESENT NUTRITIONAL STATUS

States	Districts	Opinion									
		Excellent		Good		Over weight		Under weight		No Idea	
		No.	%	No.	%	No.	%	No.	%	No.	%
Tamil Nadu	Coimbatore	160	32	214	43	126	25	-	-	-	-
	Erode	133	27	264	53	74	15	-	-	29	5
	Tirupur	74	15	327	65	67	14	-	-	32	6
	Salem	35	7	416	83	49	10	-	-	-	-
Kerala	Kottayam	67	13	347	69	86	18	-	-	-	-
	Pathanamthitta	69	14	369	74	62	12	-	-	-	-
	Allepey	61	12	309	62	106	22	-	-	24	4
	Thrissur	67	13	344	69	89	18	-	-	-	-

It was noted that only 25 per cent from Coimbatore, 15 per cent from Erode, 14 per cent from Tirupur and 10 per cent from Salem agreed that the subject was over weight. Most of the parents were of the misconception that the subjects' weight status was excellent. It was 32 per cent in Coimbatore, 27 per cent in Erode, 15 per cent in Tirupur and seven per cent in Salem. Five per cent of the parents from Erode and six per cent from Tirupur had no idea on the nutritional status of the subjects.

In Kerala, only 18 per cent of the parents from Kottayam, 12 per cent from Pathanamthitta, 22 per cent from Allepey and 18 per cent from Thrissur admitted that their children were overweight. Four per cent of the parents from Allepey had no idea on the present weight status of the subjects. Sixty nine per cent of the parents from Kottayam, 74 per cent from Pathanamthitta, 62 per cent from Allepey and 69 per cent from Thrissur claimed that the subjects' weight status was good enough.

Brug (2007) is of the opinion that there is a general misconception in parents in India and other developing countries that an obese child is a healthy child. An that if the child is fat, "baby fat" will go away with time. In an effort to keep child "healthy", he or she is fed in excess. Many of these children remain obese for life.

A survey carried out by the American Obesity Association into parental attitudes towards their children's weight showed the majority of parents think that recess should not be reduced or replaced. Thirty per cent expressed that they were concerned with their child's weight, 35 per cent of the parents though that their child's school was not teaching them enough about childhood obesity and over five per cent through that childhood obesity was the greatest risk to their child's among long term health (Mechelen, 2007).

14. Complications during Pregnancy

Complications during pregnancy deals with the symptoms and problems that is associated with pregnancy. A woman who has been well-nourished before conception begins her pregnancy with reserves of several nutrients so that the needs of the growing foetus can be met without affecting her health. Infants, who are well-nourished in the womb, have an enhanced chance of entering life in good physical and mental health (Srilakshmi, 2004). A good percentage of the mothers experienced certain complications during pregnancy. The details were elicited and are given in Table LVI.

TABLE LVI

COMPLICATIONS DURING PREGNANCY

States	Districts	Details Regarding Pregnancy			
		Complications		No Complications	
		No.	%	No.	%
Tamil Nadu	Coimbatore	416	83	84	17
	Erode	329	66	171	34
	Tirupur	240	48	260	52
	Salem	439	88	61	12
Kerala	Kottayam	394	79	106	21
	Pathanamthitta	319	64	181	36
	Allepey	224	45	276	55
	Thrissur	243	69	157	31

It was clear that 83 per cent the mothers in Coimbatore, 66 per cent in Erode, 48 per cent in Tirurpur, 88 per cent in Salem had complication during gestational period. In Kerala, 79 per cent of the mothers in Kottayam, 64 per cent in Pathanamthitta, 45 per cent in Allepey and 69 per cent in Thrissur had complications during pregnancy.

15. Type of Complication Experienced during Pregnancy

The type of complications experienced during pregnancy is categorized as routine problems and serious problems. The details regarding the type of complications experienced by the mothers during pregnancy are depicted in Table LVII.

TABLE LVII

TYPE OF COMPLICATIONS

States	N	Districts	Type of Complications Experienced													
			Stress		Anemia		Hypertension		Diabetes		Overweight		Underweight		Oedema	
			No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Tamil Nadu	416	Coimbatore	118	28	-	-	26	6	209	50	17	4	-	-	46	12
	329	Erode	46	14	42	13	34	10	147	45	21	6	-	-	39	12
	240	Tirupur	19	8	27	11	21	9	126	53	14	6	12	5	21	8
	439	Salem	172	39	112	26	27	6	74	17	12	3	-	-	42	9
Kerala	394	Kottayam	125	32	13	3	48	12	95	24	32	8	-	-	81	21
	319	Pathanamthitta	109	34	17	5	45	14	83	26	31	10	-	-	34	11
	224	Allepey	35	16	42	19	14	6	59	26	18	8	27	12	29	13
	343	Thrissur	152	45	15	4	29	8	63	19	29	8	22	6	33	10

It was noted that 28 per cent in Coimbatore had stress and 50 per cent had gestational diabetes. In Erode, 12 per cent had oedema at extremes, 13 per cent were anaemic and six per cent were overweight. Fifty three per cent of the mothers in Tirupur had diabetes during pregnancy and nine per cent experienced hypertension. In Salem, nine per cent had oedema, 17 per cent were diabetic and 39 per cent experienced stress during pregnancy.

The type of complications experienced by the mothers of Kottayam district was in the order of 32 per cent for stress, three per cent for anemia, 12 per cent for blood pressure, 24 per cent for gestational diabetes, eight per cent for overweight and 21 per cent for oedema. In Pathanamthitta, 10 per cent of the mothers were overweight, 14 per cent had hypertension and 34 per cent had stress. Twelve per cent of the mothers in Allepey district were underweight, 19 per cent were anemic and 13 per cent had oedema at extremes. In Thrissur, 45 per cent experienced stress, eight per cent had high blood pressure and six per cent were underweight during pregnancy.

The nutritional complication anaemia resulting mainly from iron deficiency, makes people unusually weak and results in low productivity. Anaemia was found to affect 43 per cent married women, 30 per cent pregnant women and 19 per cent men aged between 15-49 years in the capital. As many as 35.4 per cent children under the age of three had stunted (low height-for-age) growth, 15.5 per cent were wasted (low weight-for-height) and 33.1 per cent overweight or obese (Mansil, 2006).

16. Weight Gain during Pregnancy

The final weight gain takes place in the third trimester of pregnancy. During pregnancy insufficient or excessive weight gain can compromise the health status of mothers and foetus. All women are encouraged to choose a healthy diet regardless of pre-pregnancy weight. The details regarding the weight gain of the mothers during pregnancy were elicited and are presented in Table LVIII.

TABLE LVIII

WEIGHT GAIN DURING PREGNANCY

States	Districts	Weight Gain in Kilograms					
		+10-12		+12-20		+20-25	
		No.	%	No.	%	No.	%
Tamil Nadu	Coimbatore	93	19	306	61	101	20
	Erode	146	29	241	48	113	23
	Tirupur	122	24	212	42	166	34
	Salem	88	18	317	63	95	19
Kerala	Kottayam	67	13	304	61	129	26
	Pathanamthitta	122	24	283	57	95	19
	Allepey	147	29	349	70	4	1
	Thrissur	69	14	326	66	105	20

It was noted that in Coimbatore 61 per cent of the mothers had +12 to 20 kilograms increase in the body weight and 19 per cent had +10 to 12 kilograms rise. In Erode, 23 per cent experienced an increase of about +20 to 25 kilograms during pregnancy. Forty two per cent of the mothers in Tirupur had +12 to 20 kilograms increase in the body weight. Those mothers selected in Salem, had a weight gain during pregnancy which was in the order of 18 per cent for +10 to 12 kilograms, 63 per cent for +12 to 20 kilograms and 19 per cent for +20 to 25 kilograms.

In Kottayam, 61 per cent and in Pathanamthitta, 57 per cent of the mothers had a weight gain of +12 to 20 kilograms during pregnancy. Nineteen per cent of the mothers in Pathanamthitta had an increase of +20 to 25 kilograms in the body weight. The weight gain of mothers during pregnancy in Allepey district was in the order of 29 per cent for +10 to 12 kilograms raise, 70 per cent for +12 to 20 kilograms rise and one per cent for +20-25 kilograms rise in the body weight. In Thrissur, it was noted that 66 per cent and 20 per cent of the mothers experienced a weight gain of +12 to 20 kilograms and +12 to 25 kilograms rise respectively in the body weight during pregnancy.

E. ASSESSMENT OF RISK FACTORS FOR CHILDHOOD OBESITY

The risk factors that were assessed for childhood obesity included lifestyle patterns, dietary practices, area of residence, type of house, socio-economic status, space allocation in the school, tuition classes, duration of tuition classes, physical activity, type of physical activity involved, family history of obesity, subjects relation to the family members with obesity, gestational diabeties of the mother, details on parenthood, working details of parent and details on maternal smoking during pregnancy.

1. Area of Residence

The urban area is characterized by higher population density and vast human features in comparison to the areas surrounding it. Areas that are not urbanized having low population density and typically much of the land devoted to agriculture is categorized as rural. The area of residence of the subjects in the selected districts of Kerala and Tamil Nadu were elicited and is presented in Table LIX and Figure XVII.

TABLE LIX

AREA OF RESIDENCE

States	Districts	Residential Area					
		Urban		Suburban		Rural	
		No.	%	No.	%	No.	%
Tamil Nadu	Coimbatore	316	63	112	22	72	15
	Erode	412	82	27	6	61	12
	Tirupur	43	9	366	73	91	18
	Salem	63	12	419	84	18	4
	Chi Square – 1007.73; df – 6; Sig – **						
Kerala	Kottayam	361	72	60	12	79	16
	Pathanamthitta	386	77	51	10	63	13
	Allepey	37	7	374	75	89	18
	Thrissur	401	80	58	12	41	8
	Chi Square – 882.46; df – 6; Sig – **						

**** - Significant at one per cent level**

It was clear that in Coimbatore, 63 per cent resided in an urban area and 22 per cent in a sub-urban area. Twelve per cent from Erode resided in a rural area whereas 82 per cent were from urban area. In Tirupur, 73 per cent resided in a suburban area and 18 per cent in a rural area. In Salem, 12 per cent resided in an urban area and 84 per cent were from a suburban area.

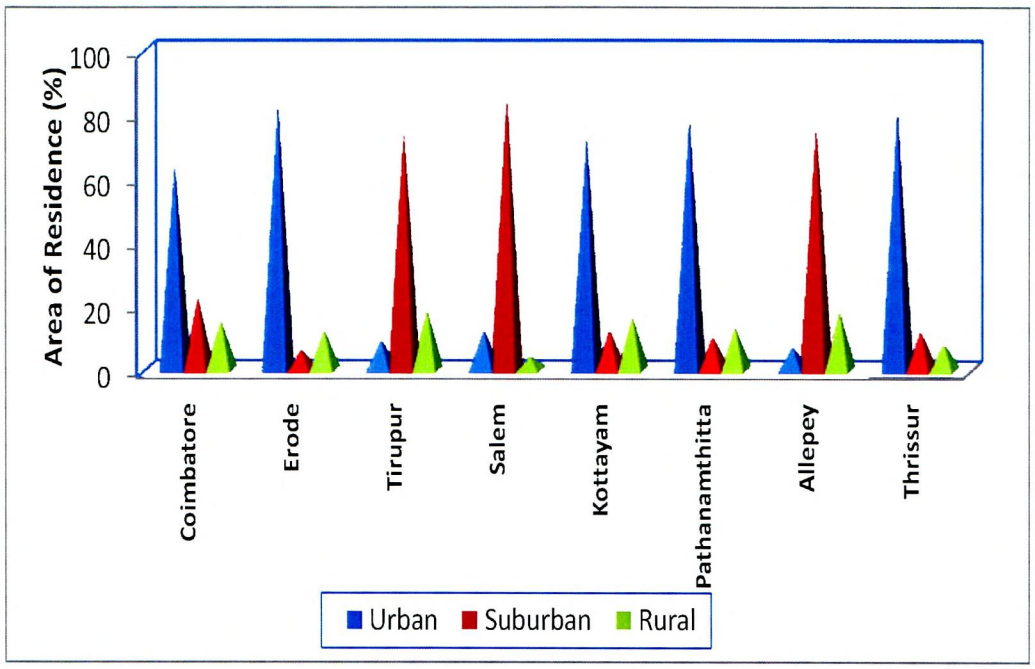


FIGURE XVII

AREA OF RESIDENCE

In Kerala, 72 per cent from Kottayam district resided in an urban area and 16 per cent were from rural area. The area of residence in Pathanamthitta was in the order of 77 per cent in urban area, ten per cent in suburban area and 13 per cent in rural area. In Allepey when 75 per cent resided in a suburban area, 18 per cent were from rural area. Eighty per cent of subjects in Thrissur district resided in an urban area and eight per cent were from a rural area.

Chi square test was applied to find out the association of childhood obesity with the area of residence. The calculated value of chi square was found to be 1007.73 in the districts of Tamil Nadu and 882.46 in the districts of Kerala. The calculated value of chi square was greater than the table value of

16.812 at one per cent level. Since the calculated value was greater than the table value it was inferred that there is significant relationship between childhood obesity in both the states and the area of residence.

The rapid progress of urbanization and demographic trends is associated with a cluster of unhealthy lifestyle. Sedentary activities and consumption of calorie-dense foods of low nutritional value might be the most important etiological factors responsible for very high rate of childhood overweight in developing nations (Missha, 2002).

It was found that the level of obesity was higher in public school students than the government school students. Kids have become more conscious of the body image and obesity might make child withdraw from the outside world (Ray, 2010).

The results of the areawise comparison between boys and girls indicated that in rural area the rate of underweight was higher when compared to overweight and obesity respectively (Geetha, 2003).

2. Type of House

The factor of consideration in the present stage was the free space allotted for each house. In flat, the space is limited and a common playground for all the members in the particular apartment is found rarely. In an individual house or villas some space will be kept aside for courtyard which promotes the free movement of the child. Table LX and Figure XVIII deal with the type of house in which the subjects from the selected districts of Kerala and Tamil Nadu were residing and the space allocation for each home was analyzed.

TABLE LX

TYPE OF HOUSE

States	Districts	House Type			
		Flat		Individual House	
		No.	%	No.	%
Tamil Nadu	Coimbatore	386	77	114	23
	Erode	212	42	288	58
	Tirupur	116	23	384	77
	Salem	241	48	259	52
	Chi Square – 300.37; df – 3; Sig – **				
Kerala	Kottayam	139	28	361	72
	Pathanamthitta	391	78	109	22
	Allepey	82	16	418	84
	Thrissur	224	45	276	55
	Chi Square – 477.05; df – 3; Sig – **				

**** - Significant at one per cent level**

It was observed that 77 per cent from Coimbatore, 42 per cent from Erode, 23 per cent from Tirupur and 48 per cent from Salem resided in apartments or flats where the individual space allotted for a family was less. Twenty three per cent from Coimbatore, 58 per cent from Erode, 77 per cent from Tirupur and 52 per cent from Salem had individual house or villas in which they were residing.

In Kerala, 72 per cent from Kottayam, 22 per cent from Pathanamthitta, 84 per cent Allepey and 55 per cent from Thrissur possess individual house with a courtyard. It was observed that 28 per cent from Kottayam, 78 per cent from Pathanamthitta, 16 per cent from Allepey and 45 per cent from Thrissur resided in flats or apartments.

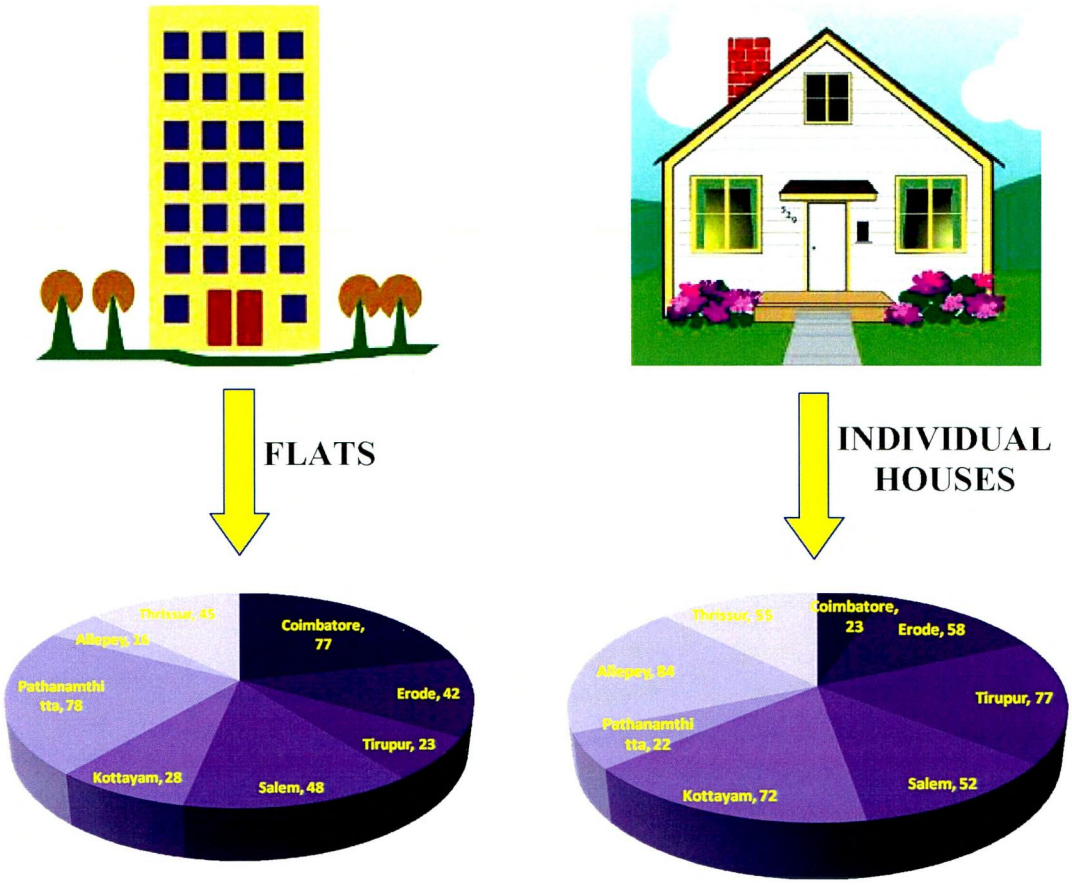


FIGURE XVIII

TYPE OF HOUSE

Chi square test was applied to find out the association of childhood obesity with the type of house. The calculated value of bvchi square was found to be 300.37 in the districts of Tamil Nadu and 447.05 in the districts of Kerala. The calculated value of chi square was greater than the table value of 11.345 at one per cent level. Since the calculated value was greater than the table value it was inferred that there is significant relationship between childhood obesity in both the states and the type of house.

The lack of appropriate play area and limited open space around home makes it difficult for children to stay physically active (Chowdthari, 2009). Numerous environmental factors that facilitate or limit physical activities have been identified. Urban housing design and land use influence the physical activity of the residents of that area (Lakshman, 2006).

3. Socio-Economic Status

Socio-economic status is one economic and socio-logical combined total measure of a person's work experience and of an individuals or family's economic and social position relative to others based on income, education and occupation. Table LXI and Figure XIX depict the socio-economic status of all the subjects in the selected districts of Kerala and Tamil Nadu.

TABLE LXI

SOCIO-ECONOMIC STATUS

States	Districts	Socio-Economic Status					
		High		Middle		Low	
		No.	%	No.	%	No.	%
Tamil Nadu	Coimbatore	316	63	184	37	-	-
	Erode	297	59	203	41	-	-
	Tirupur	168	34	332	66	-	-
	Salem	321	64	179	36	-	-
	Chi Square – 327.69; df – 6; Sig – **						
Kerala	Kottayam	307	61	193	39	-	-
	Pathanamthitta	269	54	231	46	-	-
	Allepey	364	73	136	27	-	-
	Thrissur	343	69	157	31	-	-
	Chi Square – 99.54; df – 6; Sig – **						

**** - Significant at one per cent level**

It was observed that, 63 per cent from Coimbatore, 59 per cent from Erode, 34 per cent from Tirupur, 64 per cent from Salem, 61 per cent from Kottayam, 54 per cent from Pathanamthitta, 73 per cent from Allepey and 69 per cent from Thrissur were from affluent families and had a high socioeconomic status. The socio-economic status was medium for 37 per cent from Coimbatore, 41 per cent from Erode, 66 per cent from Tirupur, 36 per cent from Salem, 39 per cent from Kottayam, 46 per cent from Pathanamthitta, 27 per cent from Allepey and 31 per cent from Thrissur

district. It was also clear that none of the subjects had a low socio-economic status.

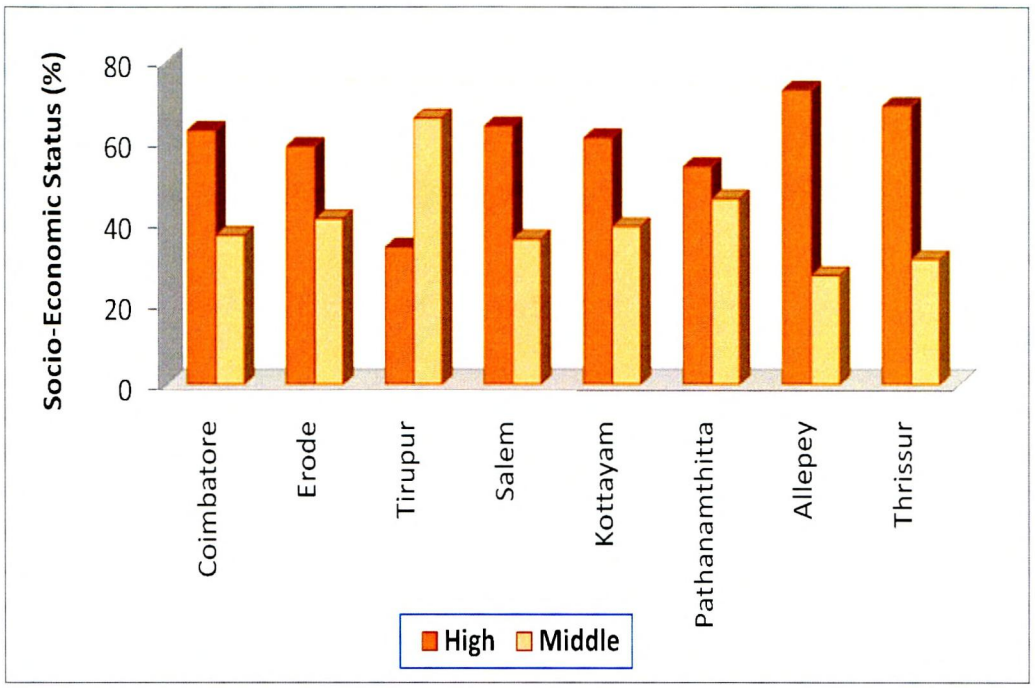


FIGURE XIX
SOCIO-ECONOMIC STATUS

Chi square test was applied to find out the association of childhood obesity with the socio-economic status. The calculated value of chi square was found to be 327.69 in the districts of Tamil Nadu and 99.54 in the districts of Kerala. The calculated value of chi square was greater than the table value of 16.812 at one per cent level. Since the calculated value was greater than the table value it was inferred that there is significant relationship between childhood obesity in both the states and the socio-economic status.

Socio Economic Status (SES) is linked to adiposity but the relationship is complex and varies with age, population, sex, ethinicity and the type of adiposity indicator. A recent review of cross-sectional studies published between 1990 and 2005 found that Socio Economic Status (SES) was inversely associated with children's overweight or obesity in 42 per cent of the reviewed studies, with another 31 per cent reporting a mixture of inverse and no associations (Kalighadi, 2007).

Technological activities are not the only household influences of childhood obesity. Over a three week period researchers studied the relationship of socioeconomic status to body composition in 194 children, ages 11 to 12. They measured weight, waist gith, stretch stature, skinfolds, physical activity, television viewing and Socio Economic Status (SES); researchers discovered Socio Economic Status (SES) inclines to upper class children compared to the lower class children (Wardle, 2006).

4. Type of School

On the basis of space allocated for playground in the schools, the schools of the subjects were categorized as obseogenic-with less space for playground and non-obesogenic with surplus playground. It was observed that most schools do not have playgrounds and the games classes have been replaced by additional extra classes. These details are depicted in Table LXII and also in Figure XX. The details were elicited from the mothers of the subjects.

TABLE LXII

SCHOOL TYPE

States	Districts	Type			
		Obesogenic		Non-Obesogenic	
		No.	%	No.	%
Tamil Nadu	Coimbatore	367	73	133	27
	Erode	256	51	244	49
	Tirupur	297	59	203	41
	Salem	128	26	372	74
	Chi Square – 242.49; df – 3; Sig – **				
Kerala	Kottayam	129	26	371	74
	Pathanamthitta	263	53	237	47
	Allepey	112	22	388	78
	Thrissur	179	36	321	64
	Chi Square – 122.49; df – 3; Sig – **				

**** - Significant at one per cent level**

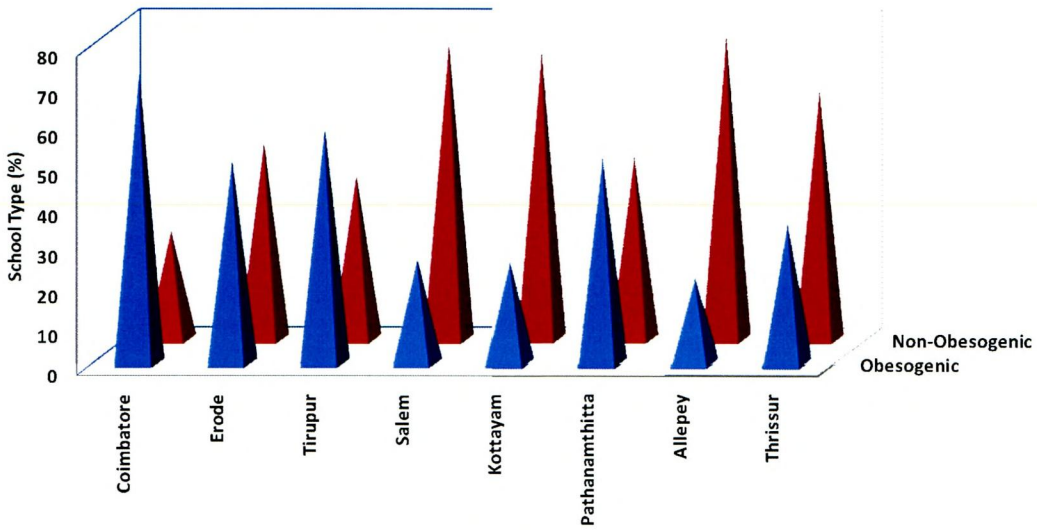


FIGURE XX

SCHOOL TYPE

In Coimbatore, when 73 per cent of the subjects' mother claimed that the school was obesogenic, it was only 51 in Erode. When 41 per cent from Tirupur said that the school was non-obesogenic, it was 74 per cent from Salem district.

It was noted that in Kerala, 26 per cent from Kottayam, 53 per cent from Pathanamthitta, 22 per cent from Allepey and 36 per cent from Thrissur claimed that the school was obesogenic with less space for playground. But 74 per cent from Kottayam, 47 per cent from Pathanamthitta, 78 per cent from Allepey and 64 per cent from Thrissur were of the opinion that the school had enough place for playgrounds.

Chi square test was applied to find out the association of childhood obesity with the school type. The calculated value of chi square was found to be 242.49 in the districts of Tamil Nadu and 122.49 in the districts of Kerala. The calculated value of chi square was greater than the table value of 11.345 at one per cent level. Since the calculated value was greater than the table value it was inferred that there is significant relationship between childhood obesity in both the states and the school type.

Changes in environmental and societal factors are likely the main explanation for doubling of severe childhood obesity over the last 30 years. Obesity is encouraged by such "obesogenic environment" conditions that promote overeating and inactivity either are already present or emerging in most population (Broderson, 2006).

5. Details on having Tuition

Children go to tuition classes for various reasons like to improve grades and to get assisted for children with special needs. Tuitions right from nursing levels leads to less time spent in outdoor activities. The details regarding tuition classes were elicited and are presented in Table LXIII and Figure XXI.

TABLE LXIII

DETAILS ON HAVING TUITIONS

States	Districts	Tuitions Class			
		Do Have		Do Not Have	
		No.	%	No.	%
Tamil Nadu	Coimbatore	229	46	271	54
	Erode	361	72	139	28
	Tirupur	402	80	98	20
	Salem	297	59	203	41
	Chi Square – 150.09; df – 3; Sig – **				
Kerala	Kottayam	256	51	244	49
	Pathanamthitta	327	65	173	35
	Allepey	406	81	94	19
	Thrissur	342	68	158	32
	Chi Square – 102.19; df – 3; Sig – **				

**** - Significant at one per cent level**

It was clear that in Tamil Nadu, 46 per cent from Coimbatore, 72 per cent from Erode, 80 per cent from Tirupur and 59 per cent from Salem had tuition classes. Fifty four per cent of the subjects in Coimbatore, 28 per cent

from Erode, 20 per cent from Tirupur and 41 per cent from Salem did not go for tuitions.

In Kerala, the percentage of subjects having tuition classes were in the order of 51 per cent from Kottayam, 65 per cent from Pathanamthitta, 81 per cent from Allepey and 68 per cent from Thrissur. Forty nine per cent from Kottayam, 35 per cent from Pathanamthitta, 19 per cent from Allepey and 32 per cent from Thrissur did not have tuitions after school. It was also observed that lack of time of the parent to assist the subject in the studies also pave the way for tuition classes.

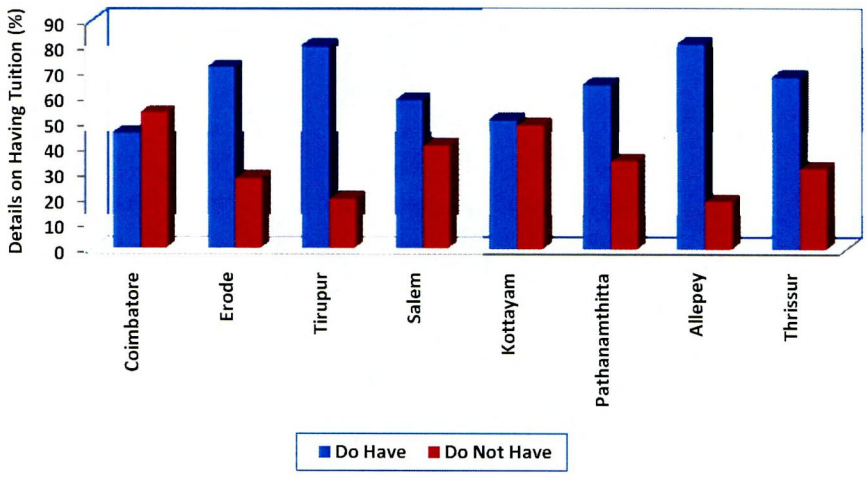


FIGURE XXI

DETAILS ON HAVING TUITIONS

Chi square test was applied to find out the association of childhood obesity with the tuition class. The calculated value of chi square was found to be 150.09 in the districts of Tamil Nadu and 102.19 in the districts of Kerala. The calculated value of chi square was greater than the table value of 11.345 at one per cent level. Since the calculated value was greater than the table value it was inferred that there is significant relationship between childhood obesity in both the states and the tuition class.

6. Duration of Tuition Classes

The duration of tuition classes were studied with the objective to analyze the free hours a child will get to spend for leisure or hobbies. The duration of tuition classes were elicited and is presented in Table LXIV.

TABLE LXIV

DURATION OF TUITION CLASSES

States	Districts	Duration in Hours					
		< 1		1-2		>2	
		No.	%	No.	%	No.	%
Tamil Nadu	Coimbatore	8	3	145	63	76	34
	Erode	163	45	149	41	49	14
	Tirupur	228	57	112	28	62	15
	Salem	134	45	96	32	67	23
Kerala	Kottayam	50	20	127	50	79	30
	Pathanamthitta	124	38	140	43	63	19
	Allepey	52	13	312	77	42	10
	Thrissur	5	1	231	69	106	31

It was noted that 63 per cent from Coimbatore, 41 per cent from Erode, 28 per cent from Tirupur and 32 per cent from Salem had tuition classes for about one to two hours daily. It was also clear that 34 per cent from Coimbatore, 14 per cent from Erode, 15 per cent from Tirupur and 23 per cent from Salem had tuitions for more than two hours daily.

In Kerala, 20 per cent from Kottayam, 38 per cent from Pathanamthitta, 13 per cent from Allepey and one per cent from Thrissur had an hour of tuition daily. The duration of tuition classes were one to two hours daily for 50 per cent of the subjects in Kottayam, 43 per cent in Pathanamthitta, 77 per cent in Allepey and 69 per cent in Thrissur. Thirty per cent of the subjects in Kottayam, 19 per cent in Pathanamthitta, ten per cent in Allepey and 31 per cent in Thrissur had tuitions for more than two hours daily.

High burden of school work and academic competitiveness have led to decreased participation in sports and any other form of physical activity. This is particularly true for girls who are sedentary from school years (Overby, 2005).

7. Advertisement and Food Choice

Studies supported the fact that advertisements do have a great impact on the food choices of the children. Hence, these details were elicited and is presented in Table LXV and Figures XXII.

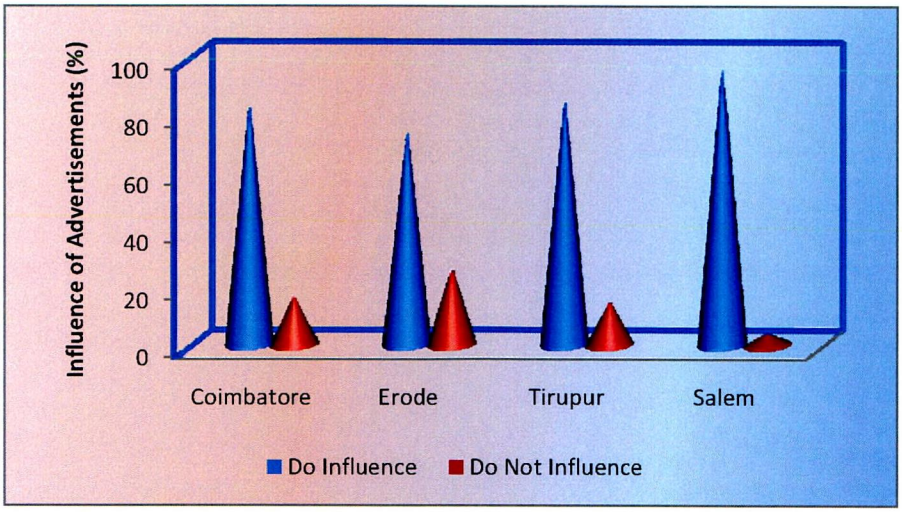
TABLE LXV

INFLUENCE OF ADVERTISEMENTS ON FOOD CHOICES

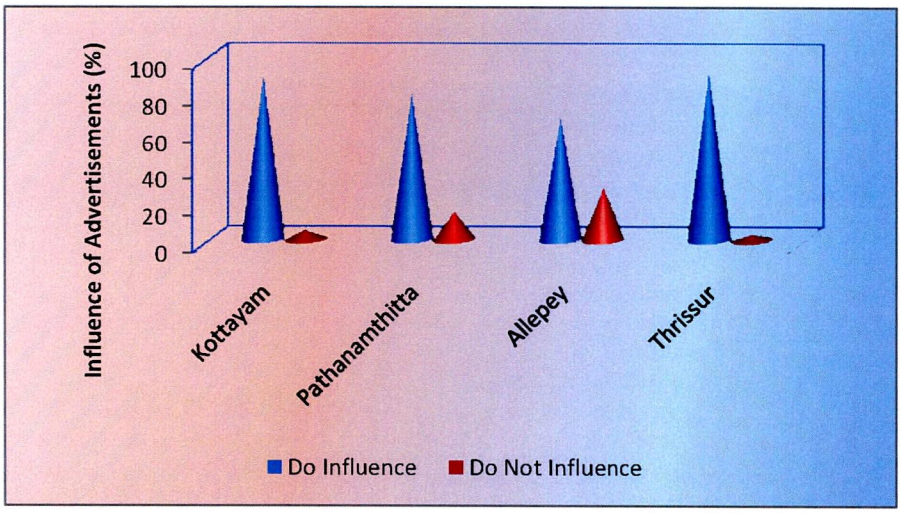
States	Districts	Influence of Advertisements			
		Do Influence		Do Not Influence	
		No.	%	No.	%
Tamil Nadu	Coimbatore	417	83	83	17
	Erode	369	74	131	26
	Tirupur	426	85	74	15
	Salem	482	96	18	4
	Chi Square – 99.41; df – 3; Sig – **				
Kerala	Kottayam	471	94	29	6
	Pathanamthitta	420	84	80	16
	Allepey	349	70	151	30
	Thrissur	481	96	19	4
	Chi Square – 182.32; df – 3; Sig – **				

**** - Significant at one per cent level**

A good per cent of the subjects in both the states agreed that advertisement influenced the food choices to a great extent. It was in the order of 83 per cent in Coimbatore, 74 per cent in Erode, 85 per cent in Tirupur and 96 per cent in Salem. In Kottayam, 94 per cent of the subject's food choices were influenced by advertisements. In Pathanamthitta for 84 per cent, in Allepey 70 per cent and in Thrissur for 96 per cent advertisements influence the food choice.



(A) TAMIL NADU



(B) KERALA

FIGURE XXII

INFLUENCE OF ADVERTISEMENTS ON FOOD CHOICES

Chi square test was applied to find out the association of childhood obesity with advertisements. The calculated value of chi square was found to be 99.41 in the districts of Tamil Nadu and 182.32 in the districts of Kerala. The calculated value of chi square was greater than the table value of 11.345 at one per cent level. Since the calculated value was greater than the table value it was inferred that there is significant relationship between childhood obesity in both the states and advertisements.

Advertising does in fact have an adverse effect on food preferences, purchasing behaviour and consumption among children says Mastings (2003).

Fast food outlets spend $3 billion in television advertisement targeted to children. A growing body of research suggests that there may be a link between exposure to food advertising and the increasing rate of obesity among children and youth, because the exposure to television advertisements influence the food choices among children (enticing them to choose more sugary foods instead of natural options) which increase the requests to parents for high sugar foods (Mathur, 2007).

8. Physical Activity

Physical activity is defined as any bodily movement produced by skeletal muscles that require energy expenditure. The details regarding the physical activity of the subjects in the selected districts were elicited and are presented in Table LXVI and also in Figure XXIII.

TABLE LXVI

PHYSICAL ACTIVITY

States	Districts	Spent Time for Physical Activity			
		Yes		No	
		No.	%	No.	%
Tamil Nadu	Coimbatore	324	65	176	35
	Erode	396	79	104	21
	Tirupur	247	49	253	51
	Salem	274	55	226	45
	Chi Square – 109.20; df – 3; Sig – **				
Kerala	Kottayam	342	68	158	32
	Pathanamthitta	367	73	133	27
	Allepey	316	63	184	37
	Thrissur	392	78	108	22
	Chi Square – 31.00; df – 3; Sig – **				

** - Significant at one per cent level

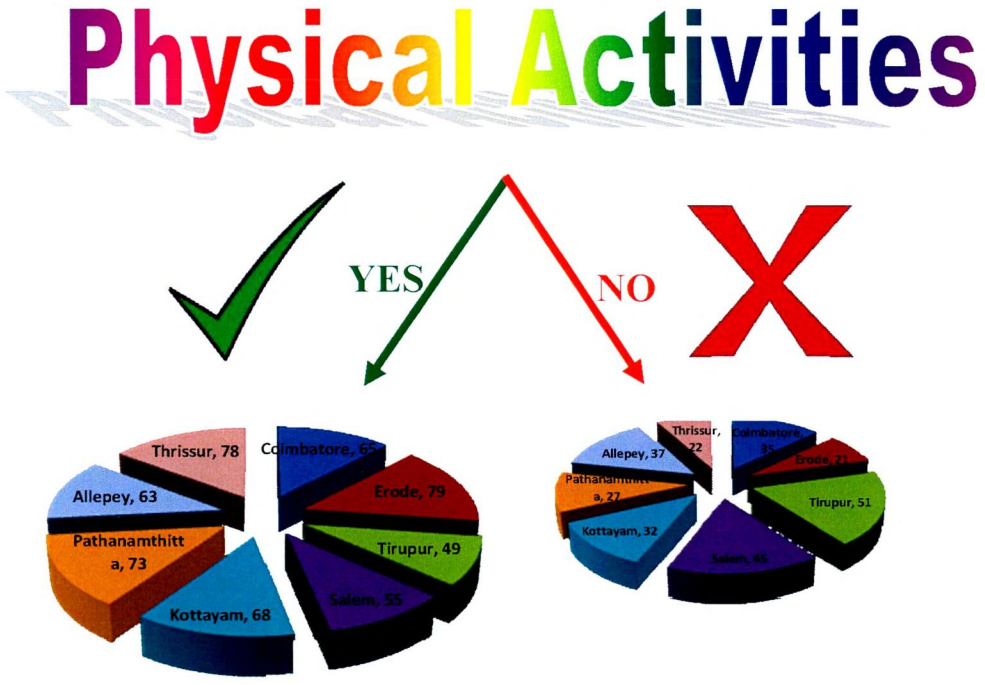


FIGURE XXIII

PHYSICAL ACTIVITY

It was noted that 65 per cent from Coimbatore, 79 per cent from Erode, 49 per cent from Tirupur and 55 per cent from Salem spend time for physical activity in Tamil Nadu. Thirty five per cent from Coimbatore, 21 per cent from Erode, 51 per cent from Tirupur and 45 per cent from Salem were not physical active.

In Kottayam, 68 per cent of the subjects were involved in physical activity and it was 73 per cent in Pathanamthitta. When 37 per cent from Allepey did not spend time for physical activity, it was 22 per cent from Thrissur district.

Chi square test was applied to find out the association of childhood obesity with physical activity level. The calculated value of chi square was found to be 109.20 in the districts of Tamil Nadu and 31.00 in the districts of Kerala. The calculated value of chi square was greater than the table value of 11.345 at one per cent level. Since the calculated value was greater than the table value it was inferred that there is significant relationship between childhood obesity in both the states and physical activity level.

Staying physically inactive leaves unused energy in the body, most of which is stored as fat. Researchers studied 16 men over a 14 day period and fed them 50 per cent more of their energy required every day through fats and carbohydrates. They discovered that carbohydrate overfeeding produced 75 to 85 per cent excess energy being stored as body fat and fat overfeeding produced 90 to 95 per cent storage of excess energy as body fat (Grant, 2004).

9. Type of Physical Activity Involved

Physical fitness is any bodily activity that enhances or maintains physical fitness and overall health and wellness. Childhood obesity is a global concern and physical activity may help decrease the effects of obesity. The details regarding the type of physical activity involved by the subjects are presented in Table LXVII.

TABLE LXVII

TYPE OF PHYSICAL ACTIVITY INVOLVED

States	Districts	Activity									
		Walk		Dance		Swim		Play		Exercise	
		No.	%	No.	%	No.	%	No.	%	No.	%
Tamil Nadu	Coimbatore	23	7	46	14	-	-	246	76	9	3
	Erode	9	2	24	6	26	7	316	80	21	5
	Tirupur	5	2	6	2	-	-	254	93	9	3
	Salem	13	6	20	8	-	-	176	78	17	8
Kerala	Kottayam	-	-	8	2	5	1	326	95	8	2
	Pathanamthitta	5	1	17	6	12	3	321	87	12	3
	Allepey	-	-	-	-	22	7	294	93	-	-
	Thrissur	-	-	72	19	-	-	276	70	44	11

It was observed that in Coimbatore, seven per cent went for walking with parents, 14 per cent had dance classes, 76 per cent were involved in play and three per cent had exercise. In Erode, when seven per cent went for swimming, 80 per cent played daily. The type of physical activity involved by the subjects of Tirupur was in the order of two per cent each for walking and dancing, 93 per cent for play and three per cent for exercise. In Salem, eight per cent each danced and exercised daily, while 78 per cent were involved in play.

In Kerala, 95 per cent of the subjects in Kottayam played daily and two per cent went for dance classes. The type of physical activity involved by the subjects of Pathanamthitta were in the order of 87 per cent for playing, six per cent for dancing, three per cent each for swimming and exercise respectively. Seven per cent of the subjects in Allepey swimmed daily and the rest 93 per cent were involved in play. In Thrissur, when 70 per cent played daily, 19 per cent and 11 per cent were engaged in dancing and exercise respectively.

Physical inactivity of children has shown to be a serious cause and children who fail to engage in regular physical activity are at greater risk of

obesity. Researchers studied the physical activity of 133 children over a three week period using an accelerometer to measure each child's level of physical activity. They discovered the obese children were 35 per cent less active on school days and 65 per cent less active on weekends compared to non-obese children (Jane, 2008).

According to Westerterp (2001) although young children may be active, their activities tend to be of low intensity and typically are not sustained over expended periods. In a current study, children spend a median of 55 per cent and 37 per cent of their walking hours in activities of moderate and light intensity respectively (Grace, 2002).

10. Family History of Obesity

Heredity is the passing of traits from ancestors to offspring. The details regarding the family history of obesity is presented in Table LXVIII and in Figure XXIV.

TABLE LXVIII

FAMILY HISTORY OF OBESITY

States	Districts	Prevalence of Obesity in the Family			
		Yes		No	
		No.	%	No.	%
Tamil Nadu	Coimbatore	474	95	26	5
	Erode	396	79	104	21
	Tirupur	408	82	92	18
	Salem	412	82	88	18
	Chi Square – 56.12; df – 3; Sig – **				
Kerala	Kottayam	379	76	121	24
	Pathanamthitta	376	75	124	25
	Allepey	448	90	52	10
	Thrissur	347	69	153	31
	Chi Square – 63.14; df – 3; Sig – **				

**** - Significant at one per cent level**

It was clear that 95 per cent from Coimbatore, 79 per cent from Erode, 82 per cent each from Tirupur and Salem had the prevalence of obesity in the family. In Kerala, 76 per cent of the subjects from Kottayam, 75 per cent from Pathanamthitta, 90 per cent from Allepey and 69 per cent from Thrissur had the history of obesity in the family.

Chi square test was applied to find out the association of childhood obesity with the family history of obesity. The calculated value of chi square was found to be 56.12 in the districts of Tamil Nadu and 63.14 in the districts of Kerala. The calculated value of chi square was greater than the table value of 11.345 at one per cent level. Since the calculated value was greater than the table value it was inferred that there is significant relationship between childhood obesity in both the states and the family history of obesity.

Childhood obesity is often the result of an interplay between many generic and environmental factors. Polymorphisms in various genes controlling appetite and metabolism predispose individuals to obesity when sufficient calories are present. As such obesity is a major feature of a number of rare genetic conditions that often presented in childhood (Arvind, 2004).

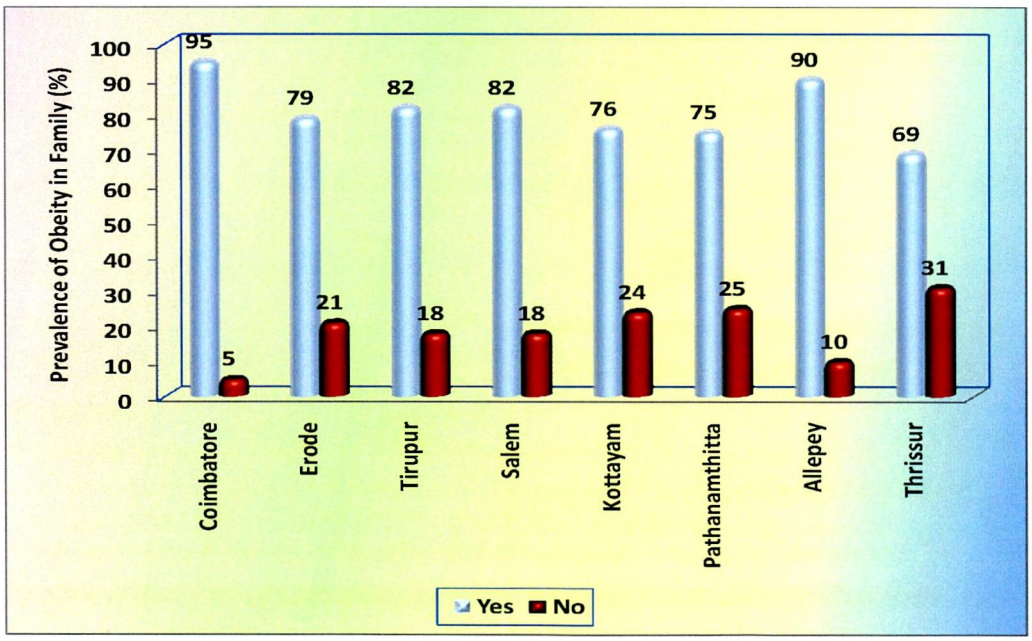


FIGURE XXIV

FAMILY HISTORY OF OBESITY

11. Subjects relation to the Family Member with Obesity

If two people are connected by circumstances of birth, they are called relatives. It is the principle binding of most basic unit of a society – the family. First degree relatives include parents, off springs and siblings. Uncle, aunt, niece, nephew and grandparents constitute second degree relatives, whereas the first cousin comes under third degree relative. The degree of relationship with the obese family member is presented in Table LXIX.

TABLE LXIX

SUBJECTS RELATION TO THE FAMILY MEMBER WITH OBESITY

States	N	Districts	Relation											
			Both Parent		Father		Mother		Grand Parents		Maternal Relatives		Paternal Relatives	
			No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Tamil Nadu	416	Coimbatore	23	5	69	15	117	24	47	10	174	37	44	9
	329	Erode	16	4	76	19	196	50	69	17	16	4	23	6
	240	Tirupur	12	3	174	43	129	32	8	1	23	6	62	15
	439	Salem	42	10	49	12	73	18	121	29	18	4	109	27
Kerala	394	Kottayam	63	17	27	7	189	50	47	12	39	10	14	4
	319	Pathanamthitta	31	8	63	17	81	22	64	17	37	10	100	26
	224	Allepey	19	4	36	8	139	31	142	32	44	10	68	15
	343	Thrissur	22	6	37	11	164	47	36	10	56	6	32	10

It was noted that in Coimbatore five per cent of the subjects had both the parents with obesity and 24 per cent of the subjects had obese mother. It was also clear that 37 per cent of the subjects had maternal relatives with obesity. In Erode, when 50 per cent of the mothers were obese, 17 per cent of the grandparents (second degree relative) had obesity. Forty three per cent of the father (first degree relative) and 32 per cent of the mothers (first degree relative) in Tirupur had obesity. In Salem, 29 per cent had obese grandparents and ten per cent had both the parents with obesity.

In Kottayam, for 17 per cent both parents were obese and for 50 per cent had obese mother. Seventeen per cent each from Pathanamthitta had obese father and grandparents. In Allepey, when 32 per cent of the grandparents were obese, eight per cent had fathers with obesity. In Thrissur, the obesity in the family was in the order of seven per cent for parents, 11 per cent for father, 47 per cent for mother, ten per cent for grandparents, 16 per cent for maternal relatives and ten per cent for paternal relatives.

12. Gestational Diabetes of Mother

Gestational Diabetes Mellitus (GDM) is a condition in which women without previously diagnosed diabetes exhibit high blood glucose levels during pregnancy. Diabetes during pregnancy resulted in an increased risk of developing childhood obesity (Whilaker, 1998). The details on gestational diabetes of the mother were elicited and are presented in Table LXX.

TABLE LXX

GESTATIONAL DIABETES

States	Districts	Gestational Diabetes			
		Diabetic		Non-Diabetic	
		No.	%	No.	%
Tamil Nadu	Coimbatore	209	42	291	58
	Erode	147	29	353	71
	Tirupur	126	25	374	75
	Salem	74	15	426	85
	Chi Square – 93.25; df – 3; Sig – **				
Kerala	Kottayam	95	19	405	81
	Pathanamthitta	83	17	417	83
	Allepey	59	12	441	88
	Thrissur	63	13	437	87
	Chi Square – 14.64; df – 3; Sig – **				

**** - Significant at one per cent level**

It was noted that 42 per cent from Coimbatore, 29 per cent from Erode, 25 per cent from Tirupur and 15 per cent from Salem had diabetes during pregnancy. In Kerala, 81 per cent the subjects' mother from Kottayam, 83 per cent from Pathanamthitta, 99 per cent from Allepey and 87 per cent from Thrissur were non-diabetics during gestational period. Nineteen per cent from Kottayam, 17 per cent from Pathanamthitta, 12 per cent from Allepey and 13 per cent from Thrissur had gestational diabetes.

Chi square test was applied to find out the association of childhood obesity with the gestational diabetes of mother. The calculated value of chi square was found to be 93.25 in the districts of Tamil Nadu and 14.64 in the districts of Kerala. The calculated value of chi square was greater than the table value of 11.345 at one per cent level. Since the calculated value was greater than the table value it was inferred that there is significant relationship between childhood obesity in both the states and the gestational diabetes of mother.

High blood sugar during pregnancy results in the baby being overfed in the womb. The result of this overfeeding may be that children become metabolically imprinted or programmed to become obese (Teresa, 2007).

Treating gestational diabetes during pregnancy may reduce the child's risk of becoming obese and gestational diabetes is associated with increased rate of offspring childhood obesity, impaired glucose tolerance and Type II Diabetes Mellitus (Toafa, 2004).

13. Details on Parenthood

Parenting is the process of promoting and supporting the physical, emotional, social and intellectual development of a child from infancy to adulthood. Single parent is a term that is mostly used to suggest that one parent has most of the responsibilities in the rising of the child. Single parent families are on rise in urban areas and the safety concerns leads to restrictions of going outdoors for physical activity. Hence, the details on parenthood were elicited and are presented in Table LXXI and also in Figure XXV.

TABLE LXXI

DETAILS ON PARENTHOOD

States	Districts	Parenthood			
		Single Parent		Both Parents	
		No.	%	No.	%
Tamil Nadu	Coimbatore	3	1	497	99
	Erode	17	3	483	97
	Tirupur	-	-	500	100
	Salem	-	-	500	100
	Chi Square – 40.00; df – 3; Sig – **				
Kerala	Kottayam	-	-	500	100
	Pathanamthitta	74	15	426	85
	Allepey	51	10	449	90
	Thrissur	14	3	486	97
	Chi Square – 106.47; df – 3; Sig – **				

**** - Significant at one per cent level**

It was observed that one per cent from Coimbatore and three per cent from Erode were single parent. None from Tirupur and Salem fell in the present category single parent. In Kerala, the percentage of single parents was 15 per cent from Pathanamthitta, ten per cent from Allepey and three per cent from Thrissur. None from Kottayam were single parent. In the present study, death or divorce of the partner resulted in single parenthood.

Chi square test was applied to find out the association of childhood obesity with parenthood. The calculated value of chi square was found to be 40.00 in the districts of Tamil Nadu and 106.47 in the districts of Kerala. The calculated value of chi square was greater than the table value of 11.345 at one per cent level. Since the calculated value was greater than the table value it was inferred that there is significant relationship between childhood obesity in both the states and parenthood.

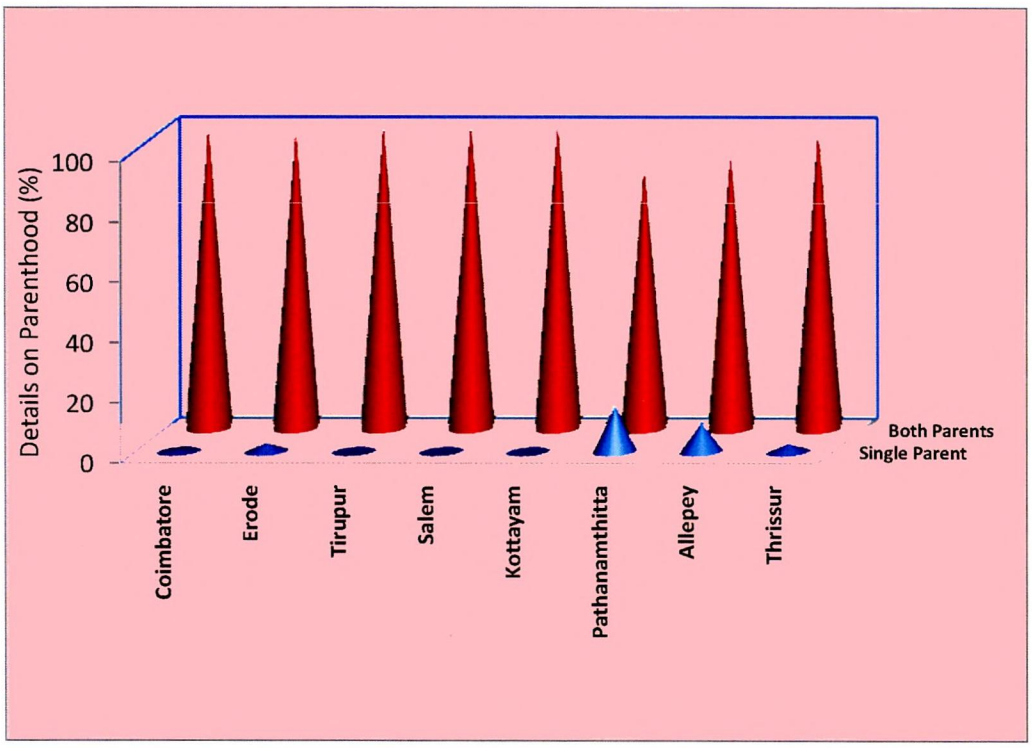


FIGURE XXV

DETAILS ON PARENTHOOD

14. Working Details of the Parent

The working details of the parents were studied with the objective to assess time spend by the parents with the child. The busy schedule of the working mother may result in buying parcel foods to the home more frequently. The working details of the parents, whether single parent is working or both parents working were elicited and are presented in Table LXXII and also in Figure XXVI.

TABLE LXXII

WORKING DETAILS OF PARENT

States	Districts	Working Members			
		Single Parent		Both Parent	
		No.	%	No.	%
Tamil Nadu	Coimbatore	178	36	322	64
	Erode	260	52	240	48
	Tirupur	424	85	76	15
	Salem	376	75	124	25
	Chi Square – 316.11; df – 3; Sig – **				
Kerala	Kottayam	284	57	216	43
	Pathanamthitta	90	18	410	82
	Allepey	392	78	108	22
	Thrissur	169	34	331	66
	Chi Square – 421.18; df – 3; Sig – **				

**** - Significant at one per cent level**

It was clear that 64 per cent of the subjects from Coimbatore, 48 per cent from Erode, 15 per cent from Tirupur and 25 per cent from Salem had both the parents working. For 36 per cent of the subjects in Coimbatore, 52 per cent in Erode, 85 per cent in Tirupur and 75 per cent in Salem only single parent was working.

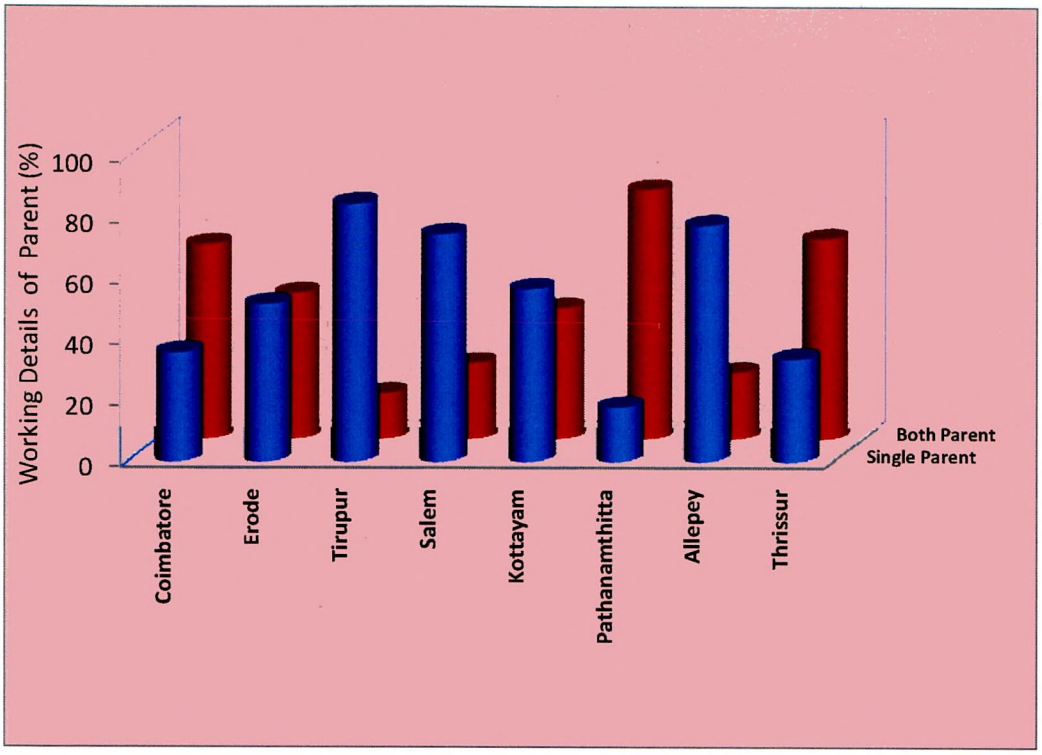


FIGURE XXVI

WORKING DETAILS OF PARENT

In Kerala, both parents were working for 43 per cent of the subjects in Kottayam, 82 per cent in Pathanamthitta, 22 per cent in Allepey and 66 per cent in Thrissur. Fifty seven per cent of the subjects in Kottayam, 18 per cent in Pathanamthitta, 78 per cent in Allepey and 34 per cent in Thrissur had single parent employed.

Chi square test was applied to find out the association of childhood obesity with the occupation of parent. The calculated value of chi square was found to be 316.11 in the districts of Tamil Nadu and 421.18 in the districts of Kerala. The calculated value of chi square was greater than the table value of 11.345 at one per cent level. Since the calculated value was greater than the table value it was inferred that there is significant relationship between childhood obesity in both the states and the occupation of parent.

Parents are often overworked and find it easy to let children order "fast foods" and hardly have anytime to oversee balanced nutrition for children (Saxena, 2004).

15. Maternal Smoking during Pregnancy

Smoking was not a common feature among Indians, that too in South. But still, the investigator was curious to know whether there were any mothers who smoked during pregnancy. Though smoking is injurious to health, some mother had a crave for smoke during pregnancy. Smoking habits of the mother during pregnancy were associated with overweight in five year old children (Suzuki, 2003). Hence the details regarding maternal smoking during pregnancy were assessed and are depicted in Table LXXIII.

TABLE LXXIII

MATERNAL SMOKING DURING PREGNANCY

States	Districts	Smoking					
		Do Smoke		Do not Smoke		Did not Respond	
		No.	%	No.	%	No.	%
Tamil Nadu	Coimbatore	29	6	447	89	24	5
	Erode	5	1	436	87	59	12
	Tirupur	-	-	500	100	-	-
	Salem	-	-	500	100	-	-
Kerala	Kottayam	5	1	421	84	74	15
	Pathanamthitta	-	-	497	99	3	1
	Allepey	-	-	500	100	-	-
	Thrissur	8	2	469	94	23	4

It was clear that in Coimbatore six per cent of the mother's admitted that they had the habit of smoking during pregnancy, 89 per cent do not smoke and five per cent hesitated to respond to the question. In Erode, when one per cent smoked during pregnancy, 87 per cent did not smoke and 12 per cent did not respond. In Tirupur and Salem none of the mothers had the habit of smoking during gestational period.

In Kottayam, one per cent of the mothers agreed that they smoked during pregnancy, 84 per cent did not smoke and one per cent were not willing to respond. Ninety nine per cent of the mothers in Pathanamthitta did not smoke while one per cent hesitated to answer the present question. Cent per cent of the mothers from Allepey did not smoke during pregnancy. In Thrissur, two per cent of the mothers smoked during pregnancy, 94 per cent did not smoke and the rest four per cent did not respond to the question. It was also made clear by few mothers that smoking was only a crave during pregnancy and not a habit.

F. PREVALENCE OF CHILDHOOD OBESITY AMONG THE SELECTED TRIBAL POPULATION OF KERALA AND TAMIL NADU

The tribal populations are recognized as socially and economically vulnerable. Their lifestyles and food habits are different from that of the rural neighbours. They depend on minor forest produce and manual labour for livelihood. They do not have adequate income. The food consumption pattern is dependent on the vagaries of nature and varies from extreme deprivation (in the lean seasons) to high intakes (in the post-harvest period). Tribes reflect a way of life that predates, and is more "natural", than that in modern states.

In order to fulfill the objective of exploring the prevailing rates of childhood obesity among the tribal population, Nilgiris from Tamil Nadu and Idukki district from Kerala were selected. A total of 500 tribal children from both the districts were surveyed and the results are summarized below.

1. Body Mass Index of the Tribal Population

The BMI of the selected tribal population in the tribal schools of Kerala and Tamil Nadu were elicited and is depicted in Table LXXIV. Mannan tribes from Idukki district and Kurumba tribe and Badukas from Nilgiris were selected for the study.

TABLE LXXIV

BMI OF TRIBAL POPULATION (N=1000)

Status	Districts	BMI GRADES							
		Underweight		Normal Weight		Over Weight		Obese	
		No	%	No	%	No	%	No	%
Kerela	Idukki	382	77	51	10	67	12	-	-
Tamil Nadu	Nilgiris	231	46	146	29	94	19	29	6

It was clear from the table that in Idukki district, 77 per cent of the selected tribes were underweight, only 10 per cent were normal weight and 13 per cent were overweight. None of the selected tribes were obese in this district. In Nilgiris when 46 per cent of the tribes were underweight, 29 per cent were normal weight. The percentage of overweight and obese children in the present district was in the order of 19 per cent and six per cent respectively. The study revealed the fact that there was an increasing trend in the percentage of overweight and obesity among the tribes though underweight children were more predominant.

2. Demographic Profile of the Obese and Overweight Tribes

The demographic profile of the obese and overweight subjects in both the districts was elicited. The study showed an increasing trend of overweight in the tribal children particularly in girls. Most of the overweight children were studying in third and fourth standards. Agriculture and fishing was the main source of income for the tribal population. Some of the selected tribes' fathers were coolies on daily wages. The education details of parents revealed the fact that most of them were illiterates except a few had lower primary education. The monthly income of the tribal people ranged from a lower limit of Rs.500 to an upper limit of Rs.2000. Most of the tribes had a joint family setup and the number of members in the family ranged from seven to twenty. All of the selected tribes were Hindus. The number of children in each family ranged between five and seven. The working details revealed the fact that

only the male population in the family went for work and the females were engaged in household activities. Single parenthood existed in many families in Idukki district. The main reason being most of the mothers were unmarried.

3. Lifestyle Practices of the Tribal Population

The lifestyle of the tribal children in both the states was elicited. None of the selected children skipped the breakfast – the primary meal of the day. In was also observed that the tribal children in both the states had rice for breakfast. Tiffin items such as ragi adai, dosai, etc., were prepared in the family only during occasions like festivals and other ceremonies. None of the selected tribes had the habit of watching television during leisure except a very few from Nilgirs. Snacking was not predominant among the tribes of both the states. It was observed that the duration of play by the tribal overweight children were much higher when compared with the obese population of the other eight districts. It ranged from two to three hours per day.

Most of the tribes were interested in outdoor games. The place of play was both school and home. Tribal boys went for hunting with other members of the family. None of the tribes received pocket money and the mode of transport to school was by walk. The tribal children dinned outside very rarely.

The duration of physical training class in a tribal school was eight hours per week. The school authorities also disclosed the fact that during free periods the children will be sent to the playground to engage themselves in any sort of physical activity they wish and they also enjoyed the play. The frequency of having meals together with parents was limited to one and it was mostly the dinner. The main reason for this was mainly lack of food for all the family members as many families find it very difficult to feed the children three times a day. Most of the tribal women did not have enough food. They mainly depend on the leftovers and if that too is not available they starve. It was also noted that the tribal parents interacted more with the children on aspects other than studies probably the reason being they were uneducated and did not know what to talk regarding their studies. Most of the obese tribes in both the states slept for about nine hours daily.

4. Dietary Pattern of the Selected Obese and Overweight Tribes in Nilgris and Idukki

From the data elicited regarding the food habits of the tribes, it was found that all were non-vegetarians, though the frequency of consumption was occasional, with the exception of fish. Fish was consumed mainly in the curry form daily, though the subjects preferred fried one. Chicken and meat were consumed by the tribes only during festivals and special occasions.

The school authorities with the help of government, provided egg and milk almost on all the days in both the district as a part of school noon meal programmes. The tribal people also agreed that the mood affect their food choices and agreed that they consumed more when they are happy or sad. Similarity was not observed in the diet preferences of tribal parent and subjects. Most of the tribal children preferred fruits and vegetables in the raw form. Though the tribal children had fleshy foods in the boiled form, the preference was for fried ones. Despite the daily consumption of fish, chicken was the favourite non-vegetarian food stuff of tribal children in both the status. The favourite outside food stuff of tribal children were paratha and gravy. The consumption of commercial foods and drinks were rare and was limited to occasions. None of the obese children had food allergy.

5. Mean Nutrient Intake of Selected Subsamples

A food weighment survey was done for three consecutive days to analyze the micronutrient and macronutrient intake. The mean nutrient intake of selected obese subsamples in both the states is depicted in Table LXXV.

TABLE LXXV

NUTRIENT INTAKE OF SELECTED SUBSAMPLES AGE : 7-9 YEARS (N=100) (Tribal)

State	Districts	Energy (Kcal)			Protein (g)			Fat (g)			Iron (mg)			Calcium (mg)		
		RDA	Total	Diff	RDA	Total	Diff	RDA	Total	Diff	RDA	Total	Diff	RDA	Total	Diff
Kerala	Idukki	1690	1710	+20	29.5	24	-5.5	30	28	-2	600	400	-200	16	13	-3
Tamil Nadu	Nilgris	1690	1832	+142	29.5	265	-3	30	25	-5	600	400	-200	16	11	-5

SDs not reported

The mean nutrient intake of obese population revealed the fact that only the net energy intake exceeded the RDA values (2010). It was 1719 Kcals in Idukki and 1832 Kcals in Nilgris. The protein and fat intake did not even met the RDA values. Two hundred milligram of calcium was deficit in the tribal diet of both the states. Inspite of consuming ragi incorporated recipes the iron consumption was much less when compared to the RDA values, 2010 indicating the prevalence of anaemia among tribes.

6. Infant Nutrition and Maternal Health during Pregnancy

Most of the obese children were born first or second in the family. The mothers did not have a record of the subjects' birth weight as most of the subjects were delivered at home. The feeding practices revealed the fact that the children were breastfed till two years continuously. None of the obese children were bottle fed. The weaning period started from sixth month for most of the subjects and the foods weaned on were homemade cereal-pulse product. Low cost supplementary foods that were supplied through government outlets were also fed to the subjects during weaning period. These supplementary foods were Poshak, Kerala Indegenous Food (KIF) and Amrutham food supplement. The mother had no idea on the present nutritional status of the subjects. The tribal subjects were immunized regularly with the help of social workers serving in the particular areas. Visit to a hospital was very rare and the tribes mainly depend on locally available medicines from plants and prayer.

Though the recorded details on mothers height and weight during pregnancy was not available, the present BMI status indicated that most of the tribal women in both the states were underweight except a few in Nilgris were overweight. Some of the tribal women recalled the weight gain during pregnancy was between +10 to 12 kilogram, while the others were totally unaware on this aspect. The complications experienced during pregnancy as listed by the tribal mothers included edema, restlessness, frequent vomiting till the third trimester and stress.

The present research revealed the fact that overweight and obesity is on rise even in the tribal population, through underweight is still predominant. Inspite of the fact that government has taken so many steps to improve the way of living of the tribal population, most of the tribes hardly find a way for bread. Most of the tribes depend on agriculture for their living. They often complaint that their products did not find a good move in the market. It was also observed by the researchers that eventhough so many projects are ongoing for the upliftment of tribes in various states of India, the actual needy peoples are not benefited. The main reason for this was found to be lack of education as most of the tribes were unaware of the rights they own in the society.

G. IMPACT OF MEDICAL NUTRITION THERAPY

Medical nutrition therapy was administered in two phases. The first phase was the medical management which included lifestyle modification, psychological support, drugs and surgery. In the present study, drugs and surgery was not included considering the age group of the children. The second phase was nutritional management which included dietary modification and nutrition education. The impact of medical nutrition therapy was assessed after a period of ten months.

1. Mean Body Mass Index of the subjects before and after Medical Nutrition Therapy

The mean Body Mass Index values of the children in the states of Kerala and Tamil Nadu before and after Medical Nutrition Therapy were elicited and are presented in Table LXXVI.

TABLE LXXVI

MEAN BODY MASS INDEX OF SUBJECTS BEFORE AND AFTER MEDICAL NUTRITION THERAPY

Age	Mean Body Mass Index (kg/m^2)							
	Tamil Nadu				Kerala			
	n	Initial Mean±SD	Final Mean±SD	't' value	n	Initial Mean±SD	Final Mean±SD	't' value
6	398	36.98±3.91	30.19±1.06	20.37**	381	33.95±2.99	28.60±2.20	15.07**
7	360	33.86±1.54	28.36±1.57	27.28**	374	34.00±1.52	28.87±1.10	24.48**
8	413	33.20±1.30	27.97±1.31	21.73**	379	32.35±1.11	28.96±1.28	13.64**
9	409	32.31±1.03	29.02±1.44	16.26**	429	32.74±1.16	29.45±1.51	13.77**
10	420	31.39±0.49	27.90±1.12	18.70**	437	31.37±0.59	28.06±1.06	21.15**

**** - Significant at 1% level**

Medical Nutrition Therapy was imparted to the selected obese children in both the states and its impact was assessed after a period of ten months. 't' test was applied to analyze the difference in the initial and final parameters. It was observed that in Tamil Nadu and Kerala there was a significant difference at one per cent level in the mean initial and mean final BMI values. The mean BMI of six year old children in Tamil Nadu after and before imparting Medical Nutrition Therapy was found to be 36.98 ± 3.94 and 30.19 ± 4.06 respectively, which was significant at one per cent level. For 10 year old subjects in Kerala, 31.37 ± 0.59 and 28.06 ± 1.06 were the mean BMI values before and after imparting Medical Nutrition Therapy. It was significant at one per cent level.

2. Mean weight of the subjects before and after Medical Nutrition Therapy

The mean weight of the subjects in both states before and after Medical Nutrition Therapy is given in Table LXXVII.

TABLE LXXVII

MEAN WEIGHT OF SUBJECTS BEFORE AND AFTER MEDICAL NUTRITION THERAPY

Age	Mean Weight (kg)							
	Tamil Nadu				Kerala			
	n	Initial Mean±SD	Final Mean±SD	't' value	n	Initial Mean±SD	Final Mean±SD	't' value
6	398	45.50±1.03	38.59±2.45	17.44**	381	45.50±1.03	38.71±2.46	17.51**
7	360	51.90±1.66	44.45±2.17	26.01**	374	51.90±1.66	45.30±1.50	24.63**
8	413	54.60±1.75	47.40±2.19	19.69**	379	54.60±1.75	49.37±2.03	11.29**
9	409	57.85±1.59	52.80±2.72	12.42**	429	57.85±1.59	53.15±2.34	12.40**
10	420	61.55±0.67	55.90±2.06	14.55**	437	61.55±0.67	56.37±1.98	18.00**

**** - Significant at 1% level**

The 't' test value proved that the mean weight of seven years old subjects in the state of Tamil Nadu before Medical Nutrition Therapy was 51.90 ± 1.66. It was reduced to a mean weight of 44.45 ± 2.17 after six months which was significant at one per cent level. In Kerala, the mean weight of nine years old subjects in the initial phase of the study was 58.25 ± 1.70, and was reduced to a mean weight of 53.15 ± 2.34 after six months. The difference in the mean weight was statistically analyzed using 't' test and found to be significant at one per cent level.

3. Mean Score of parents before and after Nutrition Education

Table LXXVIII shows the mean score of the parents before and after nutrition education in both states.

TABLE LXXVIII

MEAN NUTRITIONAL SCORES OF PARENTS BEFORE AND AFTER MEDICAL NUTRITION THERAPY

Age	Mean Score (Max 25)							
	Tamil Nadu				Kerala			
	n	Initial Mean±SD	Final Mean±SD	't' value	n	Initial Mean±SD	Final Mean±SD	't' value
6	398	8..62±5.41	21.25±2.16	14.52**	381	11.95±6.22	21.50±1.69	10.42**
7	360	8.17±4.35	20.90±2.46	16.13**	374	7.75±4.52	26.92±2.45	17.58**
8	413	11.32±5.44	20.92±2.25	10.29**	379	5.77±4.03	20.70±2.24	23.39**
9	409	13.45±3.00	21.80±1.24	17.16**	429	13.92±2.73	21.52±1.53	15.78**
10	420	8.15±6.24	18.22±3.51	1.61**	437	10.95±4.99	18.50±3.57	10.84**

**** - Significant at 1% level**

The nutritional knowledge of the parents before and after imparting Medical Nutrition Therapy was assessed. It was observed that for eight year old obese subjects parents in Tamil Nadu, the mean score for the test was 11.32 ± 5.44 and 20.92 ± 2.25, before and after nutrition education respectively. The 't' test value proved there is a significant difference in the mean nutritional score after imparting Medical Nutrition Therapy and was significant at one per cent level. In Kerala, the ten year old obese subject's parents scored a mean value of 10.95 ± 4.99 before nutrition education and 18.50 ± 3.57 after nutrition education. There was significance at one per cent level for the mean nutritional scores of the parents.

4. Comparison between the mean nutritional score of the parents

Table LXXIX depicts the comparison between the mean score obtained by the parents in both states.

TABLE LXXIX

COMPARISON BETWEEN THE MEAN NUTRITIONAL SCORE OF THE PARENTS

Age	Nutritional Scores (Max. 25)							
	Initial				Final			
	n	Kerala Mean±SD	Tamil Nadu Mean±SD	't' value	N	Kerala Mean±SD	Tamil Nadu Mean±SD	't' Value
6	398	11.95±6.22	8.62±5.41	2.54**	381	21.50±1.69	21.25±2.16	0.57^{NS}
7	360	7.75±4.52	8.17±4.35	0.42**	374	20.92±2.45	20.90±2.46	0.045**
8	413	5.77±4.02	11.32±5.44	5.196**	379	20.70±2.24	20.92±2.25	0.447^{NS}
9	409	13.92±2.73	13..45±3.00	0.73^{NS}	429	21.52±1.53	21.80±1.24	0.88^{NS}
10	420	10.95±4.99	8.15±6.24	2.215*	437	18.50±3.57	18.22±3.51	0.34^{NS}

**** - Significant at 1% level; * - Significant at 5% level; NS – Not Significant**

The nutritional scores gained by the parents in the states of Kerala and Tamil Nadu were statistically assessed by applying 't' test. The mean scores of six year old subject's parents before imparting Medical Nutrition Therapy was found to be 11.95 ± 6.22 in Kerala and 8.62 ± 5.41 in Tamil Nadu. After Medical Nutrition Therapy the scores raised to 21.50 ± 1.69 in Kerala and 21.25 ± 2.16 in Tamil Nadu. The difference in the nutritional knowledge of the parents in both the states before and after imparting Medical Nutrition Therapy was assessed. The results showed that the nutritional score of parents of ten year old subjects before giving nutrition education showed a difference which was significant at five per cent level. The mean scores was found to be 10.95 ±4.99 in Kerala and 8.15±6.24 in Tamil Nadu.

5. Comparison between the mean weight of the subjects

A comparative study on the mean weight of the subjects in the state of Kerala and Tamil Nadu were done and is presented in Table LXXXI.

TABLE LXXX

COMPARISON BETWEEN THE MEAN WEIGHT OF THE SUBJECTS

Age	Weight (kg)							
	Initial				Final			
	n	Kerala Mean±SD	Tamil Nadu Mean±SD	t value	N	Tamil Nadu Mean±SD	Kerala Mean±SD	t value
6	398	43.84±2.27	45.50±1.03	4.207**	381	38.71±2.46	38.59±2.45	0.209^{NS}
7	360	52.12±1.71	51.90±1.66	0.56^{NS}	374	45.30±1.50	44.45±2.17	2.034*
8	413	54.00±1.60	54.60±1.75	1.599^{NS}	379	49.375±2.03	44.45±2.19	4.179**
9	409	58.25±1.70	57.85±1.59	1.084^{NS}	429	53.15±2.34	52.80±2.72	0.615^{NS}
10	420	61.65±0.863	61.55±0.677	0.575^{NS}	437	56.37±1.98	55.90±2.06	1.505^{NS}

**** - Significant at 1% level; * - Significant at 5% level; NS – Not Significant**

The mean weight before and after imparting Medical Nutrition Therapy was analyzed using 't' test. A significant difference was found in the weight of six year old children at one per cent level. 't' test values also showed that after imparting Medical Nutrition Therapy the mean weight of seven years old children, in the states of Kerala and Tamil Nadu showed a significant difference at five per cent level. The mean weight of the seven year old children in Kerala was 45.30±1.50 and that of Tamil Nadu was 44.45±2.17.

6. Comparison between the mean Body Mass Index of the Subjects

Body Mass Index of the subjects in both the states was compared and is presented in Table LXXXI.

TABLE LXXXI

COMPARISON BETWEEN THE BODY MASS INDEX OF THE SUBJECTS

Age	Body Mass Index (kg/m^2)							
	Initial				Final			
	n	Kerala Mean±SD	Tamil Nadu Mean±SD	't' value	N	Tamil Nadu Mean±SD	Kerala Mean±SD	't' value
6	398	33.95±2.99	36.98±3.94	3.86**	381	30.19±4.06	28.60±2.20	2.174*
7	360	34.00±1.52	33.86±1.54	0.404**	374	28.36±1.57	28.87±1.10	1.67^{NS}
8	413	32.359±1.119	23.207±1.30	31.20**	379	27.97±1.31	28.965±1.28	3.399**
9	409	32.74±1.1653	32.31±1.03	1.725^{NS}	429	29.02±1.44	29.45±1.51	1.310^{NS}
10	420	31.379±0.597	31.39±0.495	0.133^{NS}	437	27.90±1.22	28.06±1.06	0.64^{NS}

**** - Significant at 1% level; NS – Not Significant**

't' test was applied to find out whether there was any significant difference in the mean Body Mass Index before and after imparting Medical Nutrition Therapy. The results of the 't' test revealed the fact that there was a significant difference in the mean Body Mass Index of six year old subjects in Kerala and Tamil Nadu before imparting Medical Nutrition Therapy and it was found to be significant at one per cent level. The mean BMI of 10 year old subjects after imparting Medical Nutrition Therapy did not show any significant difference. The mean Body Mass Index of 10 year old subjects after imparting Medical Nutrition Therapy was 28.06±1.06 in Kerala and 27.90±1.12 in Tamil Nadu.

7. Analysis of covariance (ANACOVA) for different parameters before imparting Medical Nutrition Therapy

ANACOVA was applied to the parameters like weight, Body Mass Index and nutritional score. The purpose was to find whether the subjects from the states of Kerala and Tamil Nadu differed significantly after removing or adjusting the effect of Medical Nutrition Therapy from the after values. These details are presented in Table LXXXII.

TABLE LXXXII

ANALYSIS OF COVARIANCE (ANAVOCA) FOR DIFFERENT PARAMETERS BEFORE IMPARTING MEDICAL NUTRITION THERAPY

Parameters	Age (Years)	Initial Values				ANACOVA F Values
		n	Kerala Mean±SD	n	Tamil Nadu Mean±SD	
Nutritional Score (Max : 25)	6	381	11.95±6.22	398	8.62±5.41	5.606*
	7	374	7.75±4.52	360	8.17±4.35	0.736^{NS}
	8	379	5.77±4.02	413	11.32±5.44	1.162^{NS}
	9	429	13.92±2.73	409	13.45±3.00	0.872^{NS}
	10	437	10.95±4.99	420	8.15±6.22	16.421**
Weight (kg)	6	381	43.84±2.27	398	45.50±1.03	26.129**
	7	374	52.12±1.71	360	51.90±1.66	25.875**
	8	379	54.00±1.60	413	54.60±1.75	2.533**
	9	429	58.25±1.70	409	57.85±1.59	7.607**
	10	437	61.65±0.863	420	61.55±0.677	0.012^{NS}
Body Mass Index (kg/m^2)	6	381	33.95±2.99	398	36.98±3.94	133.053**
	7	374	34.00±1.52	360	33.86±1.54	44.028**
	8	379	32.359±1.119	413	33.207±1.30	4.888*
	9	429	32.74±1.1653	409	32.31±1.03	1.162^{NS}
	10	437	31.379±0.597	420	31.39±0.495	5.740*

**** - Significant at 1% level; * - Significant at 5% level; NS – Not Significant**

ANACOVA results showed that the mean nutritional scores of the parents before imparting nutritional education did not showed any significant difference for seven, eight and nine year old children's parents. A significant difference at the level of five per cent was observed for the parents of six year old children. The mean weight value of the children in both the states before imparting Medical Nutrition Therapy differed significantly at one per cent level

for six, seven and nine year old subjects. For six year old subjects in Kerala, the mean weight before imparting Medical Nutrition Therapy was found to be 43.84±1.03. This was found to be significant at one per cent level. The mean Body Mass Index of the eight year old children in the state of Kerala and Tamil Nadu was found to be 32.359±1.119 and 33.207±1.30 respectively which was significant at five per cent level.

8. Analysis of Covariance (ANACOVA) for different parameters after imparting Medical Nutrition Therapy

Table LXXXIII shows the ANACOVA values for the parameters such as weight, nutritional scores and Body Mass Index of the subjects in the states of Kerala and Tamil Nadu.

TABLE LXXXIII

ANALYSIS OF COVARIANCE (ANAVOCA) FOR DIFFERENT PARAMETERS AFTER IMPARTING MEDICAL NUTRITION THERAPY

Parameters	Age (Years)	Final Values				ANACOVA F Values
		n	Kerala Mean±SD	n	Tamil Nadu Mean±SD	
Nutritional Score (Max : 25)	6	381	21.50±1.69	398	21.25±2.16	0.008^{NS}
	7	374	20.92±2.45	360	20.90±2.46	0.008^{ns}
	8	379	20.70±2.24	413	20.92±2.25	0.026^{NS}
	9	429	21.52±1.53	409	21.80±1.24	0.910^{NS}
	10	437	18.50±3.57	420	18.22±3.51	0.381^{NS}
Weight (kg)	6	381	38.71±2.46	398	38.59±2.45	5.833**
	7	374	45.30±1.50	360	44.45±2.17	3.954*
	8	379	49.375±2.03	413	47.40±2.19	19.648**
	9	429	53.15±2.34	409	52.80±2.72	0.092^{NS}
	10	437	56.37±1.98	420	55.90±2.06	1.100^{NS}
Body Mass Index (kg/m^2)	6	381	28.60±2.20	398	30.19±4.06	1.841^{NS}
	7	374	28.87±1.10	360	28.36±1.57	3.164^{NS}
	8	379	28.965±1.28	413	27.97±1.31	16.163**
	9	429	29.45±1.51	409	29.02±1.44	0.026^{NS}
	10	437	28.06±1.06	420	27.90±1.12	0.484^{NS}

**** - Significant at 1% level; * - Significant at 5% level; NS – Not Significant**

ANACOVA results showed that there was no significant difference between the mean nutritional scores achieved by the parents of Kerala and Tamil Nadu after imparting nutrition education. With regard to the difference in mean weight achieved after Medical Nutrition Therapy of the obese children in both the states, one per cent significance was found for eight year old children. The mean weight for eight year old children in Kerala after imparting Medical Nutrition Therapy was 49.375±2.03 and that for Tamil Nadu was 47.40±2.19. The mean weight attained by the seven year old children in Kerala after Medical Nutrition Therapy was 38.71±2.46 and 38.59±2.45 which was found to be significant at five per cent level. ANACOVA results also showed that there was no significant difference between the mean Body Mass Index values of he children in the age group six, seven, nine and ten in the states of Kerala and Tamil Nadu after imparting Medical Nutrition Therapy. For eight year old children in Kerala, the mean Body Mass Index values was 28.965±1.10 and for Tamil Nadu it was 27.97±1.31 which was found to be significant at one per cent level.