



Classification and Distribution of Gujarati and Non Gujarati Girls According to Obesity Epidemiology: A Prevalence Study

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Abstract

The WHO has drawn attention to fact that obesity is our modern non communicable “epidemic” that is, disease that affects population not an unavoidable attribute of aging^[2]. Until recently, females were thought to be protective gender, due to their hormone, estrogen but recent data collected from American Heart Association reveals that since two decades every year globally more females die of this cause than all other causes of death combined together^[9]. For this reason, we decided to study the prevalence of overweight and obesity in the girls of two communities that is Gujarati’s and Non Gujarati’s and segregated them in various groups to match the various parameters against them. The 1001 girls residing in different hostels from different colleges were selected for the study. Two groups were made and the total girls were categorized into Gujarati and Non Gujarati groups respectively. They were further classified according to categories like age, inhabitation, socioeconomic status, diet, weight, height, body mass index, Majority of our subjects were more than 20 years of age (52%). Most of them (76%) belonged to urban areas and 45% had middle socio economic status. Mainly the girls were strictly vegetarians (72%). Sixty percent total girls had a weight range of 53-65kg. Only 20% had height less than 1.52m. Forty percent were in overweight category according to body mass index with BMI range of 25-29.9Kg/m².

Keywords: MDA, WHR, BMI, Fibre, Obesi.

Introduction

The dramatic increase in the prevalence of obesity over the past few decades strongly suggest that preventive strategies will become more important as time goes on.^[6] Public health approaches that emphasize education have almost been uniformly unsuccessful at preventing weight gain or producing weight loss. Public health strategies that virtually impose behavior change along with healthy food are more successful in this regard.^[3] The average weight, body mass index, waist

circumference, hip circumference, waist hip ratio, body fat percent total body fat, lean body mass and skin fold thickness in girls of age less than 20 were low as compared to the higher age groups (59.58±6.84kg v/s 60.06± 6.85kg; 24.03±3.09kg/m² v/s 24.39±3.43kg/m²; 29.18±3.23 cm v/s 29.8±3.54cm; 35.82±1.71inches v/s 35.91±1inches.78; 0.82±0.08 v/s 0.83±0.09; 25.18±7.65% v/s 26.75±8.16%; 17.29±4.5kg v/s 17.81±4.76kg; 42.25±2.73kg v/s 42.29±2.89kg; 55.63±8.72mm v/s 56.41±7.98mm). Waist circumference

in lower class was 29 ± 3.17 cm as compared to waist circumference of 30 ± 3.50 cm in the middle class. Body fat percent was also higher for the middle category (26 ± 8.12 %) as compared to that in the lower class (25 ± 7.24 %). Total body fat was higher for middle and upper class (18 ± 4.76 kg, 18 ± 4.49 kg) in comparison to that in lower class (17 ± 4.60 kg).

Material and Method

The present study encompasses classification and distribution of girls from 2 different communities according to obesity epidemiology aged between 18 to 30 years. The girls were residing in hostels of Pacific Dental College, Udaipur.

Selection of Girls for the Study

This study has been conducted on 1001 girls who were residing in different institutional hostels like Geetanjali Medical College, Dental Colleges, Engineering Colleges, Pharmacy Colleges and others. Actually these girls had come from different districts of Gujarat, Rajasthan mainly and also from other States like Maharashtra, Uttar Pradesh, Madhya Pradesh etc. for higher studies, so they were selected for this study. Girls were randomly selected irrespective of their caste and creed. Interview schedule was developed to collect the general information regarding age, dietary habits, socioeconomic status, suffering from any illness, or taking any treatment, caste, religion etc. The subjects with any clinical or biochemical evidence of liver, kidney or endocrine disease and those on treatment that effect the lipid metabolism were excluded from the study. The categorization of obese subjects were made on the basis of body mass index (BMI) or waist hip ratio (WHR) or standard chart of desirable weight in relation to height, published by Metropolitan Life Insurance Company (Bray, 1978) [REF] as well as on the basis of skin fold thickness (Darnin and Womersley, 1974) [REF]. Normal subjects of identical age group with that of respective obese group acted as control.

Measurement of different Anthropometric parameters:

- i. **Age:** The age of the Gujarati and non Gujarati girls were recorded from their personal biodata
- ii. **Height:** Height was recorded using a measuring scale, with the individual standing straight without shoes next to the wall, with the heels, buttocks, shoulders and occipital touching the wall. The head was kept erect. The measuring scale was fixed on the wall. Height was measured in centimeters to the nearest of 0.1cm to the nearest 0.1cm.
- iii. **Weight:** Weight was recorded by weighing machine calibrated daily at the beginning of each working day. The individual was requested to wear light dress and the weight was recorded with the individual barefooted by taking two successive readings to the nearest 100gm, the mean of which was recorded.
- iv. **BMI:** The most widely used clinical tool for measurement of obesity is the Body Mass Index (BMI) i.e. wt. in Kg / m² height

BMI was accurately calculated using SI units. BMI was categorized as follows as per reported [4].

Category	BMI range- kg/m ²
Starvation	Less than 16
Underweight	From 16.5 to 18.5
Normal	From 18.5 to 24.9
Overweight	From 25 to 29.9
Obese	From 30 to 35

Recently the Ministry's Consensus for the prevention and management of obesity and metabolic syndrome for the country has declared that the country's new diagnostic cut off for the body mass index is 23kg/m² as opposed to 25kg/m² globally [Health Ministry, Diabetes Foundation of India, All India Institute of Medical

Sciences, Indian Council of Medical Research, The National Institute of Nutrition, 11/26/2008]. According to them, a person above body mass index of 23kg/m² will now be considered as overweight and below that as one with normal BMI – unlike the cut off limit of 25kg/m² earlier. Those with BMI of 25kg/m² will be clinically termed obese as opposed to 30kg/m² at the international level, and those with BMI of 32.5kg/m² will require bariatric surgery to estimate excess flab.

Statistical Analysis

Data were analyzed statistically by using student t test with the help of SPSS software version 19.

Results

Prevalence of Total, Gujarati and Non-Gujarati girls according to Age:

Our analysis uncovers that weight increases with age. More percentage of overweight and obese girls was above 20 year age group. The average weight, body mass index, waist circumference, hip circumference, waist hip ratio, body fat percent total body fat, lean body mass and skin fold thickness in girls of age less than 20 were low as compared to the higher age groups (59.58±6.84kg v/s 60.06± 6.85kg; 24.03±3.09kg/m² v/s 24.39±3.43kg/m²; 29.18±3.23 cm v/s 29.8± 3.54cm; 35.82±1.71inches v/s 35.91±1inches.78; 0.82±0.08 v/s 0.83±0.09; 25.18±7.65% v/s 26.75±8.16%; 17.29±4.5kg v/s 17.81±4.76kg; 42.25±2.73kg v/s 42.29±2.89kg; 55.63±8.72mm v/s 56.41±7.98mm).

Table: 1 Distribution of Girls according to age

Age(years)	Gujrati Girls		Non -Gujrati Girls		Total Girls	
	(n)	(%)	(n)	(%)	(n)	(%)
> 20 years	192	36%	328	69%	520	52%
< 20 years	334	64%	147	31%	481	48%
Total Girls	526	100%	475	100%	1001	100%

Table No.2 Distribution of Girls according to Inhabitanace

Inhabitanace	Gujrati Girls		Non -Gujrati Girls		Total Girls	
	(n)	(%)	(n)	(%)	(n)	(%)
Rural Inhabitanace	69	13%	173	36%	242	24%
Urban Inhabitanace	457	87%	302	64%	759	76%
Total Girls	526	100%	475	100%	1001	100%

Table No.3 Distribution of Girls according to Socio-economic status

Socio economic status	Gujrati girls		Non -Gujrati girls		Total girls	
	(n)	(%)	(n)	(%)	(n)	(%)
Lower	64	12%	130	27%	194	19%
Middle	183	35%	264	56%	447	45%
Upper	279	53%	81	17%	360	36%
Total Girls	526	100%	475	100%	1001	100%

Table No.4 Distribution of girls according to Dietary Habits

Dietary Habits	Gujrati girls		Non -Gujrati girls		Total girls	
	(n)	(%)	(n)	(%)	(n)	(%)
Vegetarian	404	77%	317	67%	721	72%
Non- Vegetarian	122	23%	158	33%	280	28%
Total Girls	526	100%	475	100%	1001	100%

Table No.5 Distribution of Girls according to the Weight range

Weight Range (kg)	Gujrati Girls		Non -Gujrati Girls		Total Girls	
	(n)	%	(n)	%	(n)	%
40-52	77	15%	70	15%	147	15%
53-65	335	64%	268	56%	603	60%
66-80	114	21%	137	29%	251	25%
Total Girls	526	100%	475	100%	1001	100%

Table No.6 Distribution of Girls according to the Height

Height (meters)	Gujrati Girls		Non -Gujrati Girls		Total Girls	
	(n)	%	(n)	%	(n)	%
< 1.52	116	22%	85	18%	201	20%
> 1.52	410	78%	390	82%	800	80%
Total Girls	526	100%	475	100%	1001	100%

Table No.7 Prevalence of overweight and obesity in Girls according to BMI

Category BMI (kg/m ²)	Gujrati Girls		Non -Gujrati Girls		Total Girls	
	(n)	(%)	(n)	(%)	(n)	(%)
Underweight <18.5	24	5%	19	4%	43	4%
Normal weight 18.5-24.99	280	53%	246	52%	526	53%
Overweight Preobese 25-29.99	212	40%	196	41%	408	41%
Obese Class 1 30-34.99	10	2%	14	3%	24	2%
Total Girls	526	100%	475	100%	1001	100%

Prevalence of Total, Gujarati and Non-Gujarati girls according to socioeconomic status:

In our study middle and upper status groups had highest prevalence of obesity and overweight. This is because of their high income, food habits and physical inactivity. In our study waist circumference in lower class was 29±3.17 cm as compared to waist circumference of 30±3.50 cm

in the middle class. Body fat percent was also higher for the middle category (26±8.12 %) as compared to that in the lower class (25±7.24%). Total body fat was higher for middle and upper class (18±4.76kg, 18±4.49kg) in comparison to that in lower class (17±4.60kg).

Prevalence of Total, Gujarati and Non-Gujarati girls according to Inhabitation:

We classified our subjects according to rural and urban category. Various statistics in past showed that urban population had greater prevalence of obesity and overweight. From our data, urbans are more affected, thus we report that prevalence has increased by two folds in rural population and by nine folds in urban population. The mean waist circumference in rural girls was less ($29\pm 3.19\text{cm}$) as compared to the mean waist circumference of the urban girls ($30\pm 3.46\text{cm}$) The body fat percent and total body fat of these girls were also less as compared to those in urban girls ($25\pm 7.67\%$ v/s $26\pm 8.01\%$, $17\pm 4.39\text{kg}$ v/s $18\pm 4.70\text{kg}$).

Prevalence of Total, Gujarati and Non-Gujarati girls according to diet:

The girls of non vegetarian groups had higher weights and body mass index range as compared to the vegetarian category. This might be due to high fatty diets with less use of dietary fibers. The average weight, waist circumference, total body fat, lean body mass and skinfold thickness in vegetarian girls were low as compared to these in non vegetarian girls ($60\pm 7.11\text{kg}$ v/s $61\pm 7.05\text{kg}$, $29\pm 3.50\text{cm}$ v/s $30\pm 3.56\text{cm}$, $17\pm 4.62\text{kg}$ v/s $18\pm 4.75\text{kg}$, $42\pm 3.20\text{kg}$ v/s $43\pm 2.87\text{kg}$, $56\pm 8.53\text{mm}$ v/s $57\pm 8.61\text{mm}$).

Prevalence of Total, Gujarati and Non-Gujarati girls according to weight and height:

Over weight and obese girls were present in the second and third category of weight range and normal weight girls mostly were of height more than 1.52m. The body fat percent, total body fat, lean body mass and skinfold thickness of girls with weight of $58\pm 6.47\text{kg}$ were low as compared to these in girls of weight of $65\pm 5.28\text{kg}$ ($23\pm 5.17\%$ v/s $38\pm 3.82\%$, $16\pm 4.04\text{kg}$ v/s $22\pm 3.52\text{kg}$, $42\pm 2.93\text{kg}$ v/s $43\pm 2.15\text{kg}$, $54\pm 7.69\text{mm}$ v/s $63\pm 6.99\text{mm}$).

Prevalence of Total, Gujarati and Non-Gujarati girls according to body mass index:

In our study we also evaluated the average anthropometric characteristics of total girls according to BMI. The average weight, waist circumference, body fat percent, total body fat, lean body mass and skinfold thickness followed

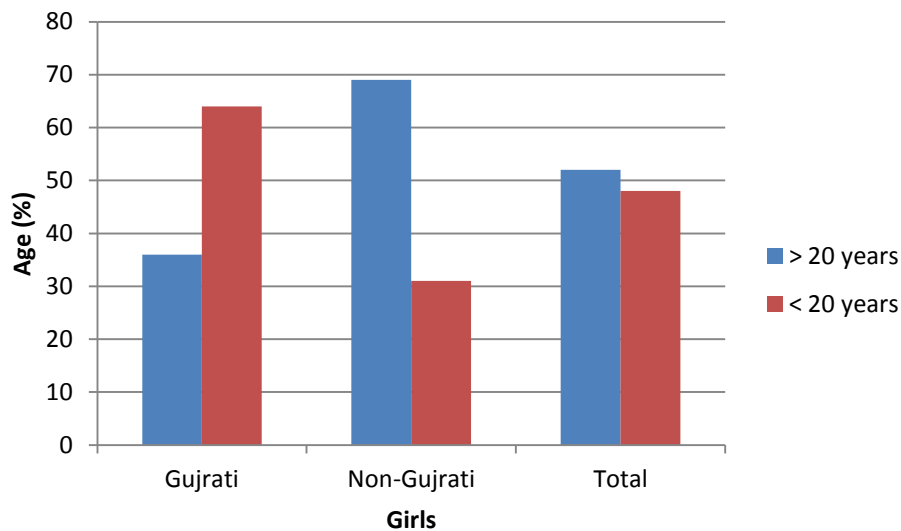
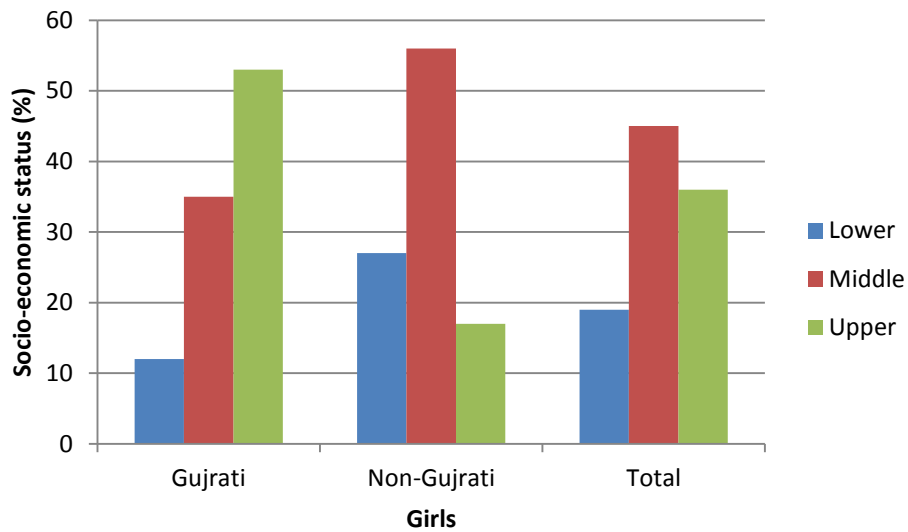
an increasing trend with increasing BMI. The increasing weights and waist circumference according to BMI were $48\pm 3.15\text{kg}$, $56\pm 4.66\text{kg}$, $65\pm 3.95\text{kg}$, $71\pm 3.56\text{kg}$; $26\pm 1.15\text{cm}$, $27\pm 2.22\text{cm}$, $32\pm 2.50\text{cm}$, $37\pm 2.22\text{cm}$ respectively. The increasing body fat percent, total body fat, lean body mass and skinfold thickness according to BMI were $20\pm 3.63\%$, $21\pm 4.63\%$, $31\pm 6.64\%$, $41\pm 6.04\%$; $9\pm 1.45\text{kg}$, $15\pm 3.82\text{kg}$, $22\pm 2.25\text{kg}$, $27\pm 1.75\text{kg}$; $39\pm 1.97\text{kg}$, $41\pm 6.44\text{kg}$, $44\pm 2.17\text{kg}$, $44\pm 2.00\text{kg}$; $46\pm 7.03\text{mm}$, $52\pm 7.22\text{mm}$, $61\pm 6.52\text{mm}$, $71\pm 4.27\text{mm}$ respectively.

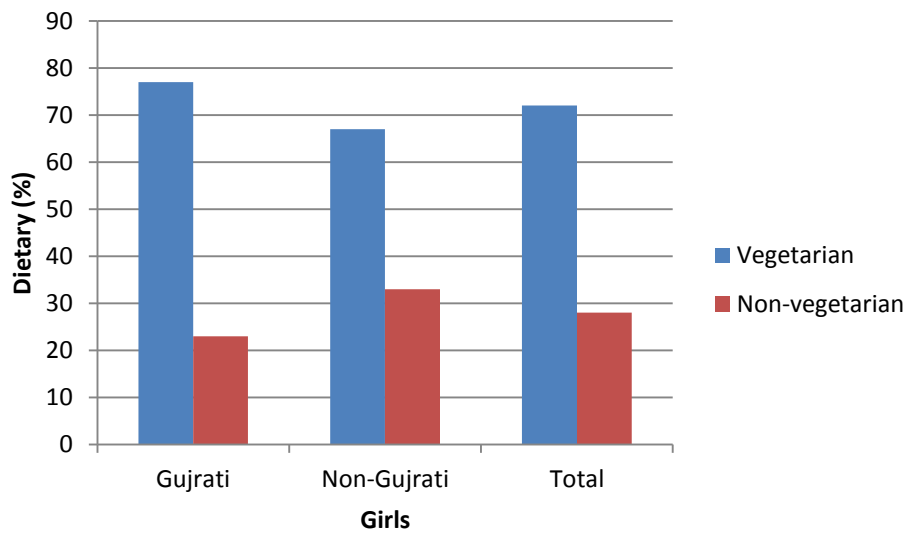
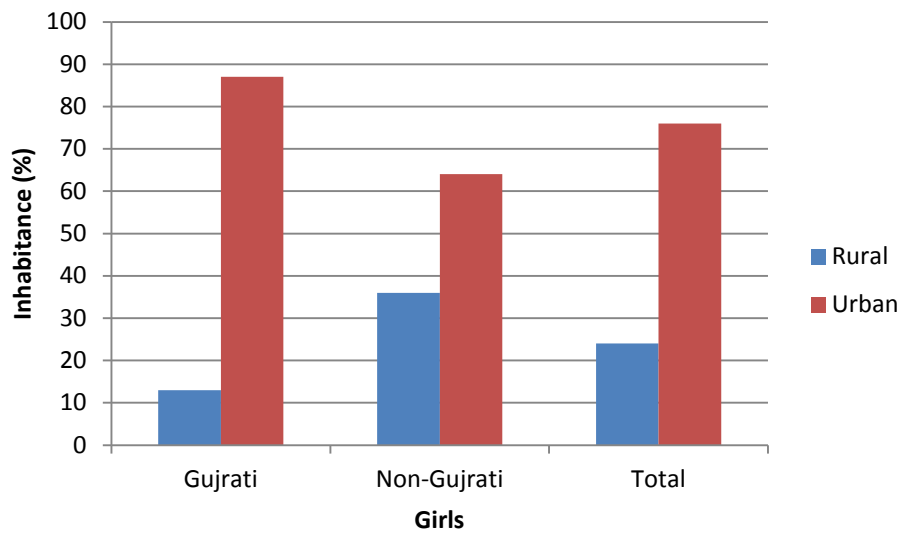
Discussion

Previous studies have shown that prevalence of obesity increases with advancing age. The 16-24 year age groups both males and females are substantially less at risk of becoming obese than older age groups and the increase of obesity for males in this age range has declined very slightly in recent years. Those aged between 25-34 years have the second lowest rates of obesity. Middle age people and those of retirement age are the most 'at risk' groups. More young males and females in 16-24 age groups have a desirable body mass index between 20 and 25 Kg/m^2 than any other body mass index category. Males of this age are twice as likely to be underweight as they are to be obese^[8]. British Heart Foundation (BHF) (2008) has proved in their article that overweight and obesity increases with age. In 2006 about 34 % of males and 32 % females aged 16-24 year were overweight/obese compared to 80 % of men aged 55-64 years and 73 % of females aged 65-74^[7]. The prevalence of central obesity also increases with age. About 10 % males and 17 % females aged 16-24 years had central obesity compared with 51 % of males and 65 % females aged 65-74^[1]. The Scottish Executive (2005) Health survey proved that only 11% cases of obesity by waist hip ratio were reported for age 16-24 years while, 18% cases for 25-34 years and 54% cases for age 75 years and over. Joint health survey unit (2008) for England reported that according to BMI 12% cases of obesity were

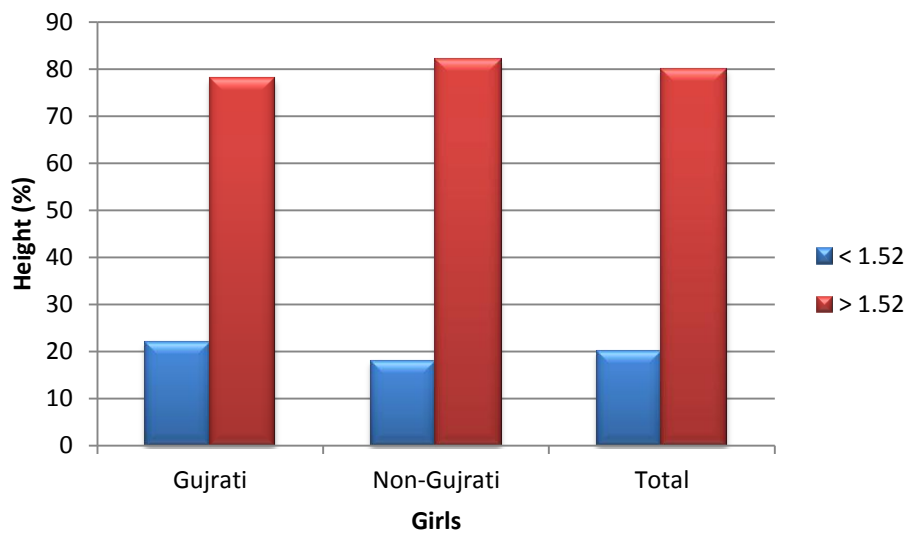
reported in age group 16-24 year,18% cases in 25-34 year and 27% cases for age group 55-76 year were reported^[4]. According to Waist Circumference prevalence in age group 16-24 year was 86% which increased to 94 % in age group 25-34 and 103% for age group 65-74 for males and for females, 16-24 age group had prevalence of 77% which increased to 83% in 25-34 age group while it was maximum of 92% for 65-74 age group^[4]. Our analysis uncovers that weight increases with age. More percentage of overweight and obese girls was above 20 year age group. According to Parizkova J et al (2007)

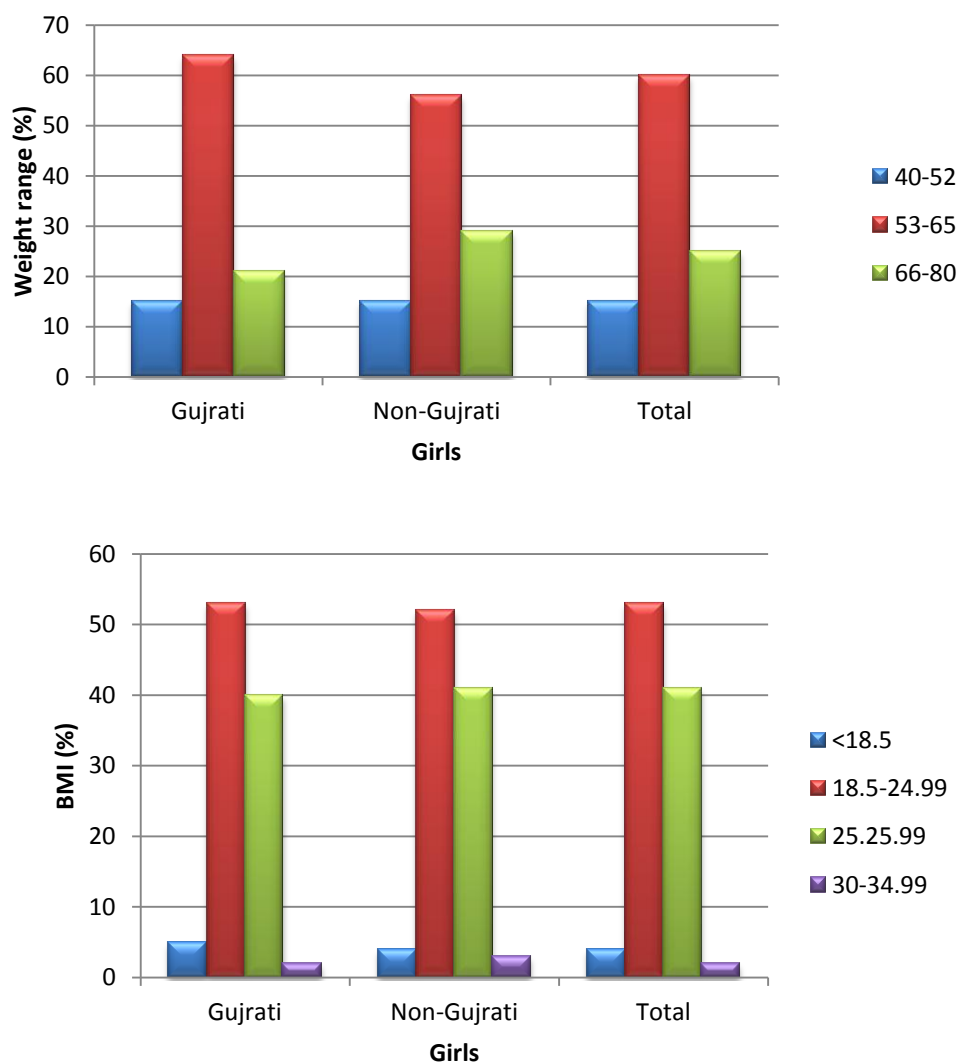
[REF] India being a country of diverse population, it has regions still struggling with burden of malnutrition but at same time there are rapidly emerging populations subgroups which are falling into trap of affluence related problems. The socio economic development has created changes in dietary intake, food consumption patterns and physical activity levels. They all have contributed to problem of increasing overweight to obesity. India is passing through transitional phase of socio economic development which has potential of altering the nutritional status of its population ^[4].





Graph.1: Distribution of Girls According to Age, Inhabitation, Socioeconomic Status and Dietary Habits.





Graph.2: Distribution of Girls According to Weight Range, Height, BMI

Socioeconomic status, which includes educational status, income per capita and profession, has a very crucial impact on prevalence of obesity and overweight, as evident in this study. In our study middle and upper status groups had highest prevalence of obesity and overweight. This is because of their high income, food habits and physical inactivity. Overweight and obesity are more prevalent among those with higher levels of education and people with high income, but is inversely related to socioeconomic status at given ages^[7]. Obesity develops in a socio cultural environment, characterized by mechanization, sedentary life style and ready access to abundant food, environmental and behavioural changes brought about by economic development; modernization etc. has been linked to the rise of

global obesity (Talmund PJ et al) (2004)^[5]. Among poorer nations adoption of industrialized food and food preferences, together with drastically decreased physical activity are the basic ingredients for accelerating obesity. Within developing countries, shifts to urbanization, non manual labour, high calorie food, sedentary life style are contributing to this growing problem, often in conjunction with undernourished segments of the population. Inhabitation difference in prevalence of obesity within India also provides information regarding risk factors that need prevention. Various statistics in past showed that urban population had greater prevalence of obesity and overweight.^[3] reported that urban prevalence of obesity was three times that of rural leading to glucose intolerance, diabetes mellitus and hyper

insulinemia. The increasing trend could be due to improper diet, may be traditionally rich food lacking in antioxidants and stress. From our data, urbans are more affected but over the period of time, rise in rural obesity subjects was also seen. The study showed that urban sub group had greater hypertension, sedentary life styles and total cholesterol levels. Decadal variation shows that obesity prevalence in urban population was 3.56 in 1960's, 3.89 in 1970's and 10.56 in 1990's. In the rural population the prevalence increased from 2.72 % (70's) and 2.1 % (80's) to 4.57% (90's). Thus they reported that prevalence has increased by two folds in rural population and by nine folds in urban population.. A relative lack of fiber in the diet of western world has been linked with increasing risk of several diseases like cardiovascular diseases, coronary artery diseases, cerebrovascular diseases, diabetes mellitus all of which are risk factors of obesity. Consumption of number of grains and grain extract has been reported to control and improve glucose tolerance and reduce insulin resistance. These conditions are associated with obesity and may be preliminary steps in progression of many chronic side effect diseases of obesity^[1]. For year's dietary guidelines for treatment of overweight and obesity have advised a low fat, low calorie diet. We categorized our girls according to their eating habits as vegetarian and non vegetarian groups. The girls of non vegetarian groups had higher weights and body mass index range as compared to the vegetarian category. This might be due to high fatty diets with less use of dietary fibers. Overweight and obesity are both labels for ranges of weight that are greater than what is generally considered healthy for a given height. The initial step in evaluation of obesity is calculation of body mass index. It correlates significantly with body fat, morbidity, mortality, calculated easily and quickly and even recommendations for treatment of obesity are based on body mass index. According to them, a person with a body mass index of 23kg/m^2 will now be considered as overweight and below that as one with normal

BMI – unlike the cut off limit of 25kg/m^2 earlier. Those with BMI of 25kg/m^2 will be clinically termed obese as opposed to 30kg/m^2 at the international level, and those with BMI of 32.5kg/m^2 will require bariatric surgery to estimate excess flab^[4]. A BMI of 25kg/m^2 is generally accepted threshold for identifying a patient at high risk for obesity related diseases (38). BMI $<18.5\text{kg/m}^2$ is considered underweight, In our analysis 41% girls were overweight and 53% belonged to normal weight category according to BMI. In our study we also evaluated the average anthropometric characteristics of total girls according to BMI. The average weight, waist circumference, body fat percent, total body fat, lean body mass and skin fold thickness followed an increasing trend with increasing BMI.

Summary

Epidemiological Study

The 1001 girls residing in different hostels from different colleges were selected for the study. Two groups were made and the total girls were categorized into Gujarati and Non Gujarati groups respectively. They were further classified according to categories like age, inhabitation, socioeconomic status, diet, weight, height, body mass index,

- 1) The total girls who belonged to the age group of less than twenty years were 48% and more than twenty years were 52%. Sixty four percent Gujarati girls were present in age <20 years, while only 36% were above 20 years. Thirty one percent Non Gujarati's were less than 20 years while 69% were more than 20 years.
- 2) The total girls who belonged to rural inhabitation were 24% and to urban inhabitation were 76%. Thirteen percent Gujarati girls were rural inhabitants, and 87% belonged to urban category. Thirty six percent Non Gujarati's were rural inhabitants, while 64% belonged to urban category.

- 3) The total girls who belonged to lower, middle and upper socioeconomic categories were 19%, 45%, and 36% respectively. Twelve percent Gujarati girls were part of lower category, 35% were belonging to middle category and 53% were having upper socio economic status. Twenty seven percent Non Gujarati's were part of lower category, 56% belonged to middle category and only 17% had upper socio economic status.
- 4) The total percentage of girls who were strictly vegetarians was 72%, and those belonging to non-vegetarian category were 28% only. Seventy seven percent Gujarati's were vegetarians while 23% were non-vegetarians. Sixty seven percent Non Gujarati's were vegetarians and 33% were non vegetarians.
- 5) The total percentage of girls belonging to weight range 40-52 kg (category 1) were 15%, those in weight range 53-65 kg (category 2) were 60% while those in weight range 66-80 kg (category 3) were 25% only. Fifteen percent Gujarati's belonged to first category, 64% belonged to second category and 21% were in the third category. Similarly 15% Non Gujarati's belonged to first category, 56% were in second category and 29% were part of third category.
- 6) The total girls with height <1.52m were 20% and with height >1.52m were 80%. Twenty two percent Gujarati girls were of height <1.52m and 78% were of height >1.52m. Eighteen percent Non Gujarati girls belonged to category of height <1.52m while 82% belonged to category of height>1.52m.
- 7) The total girls who were underweight according to body mass index were only 4%. Normal weight category had maximum 53% girls, 41% belonged to overweight or pre obese category and only 2% belonged to obese class 1 category of

body mass index. Five percent Gujarati girls were underweight according to body mass index, 53% were normal weight, 40% were overweight and 2% percent were obese. Four percent of Non Gujaratis were underweight according to body mass index, 52% were normal weight, 41% were overweight and 3% were belonging to obese class 1 category.

Conclusion

Majority of our subjects were more than 20 years of age (52%). Most of them (76%) belonged to urban areas and 45% had middle socio economic status. Mainly the girls were strictly vegetarians (72%). Sixty percent total girls had a weight range of 53-65kg. Only 20% had height less than 1.52m. Forty percent were in overweight category according to body mass index with BMI range of 25-29.9Kg/m². At the beginning of the third millennium, obesity became the most frequent global metabolic disease^[6]. Increasing prevalence has been shown not only in the industrially developed countries, but also in the developing countries. This concerns all age categories because of the investigation of dietary behaviour and dietary lifestyles specifically in girls^[9] and the prevalence of obesity varies remarkably across countries with different socioeconomic development levels.

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