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Compliance With Diet and Physical Activity Recommendations Among Obese Patients Seeking Nutritional Therapy: A Hospital-Based Study in Sri Lanka

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ABSTRACT

Aims: This study aimed to identify the adherence of healthy dietary patterns and physical activity among the obese population seeking nutritional therapy. **Methods:** A descriptive cross-sectional study was conducted among 123 obese patients, seeking nutritional therapy for the first time. Dietary patterns and physical activity levels were assessed via a 7-day food diary and the Global Physical Activity Questionnaire, respectively. Pearson's Chi-square ($\chi2$) tests and Fisher's exact tests were used to test the relationship between factors. **Results:** The majority of the participants were female (85.3%) and were above 45 years (51.2%). Out of all the patients, 30.7% of patients were morbidly obese and 28.4%, 7.3%, 64.2%, 16.2% and 5.7% of patients had unhealthy dietary patterns of carbohydrates, fats, fruits, salt and sugar respectively. Morbid obesity was associated with unhealthy dietary patterns of carbohydrates, proteins and fruits. A significant proportion (61.0%) of patients did not exercise. In addition, 47.2% of the population had at least one co-morbidity, with dyslipidaemia being the most common. Fast food consumption and reduced fruit intake were significantly associated with the presence of co-morbidities. **Conclusions**: Most adults in this study did not adhere to the recommended diet and physical activity levels. there is a need to encourage healthy eating and adequate exercise to prevent the development of obesity and other non-communicable diseases.

Keywords: Dietary patterns, obesity, physical activity

INTRODUCTION

Overweight and obesity are defined by the WHO as abnormal or excessive fat accumulation that presents a risk to health (1). The World Obesity Federation predicts that one in five women and one in seven men are likely to be obese by 2030 (2).

It is commonly speculated that developed countries a higher prevalence of obesity. More than two-thirds of the urban population in Sri Lanka are reported to be overweight or obese (3).

The danger of obesity lies in its significance as a risk factor for the development of an array of non-communicable diseases [NCD] (4-5). In Sri Lanka alone, 11% and 20% of the population suffer from Diabetes Mellitus (DM) and hypertension, show respectively (6-8).

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A typical Sri Lankan diet is mostly cereal-based (9,10). More than 65% of Sri Lankans consume over the recommended amount of starch, and a third of the population does not meet the recommended intake of other nutrients such as fruits, vegetables, proteins and dairy (9). The consumption of readily available processed foods contributes to the development of obesity (11,12).

The lack of physical activity [PA] is a major risk factor for obesity (13). The recommended activity level of 150 minutes of moderate-intensity exercise or 75 minutes of vigorous-intensity exercise per day for adults, is seldom achieved (14). Low and middle-income countries (LMICs) have reported only 50% of the physical activity of high-income countries (15). Obese individuals can control their body weight adjusting the diet and physical activity (15).

Studies exploring the effect of dietary patterns and physical activity on obesity and its associated comorbidities are abundant in the developed part of the world, yet there is an apparent paucity of recent literature on LMICs. Evaluating the level of compliance with dietary and physical activity recommendations among obese patients seeking nutritional therapy will help to explore the modifiable factors in this cohort of individuals.

MATERIALS AND METHODS

Study Design and Sampling Technique

A descriptive cross-sectional study was carried out among 123 patients, registered at the Nutrition Clinic at University Hospital Kotelawala Defense University. This clinic has a draining area ranging from Kalutara district to Gampaha covering the western province and few occasional patients from other provinces. Most patients have completed secondary education. All patients aged 18 and above with a Body Mass Index (BMI) exceeding 30 kg/m2 (fulfilling the definition of obesity) were recruited for the study. Pregnant patients and patients with liver or renal disease were excluded, as these were the main comorbidities seen amongst the referrals in the given populations, and can impair the appetite of the individuals due to disease, in addition to having significant body mass due to edema in severe cases. A convenient sampling technique was utilized from January 2021 for six months, recruiting all consecutive consenting individuals. Participants were educated regarding the purpose of the study and informed written consent was obtained.

Data Collection

Each participant's height and weight were measured by trained investigators, using a stadiometer (to the nearest 0.1cm) and a calibrated electronic scale (to the nearest 0.1kg), respectively. BMI was calculated using the data. Asia-Pacific anthropometric cut-offs (21) were used to define obesity. Those with a BMI between 30 and 35 kg/m2 were categorized as "obese" and those with a BMI above 35kg/ "morbidly obese". Sociodemographic data were filled in the questionnaire before handing the food and physical activity diary. The questionnaires and diaries were pretested among 15 individuals of the same population who were excluded from the study.

Dietary intake was evaluated by providing each participant with a pre-designed food diary and a physical activity diary, provided upon initial registration. Diaries were maintained for seven days. Clear instructions, using the participant's preferred language were given on how to maintain the diary. The need for entry of all consumed foods and beverages, irrespective of quantity or repetition, was emphasized. To further improve the reliability of maintaining records, a mock entry was made. A contact number of an investigator was made available to the participant during the week for further clarification. Participants were reassured that they would not be judged or criticized based on their diary records, to improve the accuracy and reliability of data. A serial number was issued to participants for identification, and were requested to return with their diaries, upon completion of a week from issue. Each diary was thoroughly assessed by an investigator, and on return following 7-day documentation, details were entered into the questionnaire based on the serial number.

Duly completed diaries were assessed in depth by the investigator to record food consumed in terms of carbohydrates and proteins, using standard serving sizes and caloric measurements. Finally, an average daily intake of each nutrient class (in terms of serving size) was obtained. In addition, the daily patterns of fruit, vegetables, salt, sugar and oil intake were derived. The level of physical activity was analyzed, based on the diary in terms of frequency, duration and intensity, using the Global Physical Activity Questionnaire (GPAQ) (16).

Those who had extremely unclear handwriting and those who had diaries of which more than 5% of the total records were incomplete in terms of food type and quantity, were removed from the study due to potential errors in analysis.

Statistical Analysis

A descriptive analysis of the data was carried out using SPSS version 25 (SPSS Inc., Chicago, Illinois), using frequency tables and graphs, with measures of central tendency. Unhealthy dietary patterns were identified, based on current food-based dietary guidelines. Chi-square tests ($\chi 2$) and Fisher's exact tests were generated to explore associations between dietary patterns, patterns of physical activity and obesity-related comorbidities. A significance level of $p<0.05$ was used.

RESULTS

Sociodemographic details

A total of 123 patients took part in the study, out of which the majority (105) were females. Most participants were above 45 years of age (51%). Our study consisted of 85 obese and 38 morbidly obese patients (30.9%). The sociodemographic details and BMI of the participants are summarized in Table 1.

Dietary patterns and obesity

Figure 1 illustrates the daily dietary patterns of the participants. In addition, 78.0% of participants consumed snacks, out of which 81.3% of snacks were unhealthy, and 19.5% of participants had a midnight snack. Fast food was consumed by 40.7%, out of which the majority (80.0%) consumed these items 1 to 3 days a week. While 23.6% skipped breakfast, 6.5% of participants skipped meals in general. Out of 123 participants, 75.6% claimed that they always consumed home-cooked food.

Table 1: Sociodemographic details and BMI of participants

Variables	**Frequency n (%)**
Gender	
Males	18 (14.6)
Females	105 (85.4)
Age category (years)	
18-35	38 (30.9)
36-45	22 (17.9)
>45	63 (51.2)
BMI (kg/m^2)	
30-35	85 (69.1)
>35	38 (30.9)

Table 2 shows the relationship between daily dietary patterns and BMI. Pearson's $\chi 2$ tests and Fisher's exact tests were done to evaluate each association; the only significant associations were between BMI and carbohydrate servings ($p<0.05$, df=1), protein servings ($p<0.05$, df=2) and fruit serving size ($p=0.03$, df=1).

Physical activity and obesity

Out of 123, 48 (39.0%) participants exercised, out of which 89.6% did moderate intensity exercises and the remainder did vigorous intensity exercises. The majority (79.2%) of the participants did moderate-intensity exercises for less than 60 minutes and 8.3% did moderate-intensity exercises for more than 60 minutes. Further, 8.3% and 4.2% did vigorous-intensity exercises for less and more than 75 minutes, respectively.

The level of physical activity when compared with BMI showed no significant association ($p=0.84$, df=1).

Figure 2 depicts the relationship between the type and duration of exercise with BMI. Fisher's exact revealed it to be statistically insignificant ($p=0.91$, df=3).

Table 2: Relationship of dietary patterns with BMI

Number of servings	BMI (kg/m²)	
	30-35	>35
Carbohydrate		
6-11	79	9
>11	6	29
χ^2 61.9 ($p<0.05$, df=1)		
Protein		
<3	36	9
3-4	47	2
>4	2	27
Fisher's Exact 72.8 ($p<0.05$, df=2)		
Oil		
<1 tbsp	15	7
1-3 tbsp	66	65
>3 tbsp	4	5
Fisher's 2.85 ($p=0.221$, df=2)		
Fruit		
<3	49	30
>3	36	8
χ^2 5.19 ($p=0.026$, df=1)		
Vegetable		
<3	63	30
>3	22	8
χ^2 0.332 ($p=0.653$, df=1)		
Salt		
<5g	74	29
>5g	11	9
χ^2 2.22 ($p=0.185$, df=1)		
Sugar		
<3 tbsp	49	25
3-6 tbsp	32	10
>6 tbsp	4	3
Fisher exact 1.88 ($p=0.391$, df=2)		

Obesity and co-morbidities

In this study population, 58 (47.2%) of the participants had co-morbidities. Out of which, 10.3% had only one co-morbidity while 87.9% and 1.7% of the participants had two and three co-morbidities, respectively. Dyslipidemia was the commonest co-morbidity (37.4% of the total), followed by Diabetes Mellitus (30.1%) and hypertension (22.8%). More than half of the patients who had a co-morbidity (53.4%) were diagnosed with it after the age of 40 years while only 10.3% of them were diagnosed before 30 years.

Reduced intake of fruits was the only significant ($p<0.05$, df=1) dietary pattern observed, salt and fat intake showed no significant association. In addition, age was significantly associated ($p<0.05$, df=2) with a co-morbidity, with older patients having more co-morbidities. Notably, gender was not significantly associated ($p=0.79$, df=1) with co-morbidity.

Dietary patterns and physical activity levels were evaluated with the presence of individual co-morbidities (DM, hypertension and dyslipidemia) as shown in Table 3. The only significant ($p<0.05$, df=1) association found was between fast food consumption and the presence of dyslipidemia.

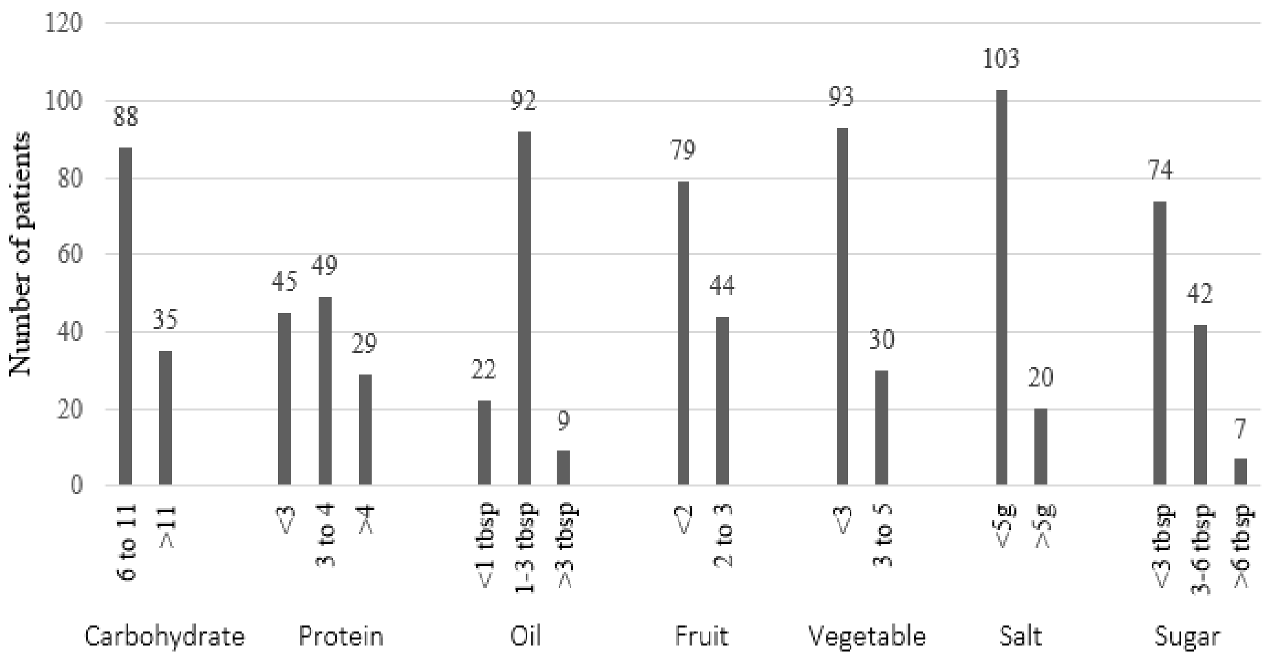

Figure 1: Daily dietary patterns of participants

Legend: 28.4%, 23.4%, 7.3%, 16.2% and 5.7% of the patients had more than the recommended intake of servings of carbohydrates, proteins, oil, salt and sugar, respectively. 64.2% and 75.6% of participants did not consume enough fruits and vegetables, respectively.

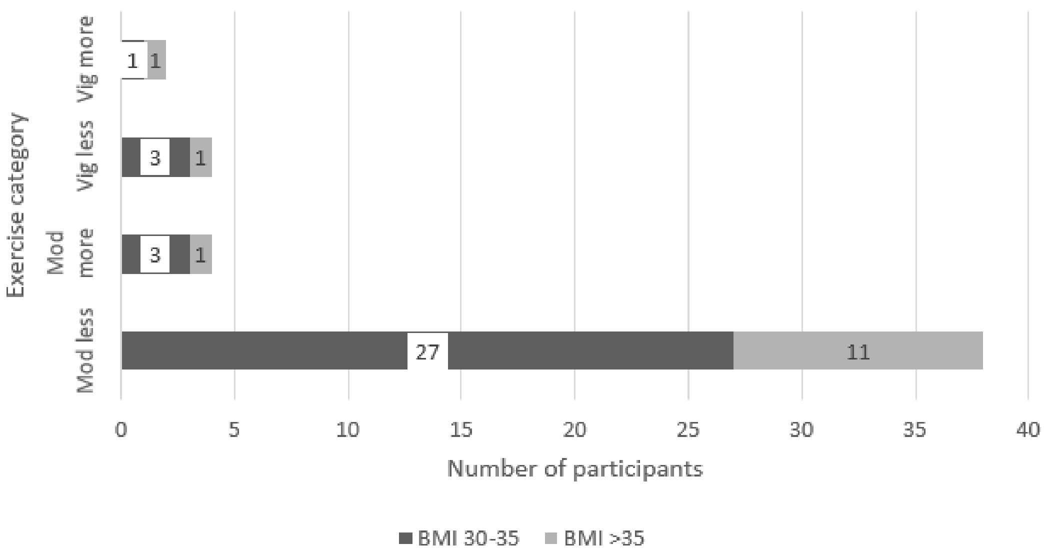

Figure 2: Relationship between exercise type and BMI

Legend: Out of the 48 patients who exercised, only a minority of the participants (29.2%) were morbidly obese. In general, moderate-intensity exercise was the commonest form of exercise (87.5%). [Mod less = moderate intensity exercise for less than an hour, Mod more = moderate intensity exercise for more than an hour, Vig less = vigorous intensity exercise for less than an hour, Vig more = vigorous intensity exercise for more than an hour]

Table 3: Relationship of dietary patterns and physical activity with co-morbidities

	DM		Hypertension		Dyslipidemia	
	Yes	No	Yes	No	Yes	No
Number of servgs						
Carbohydrate						
6-11	29	15	21	23	34	10
>11	8	6	7	7	12	2
	χ^2 0.35 (p=.75, df=1)		χ^2 0.02 (p=1.00, df=1)		χ^2 0.47 (p=.71, df=1)	
Protein						
<3	14	6	9	11	16	4
3-4	17	8	12	13	18	7
>4	6	7	7	6	12	1
	χ^2 2.28 (p=.36, df=2)		χ^2 0.25 (p=.94, df=2)		χ^2 2.16 (p=.41, df=2)	
Oil						
<1 tbsp	10	4	7	7	11	3
1-3 tbsp	24	17	21	20	34	7
>3 tbsp	3	0	0	3	1	2
	Fisher's 2.05 (p=0.31, df=2)		Fisher's 2.61 (p=0.37, df=2)		Fisher's 3.73 (p=0.12, df=2)	
Fruit						
<3	19	11	15	15	21	6
>3	18	10	13	15	21	7
	χ^2 0.01 (p=1.00, df=1)		χ^2 0.07 (p=.79, df=1)		χ^2 0.02 (p=1.00, df=1)	
Vegetable						
<3	27	17	21	23	36	8
>3	10	4	7	7	10	4
	χ^2 0.47 (p=.49, df=1)		χ^2 0.02 (p=.89, df=1)		χ^2 .69 (p=.46, df=1)	
Salt						
<5g	31	17	21	27	40	8
>5g	6	4	7	3	6	4
	χ^2 .08 (p=1.00, df=1)		χ^2 2.28 (p=.13, df=1)		χ^2 2.78 (p=.19, df=1)	
Sugar						
<3 tbsp	23	15	19	19	32	6
3-6 tbsp	12	6	8	10	13	5
>6 tbsp	2	0	1	1	1	1
	Fisher's 1.00 (p=.55, df=2)		Fisher's .42 (p=.89, df=2)		Fisher's 2.65 (p=.19, df=2)	
Unhealthy snacks						
Yes	10	4	5	9	13	1
No	27	17	23	21	33	11
	χ^2 2.28 (p=.54, df=1)		χ^2 1.17 (p=.36, df=1)		χ^2 2.06 (p=.15, df=1)	
Fast food						
Yes	21	14	16	19	31	4
No	16	7	12	11	15	8
	χ^2 0.55 (p=.58, df=1)		χ^2 0.23 (p=.79, df=1)		χ^2 4.61 (p=.04, df=1)*	
Physical activity						
Present	25	10	15	20	29	6
Absent	12	11	13	10	17	6
	X2 2.23 (p=.17, df=1)		X2 1.04 (p=.42, df=1)		X2 .68 (p=.41, df=1)	

*Statistically significant

DISCUSSION

The study had a significant majority of (85%) females, which aligns with previous Sri Lankan studies (7,15) and global obesity patterns (17). There was no significant relationship between morbid obesity (BMI >35 kg/m²) and gender, possibly due to the reduced proportion of morbidly obese patients (30.9%) in our sample. Most participants were above 45 years old, a finding corroborated by the literature (19,20), which attributes this to physiological changes associated with ageing.

Sri Lanka has food-based dietary guidelines, issued by the Ministry of Health, which summarize the recommended serving sizes of different food categories (21). Only 35 patients from our study consumed more than 11 servings of carbohydrates, surpassing the recommended intake. This proportion is less than that observed in a previous national study (9). Explained perhaps by the health-focused nature of the population. High intake of carbohydrates was associated with higher levels of morbid obesity in the study. High carbohydrate consumption which was linked to insulin resistance (22) was not found in this study population.

The results from our study did not reveal any association between carbohydrate consumption and diabetes $\chi2$ 0.35 ($p=.75$, $df=1$). However, several other studies have highlighted the significance of carbohydrates in type 2 diabetes mellitus, especially in Asian populations (24). Among participants 64.2% consumed less than the recommended intake of fruits, a finding consistent with previous studies (9]). Additionally, we found that fruit consumption was associated with lower levels of morbid obesity, a finding mirrored in another study (26).

Only 16.3% of the population consumed more than the recommended amount of salt. Our findings regarding unhealthy snacking and fast-food consumption align with the global trend of increased consumption of energy-dense, nutrient-poor food (26,27). Such dietary practices are known to contribute to obesity, as demonstrated by Sri Lankan studies (28).

The fact that 23.6% of the study population skipped breakfast is a key finding, as it has been shown that skipping breakfast and late lunch increases the likelihood of becoming overweight or obese in the future (29).

A significant proportion of patients (61.0%) did not engage in regular exercise. Consistent with other studies conducted in Sri Lanka (30). Contrary to expectations, the study did not find a significant association between physical activity and obesity.

Our study identified dyslipidemia as the most common comorbidity, followed by diabetes mellitus (DM). A recent survey in Sri Lanka estimated that the prevalence of DM (23.0%) was higher than in most other Asian countries (31). Most patients with comorbidities had two of the comorbidities studied (89.7%), a pattern commonly observed. Fast food consumption was linked to DM and dyslipidemia. These findings align with those from several other studies (32,33).

This study has limitations. Firstly, participants may not have accurately recorded all foods consumed over a week, despite repeated emphasis. As a single-center study, the findings may not fully represent the dietary patterns of the entire country.

CONCLUSION

Despite the availability of food-based guidelines and physical activity recommendations, it is evident from our findings that this cohort of participants does not adhere to such practices. However, these participants have taken the first step by seeking nutrition therapy to improve their health and well-being. Thus, these findings underscore the urgent need for targeted interventions to promote healthier dietary habits, increase physical activity, and address the high prevalence of comorbidities associated with obesity. A holistic approach, through relevant stakeholders and policymakers, which combines nutritional education stressing the recommendation of diet and physical activity is essential to prevent obesity and its associated burden effectively.

Author declaration

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Authors' contributions:
Conceptualization and Design: SACD, RJ, KCSD; Data Collection and Data Analysis: SACD; Manuscript Writing: SACD; Editing and Finalizing the Manuscript: SACD, SAKN, KCSD, Supervision: SACD.

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The authors declare that there is no financial or non-financial conflict of interest.

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Statement on data availability:
Data is available upon request from the corresponding author.

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