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Gender Disparities in the Prevalence of Obesity and its Determinants among Younger Adults in Southern India

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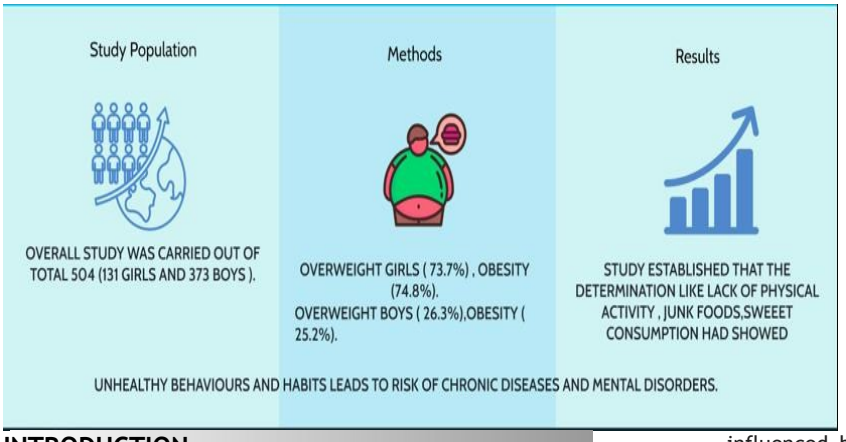
ABSTRACT

Background: Behavioural patterns and life style habits rapidly impacts on health of the young adults and it seems to be most severely influenced by the obesity epidemic worldwide which emphasizes the significance of resolving weight-related effects of the identified risk factors. The current study was aimed to identify the gender disparities in the frequency of obesity and overweight in young adults with its determinants. **Methodology:** The study was a prospective observational study and conducted from April 2023 to October 2023 among 504 undergraduate students those between the age group of 18–20 years in a private college of an urban area of south India, Tamilnadu. Information was collected using a pre-designed data entry form about the younger adults. Body mass index (BMI) was calculated based on weight and height measurements of study population. **Results:** A total of 504 (131 girls and 373 boys) younger adults, 91(24%) with boys and 38(29%) with girls were included in the study. The prevalence of overweight and obesity was, 68 (74.8%) for girls and 23 (25.2%) for boys, and 28 (73.7%) for girls and 10 (26.3%) for boys respectively. Lack of physical activity, sweet eating habits, take junk food regularly were showed significant difference ($p<0.05$) between boys and girls. There was no significant difference ($p>0.05$) in age, non-vegetarian diet, area of residence and duration of sleep between boys and girls. **Conclusion:** This study established that the determinants like lack of physical activity, junk food and sweet consumption had showed significant differences between overweight and obese boys and girls. Conversely unhealthy behaviors in early adulthood may contribute to chronic diseases and mental health disorders later in life, underscoring the need for gender specific preventive strategies.

Graphical Abstract:



INTRODUCTION

Obesity is a significant burden on healthcare systems around the world [1]. It is estimated that the prevalence of obesity in South and Southeast Asia would double between 2010 and 2030[2]. Obesity is a complex, multidimensional problem and it can be influenced by genetics, environment, and energy imbalance a condition in which energy intake exceeds energy expenditure[3,4] .Over 50 medical diseases have a strong correlation with obesity and it is linked to early adult mortality as well as psychosocial and cardio metabolic comorbidities[5]. High body mass index

(BMI) is one of the most important population health indicators available today [6]. Hypertension is a major cause of cardiovascular disease (CVD), stroke, and kidney damage, making it one of the most serious complications of obesity. According to epidemiology research, obesity and overweight account for 65–75% of the risk for primary (essential) hypertension [7].

According to global facts, most high and upper middle income countries have a higher prevalence of obesity among boys than girls between the ages of 5-19[8]. Obesity can vary significantly according to a individual's gender because it has both physiological and social factors, which. There are also changes between the sexes in terms of how fat tissue is stored and metabolized, and these differences may have origins in evolution. Sex differences may also exist in the health effects of excessive weight gain [9]. The disparity in the incidence and rate of increase of obesity between men and women has prompted many authors to investigate into the gender-related pathogenic mechanisms and obesity phenotype in an attempt to identify a weight-loss approach specific to a particular gender over the other. In addition to variations in prevalence, there is a gender-specific distribution of adipose tissue. There are established gender differences in body composition for a given BMI, such as more fat-free mass in male and higher adiposity in female[10].

Research on adolescents has shown that men typically consume more fast food, women are more likely to pay attention to what they eat in order to maintain good health and meet dietary guidelines. Menstrual cycles have also been linked to cravings for foods high in fat and carbohydrates[11]. Boys and girls may have distinct biological causes of overweight and obesity in addition to distinct social and cultural contexts. Differences between boys and girls include differences in hormone biology, patterns of weight gain, and vulnerability to specific social, ethnic, genetic, and environmental influences[12].The chances of young people

becoming inactive during their free time have grown in the last several years.

In particular, the increased availability of video games, TV shows, and internet browsing

has been linked favorably to overweight, and among adolescents, the amount of time spent engaging in sedentary activity is

negatively correlated with physical exercise[13].The dynamic nature of young adulthood often fosters a period of

exploration, experimentation and adaptation, leading to diverse range of behavioural patterns lifestyles rapidly among the

individuals leading to develop high-risk health behaviours, such as smoking, improper eating, and a lack of activity which can have

long-term negative impacts[14].

The global obesity epidemic indeed presents a significant challenge and it's concerning that the next generation of young adults appears to be particularly affected. Resolving the weight-related effects of identified risk factors is crucial [15].The prevalence of overweight among young adult is not well studied, so more attention needs to be given to these individuals. Furthermore, while the majority of research on overweight focuses on children and adolescents, it is essential to study other groups at different stages of life, particularly young adulthood. As the number of overweight and obese young adults rises, it is becoming apparent to take preventative measures to improve the health to cope up with the current scenario [16].The current study was aimed to examine the gender disparities in the occurrence of obesity and determinants of undergraduate adults in south India.

2.Methodology

2.1 Study subject and selection

The study was a prospective observational study and conducted from April 2023 to October 2023 among 504 undergraduate students those between the age group of 18–20 years in a private college at urban area of in south India, Tamilnadu. Inclusion criteria for the study participants were BMI ≥25 with both sex and BMI < 25 participants or age < 18 years were excluded from this study.

2.2Data collection

A pre designed validated questionnaire used as data entry form to collect the variables included age, gender, physical exercise, dietary habit like vegetarian or non-vegetarian, take junk food regularly, sweets eating habits, family history of obesity, menstruation cycle (regular/irregular) for female, education, place of residence, alcohol consumption .cigarette smoking, and duration of sleep. A direct face to face interview was conducted to collect the data in the college campus .A well designed validated leaflet information on risk.

Complications of overweight and obesity with the preventive measures was distributed to the study population emphazing on the awareness on the health concerns.

2.3Anthropometric measurements

A computerized weighing machine and heightometers were used to measure the participants' weight and height. The formula used to determine the body BMI was weight (kg)/height (m). Four categories were identified using the adult WHO BMI criteria. This study using the recently defined and published BMI cut-off values for classifying obesity and overweight. The BMI cut-off points for adult health were approximately 25 kg/m2 for overweight people and 30 kg/m2 for obese people[17]. The weighing devices and heightometers used for this study have been examined and calibrated. Every day, the two instruments were calibrated before the data collecting commenced.

2.4Ethical approval

The protocol for the study was reviewed and approved by Institutional Human Research Ethical Committee of Karpagam Faculty of Medical Sciences and Research (Ref: IHEC/285/KAHE/04/2023). An informed written consent was retrieved from all patients with clarification of the study protocol.

2.5 Statistics analysis

Data was analysed by SPSS version 20.0. The chi square test was used to compare categorical data between boys and girls. $P<0.05$ was considered as statistically significant.

3.Results

The baseline features of the study sample are shown in **Table 3.1.** Overall 504 (131 girls and 373 boys) younger adults, 91(24%) with boys and 38(29%) with girls had met the inclusion criteria. The occurrence of overweight and obesity was, 68 (74.8%) for girls and 23 (25.2%) for boys, and 28 (73.7%) for girls and 10 (26.3%) for boys respectively. In girls, lack of physical activity 24(85.7%), sweet eating habits 17(67.8%), area of residence in urban 08(80%), duration of sleep 6-8 hours 23(82.1%) were predominant in over weight group. 07(70%) in 18 years, non-vegetarian diet 09(90%), take junk food regularly 03(30%), family history of obesity 08(80%), irregular menstruation 06(60%) were found to be more in obesity group.

S.No	Parameters	Overweight (n=28)	Obese (n=10)
1	**Age**		
	18 years	17(60.7)	07(70)
	19 years	10(35.7)	02(20)
	20 years	01(3.6)	01(10)
2	**Physical exercise**		

	Yes	04(14.3)	03(30)
	No	24(85.7)	07(70)
3	**Diet habit**		
	Vegetarian	03(10.7)	01(10)
	Non- Vegetarian	25(89.3)	09(90)
4	**Regular junk food**		
	Yes	07(25)	03(30)
	No	21(75)	07(70)
5	**Sweet eating habits**		
	Yes	19(67.8)	05(50)
	No	09(32.1)	05(50)
6	**Family history of obesity**		
	Yes	06(21.4)	02(20)
	No	22(78.6)	08(80)
7	**Menstruation**		
	Regular	21(75)	04(40)
	Irregular	07(25)	06(60)
8	**Area of Residence**		
	Urban	14(50)	08(80)
	Rural	14(50)	02(20)
9	**Duration of sleep**		
	<6 hours	02(7.2)	01(10)
	6-8 hours	23(82.1)	08(80)
	>8 hours	03(10.7)	01(10)

Table.3.1: Baseline Characteristics of overweight & obese girls

In boys, as shown in **Table 3.2**, 49 (72.1%) of 18 years, sweet eating habits 29(42.6%), lack of physical activity 47(69.1%), duration of sleep 6-8 hours 50(73.5%), family history of obesity 52(76.5%) were predominant in over weight group. Non-vegetarian diet 22(95.7%), take junk food regularly 19(82.6%), smoking 22(95.7%), alcoholic 21(91.3%), area of residence in urban 14(60.9%) were higher in obesity group. It showed that above factors were not same in girls and boys according to overweight and obese groups

S.No	Parameters	Overweight (n=68)	Obese (n=23)
1	**Age**		
	18 years	49(72.1)	16(69.5)
	19 years	13(19.1)	04(17.4)
	20 years	06(8.8)	03(13)
2	**Physical exercise**		
	Yes	21(30.9)	14(60.8)
	No	47(69.1)	09(39.2)
3	**Diet habit**		
	Vegetarian	05(7.3)	01(4.3)
	Non- Vegetarian	63(92.7)	22(95.7)
4	**Regular junk food**		
	Yes	23(33.8)	19(82.6)
	No	45(66.2)	04(17.4)
5	**Sweet eating habits**		
	Yes	29(42.6)	08(34.8)
	No	39(57.3)	15(65.2)
6	**Family history of obesity**		
	Yes	16(23.5)	12(52.1)
	No	52(76.5)	11(47.9)
7	**Smoking**		
	Yes	07(10.3)	01(4.3)
	No	61(89.7)	22(95.7)
8	**Alcoholic**		
	Yes	09(13.2)	02(8.7)
	No	59(86.8)	21(91.3)
9	**Area of Residence**		
	Urban	32(47.1)	14(60.9)
	Rural	36(52.9)	09(39.1)
10	**Duration of sleep**		
	<6 hours	08(11.8)	04(17.4)
	6-8 hours	50(73.5)	14(60.9)
	>8 hours	10(14.7)	05(21.7)

S.No	Parameters	Girls (n=38) BMI ≥25	Boys (n=91) BMI ≥25	P value
1	**Age**			
	18 years	34(63.1)	65(71.4)	0.386
	19 years	12(31.6)	17(18.6)	
	20 years	02(5.3)	09(9.9)	
2	**Physical exercise**			
	Yes	07(18.4)	35(32.9)	0.0268*
	No	31(81.6)	56(67.1)	
3	**Diet habit**			

	Vegetarian	04(10.5)	06(6.6)	0.4463
	Non- Vegetarian	34(89.5)	85(93.4)	
4	**Regular junk food**			
	Yes	10(26.3)	42(46.1)	0.0363*
	No	28(73.7)	49(53.8)	
5	**Sweet eating habits**			
	Yes	24(63.1)	37(40.6)	0.0196*
	No	14(36.8)	54(59.4)	
6	**Family history of obesity**			
	Yes	08(21.1)	28(30.8)	0.2620
	No	30(78.9)	63(69.2)	
7	**Area of Residence**			
	Urban	22(57.9)	46(50.5)	0.4462
	Rural	16(42.1)	45(49.5)	
8	**Duration of sleep**			
	<6 hours	03(7.9)	12(13.2)	0.4164
	6-8 hours	31(81.6)	64(70.3)	
	>8 hours	04(10.5)	15(16.5)	

Table.3.2: Baseline Characteristics of overweight & obese Boys
* P<0.05 as significant based on chi square test.

Table.3.3: Summation of overweight and obese Adults with their characteristic differences based on gender differences (Girls vs Boys)

Characteristic of the examined younger adults based on gender differences (Girls vs Boys) was showed in table.3.3. Lack of physical activity, sweet eating habits, take junk food regularly were showed significant difference (p<0.05) between boys and girls. Girls with lack of physical activity 31(81.6%), sweet eating habits 24(63.1%) were significantly higher than boys with lack of physical activity 56(67.1%) and sweet eating habits 37(40.6). Boys have taken junk food regularly 49(53.8%) was greater compared to that of girls 10(26.3%).

There was no significant difference in age, non-vegetarian diet, area of residence, diet habits, and duration of sleep between boys and girls. Nearly 90% of both groups followed the non- vegetarian diet and it showed no gender difference. But sweet eating habits was significantly higher in girls 24(63.1%) than boys 37(40.6%) and intake of junk food regularly was significantly higher in boys 42(46.1%) than girls 10(26.3%). The obesity, overweight girls and boys were approximately equally distributed in urban and rural area. In this 22(57.8%) of girls who are lived in urban area was higher than boys 46(50.5%). The duration of sleep slightly lower in boys compared than girls (< 6 hours girls 03(7.9%) vs boys 12(13.2%)).

DISCUSSION

In India, 40.32% of adults was affected by obesity[18]. In younger adults, the current study found that girls were more likely than boys to be overweight or obese. Compared with other studies, this result was significant. According to an Indian study the prevalence of obesity was higher (6.4%) in male than female (5.8%)[19].A Saudi Arabia study showed that compared to female students male students had a greater chance of obesity[20]. A study in the United Arab Emirates reported that male students being more overweight and obese (18.6%) than female students (21.5%)[21]. Based on the current study, girls were more likely than boys to report not exercising regularly. The results of the earlier study were likewise confirmed[22,23]. Studies have shown that those who engage in less physical exercise experience greater levels of food cravings than those who engage in more physical activity, indicating the importance of physical activity as an appetite regulator[24]. Globally, including in India, children, adolescents, and adults have a decreasing profile of physical activity. One of the major factors contributing to this tendency among young people may be the rising use of social media, computers, televisions, cell phones, and virtual gaming. A reduction in outdoor activity and an rise in the usage of motor vehicles for mobility also contribute to the obesity[25].

About 40% of people globally fail to achieve the recommended levels of physical activity. According to age-standardized estimates, 34.03% of Indians do not engage in sufficient physical activity. In terms of walking, India is rated 39th out of 46 countries. This becomes crucial because cardiac issues are growing more common in young individuals. In the present and the future, young adults (18–35 years old) will play an essential part in the economically productive age group. [26].

In this study 42(46.1%) boys and 10(26.3%) girls had taken junk food regularly. Approximately a one-third of adults consume junk food on a regular basis and central adiposity or obesity is a significant risk factor for cardiac issues and other non-communicable illnesses. Inadequate diets may cause weakened immune systems, increased vulnerability to oral and systemic illnesses, impaired physical and mental growth, and decreased productivity[27]. A 70% of people worldwide had reported consuming more junk food than they used to, with young adults consuming it more frequently than other age groups[28].

Girls are more likely than boys to consume health-promoting items like fruit or meat substitutes, and they also report a lower overall quality of diet[29]. More often than boys, girls reported to consuming sweets[30]. Vegetarian diets high in legumes, nuts, pulses, and whole grains have been proposed to have protective effects against the risk of obesity and overweight. Consuming fruits and vegetables has been shown to lower the risk of obesity. A study found that young people with a BMI that was lower than that of individuals who have taken more vegetables, fruits and pulses twice a week. [31].

The primary cause of the worldwide obesity pandemic has

been shown to be an increase in BMI in rural areas[32]. A number of studies have recently shown correlations between higher levels of traffic noise, air pollution, and road traffic and increased rates of childhood obesity and growth[33]. In urban areas, the risk of being overweight or obese is increased by poor diets, inactivity, potentially hazardous and stressful areas[34]. The incidence of obesity has significantly increased in India, both in urban and rural areas. The increased obesity in India are due to rising urbanization, modifying lifestyles, and behavioral changes [35]. Individuals must adopt healthier lifestyle choices, such as limiting sedentary activities, eating healthier whole foods, and enhancing physical activity, in order to prevent obesity in younger adults.

CONSLUSION

Healthy patterns established during the young adulthood can set the trajectory for future health. Obesity and overweight have become global issues with seriously rising health risks. Determinants like lack of physical activity, junk food and sweet consumption had showed significant differences between overweight and obese boys and girls. The incidence other factors like age, area of living, sleep pattern and family history of obesity have not shown any differences. However, this burden can be minimized by providing an active intervention program in a healthy environment. Programs for improving health must be intended, and the difficulties in carrying them out must be acknowledged. Raising awareness about health concerns is paramount for promoting well-being and preventing potential risks. Therefore, monitoring the prevalence of obesity through larger, globally representative investigations is necessary, as is raising awareness of the emerging trends.

Limitations

The study is observational, which limits the ability to establish causal relationships between identified
Risk factors and obesity/overweight. Larger sample, more diverse, and longitudinal study designs
is needed to validate these findings and explore the causal pathways underlying obesity in young
adults.

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