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ORIGINAL ARTICLE

Impact of Unbalanced Diet on Mesenteric Anatomy and Gastrointestinal Disorders in the Pakistani Population. A Clinical Study

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ABSTRACT

Background: Pakistan has been rapidly urbanized, and this has resulted in a change from traditional, nutrient-rich meals to energy, nutrient-poor diets. They are associated with increased incidences of metabolic and GI disorders. Unbalanced diets may have adverse affects on an active organ, the mesentery, which plays a role in lipid metabolism and immune regulation.

Objectives: The objective of this clinical study was to analyze the association of unbalanced dietary patterns with mesenteric anatomical anomalies and the severity of GI symptoms in a Pakistani population.

Methodology: Present study was conducted in tertiary care hospitals of Nawaz Sharif Medical College, Gujrat and Khawaja Muhammad Safdar Medical College Sialkot from January 2022 to January 2023. One 100 adult patient (18 to 65 years) presenting with GI symptoms at tertiary care centers were enrolled in a 12-month prospective observational study. A validated food frequency questionnaire (FFQ) specific to local dietary habits was used to assess dietary intakes, and participants were categorized into balanced and unbalanced diet groups. These included comprehensive clinical evaluations, including anthropometric measurements and standardized GI symptom assessments. Mesenteric fat thickness, arterial wall thickness, and vessel compliance were evaluated by radiological means using abdominal ultrasonography and computed tomography (CT) scans. Associations between dietary quality, mesenteric parameters, and GI symptom severity were assessed through statistical analyses using Pearson's correlation and multivariate regression (SPSS version 26).

Results: Among patients with unbalanced diets, the BMI and GI symptom severity were significantly higher. Increased mesenteric fat thickness and arterial wall thickness and reduced vessel compliance ($p < 0.001$) were the radiological findings. Pearson's correlations were significant ($p < 0.001$) between poor dietary quality and mesenteric fat ($r = 0.48$) and between mesenteric fat and GI symptoms ($r = 0.41$). Unbalanced diet score ($\beta = 0.35$, $p = 0.002$) and mesenteric fat thickness ($\beta = 0.32$, $p = 0.004$) were independent predictors of GI symptom severity by multivariate regression.

Conclusion: Adverse mesenteric changes and increased GI symptom severity in the Pakistani population are highly associated with unbalanced diets.

Keywords: Unbalanced Diet, Mesenteric Anatomy, Gastrointestinal Disorders, Pakistani Population, Nutritional Assessment, Clinical Study

INTRODUCTION

In the last few decades, Pakistan has undergone a radical change in dietary habits with the pace of urbanization, socioeconomic transition, and globalization. The Pakistani diet is traditionally a balance of locally sourced grains, legumes, fruits, and vegetables, but a shift towards energy-dense, nutrient-poor foods has occurred[1]. Today, we are seeing this shift toward high intakes of refined carbohydrates, saturated fats, and processed foods associated with a spectrum of adverse health outcomes, including metabolic syndrome, cardiovascular diseases, and gastrointestinal (GI) disorders[2].

In history, the mesentery was considered a passive anatomical structure that supported the intestines. However, recent scientific advances have repositioned the mesentery as a metabolically active organ with a pronounced immune modulatory, inflammatory, and lipid metabolic role[3]. Specifically, the pathogenesis of many GI disorders, including IBS, has been linked to alterations of mesenteric fat composition and architecture. It is thought to be an unbalanced diet that favors excessive deposition of mesenteric adipose tissue and vascular remodeling that may lead to intestinal perfusion disturbances and disturbed intestinal motility. It is believed that these pathophysiological changes play a role in diseases, including chronic intestinal ischemia, irritable bowel syndrome, and inflammatory bowel disease[4, 5].

There is much interest in the scientific community on the relationship between dietary patterns and gastrointestinal health. There have been many studies that have proven that a quality diet contributes to metabolic disorders, but the specific effect of diet-induced changes in mesenteric regions on GI function is still not well explored, especially in the Pakistani context [6]. The setting of this research is distinctive in that Pakistan's cultural and culinary traditions combine with the growing influence of Westernized dietary customs. Understanding how such dietary transitions affect mesenteric anatomy is important because changes such as these may be early indicators of gastrointestinal pathology and, therefore, potential targets for prevention and intervention[7].

There is emerging evidence that the mesentery is essential for maintaining gut homeostasis. Mesenteric fat distribution changes may initiate a sequence of local inflammatory responses that may have an impact on the integrity and function of the gastrointestinal tract[8]. Furthermore, vascular changes within the mesentery, such as increased arterial stiffness and decreased compliance, may contribute to an impaired blood supply to intestinal tissues and thus further worsen GI dysfunction. Dietary factors, mesenteric anatomical alterations, and GI disorders thus are a complex and multifaceted field of investigation with a clear impact on public health and clinical practice[9].

There are several studies conducted in different populations that found that high saturated fats and refined sugars diets are related to increased visceral adiposity and systemic inflammation. However, there is a paucity of data regarding the mesenteric changes and their direct relation to the gastrointestinal symptoms. There is a need to delineate the mechanisms by which unbalanced diets alter mesenteric structure and function in Pakistan, where traditional dietary practices are rapidly evolving. Insights as such are crucial for advancing early markers of diagnosis and targeted therapeutic strategies for combating the growing incidence of GI disorders[10].

Additionally, the regional epidemiological trends are suggestive of an increasing burden of gastrointestinal conditions not entirely accounted for by established risk factors, including genetics or lifestyle. To investigate the contribution of diet-induced mesenteric modifications to gastrointestinal health, researchers have observed this[11]. In this context, such knowledge of underlying mechanisms linking unbalanced dietary intake to mesenteric adiposity and vascular changes may provide new perspectives on

the prevention and management of disease. For example, dietary interventions designed to reduce mesenteric fat deposition and improve vascular health may reduce the progression of GI disorders and improve patient outcomes[12].

Therefore, the aim of the present study was to demonstrate that an unbalanced diet leads to the development of significant changes in the anatomy of the mesenteric which, in turn, are of central importance in the pathogenesis of gastrointestinal diseases. In this investigation, the mesentery's structural and functional changes due to poor dietary quality are elucidated by integrating clinical assessments with advanced radiological imaging techniques. The significance of these associations extends beyond clinicians and researchers to include its use as a basis for public health initiatives designed to enhance nutritional balance[13].

The main gap in the current literature is addressed by this study on the direct influence of unbalanced dietary patterns on mesenteric anatomy and gastrointestinal function in the local Pakistani population. The results are anticipated to improve our understanding of the intricate interrelationships between diet, mesenteric structure, and GI health, leading to the development of effective, evidence-based strategies to prevent and treat gastrointestinal disorders[14, 15].

MATERIALS AND METHODS

A clinical study was conducted in tertiary care hospitals of Nawaz Sharif Medical College, Gujrat and Khawaja Muhammad Safdar Medical College Sialkot from January 2022 to January 2023 prospectively over a period of 12 months to assess relationship between unbalanced dietary patterns, mesenteric anatomical alterations and gastrointestinal disorders in Pakistani population. It was an observational study that allowed for detailed clinical and radiological assessment of patients with gastrointestinal symptoms.

Consecutively, one hundred adult patients, 18–65 years of age were recruited from tertiary care centres in Pakistan. All participants had chronic abdominal pain, bloating, altered bowel habits, and provided informed consent prior to enrolment. Patients with a history of major abdominal surgery, congenital mesenteric anomalies, chronic systemic diseases, or patients who were taking medications that could affect gastrointestinal motility or mesenteric fat deposition were excluded to minimize confounding factors.

A validated food frequency questionnaire (FFQ) designed specifically to capture the nuances of both traditional and modern Pakistani dietary practices was used to assess dietary intake. The questionnaire included the amount and how often we consumed certain food groups, like foods that are high in refined carbohydrates, saturated fats, and processed ingredients, as well as fruits, vegetables, whole grains, and lean proteins. Once the nutritional score was computed, participants were then categorized into balanced and unbalanced diet groups, as determined by higher nutritional scores indicative of better, more balanced diets.

Detailed anthropometric measurements, including body mass index (BMI) and waist to hip ratio, as well as systematic documentation of their gastrointestinal symptoms by systematic use of standardized assessment forms, were undertaken across all participants. Abdominal ultrasonography and computed tomography (CT) scans were used to evaluate radiologically mesenteric fat thickness, vascular morphology, and overall mesenteric architecture, and abdominal ultrasonography was used to evaluate abdominal aortic diameters. All centers standardized on imaging protocols, and two experienced radiologists, blinded to the dietary data of the participants, independently interpreted the results to minimize interobserver variability.

Data were collected from clinical examination, dietary assessment and radiological evaluation using a secure, anonymized database, at baseline. To ensure data accuracy, quality control was instituted on a regular basis. Gastrointestinal symptoms and associated mesenteric changes were monitored over 12 months, by obtaining follow-up data at pre-determined intervals.

SPSS version 26 was used for statistical analyses. Demographic and baseline variables were summarized using descriptive statistics, mean ± standard deviation for continuous data and frequencies and percentages for categorical data. A correlation between dietary scores and mesenteric anatomical parameters was examined by computation of Pearson's correlation coefficients. Furthermore, multivariate regression models were used to adjust for the potential confounders such as age, gender, and BMI with a p-value of less than 0.05 as statistically significant.

RESULTS

The results of this clinical study were analyzed using SPSS version 26, and there were statistically significant differences between patients with balanced and unbalanced diets. The demographic and clinical characteristics of the study participants were first compared between the two dietary groups. Participants were in their 40s (42 ± 10 years) and, overall, were 65% male; the unbalanced group had a significantly higher body mass index (BMI) than the balanced group. Furthermore, the severity of gastrointestinal (GI) symptoms was much higher in the patients who ate an unbalanced diet. Table 1 summarizes these findings.

Table 1: Demographic and Clinical Characteristics

Parameter	Overall (n=100)	Balanced Diet (n=30)	Unbalanced Diet (n=70)	p-value
Age (years, mean ± SD)	42 ± 10	41 ± 9	42 ± 10	0.65
Male (%)	65 (65%)	18 (60%)	47 (67.1%)	0.45
BMI (kg/m², mean ± SD)	27.8 ± 4.5	25.1 ± 3.7	28.5 ± 4.2	< 0.01
GI Symptom Severity*	3.2 ± 0.8	2.7 ± 0.6	3.4 ± 0.8	< 0.01

*GI Symptom Severity was assessed on a standardized scale, with higher scores indicating more severe symptoms.

Table 2: Radiological Findings

Parameter	Balanced Diet (n=30)	Unbalanced Diet (n=70)	p-value
Mesenteric Fat Thickness (cm, mean ± SD)	1.2 ± 0.3	1.8 ± 0.4	< 0.001
Arterial Wall Thickness (mm, mean ± SD)	1.0 ± 0.2	1.3 ± 0.3	< 0.001
Vessel Compliance (score)**	4.2 ± 0.5	3.7 ± 0.6	< 0.01

**Vessel Compliance was rated on a standardized scale where higher scores indicate better compliance.

Mesenteric anatomy was further radiologically evaluated for significant differences between the two groups. Increased mesenteric fat thickness, arterial wall thickness and reduced vessel compliance was found in patients with an unbalanced diet, which suggested vascular remodeling and impaired intestinal perfusion. The anatomical basis of the heightened gastrointestinal symptoms in the unbalanced diet group is given by these radiological findings. Table 2 presents detailed radiological results.

Correlation analyses were performed to explore the relationship between dietary quality, mesenteric anatomical changes, and gastrointestinal symptom severity. Significant positive correlation of poorer dietary quality with increased mesenteric fat thickness ($r = 0.48$, $p < 0.001$) and moderate positive correlation between greater mesenteric fat thickness and more severe GI symptoms ($r = 0.41$, $p < 0.001$) were found by Pearson's correlation coefficients. A multivariate regression analysis was conducted for further assessment of the independent effects of these variables. We adjusted for age, gender, and BMI in this analysis. Both the unbalanced diet score ($\beta = 0.35$, $p = 0.002$)

and mesenteric fat thickness (β = 0.32, p = 0.004) were significant independent predictors of the severity of gastrointestinal symptoms. In the overall model, dietary quality and related mesenteric changes accounted for 45% of the variance in GI symptoms (R^2 = 0.45), and these factors are important determinants of GI health. The details of the statistical results are in Table 3.

Table 3: Multivariate Regression Analysis Predicting GI Symptom Severity

Variable	β coefficient	Standard Error	p-value
Unbalanced Diet Score	0.35	0.12	0.002
Mesenteric Fat Thickness	0.32	0.11	0.004
Age	0.05	0.03	0.08
Gender (Male=1, Female=0)	0.04	0.10	0.68
BMI	0.21	0.09	0.03
Model Statistics	R^2 = 0.45		

Overall, the results of the study demonstrate strong evidence that an unbalanced diet is associated with significant mesenteric anatomical changes, including increased fat deposition and vascular remodeling, which in turn are related to larger gastrointestinal symptom severity. The statistical analyses, both correlation and multivariate regression, confirm the independent contribution of dietary quality and mesenteric changes to gastrointestinal health. This is in agreement with previous reports that dietary factors can modulate metabolic and gastrointestinal function (e.g., Smith et al., 2019; Khan et al., 2021).

DISCUSSION

This present clinical study provides evidence that unbalanced dietary patterns have the potential to have a significant impact on mesenteric anatomy, which in turn leads to gastrointestinal (GI) disorders among the Pakistani population. We find that patients with an unbalanced diet had higher body mass index (BMI), thicker mesenteric fat, and increased arterial wall changes as well as less vessel compliance, compared with patients with a balanced diet[16].Pearson's correlation and multivariate regression analysis demonstrated that these anatomical alterations were closely correlated with an increase in GI symptom severity (Table 3). The independent contribution of both unbalanced diet scores and mesenteric fat thickness to GI symptom severity even after adjustment for confounding variables such as age, gender, and BMI indicate that dietary quality is of paramount importance in preserving gastrointestinal health[17].

These results are consistent with the previous literature that associates poor dietary habits with visceral adiposity as well as systemic inflammation (Smith et al., 2019; Khan et al., 2021). Mesenteric fat deposition observed is likely to drive local inflammatory processes, affect vascular function, and compromise intestinal perfusion, collectively contributing to GI dysmotility and symptom severity[18]. The strong linkage between mesenteric anatomical changes and gastrointestinal symptoms suggests that the mesentery has a role in active rather than passive gut physiology. Given the context of these findings in Pakistan, where urbanization is rapid and is accompanied by the adoption of Westernised dietary patterns, this is of particular significance[19].

Additionally, the moderate to strong correlations between dietary quality, mesenteric fat thickness, and symptom severity in our study support the idea that dietary improvement interventions may have a beneficial effect on mesenteric health and, therefore, gastrointestinal function[20]. Dietary interventions may provide a means to reduce mesenteric adiposity, improve vascular compliance, and reduce the overall burden of healthcare in this region by preventing and managing GI disorders[21].

CONCLUSION

This 12-month clinical study concludes that dietary patterns unbalanced to US recommendations are independently associated with significant mesenteric anatomical changes, including increased mesenteric fat deposition and vascular remodelling, which in turn are associated with increased severity of gastrointestinal symptoms in the Pakistani population. These findings emphasize the crucial role of dietary quality in maintaining mesenteric and gut health and highlight the necessity for public health interventions in improving nutritional education and intervention. Further elucidation of the mechanisms underlying these associations is warranted, as are future longitudinal studies and interventional trials to evaluate the effectiveness of targeted dietary changes to mitigate gastrointestinal morbidity.

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