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ORIGINAL ARTICLE

Comparative Evaluation of Dietary Patterns and Nutrient Intake in Obese and Non-Obese Adults of Lahore

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ABSTRACT

Background: Obesity is a major public health problem worldwide and especially in an urban setting such as Lahore where dietary transition is driving health outcome. Sometimes, the development of obesity is attributed to nutritional imbalances. Nevertheless, there are limited comparative data on dietary patterns of obese and non-obese adults in Pakistan.

Aim: To assess and compare dietary patterns, nutrient intake and caloric distribution between obese and non- obese adults living in Lahore to identify dietary risk factors which are modifiable in order to reduce the risk of obesity.

Methodology: Comparative study was carried out on 100 adult participants (50 obese and 50 non-obese) aged 20 to 50 years from urban health clinics and community centers in Lahore. Records were made of anthropometric measurements (BMI, waist circumference). The daily nutrient intake, macronutrient distribution, and adherence to balanced diet were assessed by a validated food frequency questionnaire and 24 hour dietary recall. Fasting glucose and lipid profile were also studied.

Results: Mean ± SD daily calories consumed were significantly greater for obese (2,630 ± 340 kcal) than non-obese (1,980 ± 290 kcal, $p < 0.001$). The obese group had excessively high saturated fat and sugar intakes and very low fiber and vegetable intakes. Furthermore, the non-obese group had a higher adherence to balanced dietary guidelines, higher whole grain, fruit and lean protein intake. Also, there was a positive correlation between total caloric intake and BMI ($r = 0.72$).

Conclusion: Significant differences in dietary pattern and intake of nutrients are shown in obese and non-obese adults in Lahore. Obesity is defined by poor dietary habits such as high caloric intake, low fiber consumption, imbalanced macronutrient ratios. These findings emphasize the importance of implementing community based nutritional interventions and public health strategies on dietary education and lifestyle modification.

Keywords: Lifestyle modification, non-obese, nutrients, caloric distribution.

INTRODUCTION

Obesity is a chronic metabolic disorder, a multifactorial disorder, characterized by excessive fat accumulation and is a risk to health. In addition to type 2 diabetes mellitus, hypertension, dyslipidemia, NAFLD, and cardiovascular complications, it has been associated[11]. The prevalence of obesity has tripled worldwide since 1975, and this rise in particular in developing country settings undergoing rapid urbanization and dietary transition is alarming. In 2022, there were 1.9 billion adults who were overweight and of these, over 650 million were considered obese, the World Health Organization (WHO) reports[10]. Epidemiological surveys in Pakistan have shown that more than 27% of adults are obese and urban centers such as Lahore have exceptionally high rates[9].

Dietary patterns form a central and modifiable contributor to obesity among various other factors[8]. WHO

and other dietary guidelines define a balanced diet as one that contains an appropriate balance of macronutrients (carbohydrates, proteins, fats) and micronutrients (vitamins and minerals) in the proportions necessary to maintain normal physiological function and prevent nutrient from deficiency diseases[7]. However, the current urban dietary landscape is characterized by higher consumption of energy dense, nutrient poor foods, such as high in Tran's fats, saturated fats, sugars, and sodium, with decreased fiber, fruits and vegetables[7]. These changes lead not only to excess caloric intake but also to impaired satiety signaling, insulin resistance, and chronic systemic inflammation[6].

Although several international studies have investigated the link between diet and obesity, there is a gap in regional specific data in South Asian populations in particular in urban Pakistani populations[5]. As the urban and peri-urban communities in Lahore are socio culturally diverse and have different food preferences as well as varying levels of health literacy, a localized investigation is needed. Knowing these dietary behaviors in obese and non-obese individuals can provide understanding of modifiable risk factors and will aid in designing culturally tailored interventions[4].

Besides providing quantitative differences in caloric intake, nutrient intake analysis also helps to identify qualitative aspects of diet such as macronutrient distribution, frequency of intake of processed food, and adherence to dietary recommendations[2]. These parameters can be evaluated among obese and non-obese individuals to determine the importance of certain dietary habits related to the pathogenesis of obesity and may provide information on public health policy and clinical dietary counseling in Pakistan[1].

This present study attempts to perform a comparative evaluation of dietary patterns and nutrient status among obese and non-obese adults of Lahore. This study seeks to map out key nutritional differences that may underlie obesity of this population by the use of both anthropometric assessments and detailed dietary recall instruments. These findings will inform the scientific literature on nutritional epidemiology in South Asia and may inform the practical dietary interventions required to reduce the growing obesity burden in urban Pakistan.

MATERIALS AND METHODS

Study Design:

This was a comparative cross sectional study conducted in different urban health clinics and community nutrition outreach centers in Lahore Pakistan from January 2024 to December 2024. The purpose of the study was to assess and compare dietary patterns and nutrient intake between obese and non-obese adults.

Study Population and Sample Size:

In the study, 100 adult participants (20 to 50 years old) were enrolled. In terms of BMI, the participants were stratified into two equal groups.

- Obese Group (n = 50): BMI ≥ 30 kg/m²
- Non-Obese Group (n = 50): BMI between 18.5 – 24.9 kg/m²

BMI classification was made according to World Health Organization (WHO) standards. To avoid confounding variables, individuals with known metabolic disorders (i.e., thyroid dysfunction, Cushing's syndrome), pregnancy, malignancies or underweight status (BMI <18.5 kg/m²) were excluded.

Sampling Technique

The recruitment of participants was done through a non-probability purposive sampling technique. Full explanation of the study objectives and procedures were given and consent was obtained voluntarily. The Institutional Review Board (IRB) gave ethical approval.

Dietary Assessment:

Dietary assessment was performed with two tools.

- Dietary Recall: Participants recorded everything they have eaten and drank, in one day. To improve recall accuracy, visual aids and standard portion size pictures were used.
- Validated semi quantitative food frequency questionnaire (FFQ): Food Frequency Questionnaire (FFQ) was administered to estimate habitual food intake in the last 3 months. The FFQ consisted of 78 food items grouped into major food groups.

Biochemical Parameters:

For assessment of these, venous blood samples were obtained after overnight fast (8–10 hours).

- Fasting Blood Glucose (FBG)
- It included Total Cholesterol, LDL, HDL, and Triglycerides.

Automated analyzers were performed in a central clinical pathology laboratory according to standard protocols and laboratory investigations.

Physical Activity and Lifestyle Assessment:

The International Physical Activity Questionnaire (IPAQ) was used to categorize the degree of self-reported physical activity. Also noted were smoking status and alcohol use.

Data Analysis:

SPSS version 26.0 (IBM Corp., Armonk, NY, USA) were used to enter all data and to analyze it. Mean ± standard deviation (SD) was used to present continuous variables (e.g. calorie intake, BMI, lipid levels). The categorical variables were expressed in the form of frequencies and percentages. Mean nutrient intake and biochemical markers were compared between obese and non-obese groups by using independent t test. Categorical variables were subjected to chi square test. To assess associations between caloric intake and BMI, Pearson's correlation analysis was undertaken. The p value < 0.05 was considered to be statistically significant.

RESULTS

Anthropometric, biochemical and dietary parameters were compared between obese and non-obese, in this comparative study of 100 adults. Obese participants had mean Body Mass Index (BMI) of 32.8 kilograms per square meter (kg/m²) with standard deviation of ±2.5 and the mean BMI was significantly lower among non-obese participants – 22.3 ± 1.6 kg/m² with p-value < 0.0001 which shows highly significant difference.Notably, differences in waist circumference also were quite different: 98.7 ± 6.4 centimeters in the obese group versus 81.2 ± 5.3 centimeters in the non-obese group (p < 0.001). The obese group had markedly elevated fasting blood glucose levels of 110.3 ± 12.5 mg/dL, a significant difference compared to the non-obese group of 92.7 ± 10.4 mg/dL (p < 0.001).

Non-obese group had a lower mean total cholesterol level of 182.3± 20.5 mg/dL compared to obese individuals (215.4 ± 24.8 mg/dL) (p = 0.002). In obese group LDL cholesterol levels were significantly higher (138.6 ± 19.2 vs 106.1 ± 17.7, p < 0.001) than in non-obese group. On the other hand, high density lipoprotein (HDL) cholesterol, an anti-cardiac risk factor, was much lower in the obese group (38.2 ± 4.8 mg/dL) than in non-obese individuals (47.3 ± 5.1 mg/dL) (p = 0.003).In addition to this disparity, triglyceride levels were further highlighted with obese subjects having an average of 178.9 ± 27.3 mg/dL and the non-obese subjects having a mean value of 129.5 ± 22.4 mg/dL, which was statistically significant (p < 0.001).

The analysis of nutritional intake indicated that obese subjects had consumed significantly more calories when compared to non-obese subjects with 2,630 ± 340 kilocalories (kcal) versus 1,980 ± 290 kcal per day (p < 0.001). Additionally, obese participants had much lower intake of dietary fiber at 17.2 ± 4.3 g per day, compared to 26.8 ± 5.1 g per day among non-obese participants (p < 0.001). In addition, the obese group consumed a significantly higher saturated fat intake, measured as a percentage of total daily caloric intake, at 12.8 ± 2.6 percent versus 8.4 ± 1.9 percent (p < 0.001), which was more atherogenic.

Total daily caloric intake, however, showed a significant positive correlation with BMI (r = 0.72, p < 0.01). A moderate negative correlation was found between fiber intake and fasting blood glucose levels (r = –0.46, p = 0.03), suggesting a possible protective role of dietary fiber.

Table-1: Comparative Analysis between Obese and Non-Obese Adults (n = 100)

Parameter	Obese (n = 50)	Non-Obese (n = 50)	p-value
BMI (kg/m²)	32.8 ± 2.5	22.3 ± 1.6	< 0.001
Waist Circumference (cm)	98.7 ± 6.4	81.2 ± 5.3	< 0.001
Fasting Glucose (mg/dL)	110.3 ± 12.5	92.7 ± 10.4	< 0.001
Total Cholesterol (mg/dL)	215.4 ± 24.8	182.3 ± 20.5	0.002
LDL Cholesterol (mg/dL)	138.6 ± 19.2	106.1 ± 17.7	< 0.001
HDL Cholesterol (mg/dL)	38.2 ± 4.8	47.3 ± 5.1	0.003
Triglycerides (mg/dL)	178.9 ± 27.3	129.5 ± 22.4	< 0.001
Daily Energy Intake (kcal/day)	2,630 ± 340	1,980 ± 290	< 0.001
Fiber Intake (g/day)	17.2 ± 4.3	26.8 ± 5.1	< 0.001
Saturated Fat (% of total calories)	12.8 ± 2.6	8.4 ± 1.9	< 0.001

DISCUSSION

The findings of this study highlight significant differences in dietary patterns, nutrient intake, and metabolic profiles between obese and non-obese adults in Lahore. Strongly associated with unfavorable dietary habits including high caloric intake, high saturated fat consumption, and low dietary fiber intake, markedly elevated BMI and waist circumference values reflected obesity. In addition, the obese group had a significantly higher mean daily caloric intake (2,630 ± 340 kcal) than indicated in the non-obese group (1,980 ± 290 kcal), which was statistically significant (p < 0.001)[11]. This is consistent with global literature showing that positive energy balance which is defined as exceeding caloric intake with expenditure is a major contributor to obesity development. This matches

previous studies in South Asia and other urbanized regions where the transition to Westernized diets (high in refined sugars, saturated fats, and processed foods) has been associated with increase in obesity prevalence[12].

Furthermore, obese individuals skewed the macronutrient distribution towards a higher proportion of calories from saturated fats and refined carbohydrates, and lower complex carbohydrates and fiber. The observed significantly lower fiber intake (17.2 ± 4.3 g/day in obese vs. 26.8 ± 5.1 g/day in non-obese, $p < 0.001$) indicates poor diet quality of the obese population[13]. Dietary fiber has important roles in glycemic control, appetite regulation, and cholesterol metabolism and its deficiency is associated with increased risk of metabolic syndrome, insulin resistance, and visceral obesity. Our study showed the negative correlation between the fiber intake and the fasting glucose levels ($r = –0.46$, $p = 0.03$) and therefore this supports its protective role[15].

In addition, the lipid profile and fasting glucose values in obese individuals were deranged and paralleled metabolic syndrome pattern[19]. The obese group had significantly higher total cholesterol, LDL cholesterol, triglycerides, and fasting glucose levels and significantly lower HDL cholesterol, which is known to be an anti-atherogenic property[14]. Additionally, these biochemical changes support the effect of poor diet quality and excess energy intake on metabolic health. These results are consistent with other studies undertaken in India, Bangladesh and urban Pakistan where dietary trends have been the main causes of the dual burden of obesity and non-communicable disease. Dietary risks are also highlighted by the GBD 2019 as one of the top causes of mortality and disability adjusted life years (DALYs) in South Asia[20]. Additionally, the obese group had a significantly higher intake of saturated fat (12.8 ± 2.6% of total energy) than is the recommended upper limit of 10% by the WHO, and hence the need for targeted dietary education[16].

It's worth mentioning that even though the non-obese group lived in the same urban setting as well, they reported better adherence to balanced diet principles such as higher intake of whole grains, fruits and lean proteins. Thus, this implies that food choices are influenced by both environmental factors and individual behavior, education and awareness[17]. Strengths of this study include a focus on a well-defined urban population, use of validated dietary assessment tools and inclusion of anthropometric, dietary and biochemical data. But with those limitations it must be said[18]. However, dietary intake was measured with a self-reported dietary intake that may introduce recall bias, and thus the study is cross sectional and causal interpretations are limited. Also, physical activity levels and socioeconomic factors, although recorded, were not analyzed in depth in terms of dietary habits in this manuscript.

CONCLUSION

Significant differences in dietary pattern and intake of nutrients are shown in obese and non-obese adults in Lahore. Obesity is defined by poor dietary habits such as high caloric intake, low fiber consumption, imbalanced macronutrient ratios. These findings emphasize the importance of implementing community based nutritional interventions and public health strategies on dietary education and lifestyle modification.

DECLARATION

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We would Like to Acknowledge our collegues and paramedical staff of hospital for supporting us for data collection and making current study possible.

Authors contribution
Each author of this article fulfilled following Criteria of Authorship:
1. Conception and design of or acquisition of data or analysis and interpretation of data.
2. Drafting the manuscript or revising it critically for important intellectual content.
3. Final approval of the version for publication.

All authors agree to be responsible for all aspects of their research work.

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Data availability:
The data that support the fndings of this study are available from the corresponding author, upon reasonable request.

Ethics approval:
This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Institutional Ethics Committee.

Consent to participate:
Informed consent was obtained from all individual participants included in the study.

Competing interests: The authors declare that the research was conducted in the absence of any commercial or fnancial relationships that could be construed as a potential confict of interest.

Conflict of interest:
The authors declared no conflict of interest.

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