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STUDY OF PREVALENCE OF OVERWEIGHT AND OBESITY AMONG YOUNG FEMALE COLLEGE STUDENTS

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ABSTRACT

Introduction: Late adolescents are tomorrow's adult population; assessment of their nutritional status is, therefore, primary to the prevention of non communicable diseases. **Methodology:** An ex-post facto study using a cross-sectional survey design was employed to find out the prevalence of overweight and obesity among young female college students in. A total of 2765 female college students aged 17-21 from 10 women's colleges in Chennai city were included in the study. Anthropometric assessments included body mass index (BMI) and body fat percent. Dietary intake was assessed using a three 24 hr dietary recall. Socioeconomic status (SES) of the sample was assessed using the Kalliath SES inventory. **Results:** Assessments of BMI indicated that only half the number of female college students (54.8%) had normal weight, while quite a few students were either overweight (13.2%) or obese (5.2%). More than a quarter of female college students were also underweight (26.9%). Mean energy intake of the students was (1828 kcal) lower than the Indian Council of Medical Research recommended values. The average intake of fruits, leafy vegetables, and other vegetables were dismally low. **Conclusion:** The findings reflect both a dual burden situation and an improper dietary pattern prevailing among the population of young female college students, necessitating the need for appropriate nutrition intervention.

KEYWORDS: Body fat percent, body mass index, dietary intake, obesity, overweight.

INTRODUCTION

Late adolescents are tomorrow's adult population, and their health and well-being are crucial. In most people's life, late adolescence is a period that marks the transition to a college or

university. The transition to college life often worsens dietary habits among late adolescents. They tend to eat fewer fruits and vegetables on a daily basis and report high intake of high-fat, high-calorie foods.[1],[2],[3] The typical college student's diet is high in fat and low in fruits and vegetables. Students often select fast food due to its palatability, availability and convenience.[4] Their dietary behavior is characterized by skipping meals,[5] consuming unconventional meals, fast foods,[6] and frequent "snacking."[7] Overall, their eating patterns are frequently erratic[8] and often these eating practices of young people contribute to obesity, eating disorders and increase the risk for several important chronic diseases later in life.

Also, nutrition transition over the past 40 years is understood to have resulted in 7% decrease in energy derived from carbohydrates and 6% increase in energy derived from fats.[9] The dynamic shift from traditional diets rich in grains, fruits, and vegetables to modern diets rich in fat, sugar and salt coupled with declining levels of physical activity due to rapid urbanization have resulted in escalating levels of obesity and thereby atherogenic dyslipidemia, subclinical inflammation, metabolic syndrome, type 2 diabetes mellitus, and coronary heart disease in Indians. Notwithstanding these concerns regarding a higher body weight, there is a serious lack of data on the prevalence of overweight and obesity in India, particularly among female college students. Therefore, the present investigation was undertaken to assess the prevalence of overweight and obesity among young female college students in addition to evaluating their dietary pattern.

MATERIALS AND METHODS

Objectives of the study

1. To assess the prevalence of overweight and obesity among female college students aged 17-21 years, in Chennai city.
2. To find out the average intake of protein, fat, and energy among young female college students.
3. To find out the influence of socioeconomic status (SES) on body mass index (BMI).
4. To find out the association of weight status with frequency of family meals, frequency of fast-food restaurant use and canteen use (FFRU and CU), sedentary behaviors and physical activity.
5. To find out the association of fruit and vegetable intake with frequency of family meals, frequency of FFRU and CU, peer influence, and media influence.

The study was carried only after the study protocol was approved by Review Committee instituted by the Department of Psychology, University of Madras. The study protocol included obtaining a written informed consent from all the subjects prior to their participation in the study.

Study design and sampling

The study is ex post facto in nature with a cross-sectional survey design. Of 20 women colleges in Chennai city, ten colleges were chosen by simple random sampling using lottery method ensuring proportionate representation of colleges from each of the four areas in the city. This included four colleges from the South, and two each from North, West and Central regions respectively. Estimation of sample size using the formula of Daniel[10] indicated a minimum sample of 205; however, with previous reports[11],[12] stating a prevalence of <10% for obesity, a greater sample size targeting at least 2000 was attempted.

After obtaining permission from each chosen institution, a convenience sample ranging from 170-300 undergraduate students allotted by the authorities from each college were included in the study. In all, a total of 2841 students participated, but data from only a sample of 2765 students were included in the final analysis while the rest were rejected on the basis of the exclusion criteria or for providing incomplete information. Students who were above the age of 21 or who reported chronic illnesses such as thyroid disorders, diabetes mellitus, and cardiovascular disease were excluded from the study.

Measures

Anthropometric measures such as height, BMI, and body fat percent were taken for all students who participated in the study. Height was measured using a body meter (SECA 208) while weight and body fat percent were assessed using the Omron Digital Body Fat Analyzer (HBF 200), which incorporates both a weighing scale and a leg-to-leg bioelectrical impedance analyzer. Information on personal factors related to weight status as well as fruit and vegetable intake was obtained through statements in the Personal Profile Performa, which also included a 3-day dietary recall schedule to obtain dietary data of the participants.

Socioeconomic status

The Kalliath SES inventory[13] was used to assess the socioeconomic status. It is an inventory, designed to measure and quantify the social position of an individual in the social hierarchy

that prevails in modern urban conglomerations. The validity of the tool has been established, and its reliability coefficient is 0.96.

Personal profile factors

A number of variables related to weight status as well as fruit and vegetable intake were assessed through questions included in the Personal Profile Performa, and their operational definitions are given below:

Frequency of family meals was "the frequency of eating a meal with all the family members in a week." Frequency of FFRU and CU was, "the frequency of eating something at a fast food restaurant or canteen in a week." Vigorous physical activity was, "the frequency of physical activity such as playing or exercising to the extent of sweating and breathing heavily," in a week. Sedentary behavior was, "the amount of time spent in hours per week in watching TV/Video and doing homework/reading or using the computer." Peer Influence was, "the tendency to alter food choices, due to the influence of friends." Media Influence was, "the preference for foods and frequency of choosing foods based on the influence of media."

Responses to questions on each personal profile variable were elicited in Likert scale with scores ranging from 0 to 5, and the final scores were dichotomized into low and high categories and utilized in subsequent computations.

Plan of analysis

Percentages were computed to obtain the prevalence of overweight and obesity. Analysis of variance was done to find out the influence of SES on BMI. Chi-square analysis was employed to find out the association of personal profile factors with weight status and intake of fruits and vegetables. The odds with which personal profile factors predicted weight status and intake of fruits and vegetables was found using Logistic regression analysis.

Data collection

In each institution, on being granted permission for data collection, the investigator coordinated with the staff in charge, to fix a convenient time for collecting data from the students in the classes allotted. The students were briefed on the nature and importance of the study and asked to fill a consent form if they were willing to participate in the study. All the students who gave their consent to participate were included in the study. As the strength of

the students in the classes varied, students were divided into batches such that the maximum number of students included per session of data collection did not exceed 40.

First, the students filled in their responses to the Kalliath SES inventory. Following this, the students were given detailed instructions for filling up the Personal Profile Performa, which elicited information on demographic details, personal profile factors and a 3-day dietary recall. The dietary recall was filled out by the students under the guidance of a dietician. The participants were guided in recording accurate amounts of food consumed with the help of the dietician's illustration of cooked volumes of food and drink using standardized cups, spoons and measures. From data on the volumes of cooked food consumed, the raw weight of foodstuffs and their nutritive values were calculated. Nutritive value of the raw ingredients was calculated using the Annapurna Software, which was then used to estimate the average intake of nutrients consumed.

Once the SES inventory and the Personal Profile Performa were filled by the students, anthropometric measurements such as height, weight and body fat percent were estimated for each privately.

Height was measured using a body meter (SECA model 208), which has a precision of up to 0.1cm. The body meter was suspended 2 m high from the floor against a straight wall. The respondent was requested to stand bare feet below the center of the measuring tongue of the body meter, leaning against the wall with the back straight, heels resting together against the wall or pillar and the hands held loosely on the side. While the respondent looked straight ahead, the measuring tongue was lowered towards the head until it gently touched the top of the head. Height measurement as appeared in the read-off area was then recorded. The SECA body meter was found reliable and valid for use in community survey[14] in the Third National Health and Morbidity Survey, on children in Malaysia.

The Omron Digital Body Fat Analyzer (HBF 200), which incorporates both a weighing scale and a leg-to-leg bioelectrical impedance analyzer, was used to measure weight (kg) and body fat percent to the nearest one decimal place. The leg-to-leg impedance method for assessment of body fat showed good correlations with the reference method-dual-energy X-ray absorptiometry in studies conducted both in the West[15] and among the urban South Indian population in India.[16]

In estimating body composition, age, gender, and height were entered manually in the analyser. The soles of both feet of the subject and the metal sole plates of the machine were cleaned with a dry cloth. The subjects were then asked to stand barefoot on the metal sole plates, with heels placed on the posterior plates and balls of the feet on the anterior plates. Subjects held their hands by their sides and stood facing forward when the readings were taken by the analyzer. Body weight and body fat percent were estimated using the standard built-in prediction equations that were displayed by the machine and recorded manually. BMI was calculated using the formula (weight in kg)/(height in m^2). Weight status was then classified in accordance to cut off values for BMI given by World Health Organization.[17] Body fat percent was also categorized according to the values proposed by Lohman.[18]

In each college based on the number of students allotted which ranged from 170 to 300 students, a minimum of four to a maximum of eight sessions were conducted. Each session lasted for 3h. It took a total of 72 sessions to collect data from 2841 students from 10 colleges. Data collection was spread across a period of 4 months from June to September 2010.

RESULTS

From [Table 1], it is evident that majority of the students (90.7%) were within the age range of 17-19 years. A small percentage of the sample was above 19 years, that is, 7.5% were 20 years and 1.8% were 21 years, respectively.

Table 1: Distribution of sample based on age, socioeconomic status, weight status, and body fat percentage.

Characteristics	Categories	*n* (2765)	Percentage
Age	17	549	19.9
	18	1154	41.7
	19	805	29.1
	20	206	7.5
	21	51	1.8
Socioeconomic status	High	516	18.7
	Middle	1853	67.0
	Low	396	14.3
Weight status	Normal	1514	54.8
	Underweight	744	26.9
	Overweight	364	13.2
	Obese	143	5.2
Body fat percentage (*n*=2722)**	Low	345	12.5
	Normal	1407	50.9
	High	642	23.2
	Very high	328	11.9

**Data for body fat percentage of 43 subjects were not recorded

Scores from the Kalliath SES inventory were interpreted with reference to contemporary social group parameters as the inventory has no general norms. Accordingly, it was found that 67% of the students belonged to middle-income group, 18.7% were from high-income group, and 14.3% from low-income group, respectively.

With regard to weight status, it is obvious that only half the female college students (54.8%) had normal weight, while a considerable number of subjects were underweight (26.9%) and quite a few students were either overweight (13.2%) or obese (5.2%), respectively.

Alternately, body composition analysis, also showed only half the number of female college students (50.9%) as having normal body fat percent, whereas close to a quarter of the subjects (23.2%) depicted a high level of body fat percent (i.e., >30%). Extremes in body fat percent, that is, very high (i.e., >35%) and very low (<20%) body fat percent were seen in 11.9% and 12.5% of the subjects, respectively. Thus, more than one-third of the population studied (34.1%) had body fat percent that was higher than normal. The findings obtained for body fat percent and BMI reveal a higher than normal body fat percent even among normal body weight subjects because as a larger percentage (34.1%) of college students were found with high to very high body fat percent in comparison with those having a higher body weight status such as overweight and obese (18.4%).

Influence of socioeconomic status on body mass index

The F-ratio in [Table 2] shows a significant difference in BMI among female college students belonging to the different socioeconomic groups. The difference in BMI between students from different socioeconomic groups was further analyzed using post-hoc Bonferroni test and is presented in [Table 3].

Table 2: Analysis of variance for the different socioeconomic groups on BMI.

Socioeconomic status	Sum of squares	df	Mean square	*F*	Significant
Between groups	1711.737	2	855.869	44.792	0.000*
Within groups	52,736.536	2760	19.107		
Total	54,448.273	2762			

*$P<0.05$. BMI: Body mass index

Table 3: Comparison of mean BMI among low, middle, and high socioeconomic groups.

Socioeconomic status	*n*	Mean	SD	Mean difference	SE
Low	396	19.91	3.67	1.55*	0.24
Middle	1851	21.46	4.41		
Low	396	19.91	3.67	2.76*	0.29
High	516	22.67	4.71		
Middle	1851	21.46	4.41	1.22*	0.22
High	516	22.67	4.71		

*P<0.05. SD: Standard deviation, SE: Standard error, BMI: Body mass index

From [Table 3], it is found that the BMI of the female college students of low socioeconomic group is significantly lower than those from middle and high socioeconomic group. Similarly, the BMI of female college students from middle socioeconomic group is also found lower than those from high socioeconomic group. Overall, an increase in BMI is found across the gradient of socioeconomic groups.

Association of weight status and personal profile factors

The association of the different categories of weight status with personal profile factors such as frequency of family meals, frequency of FFRU and CU, sedentary behaviors and vigorous physical activity are analyzed and presented in [Table 4].

Table 4: Association of weight status with frequency of family meals, frequency of FFRU and CU, sedentary behaviors and vigorous physical activity.

	Under weight (*n*=744) *n* (%)	Normal (*n*=1513) *n* (%)	Overweight (*n*=364) *n* (%)	Obese (*n*=143) *n* (%)	Significant
Frequency of family meals					
Low (1608)	415 (55.8)	906 (59.9)	200 (54.9)	87 (60.8)	0.14 NS
High (1156)	329 (44.2)	607 (40.6)	164 (45.1)	56 (39.2)	
FFRU and CU					
Low (2161)	569 (76.5)	1195 (78.9)	285 (78.3)	112 (78.3)	0.62 NS
High (604)	175 (23.5)	319 (21.1)	79 (21.7)	31 (21.7)	
TV/video watching					
Low (1418)	363 (48.8)	784 (51.8)	193 (53)	78 (54.5)	0.384 NS
High (1347)	381 (51.2)	730 (48.2)	171 (47)	65 (45.5)	
Computer use reading/doing homework					
Low (1747)	498 (66.9)	945 (62.4)	207 (57)	97 (67.8)	0.01*
High (1017)	246 (33.1)	569 (37.6)	156 (43)	46 (32.2)	
Hours spent sleeping					
Low (1329)	337 (45.3)	724 (47.8)	184 (50.5)	84 (58.7)	0.02*
High (1436)	407 (54.7)	790 (52.2)	150 (49.5)	59 (41.3)	
Vigorous physical activity					
Low (2266)	660 (88.7)	1277 (84.5)	244 (67.2)	85 (59.4)	0.00**
High (496)	84 (11.3)	235 (15.5)	119 (32.8)	58 (40.5)	

**P<0.01, *P<0.05. NS: Not significant, FFRU and CU: Fast food restaurant use and canteen use

From [Table 4], it is evident that weight status of female college students was significantly associated with vigorous physical activity (P < 0.01). Weight status was also associated with hours spent on sedentary activities such as computer use/reading/doing homework and hours spent sleeping (P < 0.05). However, weight status of female college students was not found to be associated with the frequency of family meals, frequency of FFRU and CU, sedentary behaviors such as TV/video watching. The associations that were found to be significant for weight status were further subjected to logistic regression analysis to predict the odds with which these factors influenced the different weight categories and the results obtained are presented in [Table 5].

Table 5: Influence of family support, sedentary behaviors- (computer use/reading/doing homework, hours spent sleeping), and vigorous physical activity on weight status categories.

Variables	Underweight		Overweight		Obese	
	OR	95% CI	OR	95% CI	OR	95% CI
Computer use/reading/doing homework	0.85 NS	0.7-1.0	1.1 NS	0.9-1.4	0.64*	0.4-0.9
Hours spent sleeping	1.1 NS	0.9-1.3	0.93 NS	0.7-1.2	0.68*	0.47-0.98
Vigorous physical activity	0.75*	0.6-0.98	2.24**	1.7-2.9	2.96**	2.0-4.3

**P<0.01, *P<0.05. NS: Not significant, OR: Odds ratio, CI: Confidence interval

From [Table 5], it is obvious that female college students who were obese had significant odds (0.6, P < 0.05) for more time spent on sedentary activities such as computer use/reading/doing homework than normal weight students, but the odds were <1. Similarly, female college students who were obese also had significant odds for more number of hours spent sleeping (0.7, P < 0.05) as compared to normal weight students but the odds were <1. The odds for vigorous physical activity was highest for obese students (2.96, P < 0.01), followed by overweight (2.24, P < 0.01) and then underweight (0.8, P < 0.05) students as compared to normal weight students. Thus, increase in body weight seems to increase the likelihood for indulging in more physical activity. Overall, obese students were found to have higher odds for involving in vigorous physical activity.

Findings of dietary assessment

The macronutrient intake of the sample calculated from the dietary recall alongside the recommended dietary allowances for Indian females is presented in [Table 6].

Table 6: RDA for Indian females and mean nutrient intake of the sample.

Nutrient	RDA*	Mean intake of sample (*n*=2765)	
		Mean	SD
Energy (kcal/day)	2040-2320	1828	713
Protein (g/day)	55-56	91.3	53.4
Fat (g/day)	20	38.3	21.3

*RDA - for 2 age groups are given in a range that is, 17-18 years (sedentary activity) and >18 years (sedentary activity) Source: Nutrient Requirements and Dietary Allowances for Indians, ICMR 2010. RDA: Recommended Dietary Allowances, SD: Standard deviation

[Table 6] shows the mean energy intake of female college students to be much lower than the recommended allowances. However, the protein and fat intakes of the sample are found to be higher than the recommended allowances. However, as the deviations from the mean are considerably high, these values have to be treated with caution.

From [Table 7], it is clear that the vegetable and fruit intake of female college students were far below the recommended allowances. In particular, the average intake of green leafy vegetables that are loaded with micronutrients and dietary fiber and have a protective effect against a host of communicable and noncommunicable diseases is found to be extremely low indicating noninclusion of green leafy vegetables among a vast majority of female college students. Similarly the average intake of fruits at 34.83 g is much lower than the recommended allowances with a high standard deviation depicting a wide variation in the consumption pattern ranging from total absence in the diet of some to a major component in the diet of others. With regard to other vegetables and roots and tubers, only 50% of the recommended allowances are consumed on a daily basis by most of the female college students. Overall, the average daily intake of fruits and vegetables among female college students is found to be way below the standard recommendations.

Table 6: RDA for Indian females and mean nutrient intake of the sample.

Nutrient	RDA*	Mean intake of sample (*n*=2765)	
		Mean	SD
Energy (kcal/day)	2040-2320	1828	713
Protein (g/day)	55-56	91.3	53.4
Fat (g/day)	20	38.3	21.3

*RDA - for 2 age groups are given in a range that is, 17-18 years (sedentary activity) and >18 years (sedentary activity) Source: Nutrient Requirements and Dietary Allowances for Indians, ICMR 2010. RDA: Recommended Dietary Allowances, SD: Standard deviation

Table 7: Mean intake of vegetables and fruits among female college students.

Foodstuff	RDA	Mean intake of the sample	
		Mean	SD
Green leafy vegetables (g)	100	3.58	11.79
Other vegetables (g)	100	45.43	58.51
Roots and tubers (g)	100	47.80	38.87
Fruits (g)	100	34.83	574.26

RDA: Recommended Dietary Allowances, SD: Standard deviation

[Table 8] shows frequency of family meals to be significantly associated with intake of other vegetables (P < 0.01), roots and tubers (P < 0.05) as well as intake of fruits (P < 0.05). Frequency of FFRU and CU was significantly associated only with intake of roots and tubers (P < 0.05) but not with intake of other vegetables or fruits. Peer influence was not significantly associated with intake of vegetables or fruits. Similarly, media influence was also not significantly associated with intake of vegetables or fruits. The associations that were significant for the intake of vegetables and fruits are further analyzed using logistic regression analysis and presented in [Table 7].

Table 8: Association of intake of vegetables and fruits with frequency of family meals, frequency of FFRU and CU, and peer influence and media influence.

	Other vegetables *n* (%)		Roots and tubers *n* (%)		Fruits *n* (%)	
	Low (1299)	High (1464)	Low (1398)	High (1365)	Low (2021)	High (743)
Frequency of family meals						
Low	802 (61.7)	805 (55.0)	844 (60.4)	763 (55.9)	1199 (59.3)	409 (55.1)
High	497 (38.3)	659 (45.0)	554 (39.6)	602 (44.1)	822 (40.7)	334 (45.9)
Significant	0.00**		0.02*		0.04*	
FFRU and CU						
Low	1019 (78.4)	1141 (77.9)	1119 (80.0)	1041 (76.3)	1596 (78.9)	565 (76.0)
High	280 (21.6)	324 (22.1)	280 (20.0)	324 (23.7)	426 (21.1)	178 (24.0)
Significant	0.72 NS		0.02*		0.10 NS	
Peer influence						
Low	1198 (92.2)	1368 (93.4)	1299 (92.9)	1267 (92.8)	1872 (92.6)	695 (93.5)
High	101 (8.8)	97 (6.6)	100 (7.1)	98 (7.2)	150 (7.4)	48 (6.5)
Significant	0.24 NS		0.97 NS		0.39 NS	
Media influence						
Low	1069 (82.3)	1191 (81.4)	1160 (83.0)	1100 (80.6)	1656 (81.9)	604 (81.3)
High	230 (17.7)	273 (19.6)	238 (17.0)	265 (19.4)	365 (19.1)	139 (19.7)
Significant	0.52 NS		0.10 NS		0.70 NS	

*$P<0.05$, **$P<0.01$. NS: Not significant, FFRU and CU: Fast food restaurant use and canteen use

[Table 9] shows that higher frequency of family meals had significantly higher odds for intake of other vegetables (1.3, P < 0.01), roots and tubers (1.9, P < 0.05), and fruits (1.2, P < 0.05) as compared to lower frequency of family meals. Besides, higher frequency of FFRU and CU indicated higher odds for intake of roots and tubers (1.2, P < 0.05).

Table 9: Influence of frequency of family meals, frequency of FFRU and CU on intake of other vegetables, roots and tubers and fruits.

Variables	Other vegetables		
	OR	CI	Significant
Frequency of family meals	1.3	1.1-1.5	0.00**
		Roots and tubers	
Frequency of family meals	1.9	1.0-1.4	0.03*
FFRU and CU	1.2	1.0-1.5	0.04*
		Fruits	
Frequency of family meals	1.2	1.0-1.4	0.04*

*P<0.05, **P<0.01. NS: Not significant, FFRU and CU: Fast food restaurant use and canteen use, OR: Odds ratio, CI: Confidence interval

DISCUSSION

Prevalence of overweight and obesity

In the present study, the prevalence of overweight and obesity among young female college students aged 17-21 years was found to be 13.2% and 5.2%, respectively. The prevalence rate found in this study is comparable to the prevalence rates previously reported from all parts of India. These studies have reported 12% overweight and 6.3% obese among boys and girls aged 12-16 years[19] 13.1% overweight and 4.3% obese among school girls (9-18 years) in[20] and 15.8% overweight and 2.7% obese among girls (13-18 year).[11] It could be learnt from these findings that most of the studies done to assess prevalence of overweight and obesity have been carried out on adolescents in the school going age but no data related to female adolescents of the college going age is available. However, in the present study, it was found that the rates for the prevalence of overweight and obesity in the college-going population were not distinctly different from those of school-going adolescents. Also, the prevalence rates for overweight and obesity were at par with the rates reported among adolescents world over. For example, data on BMI from 13 countries in Europe, the United States, and Israel showed that the prevalence of overweight and obesity among adolescent girls aged 15 years was on an average 15.3% and 5.5%, respectively.[21] The prevalence of overweight and obesity among Iranian adolescent girls (12-17 years) was found to be 18.6% and 5.9%, respectively.[22]

Another major finding that emerged in this study was the high prevalence rate of underweight (26.9%) that accounted for one-fourth of the study population of female college students. In total, the study population presented a sizeable number of students who were underweight,

alongside students who were overweight and obese at rates equivalent to those found in developed countries. Thus, these findings potentially project the dual burden situation that is confronting developing countries like India. The high prevalence of underweight observed in this study reiterates the fact that India's higher economic growth has not translated into a superior nutritional status. Further, in the present study, a lower BMI was associated with a lower SES. Researchers[23] point to low family income and low educational level of parents as primary reasons for deficient nutrient intakes that lead to undernutrition.

Further, examining the association of personal profile factors with weight status has revealed that among the factors studied, vigorous physical activity, and time spent on sedentary activities such as using computer/reading/doing homework and hours spent on sleeping were significantly associated with weight status. On the other hand, frequency of FFRU and CU and time spent on sedentary behaviours such as watching TV/video were not associated with weight status.

Sedentary behaviours such as television watching and computer use put adolescents at risk for overweight. In the present study, among the sedentary behaviours documented, time spent on using computer/doing homework/reading was significantly associated with weight status, with significant odds for these behaviours among obese subjects. However, time spent watching TV/video was not significantly associated with weight status. On the other hand, results from a similar study conducted by Utter et al.[24] have shown slightly different observations wherein TV/video use was significantly associated with BMI of middle and high school students in the United States. However, the lack of association reported in the present study between weight status and TV/video watching could be because TV/video watching was widespread and habitual among most adolescents belonging to all weight groups, indicating that factors other than weight status such as the type and variety of entertainment provided by television channels, lifestyle adopted in the families residing in a city like Chennai, could well be considered as factors contributing to the time spent on these sedentary activities.

Duration of sleep is an important antecedent of obesity. Decreased duration of sleep and increased television viewing were significantly associated with overweight in urban Indian children aged 6-16 years.[25] However, the results of the present study differ from these findings as a significant association between duration of sleep and weight status was found, with the odds for longer duration of sleep being significant for female college students who

were obese. In other words, female college students who were obese sleep more than female college students of normal weight. Information on hours of sleep collected in the present study was inclusive of both sleeping during day and night, therefore an increase in the hours spent on sleeping would imply physical inactivity and less energy expenditure that could increase the probability of gaining weight.

A lower level of physical activity and habitual exercise is associated with higher BMI.[26] A body of research work[19],[27],[28] supports the traditional view that physical activity is inversely associated with being overweight. The findings of the present study indicate a significant association between weight status and vigorous physical activity. However, the results for predictive analysis showed significantly higher odds for high vigorous physical activity among obese and overweight as compared to normal weight students. These findings revealed that indulging in physical activity was driven by a strong desire for weight reduction and not for the purpose of improving health or maintaining normal weight. This necessitates the promotion of regular physical activity, for good health, weight maintenance and prevention of overweight and obesity rather than encouraging physical activity after having gained weight.

Personal profile factors in relation to vegetable and fruit intake

Findings of the present study showed energy intake and intake of fruits and vegetables to be lower than the recommended allowances. But the frequency of family meals was found to be significantly associated with intake of fruits, other vegetables and roots and tubers. Further, higher frequency of family meals had significantly higher odds for the intake of fruits, other vegetables and roots and tubers. Thus, parental presence at a meal is found to be positively associated with adolescents' higher consumption of fruits, and vegetables. Similarly, frequency of family meals was positively associated with intake of fruits, vegetables, grains, and calcium-rich foods and negatively associated with soft drink consumption in a study reported by[29] Neumark-Sztainer et al. Swarr and Richards[30] also described that spending more time with parents was a key factor that resulted in healthy eating attitudes among adolescents.

A greater number of meals these days are consumed away from home by adolescents, particularly from restaurants and fast food places. In the present study, FFRU and CU were not found to be associated with intake of healthy food groups such as fruits and other vegetables. On the other hand, high frequency of FFRU and CU indicated higher odds, for the

consumption of roots and tubers. These findings are in consonance with that of French et al.,[31] who found fast food dining to be inversely associated with consumption of fruits, vegetables, and milk. The association between frequency of FFRU and CU with intake of roots and tubers is not surprising given the fact that foods consumed in fast food joints commonly include starchy vegetables such as potatoes and carrots particularly as stuffing in a number of dishes.

Findings in the present study showed no significant associations for the intake of healthy food groups such as fruits and vegetables, and peer influence as well as media influence. These findings are in concordance with the assumption that peer and media for the most part influence negative and unhealthy behaviours and not healthy behaviours.

CONCLUSION

The prevalence rate for overweight and obesity among young female college students found in the present study are similar to the prevalence rates reported in studies done earlier on adolescents in the various cities of India. The survey has also indicated a high percentage (26.9%) of female college students in the underweight category. This depicts the dual burden situation prevailing among female college students in. This demands immediate attention from the government to evolve a suitable policy that addresses both extremes of the dual burden situation.

The role of family is found to have a significant influence on the intake of healthy food groups such as fruits and vegetables. Parents need to be educated to encourage adolescents to have meals along with the family on a regular basis to ensure nutrient adequacy and curb the problem of overweight, obesity, and underweight.

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Conflicts of interest

There are no conflicts of interest.

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