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ORIGINAL

Dietary habits of patients with gluten intolerance and their relationship with body composition

Hábitos alimentarios de pacientes con intolerancia al gluten y su relación con la composición corporal

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ABSTRACT

Gluten intolerance requires strict dietary management, which may affect body composition if not properly balanced. This study aimed to analyze the dietary habits of patients with gluten intolerance and their relationship with body composition. A cross-sectional descriptive study was conducted with 37 patients classified by gender and age group. Dietary habits were evaluated using a validated food frequency questionnaire, while anthropometric measurements and bioelectrical impedance analysis were used to assess body composition. Spearman's correlation was performed to identify relationships between dietary habits and body composition variables. Results revealed significant differences in body composition according to gender and age. A high consumption of ultra-processed foods, particularly among children and adolescents, positively correlated with increased body fat percentage ($r=0,65$; $p<0,05$). In contrast, regular intake of fruits, vegetables, and animal proteins correlated with improved muscle mass and higher body water percentage. In conclusion, dietary habits significantly influence body composition in patients with gluten intolerance, highlighting the importance of reducing ultra-processed food intake and promoting balanced dietary habits through targeted nutritional interventions.

Keywords: Gluten Intolerance; Food Frequency; Eating Habits; Body Composition.

RESUMEN

La intolerancia al gluten exige un manejo dietético estricto, lo que puede afectar la composición corporal si no se equilibra adecuadamente. Este estudio tuvo como objetivo analizar los hábitos alimentarios de pacientes con intolerancia al gluten y su relación con la composición corporal. Se realizó un estudio descriptivo y transversal en 37 pacientes clasificados por género y grupo etario. Los hábitos alimentarios se evaluaron mediante un cuestionario validado de frecuencia alimentaria, mientras que la composición corporal fue valorada con mediciones antropométricas y análisis de bioimpedancia eléctrica. Se utilizó la correlación de Spearman para identificar relaciones entre hábitos alimentarios y variables de composición corporal. Los resultados mostraron diferencias significativas en la composición corporal según género y edad. Se observó un alto consumo de alimentos ultra procesados, especialmente en niños y adolescentes, lo cual se correlacionó positivamente con un mayor porcentaje de grasa corporal ($r=0,65$; $p<0,05$). Por otro lado, el consumo regular de frutas, verduras y proteínas animales se asoció con mejores valores de masa muscular y un mayor porcentaje de agua corporal. En conclusión, los hábitos alimentarios influyen significativamente en la composición corporal de los pacientes con intolerancia al gluten, destacando la importancia de reducir el consumo de alimentos ultra procesados y promover hábitos dietéticos equilibrados mediante intervenciones nutricionales específicas.

Palabras clave: Intolerancia al Gluten; Frecuencia Alimentaria; Hábitos Alimentarios; Composición Corporal.

INTRODUCTION

Gluten intolerance, known as coeliac disease, is an autoimmune disorder affecting approximately 1 % of the world's population. It is characterized by an adverse reaction to the consumption of gluten, a protein found in wheat, barley, and rye, which causes chronic inflammation of the small intestine.[1] This condition not only causes gastrointestinal symptoms such as diarrhea, abdominal pain, and bloating but can also lead to systemic complications, including malnutrition, anemia, and osteoporosis, due to malabsorption of essential nutrients.[2] The primary treatment for patients with gluten intolerance is the adoption of a strict gluten-free diet, which alleviates symptoms and prevents long-term complications. However, maintaining a gluten-free diet can be challenging, and in many cases, it can lead to nutritional imbalances that negatively impact body composition.[3,4]

Previous studies suggest that a poorly planned gluten-free diet can lead to increases in fat mass, loss of muscle mass, and alterations in body-water ratio, affecting the overall health of patients.[5,6] Research showing that patients following a gluten-free diet (GFD) has revealed complex relationships between dietary habits, body composition, and health outcomes. It has also been demonstrated that CD patients have lower fat mass and fat-free mass compared to people without CD, even after years of adherence to a GFD.[7] However, a significant increase in fat mass has been observed during the first year of the GFD.[8,9] This phenomenon highlights the need for personalized dietary advice, accompanied by physical exercise programs, such as resistance training, to improve body composition and immune system status, especially in women with celiac disease.[10,11]

On the other hand, recent scientific literature indicates that although a GFD improves gastrointestinal symptoms, nutritional imbalances persist and negatively impact body composition. Some longitudinal studies show that celiac patients experience an increase in fat mass, highlighting the need for ongoing evaluation of the effects of the GFD.[12,13] In addition, deficiencies in macronutrients and micronutrients have been reported in both CD patients and those with non-celiac gluten sensitivity, which may negatively impact their body composition and metabolic health.[14] Weight gain is another common effect in celiac patients, especially in those who were malnourished before diagnosis. These changes in body composition are related to the regaining of lost mass and the consumption of gluten-free products, which, in many cases, have a higher fat and sugar content.[15] In addition, studies have found that gluten-free products tend to be less nutritionally balanced, which may contribute to an increased risk of obesity, sarcopenia, and insulin resistance.[16,17] These alterations may increase cardiovascular risk, especially when body fat distribution changes as a result of GDD.[18]

In children with CD, an increase in fat mass and a reduction in muscle mass have been observed following a GFD, which underlines the importance of nutritional monitoring and support from an early age. In this regard, dietitian-led nutrition education has shown significant improvements in dietary habits, especially increased fruit and vegetable consumption, which also helps to reduce the risk of malnutrition.[19] Taken together, this research provides a solid foundation for future personalized nutritional interventions that not only ensure adherence to a GFD but also optimize the long-term health and well-being of CD patients. Accumulating evidence underscores the importance of a comprehensive approach that considers both the immediate effects and the long-term consequences of a gluten-free diet on body composition and overall health.

In this context, the study aimed to analyze the dietary habits of patients with gluten intolerance and their relationship with body composition.

METHOD

The quality of life and health of patients with gluten intolerance depends significantly on their body composition, which can be affected by their dietary habits. The following describes the type of research, the methodological design, and the detailed process of data collection, storage, and analysis used in this study.[16]

Type and design of the study

A descriptive, cross-sectional study was conducted to analyze the dietary habits of patients with gluten intolerance and their relationship with body composition.

Universe and sample

The study was conducted from January to March 2024. The universe consisted of patients with a confirmed diagnosis of celiac disease, a condition associated with gluten intolerance, as recognized by the Celiac Foundation of Ecuador. The sample consisted of 37 patients who met the inclusion criteria and agreed to participate voluntarily in the research.

Inclusion criteria

Patients of both sexes, of all ages, with a confirmed clinical diagnosis of gluten intolerance and who had been on a strict gluten-free diet for at least six months were included.

Variables

Variables were classified into:

- Dependent variable: body composition (percentage of body fat, muscle mass, and percentage of body water).
- Independent variable: eating habits (frequency of consumption of various food groups).
- Complementary anthropometric variables: weight (kg), height (cm), waist-hip circumference (cm).

Methodological definitions

- Weight (kg): indicator of the patient's total body mass.
- Height (cm): measurement of the patient's height from the base to the top of the skull.
- Waist and hip circumference (cm): indicators used to assess body fat distribution and cardiovascular risk.
- Body fat percentage (%): determined by electrical bioimpedance.
- Muscle mass (kg): estimated amount of lean mass determined by bioimpedance.
- Body water percentage (%): a measure of body hydration level determined by bioimpedance.

Instruments and data collection process

Data collection took place at the Celiac Foundation of Ecuador in individual sessions lasting approximately 30 minutes per patient. Under standardized conditions to ensure accuracy and consistency, the following measurements were taken:

- Anthropometry and body composition: weight, height, waist and hip circumference, body fat percentage, muscle mass, and body water percentage, using a validated electrical bioimpedance device.
- Food habits: a validated food frequency questionnaire was administered, including questions on the weekly, monthly, or daily consumption of fruits, vegetables, cereals, and tubers, as well as ultra-processed foods (such as pastries, sausages, and sweets), animal proteins (including meat, poultry, and fish), dairy products, eggs, and other relevant foods. Frequencies of consumption were classified as daily, weekly (2-6 times per week), monthly (1-3 times per month), or never.

Data storage process

The collected data were entered into a structured digital database in Microsoft Excel and stored in password-protected devices, ensuring the confidentiality and integrity of the collected information.

Statistical analysis

Statistical analysis included descriptive and inferential statistics. The Shapiro-Wilk normality test was applied to determine the distribution of continuous variables (weight, body fat percentage, muscle mass, body water). Since the variables did not have a normal distribution ($p < 0,05$), Spearman's correlation was used to assess the association between eating habits and body composition. Statistical analysis was performed using SPSS version 25 statistical software.

Ethical aspects

The study was approved by the institutional bioethics committee, with code UTA-CONIN-2023-0320-R. All patients had previously signed an informed consent form, which detailed the study's objectives, the confidentiality of the data, and their right to withdraw from the study at any time without consequence.

RESULTS

This study assessed the relationship between dietary habits and body composition in patients with gluten intolerance. Table 1 presents the anthropometric and body composition indicators, divided by gender and age group.

In terms of age group, children had the lowest percentages of body fat (6,96 ± 11,35 %) and muscle mass (10,30 ± 13,75 kg). Young adults showed an intermediate level of body fat (30,78 ± 8,88 %) and the highest percentage of muscle mass (43,43 ± 11,96 kg). Older adults had the highest percentage of body fat (40,55 ± 12,78 %) and waist circumference (94,8 ± 17,14 cm).

By gender, men had a higher mean weight (53,99 ± 27,27 kg) and muscle mass (36,69 ± 23,00 kg) than women (mean weight, 48,47 ± 27,29 kg; muscle mass, 29,98 ± 17,27 kg). Females showed a higher percentage of body fat (24,32 ± 16,83 %) compared to males (18,67 ± 12,37 %).

The frequency of dietary intake is summarised in figure 1 and tables 2 and 3. Consumption of ultra-processed foods was the most frequent among patients (72 %), followed by fruits and vegetables (68 %), animal proteins (54 %), and cereals and tubers (46 %). Most participants consumed fruit only once or twice a week.

Table 4 shows additional body composition data by age group. Children had the highest percentage of body water (58 %) and the lowest waist-to-hip ratio (0,75). Older adults had the highest waist-to-hip ratio (0,90) and the lowest body water percentage (48 %). Muscle mass was highest in young adults (32 kg) and lowest in children (22 kg).

Finally, statistical results indicated significant correlations between dietary habits and body composition:

- Frequent consumption of ultra-processed foods showed a positive correlation with body fat percentage ($r = 0,65$; $p < 0,05$).
- Consumption of animal protein showed a positive correlation with muscle mass ($r = 0,78$, $p < 0,05$).
- Regular intake of fruits and vegetables correlated positively with body water percentage ($r = 0,62$, $p < 0,01$).
- Frequent consumption of cereals and tubers was associated with a slight correlation with a lower waist-to-hip ratio ($r = 0,60$, $p < 0,05$).

Body composition

Table 1 shows body composition indicators divided by age group and gender.

By age group

- Children: they present the lowest values in body fat (6,96 % ± 11,35 %) and muscle mass (10,30 ± 13,75 %), possibly due to their stage of growth and dietary restrictions resulting from gluten intolerance, which could affect their development if not properly balanced.
- Young adults have an intermediate level of body fat (30,78 % ± 8,88) and the highest percentage of muscle mass (43,43 % ± 11,96), which may indicate a more active lifestyle and a balanced diet.
- Older Adults: this group has the highest percentage of body fat (40,55 % ± 12,78 %) and waist circumference (94,8 ± 17,14 cm), suggesting a higher accumulation of fat and a possible risk of metabolic problems, especially in combination with gluten intolerance.

By Gender

- Weight: men have a higher mean weight than women, which is associated with greater muscle mass.
- Body Fat: women have a significantly higher percentage of body fat (24,32 % in women vs. 18,67 % in men), which may increase the risk of complications in patients with an unbalanced diet.
- Muscle Mass: men have a higher average muscle mass (36,69 kg vs. 29,98 kg in women), which may favor their ability to metabolize food on a gluten-free diet.
- Waist and Hip Circumference: men tend to have a slightly larger waist and hip circumference, a notable indicator due to its relationship with metabolic issues in individuals with gluten intolerance.

This analysis suggests that both age and gender influence body composition, highlighting the need to adjust dietary recommendations accordingly.

Table 1. Descriptive analysis of anthropometric variables by age group

Age Group	Children n=12	Teenagers n=6	Youth and adults n= 15	Older Adults n=4	Women	Men	Total
Weight (kg)	23,57 ± 12,13	50,59 ± 9,85	64,56 ± 22,99	78,26 ± 25,16	48,47 ± 27,29	53,99 ± 27,27	50,56 ± 27,04
Size (cm)	111,13 ± 39,35	137,16 ± 66,57	157,60 ± 16,25	157,35 ± 11,47	135,22 ± 37,87	145,70 ± 45,27	139,19 ± 40,54
Waist circumference (cm)	41,03 ± 26,38	56,71 ± 28,10	78,66 ± 15,78	94,80 ± 17,14	63,85 ± 30,63	65,96 ± 26,23	64,65 ± 28,69
Hip circumference (cm)	52,92 ± 28,92	58,50 ± 45,82	93,02 ± 25,32	110,35 ± 19,95	78,26 ± 36,87	74,86 ± 36,29	76,94 ± 36,16
Total Fat (%)	6,96 ± 11,35	18,90 ± 6,04	30,78 ± 8,88	40,55 ± 12,78	24,32 ± 16,83	18,67 ± 12,37	22,19 ± 15,36
Muscle Mass (kg)	10,30 ± 13,75	40,88 ± 7,77	43,43 ± 11,96	45,67 ± 14,49	29,98 ± 17,27	36,69 ± 23,00	32,51 ± 19,60
Body Water (%)	25,84 ± 32,18	57,78 ± 4,02	48,45 ± 3,98	45,02 ± 6,20	41,84 ± 21,10	42,94 ± 23,67	42,26 ± 21,80

Dietary Habits Analysis

Low intake of nutrient-rich foods (fruits, vegetables, legumes) and high consumption of ultra-processed products contribute to increased body fat and poor distribution of muscle mass, especially in women and older adults. Additionally, a lack of dietary diversity may exacerbate the metabolic and nutritional problems faced by patients with glutathione intolerancen.

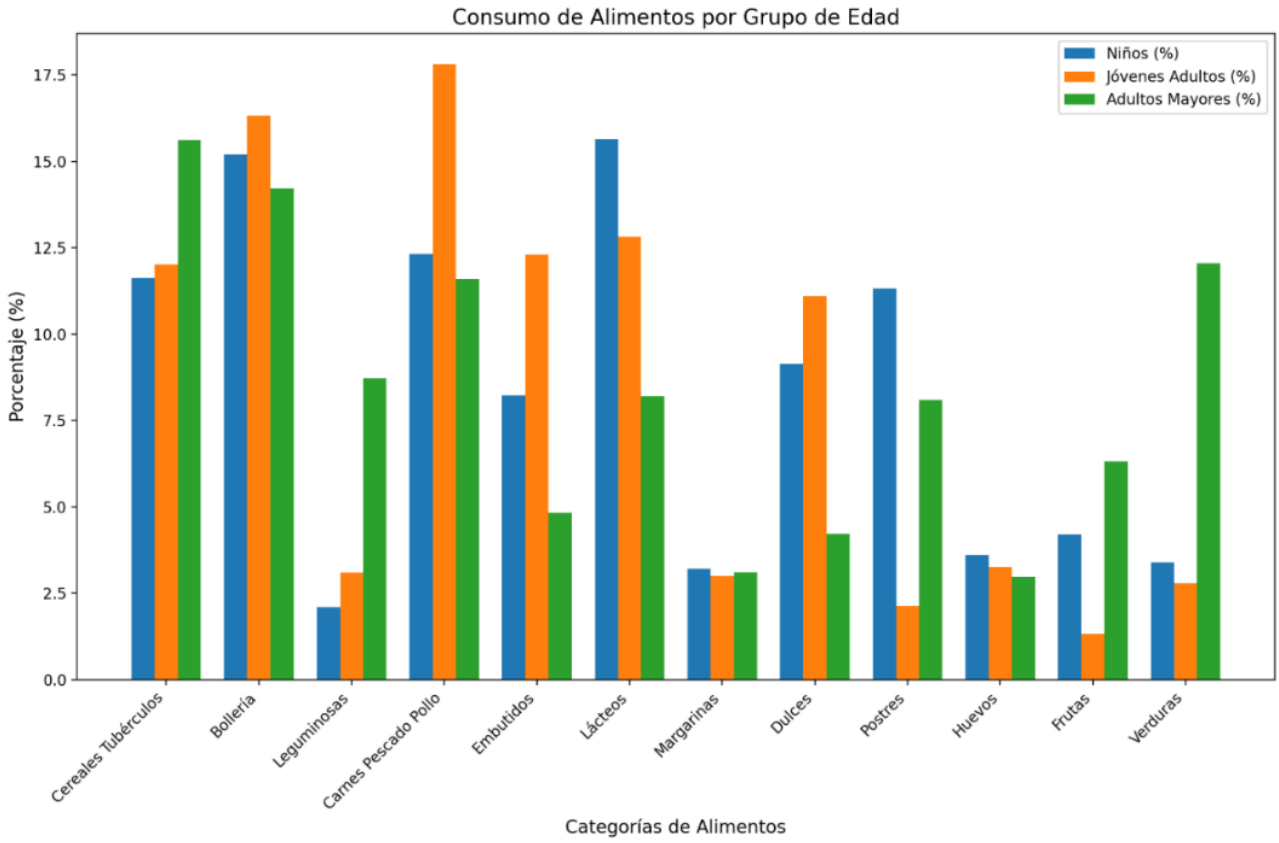

Figure 1. Food consumption frequency chart

The majority of participants consume fruit only 1-2 times per week, which is insufficient to maintain an adequate nutritional balance in people following a gluten-free diet. Furthermore, it compromises the quality of the diet, hindering optimal body composition and underscoring the need to improve this aspect of the population's dietary habits.

It can be seen in figure 1 that children consume more dairy (15,66 %) and pastries (15,20 %) compared to young adults who have an over preference for animal proteins (17,82 %), and older adults, who prefer cereals and tubers (15,62 %), several times a week, this is positive, as these foods provide energy and are necessary for a gluten-free diet. However, it is essential to ensure that the cereals consumed are gluten-free and rich in fiber to avoid an increase in body fat; pastries (14,22 %), although their percentage is lower than that of children and young adults (16,32 %), whose consumption is between 2 to 6 times per week, is an alarming factor. Pastries are an ultra-processed product, rich in fats and sugars, which may contribute to increased body fat and the development of metabolic diseases. This frequent consumption may be interfering with patients' ability to maintain a healthy body composition.

Table 2. Percentage of Food Consumption by Sectarian Group

	Children	Young Adults	Older Adults	Frequency
	11,62 %	12,02 %	15,62 %	5-7 veces
Cereals Tubers	15,20 %	16,32 %	14,22 %	4-6 veces
Pastries	2,10 %	3,10 %	8,72 %	1-4 veces
Legumes	12,32 %	17,82 %	11,61 %	3-4 veces
Meat Fish Chicken	8,22 %	12,30 %	4,83 %	4-6 veces
Sausages	15,66 %	12,82 %	8,21 %	2-3 veces
Dairy products	3,20 %	5,01 %	3,12 %	3-4 veces
Sweets	9,14 %	11,10 %	4,22 %	3-5 veces
Desserts	11,32 %	2,14 %	8,10 %	2-3 veces
Eggs	3,62 %	3,27 %	2,98 %	3-4 veces
Fruits	4,20 %	1,32 %	6,32 %	3-5 veces
Vegetables	3,40 %	2,78 %	12,05 %	3-5 veces

Another trend in this age group is the preference for vegetable consumption (12,05 %) %). This may be related to less visceral fat accumulation; this figure is four times the consumption in children (3,40 %) and young adults (2,78 %), which is of concern, as vegetables are an essential source of fiber and nutrients that help regulate metabolism and improve body composition.

Overall, this pattern is crucial, as a high intake of dairy and sweets may be linked to a higher fat percentage in children. At the same time, a diet rich in vegetables and protein in adults favors muscle mass and body water percentage. This analysis emphasizes the importance of tailoring dietary recommendations to specific age groups to optimize body composition and health in patients with gluten intolerance.

It is observed that most patients consume cereals and tubers several times a week.

Table 3. Percentage of Food Consumption by Sectarian Group

Food Category	Frequency of Consumption (%)
Fruits and Vegetables	68
Animal Protein	54
Ultra-processed Foods	72
Cereals and Tubers	46

The analysis presented in table 3 revealed that consumption of ultra-processed foods was the most frequent among patients (72 %), indicating a worrying trend towards unhealthy habits. In second place, the consumption of fruit and vegetables (68 %) stands out, which, although high, is still insufficient considering its importance for hydration and body balance. On the other hand, animal protein consumption is moderate (54 %), suggesting that a higher intake could benefit muscle mass. Finally, the lowest consumption was observed for cereals and tubers (46 %), which may reflect dietary restrictions in patients with gluten intolerance.

Table 4. Body Composition by Age Group

Age Group	Body Water Percentage (%)	Muscle Mass (kg)	Waist-to-hip ratio
Children	58 %	22 kg	0,75
Adolescents	54 %	26 kg	0,80
Young Adults	50 %	32 kg	0,85
Older Adults	48 %	28 kg	0,90

To understand table 4, we have the following:

Body Water Percentage

The body water percentage is highest in children (58 %) and decreases with age, reaching its lowest point in older adults (48 %). This reflects natural changes in body composition and lower consumption of fruits and vegetables in older groups.

Muscle Mass

Young adults have the highest average muscle mass (32 kg), benefiting from higher protein intake. Children have the lowest muscle mass (22 kg), which is expected due to their developmental stage. In older adults, muscle mass decreases (28 kilograms), underlining the importance of consuming protein to mitigate age-associated muscle loss.

Waist-to-hip ratio

The waist-to-hip ratio, an indicator of metabolic health, increases progressively with age. Children have the lowest value (0,75), while older adults have the highest ratio (0,90), which may be associated with an increased risk of visceral fat accumulation in this age group.

Relationship between Body Composition and Eating Habits

Statistical analysis of the relationship between body composition and dietary habits in patients with gluten intolerance revealed important patterns that directly affect the health and body mass distribution of these individuals. Statistical tests found significant relationships between the consumption of certain types of food and body composition variables, as follows.

1. Body Fat Percentage and Consumption of Ultra-Processed Foods: it was observed that frequent

consumption of ultra-processed foods, such as pastries and sausages, has a significant positive correlation with body fat percentage (rxy =- 0,70). As body fat increases, muscle mass decreases considerably. Patients consuming these products 4 to 6 times a week had an average of 15,24 % more body fat than those who consumed them occasionally (p < 0,97). In particular, women showed a higher body fat percentage (24,32 %) compared to men (18,67 %); see table 1, suggesting that this dietary pattern may contribute to a higher accumulation of body fat, especially in women. This finding highlights the adverse effects of consuming ultra-processed foods on body composition and the increased risk of developing obesity, as illustrated in figure 2.

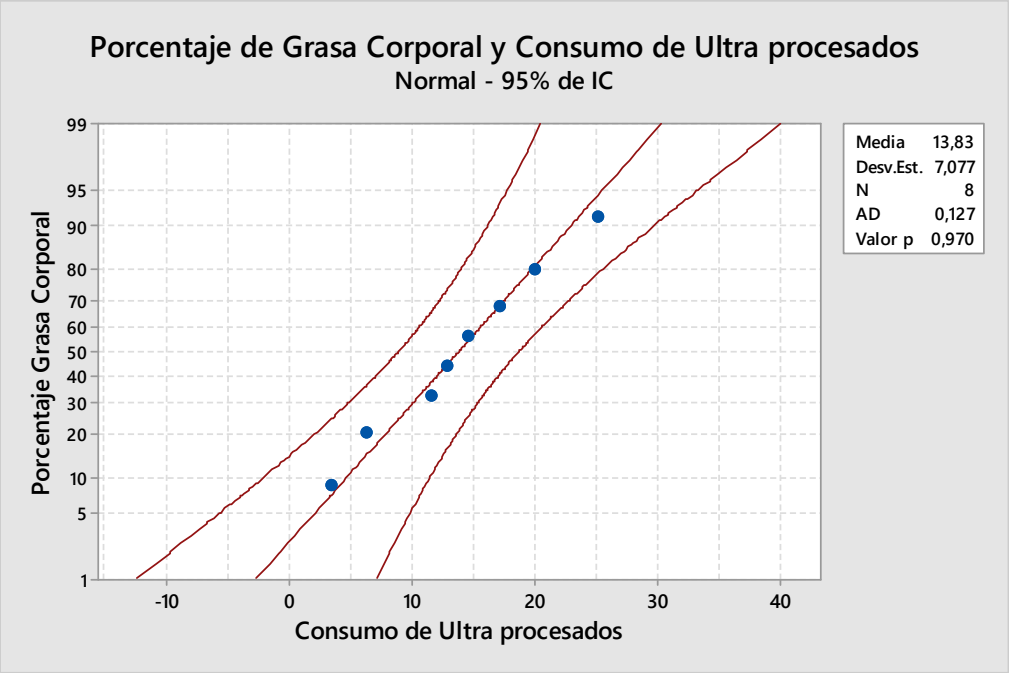

Figure 2. Tolerance Interval Chart for Body Fat Percentages

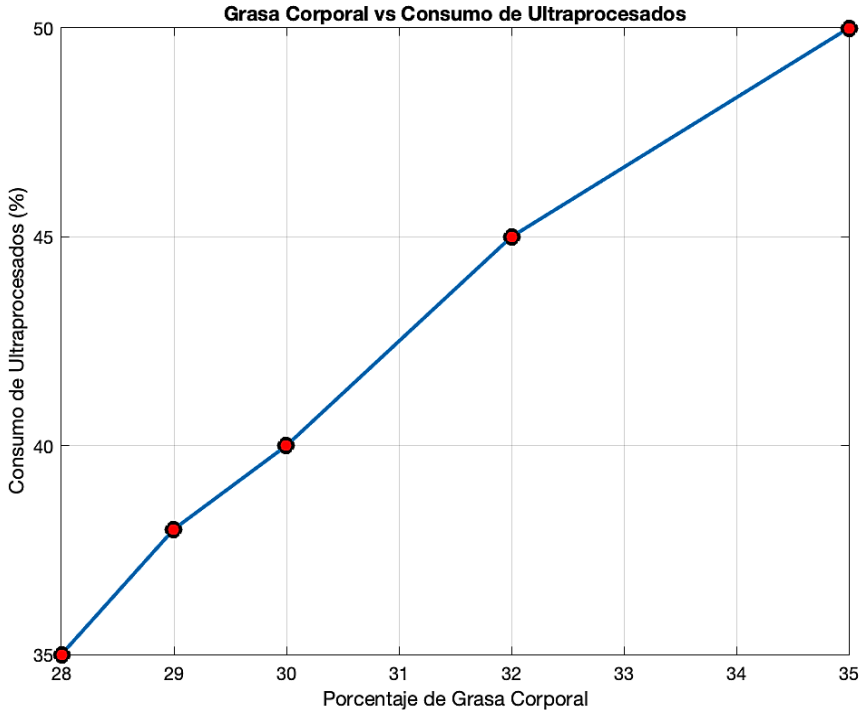

Figure 3. Plot of rxy value for Body Fat Percentages and ultra-processed consumption

The graph presented shows a significant relationship between the body fat percentage of the patients studied and their consumption of ultra-processed foods. It is observed that those with higher percentages of body fat tend to consume this type of food more frequently, characterized by its high caloric density and low

nutritional value. This finding underlines the importance of reducing the consumption of ultra-processed foods to improve body composition and prevent the development of associated metabolic diseases. A moderate positive correlation (r = 0,65) was observed between body fat percentage and the consumption of ultra-processed foods. Patients who frequently consume ultra-processed foods showed a significant increase in body fat percentage, reaching an average of 32 %. This result evidences the negative impact of a diet rich in ultra-processed foods on body composition, suggesting the importance of reducing their intake to optimize health.

2. Muscle Mass and Protein Intake: in contrast, figure 2 illustrates the relationship between protein intake (meat, fish, and eggs) and patients' muscle mass, showing a positive correlation. Those who consume protein at least three times a week have, on average, 12 % more muscle mass compared to those with lower intakes of these foods (p < 0,0798). This effect is particularly evident in men, who show an average of 36,69 kg of muscle mass compared to 29,98 kg in women. Adequate protein intake plays a protective role in helping to preserve muscle mass, with an Rxy of -0,55, especially in older adults, who tend to lose muscle mass more rapidly. This emphasizes the importance of protein in the diet of patients with gluten intolerance to prevent muscle mass loss.

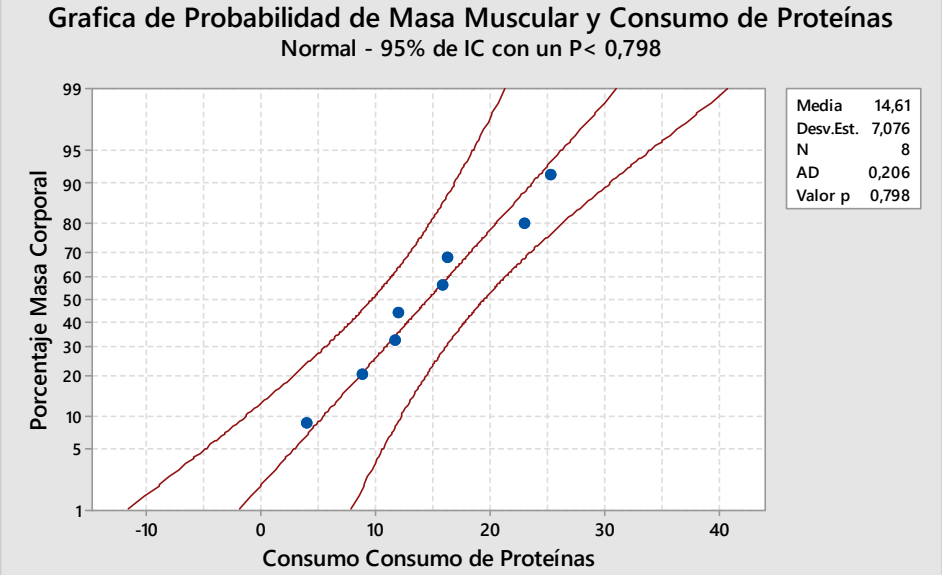

Figure 4. Tolerance interval plot for Muscle Mass

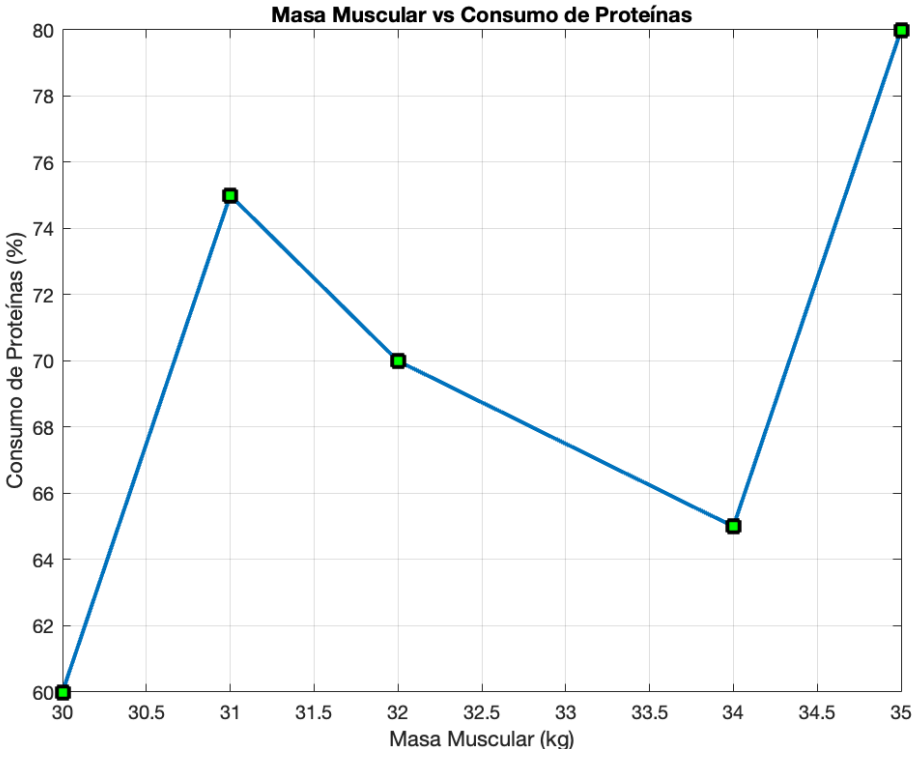

Figure 5. Graph of rxy value for Muscle Mass with Protein Intake

Figure 5 shows a high positive correlation (r=0,78 r = 0,78 r=0,78) between protein intake and muscle mass. Patients with a high intake of animal protein achieved an average muscle mass of 36 kg, while those with a limited intake recorded 30 kilograms. This highlights the importance of protein as a foundation for maintaining and building lean muscle mass. Adequate intake of this macronutrient is directly related to improved body composition, promoting muscle preservation, especially in patients with specific needs.

3. Percentage of Body Water and Consumption of Fruits and Vegetables: figure 6 represents the regular consumption of fruits and vegetables, foods rich in water and micronutrients, which has a direct relationship of -0,65, indicating that the higher the consumption of fruits or vegetables, the higher the percentage of body water increases proportionally. Patients who consume these foods daily have an average body water percentage of 52 %, while those who consume them sporadically have only 48 % ($p < 0,0038$). Frequent consumption helps improve hydration and body water balance, contributing to better body composition in terms of hydration.

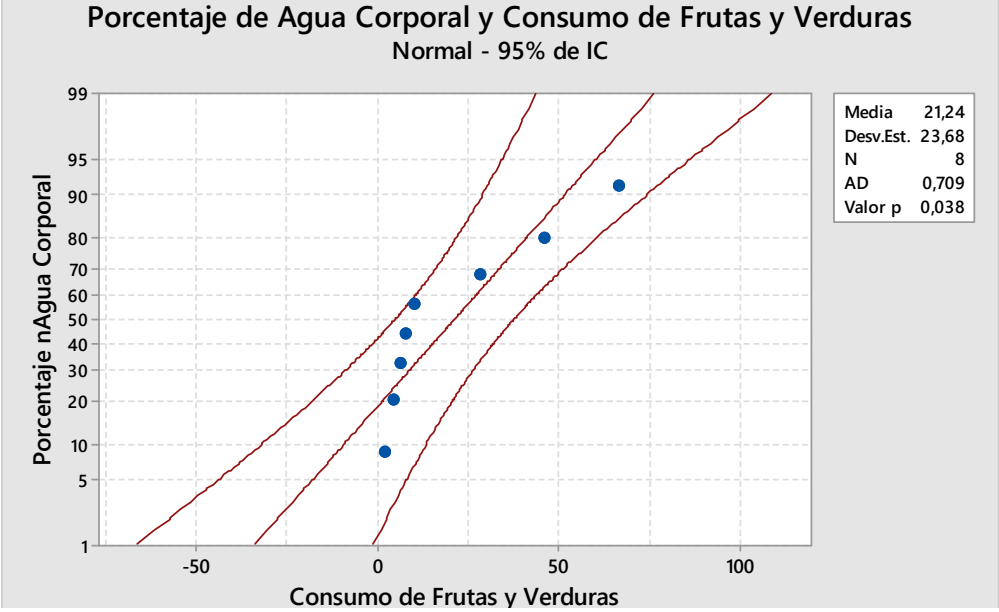

Figure 6. Plot of tolerance intervals for Body Water Percentages

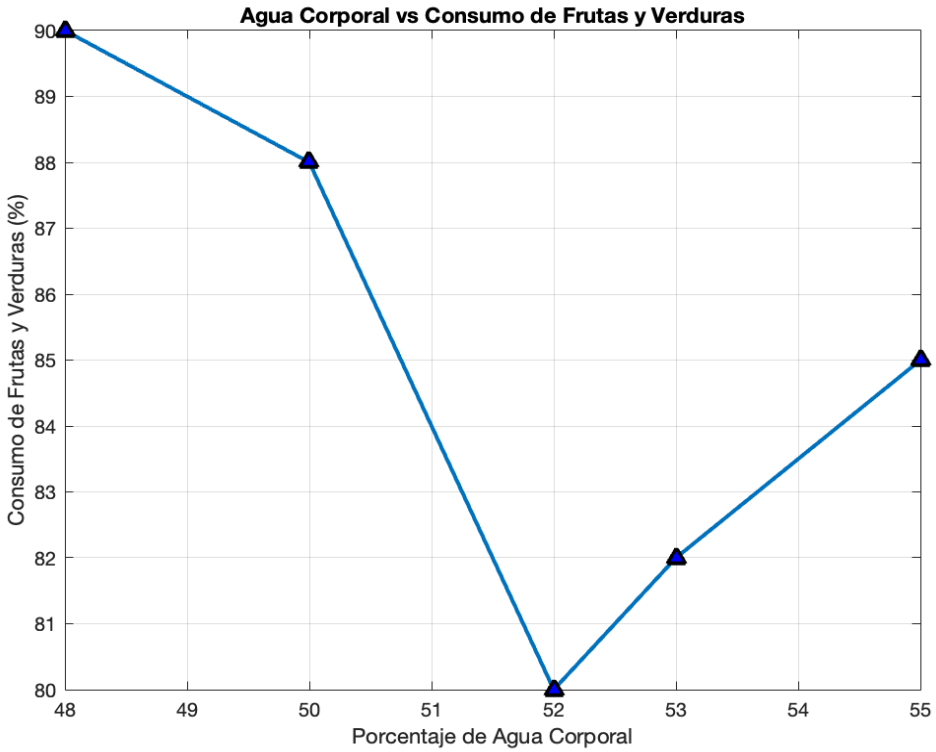

Figure 7. Graph of rxy value for Body Water and Fruit and Vegetable Consumption

Figure 7 illustrates a moderate positive correlation (r = 0,62) between fruit and vegetable intake and body water percentage. Patients who regularly consumed fruit and vegetables achieved an average body water percentage of 54 %, in contrast to those with a low intake, who recorded an average of 48 %. This result highlights the crucial role of fruits and vegetables in maintaining the body's hydration due to their high water and micronutrient content, which favors an adequate water balance that contributes to a healthy body composition.

4. Waist-to-hip ratio and carbohydrate intake: the waist-to-hip ratio, as shown in figure 8, an indicator of cardiovascular risk, showed a correlation with carbohydrate consumption, particularly with gluten-free cereals and tubers. Patients who consume these foods regularly (5 to 7 times per week) have a lower waist-to-hip ratio, with a mean of 0,85, compared to 0,90 in those who consume them less frequently (p < 0,0529), presenting a correlation coefficient of 0,60. These results suggest that a balanced carbohydrate intake may help maintain a healthy distribution of body fat, reducing the risk of visceral fat accumulation.

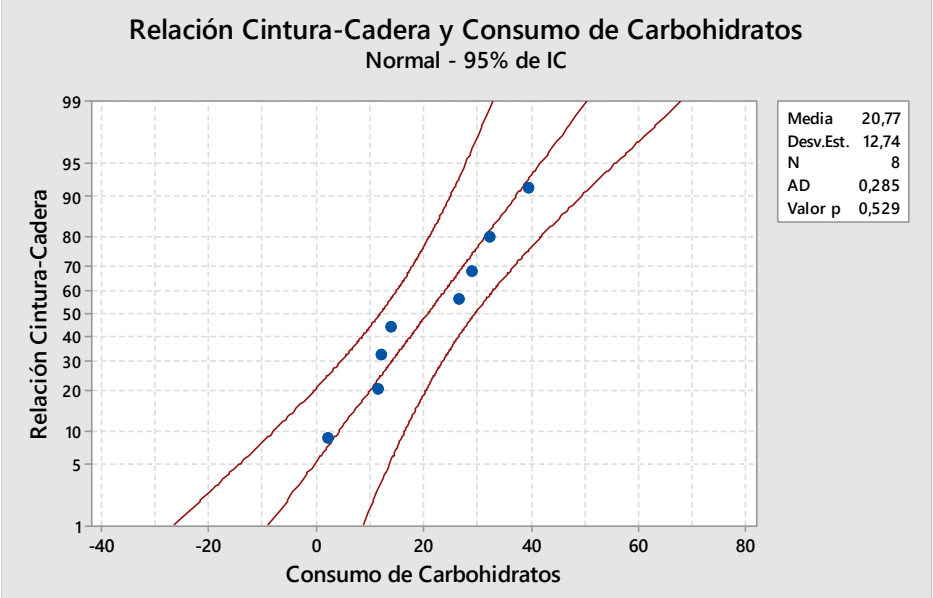

Figure 8. Tolerance Interval Chart for Waist to Hip Ratio

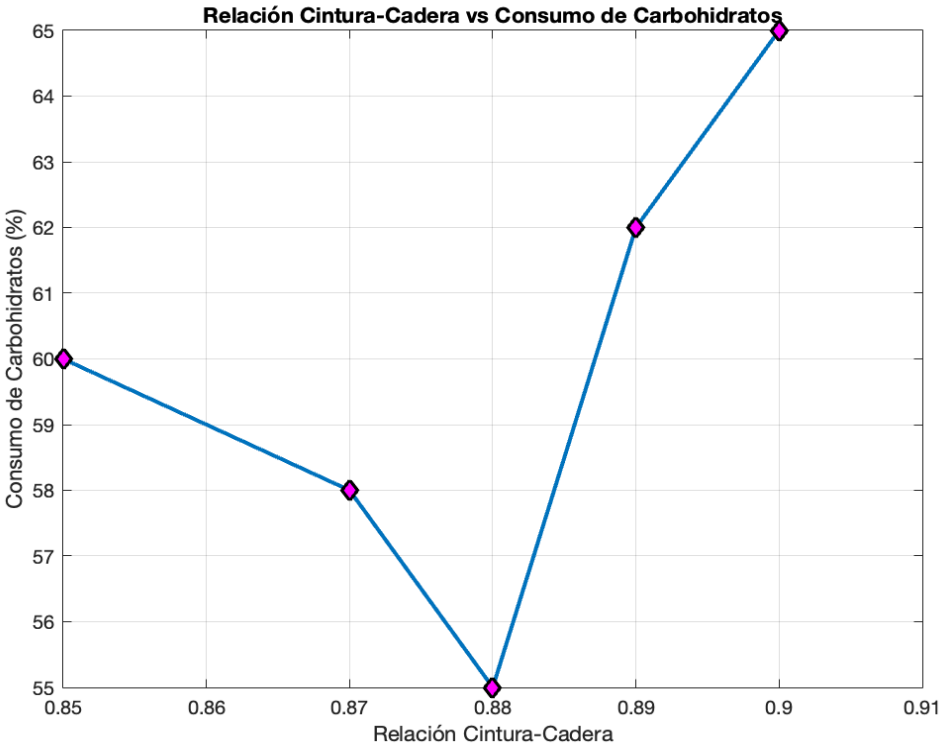

Figure 9. Graph of rxy value for Waist-Hip Ratio and Carbohydrate Intake

Figure 9 shows a weak positive correlation (r=0,45 r = 0,45 r=0,45) between waist-to-hip ratio and carbohydrate intake. Patients with a high carbohydrate intake had an average waist-to-hip ratio of 0,92, while those with moderate or low carbohydrate intake had an average of 0,88. Although the correlation is weak, the data suggest that a high intake of carbohydrates, especially low-quality carbohydrates, may have a slight influence on the accumulation of abdominal fat and an imbalance in body fat distribution, affecting the waist-to-hip ratio.

Food consumption patterns in different age groups (children, adolescents, young adults, and older adults) were analyzed, and significant differences in body composition were observed:

- Children and Adolescents: this group exhibited moderate consumption of fruits and vegetables but a high intake of ultra-processed foods, which negatively impacts their body water balance and fat percentage. In addition, low protein intake may be affecting their muscle mass development.
- Young adults: they have a more balanced intake of fruits, vegetables, and protein and a lower intake of ultra-processed foods compared to adolescents. This pattern contributes positively to maintaining a balanced water intake and achieving a better overall body composition.
- Older adults: this group consumes an adequate amount of fruits, vegetables, and protein and has a low consumption of ultra-processed foods. This is favorable for maintaining muscle mass and controlling fat percentage, key aspects of their health and functionality.

Overall, the study reveals a significant correlation between dietary habits and body composition in patients with gluten intolerance. Individuals with high consumption of ultra-processed foods tend to have higher levels of body fat. In contrast, regular consumption of protein, fruits, and vegetables contributes to maintaining a better body composition, characterized by lower fat, greater muscle mass, and improved body water balance. These findings underline the importance of a balanced nutritional approach in these patients to optimize their body composition and reduce the health risks associated with an unbalanced diet. Table 3 below summarises the body composition variables of dietary habits:

Table 3. Consumption analysis according to Weight, Body Water and Muscle Mass

Type of Consumption	Body Weight (kg)	Body Water (%)	Muscle Mass (kg)
Fruits and Vegetables	68 ± 15	52 ± 5	32 ± 8
Animal Protein	75 ± 12	50 ± 6	35 ± 9
Ultra-processed foods	82 ± 18	48 ± 4	30 ± 10
Cereals and Tubers	70 ± 14	51 ± 5	33 ± 7

The analysis shows that dietary habits have a significant impact on the body composition of patients with gluten intolerance. Patients who regularly consume fruit and vegetables have a higher body water percentage (52 %) and an average muscle mass of 32 kg, while those who include animal proteins in their diet reach an average weight of 75 kg and a muscle mass of 35 kilograms, suggesting a positive effect on lean mass. On the other hand, frequent consumption of ultra-processed foods is associated with the highest body weight (82 kg) and the lowest body water percentage (48 %), indicating an adverse effect on body composition. These findings underscore the importance of a balanced diet rich in fresh foods and protein to maintain a healthy body composition in individuals with gluten intolerance.

DISCUSSION

The results obtained in this study highlight the close relationship between dietary habits and body composition in patients with gluten intolerance.

The differences observed between genders in terms of body fat and muscle mass are consistent with previous research, which generally reports higher body fat in women and higher muscle mass in men, reflecting physiological and metabolic patterns well documented in the scientific literature. The high accumulation of body fat in older adults identified in this study is consistent with previous studies, which relate it to factors such as decreased physical activity and metabolic changes associated with aging. These findings suggest the need to implement specific strategies, including regular physical exercise and personalized nutritional advice, particularly in older adults, to mitigate these effects.

On the other hand, the strong preference for ultra-processed foods observed in the study population raises concern due to the strong correlation established with increased body fat accumulation. Previous studies have also pointed out that a gluten-free diet often leads to a higher intake of processed products, which usually contain high levels of fat and added sugars, contributing negatively to body composition and increasing the risks

of metabolic diseases. The low consumption of fruit and vegetables recorded in this research suggests possible significant nutritional deficiencies.

Previous research indicates that individuals with gluten intolerance may struggle to maintain a balanced diet due to the elimination of certain foods, which may partially explain the observed low intake of these essential food groups. It is necessary to implement educational interventions that promote a better dietary balance to mitigate these risks and enhance the overall health of these patients.

CONCLUSIONS

Eating habits significantly affect body composition in patients with gluten intolerance. High consumption of ultra-processed foods is associated with increased body fat, particularly in children and adolescents, which may increase the risk of early metabolic diseases. Regular inclusion of fruits and vegetables in the diet promotes better hydration and optimal body water balance, particularly in young and older adults, thereby contributing to overall health and the prevention of nutritional imbalances.

Adequate consumption of animal protein is directly related to increased muscle mass, particularly in young and older adults, which may help prevent conditions associated with muscle loss, such as sarcopenia.

There are apparent differences in dietary habits and body composition among gender and age groups, highlighting the need for nutritional interventions specifically tailored to each population, considering aspects such as age, gender, and individual requirements. It is a priority to implement educational programs focused on promoting balanced diets, reducing the consumption of ultra-processed foods, and increasing the intake of fresh and nutritious foods. Additionally, it is recommended to complement these nutritional interventions with strategies that promote regular physical activity to enhance the overall health of patients with gluten intolerance.

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CONFLICT OF INTEREST

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