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"The Relationship Between Clinical Gastrointestinal Symptoms, Body Mass Index, Dietary Patterns, and Their Association with Hemoglobin Levels Among a Female Students in Zliten City"

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"العلاقة بين الأعراض السريرية للجهاز الهضمي، ومؤشر كتلة الجسم، والأنماط الغذائية، وارتباطها بمستويات الهيموجلوبين لدى الطالبات في مدينة زليتن"

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Abstract:
Nutritional anemia is a common health problem influenced by numerous behavioral, nutritional, and clinical factors. This exploratory study aimed to assess the relationship between hemoglobin levels and certain gastrointestinal clinical manifestations (such as diarrhea and flatulence), body mass index (BMI), and dietary patterns in a sample of individuals in Zliten. A cross-sectional study was conducted on a purposive sample of 50 cases. Behavioral and clinical data were collected using a custom-designed questionnaire that demonstrated sufficient face validity, while hemoglobin levels were measured in the laboratory. The data were statistically analyzed using SPSS software (version 25), employing chi-squared (χ^2) tests, linear correlation, and one-way analysis of variance (ANOVA). The results revealed a statistically significant linear relationship between the severity of anemia and the frequency of recurrent diarrhea ($P = 0.023$), while no significant relationship was found with the presentation of flatulence ($P = 0.176$). On the other hand, analysis of variance (ANOVA) indicated no statistically significant differences in mean hemoglobin levels attributable to body mass index (BMI) ($F = 0.060$). Similarly, dietary patterns related to whole grains showed no significant differences ($P = 0.983$) due to the homogeneity of consumption habits in the study population. The study concluded that anemia in the studied sample is closely linked to functional gastrointestinal disorders that negatively affect physiological nutrient absorption, while being completely independent of BMI. This highlights the issue of Hidden Hunger and the importance of food quality rather than quantity. The study recommends that gastrointestinal health assessment be a fundamental component of anemia diagnosis and treatment protocols.

Keywords: Gastrointestinal, BMI, Anemia, constipation, Dietary Patterns ,

الملخص

يُعدّ فقر الدم التغذوي مشكلة صحية شائعة تتأثر بالعديد من العوامل السلوكية والتغذوية والسريرية. هدفت هذه الدراسة الاستكشافية إلى تقييم العلاقة بين مستويات الهيموجلوبين وبعض الأعراض السريرية المعوية (مثل الإسهال وانتفاخ البطن)، ومؤشر كتلة الجسم، والأنماط الغذائية لدى عينة من الأفراد في زليتن. أُجريت دراسة مقطعية على عينة مقصودة مكونة من 50 حالة. جُمعت البيانات السلوكية والسريرية باستخدام استبيان مُصمم خصيصًا يتمتع بمصداقية ظاهرية كافية، بينما قُيست مستويات الهيموجلوبين في المختبر. حُللت البيانات إحصائيًا باستخدام برنامج (SPSS الإصدار 25)، باستخدام اختبارات مربع كاي(χ^2) ، والارتباط الخطي، وتحليل التباين أحادي الاتجاه .(ANOVA) كشفت النتائج عن وجود علاقة خطية ذات دلالة إحصائية بين شدة فقر الدم وتكرار الإسهال($P = 0.023$) ، بينما لم تُلاحظ أي علاقة ذات دلالة إحصائية مع انتفاخ البطن .($P = 0.176$) من جهة أخرى، أظهر تحليل التباين (ANOVA) عدم وجود فروق ذات دلالة إحصائية في متوسط مستويات الهيموجلوبين المرتبطة بمؤشر كتلة الجسم .($F = 0.060$) (BMI) وبالمثل، لم تُظهر الأنماط الغذائية المتعلقة بالحبوب الكاملة أي فروق ذات دلالة إحصائية ($P = 0.983$) نظرًا لتجانس عادات الاستهلاك لدى عينة الدراسة. وخلصت الدراسة إلى أن فقر الدم في العينة المدروسة يرتبط ارتباطًا وثيقًا باضطرابات الجهاز الهضمي الوظيفية التي تؤثر سلبًا على امتصاص العناصر الغذائية، مع كونه مستقلًا تمامًا عن مؤشر كتلة الجسم. وهذا يُسلط الضوء على مشكلة الجوع الخفي وأهمية جودة الطعام بدلًا من كميته. وتوصي الدراسة بأن يكون تقييم صحة الجهاز الهضمي عنصرًا أساسيًا في بروتوكولات تشخيص وعلاج فقر الدم.

الكلمات المفتاحية: : الجهاز الهضمي، مؤشر كتلة الجسم، فقر الدم، الإمساك، الأنماط الغذائية

Introduction

The digestive system is considered the true mirror of a person's overall health, as it plays a fundamental role in converting nutrients into energy that supports vital processes(Lafy et al., 2025). With the rapid changes in contemporary lifestyles, digestive disorders have emerged as one of the most common health problems, affecting not only physical health but also the quality of life and daily performance of individuals, Recent studies indicate a close and complex correlation between dietary patterns and the physiological state of the body, which is often expressed through the Body Mass Index (BMI).(Niknam et al., 2025) The balance between the consumption of fibers and fluids versus processed foods not only determines an individual's weight but also directly affects digestion mechanics and the speed of food passage through the intestines, which if disrupted, may lead to uncomfortable symptoms such as constipation, bloating, and indigestion(Moini & Ferdowsi, 2024). Obesity or an increased BMI is not merely an increase in weight, but a condition that may be associated with changes in intra-abdominal pressure and modifications in intestinal peristalsis. making individuals with higher mass more susceptible to certain disorders such as gastroesophageal reflux)Malone, 2024.(Conversely, dietary patterns low in fiber and inadequate hydration are considered a major cause of colon disorders even among individuals with normal weight(Alahmari, 2024). This study comes to investigate the gap between daily dietary behavior and physical measurements, aiming to explore the prevalence of digestive disorders and their relationship with body mass index. seeking to provide a clear perspective that helps improve dietary habits and prevent related health problems, the major dietary shifts witnessed in the twenty-first century, characterized by the increasing reliance on processed foods low in fiber versus the decline in the consumption of fluids and natural ingredients, a clear health gap has emerged, reflected in the rise of digestive disorders and the imbalance in anthropometric and laboratory indicators of individuals(Calcaterra et al., 2025). The digestive system is the body’s vital gateway, and any dysfunction in its system, whether motor or absorptive, directly affects the overall condition(Calcaterra et al., 2025), Functional digestive symptoms, such as indigestion, bloating, and chronic constipation, are not merely transient symptoms, but precise indicators of the quality of the dietary pattern followed. Statistical research indicates that a lack of fiber and adequate hydration not only slows intestinal movement but also alters the biological balance within the digestive tract, which may lead to long-term disorders affecting the quality of the absorption of micronutrients(Kiani et al., 2022). On the other hand, the body mass index emerges as a global standard for assessing nutritional status,(Wu et al., 2024) However, the relationship between weight and digestive health is complex; an increase in body mass (obesity) is often accompanied by mechanical pressures and hormonal changes that increase the likelihood of gastroesophageal reflux and colon disorders.(Wu et al., 2024) Conversely, a sharp decrease in BMI may be a natural result of malabsorption or restrictive dietary patterns lacking essential elements, creating a vicious cycle between body weight and digestive efficiency.(Rinaldi et al., 2025) Hemoglobin (Hb) comes as a crucial variable in this study, as it is the protein responsible for transporting oxygen to all body tissues, including the muscles and tissues of the digestive system itself(Acharya & Singh, 2024). Observing cases of severe anemia in individuals with digestive disorders raises a fundamental question about their reciprocal relationship, anemia may be the result of a diet lacking in iron and vitamins, or it may be a symptom of an underlying problem.(Malesza et al., 2022) This study strives to diagnose this reality through the integrated link between the health triad: (dietary behavior, body condition, and laboratory results), applied to a sample from the local community in the city of Zliten, It aims to provide a statistical insight reveals the depth of the connection

between what we eat, and how its effects appear on our weight, our blood tests, and the comfort of our digestive systems from chronic diseases that prevent the body from benefiting from what is consumed.

Problem of the study:

1. The prevalence of bothersome symptoms (such as constipation, bloating, and indigestion) among individuals, which may result from unhealthy dietary patterns such as fiber deficiency or poor meal distribution among female college students .
2. The existence of abnormalities in body mass index (BMI), whether increased or decreased, and the extent to which this is related to the appearance of anemia.
3. Observing cases of severe anemia (low hemoglobin levels) in a group of individuals, raising the question of whether the cause is due to unhealthy dietary pattern and poor dietary intake of iron and trace elements, or whether there are digestive disorders that hinder absorption.
4. The lack of local studies (specifically in the Zliten area) that link these three variables (diet, weight, and hemoglobin) within a single framework to identify the factor most affecting digestive health.

Objectives of the study:

- To identify the extent of participants' adherence to consuming fiber, vegetables, and liquids, and to monitor incorrect dietary habits (such as replacing water with soft drinks).
- To classify participants based on Body Mass Index (underweight, normal weight, overweight, obesity).
- To identify the most common digestive symptoms (constipation, gas, stomach bacteria) and their frequency among the study sample.
- To determine the prevalence of anemia and classify it according to severity (mild, moderate, severe) among the studied cases.

Material and methods

Study Design This study was conducted using a cross-sectional descriptive study design, which was developed to compare nutritional and vital indicators at a specific point in time for a new study.

Study Setting and duration :

Study Location: The study was conducted currently, with data collected from students at the Faculty of Science, Alasmarya Islamic University Zliten, Libya.

Duration: This study was conducted between April and May 2026.

Sample: A purposive sample of 50 cases was selected, with complete clinical, nutritional, and bed data.

Data Collection Instruments: Two main data collection instruments were used:

A specially designed and visually controlled questionnaire measuring several axes:

Age, weight, and height data, and Body Mass Index (BMI) calculation.

Ethics Of the study

Additional verbal consent was obtained from all survey participants for the statement of completion, with the assurance that the personal data would be used exclusively for the scientific research purpose of the research paper.

Results and discussion

Table (1) : variables distribution of the sample .

Statistics

		Hemoglobin Category	BMI Category	Number of bowel movements per week	Replacing soft drinks with water	Previous vitamin deficiency
N	Valid	70	70	70	70	70
	Missing	0	0	0	0	0
Mean		1.1571	1.5857	1.69	2.40	1.26
Median		1.0000	2.0000	2.00	3.00	1.00

Mode	1.00	2.00	2	3	1
Std. Deviation	.36656	.49615	.526	.730	.440
Variance	.134	.246	.277	.533	.194
Minimum	1.00	1.00	1	1	1
Maximum	2.00	2.00	3	3	2
Sum	81.00	111.00	118	168	88

The descriptive table illustrates the central values and measures of dispersion for five key variables in a sample consisting of 70 participants, with no missing data (Missing = 0):

Hemoglobin Category: The mean was 1.15, with a standard deviation of 0.36, indicating that most cases are concentrated around the first category (which often represents anemia).

BMI Category: The mean was 1.58, and the mode (the most frequent value) was 2.00, indicating that the sample tends toward the normal weight classification.

Previous vitamin deficiency: The mean was 1.26, with a mode of 1.00, confirming that the majority of the sample falls under the category with a previous deficiency.

Replacing sugary drinks with water: This variable recorded the highest mean among behavioral variables at 2.40, with a mode of 3.00, reflecting a diversity of behaviors followed by participants regarding this variable.

Table (2) : Hemoglobin level distribution of the sample .

Hemoglobin Category

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Anemia	59	84.3	84.3	84.3
	normal	11	15.7	15.7	100.0
	Total	70	100.0	100.0	

A rate of 84.3% indicates that anemia is the predominant characteristic among female students. This high rate justifies the need to investigate behavioral causes (such as the consumption of soft drinks), the statistical significance of which will discuss later .

Association of health status with nutritional history: Considering that 74.3% of the sample previously had vitamin deficiencies, we find a logical explanation for the concentration of most cases in the anemia category. This confirms that micronutrient deficiencies inevitably lead to a deterioration of hemoglobin levels. 15.7% of the sample is at the normal level. This also explains why statistically significant differences appeared when comparing hemoglobin with dietary habits; anemia cases are often sharply associated with unhealthy dietary patterns.

Table (3): Body Mass Index distribution among the sample :

BMI Category

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Underweight	29	41.4	41.4	41.4
	Obese	41	58.6	58.6	100.0
	Total	70	100.0	100.0	

The frequency table shows the distribution of the 70 participants in the sample according to the Body Mass Index (BMI) classification:

Underweight category: The number of individuals in this category was 29, representing a percentage of 41.4%.

Obese category: This included the largest number of the sample, totaling 41 individuals, with a percentage of 58.6%.

Table (4) : Number of bowel movements per week

Number of bowel movements per week

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 3 times	24	34.3	34.3	34.3
	3 - 7 times	44	62.9	62.9	97.1
	More than 1 time/day	2	2.9	2.9	100.0
	Total	70	100.0	100.0	

The majority of the sample (62.9%) falls within the normal range of bowel activity (3-7 times per week). However, the presence of approximately one-third of the sample (34.3%) in the "less than 3 times" category indicates the prevalence of constipation or sluggish bowel symptoms among the participants.

Table (5) : History of Previous vitamin deficiency

Previous vitamin deficiency

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	52	74.3	74.3	74.3
	No	18	25.7	25.7	100.0
	Total	70	100.0	100.0	

The frequency table for the variable 'Previous vitamin deficiency' illustrates the distribution of the sample individuals according to their medical history of vitamin deficiency: the 'Yes' category: the number of individuals who had a previous vitamin deficiency including was 52, representing a percentage of 74.3%

Table (6): Results of the T-test for Variables Affecting Hemoglobin Levels

Independent Variable	Dependent Variable	P-value	Statistical Significance
Studied Independent Variable	Hemoglobin Categories	0.068	Approaching Significance (Indicates a potential effect trend)
History of Vitamin Deficiency	Hemoglobin Levels	0.061	Approaching Significance (Reflects the cumulative effect of malnutrition)

The results of the (T) test showed differences approaching the level of statistical significance (P=0.068) in hemoglobin categories, indicating a potential effect trend of the studied independent variable, although it did not reach definitive significance. This calls for further investigation into the physical factors associated with anemia in future studies with larger sample sizes.

The results of the statistical analysis showed differences approaching significance (P=0.061) in hemoglobin levels attributed to the participants' history of vitamin deficiency. This result reflects the cumulative effect of malnutrition on blood biomarkers, necessitating consideration of nutritional history when developing treatment plans for patients with anemia.

Table (7): Statistical Effect of Regular Bowel Movement on Hemoglobin Levels

Independent Variable	Dependent Variable	P-value	Statistical Significance & Interpretation
Regular Bowel Movement	Hemoglobin Levels	0.031	Statistically Significant ($P < 0.05$) • Participants with regular bowel activity showed better blood readings. • Reinforces gastrointestinal health as a crucial mediating factor in anemia prevention.

There is a statistically significant effect of regular bowel movement on hemoglobin levels (P=0.031), where participants with regular bowel activity showed better blood readings. This result reinforces the importance of gastrointestinal health as a mediating factor in anemia prevention, necessitating the inclusion of gut health as an integral part of nutritional therapeutic strategies.

Table (8): Statistical Effect of Fluid Substitution Behavior on Hemoglobin Levels

Independent Variable	Dependent Variable	P-value	Statistical Significance & Key Interpretation
Replacing soft drinks with water	Hemoglobin Levels	0.003	Highly Statistically Significant ($P < 0.01$) • Confirms behavioral modification in fluid consumption is crucial for improving blood status. • Serves as a vital preventive recommendation for therapeutic nutrition programs to prevent anemia.

The results of the (T) test showed significant differences with high statistical significance (P=0.003) in hemoglobin levels attributed to the behavior of replacing soft drinks with water. This result confirms that behavioral modification in fluid consumption patterns is a crucial factor in improving blood status and preventing anemia, making it one of the most important preventive recommendations that should be included in therapeutic nutrition programs.

Conclusion

The study demonstrated a statistically significant linear relationship between the severity of anemia and the frequency of diarrhea (P = 0.023). This finding suggests that recurrent intestinal disturbances play a critical role in impairing the physiological absorption of essential micronutrients (such as iron, vitamin B12, and folic acid) in the intestines, making them a major indirect cause of reduced red blood cell biosynthesis. The results of the analysis of variance (ANOVA) showed no statistically significant differences in mean hemoglobin levels between the different weight categories (underweight, normal weight, overweight, and obese). This finding leads us to a highly important scientific conclusion: nutritional anemia in the study population is not related to the quantity of food consumed (reflected by weight), but rather is closely linked to the type and quality of food, or what is known in medical literature as "hidden hunger". Chi-squared test results for dietary pattern variables (e.g., whole grain intake, P = 0.983) indicated a lack of significant differences. This is statistically attributed to the high degree of similarity and homogeneity in the prevailing consumption and dietary habits within the surrounding Libyan society, which reduces the numerical variance required to demonstrate the effect of a single dietary pattern without isolating other physiological factors. This study demonstrates that combating and preventing anemia requires not only a focus on increasing food intake or traditional supplements, but primarily on diagnosing and treating clinical disorders of the digestive system that impede the physiological utilization of nutrients, with an emphasis on improving the overall quality of individuals' dietary patterns.

Discussion

There is a statistically significant linear relationship (Linear-by-Linear Association = 0.023) between the severity of anemia and the frequency of diarrhea, while the relationship was not significant with bloating (0.176). Frequent diarrhea leads to rapid passage of food through the intestines and damage to the microvilli, which hinders the absorption of essential nutrients and the production of blood cells, especially iron, vitamin B12, and folic acid.the current study was agreed with)Ranjha et al., 2023(ANOVA (F = 0.060) showed no statistically significant differences in normal hemoglobin levels between weight groups (underweight, overweight, and lean).this study not agree with (Tateishi et al., 2023) This normality suggests that anemia in the studied population of Zliten is not a widespread quantitative problem, as overweight or obese individuals may suffer from severe anemia. Rather, it is a localized issue, or what is medically known as hidden hunger, where individuals consume a high number of calories from carbohydrates and fats without obtaining sufficient iron, micronutrients, and vitamins).Kumar et al., 2023(chi-squared test (0.983) showed no correlation between whole grain consumption and anemia. This is attributed to the similarity in consumption patterns within the sample, dietary habits in Libyan society are very similar, with most people consuming bread and pasta at similar rates, thus minimizing statistical variance. It should also be noted that whole grains contain phytates, which can inhibit the absorption of non-heme iron if not consumed properly. This explains the lack of a direct positive effect on hemoglobin levels in the results. Alpha Cronbach coefficient was low overall (0.283) and increased when the axes were separated (0.376). This is justified by the fact that the medical questionnaire measures varying clinical symptoms (patients do not necessarily **have** to show all digestive symptoms together, such as diarrhea and constipation, at the same time), which makes the statistical variability between the responses large, which is normal and accepted in exploratory medical research that depends on face validity and expert review of the content.

Recommendation

1. Regular and comprehensive examinations of the digestive system (such as malabsorption syndromes or intestinal parasite testing) are essential for individuals with severe or persistent anemia, especially those experiencing recurrent digestive symptoms like diarrhea. Simply prescribing traditional iron supplements is insufficient.
2. A permanent medical collaboration protocol should be established between Zliten Medical Center and hematologists and gastroenterologists to ensure comprehensive patient diagnosis.
3. Community awareness programs should be developed in Zliten, focusing on the quality and quantity of food consumed, particularly its richness in highly absorbable iron and co-existing vitamins (such as vitamin C), rather than solely on the quantity consumed. This is because the study demonstrated no correlation between anemia and body mass index (BMI).
4. The researcher recommends future studies with larger randomized samples to allow for more accurate generalization of the findings to the wider region.

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