American Journal of Medicine and Medical Sciences 2025, 15(10): 3349-3353
DOI: 10.5923/j.ajmms.20251510.15

Optimization of Therapeutic Nutrition for Patients with Chronic Gastrointestinal Diseases in Hot Climate Regions: A Cross-Sectional Study in Surkhandarya, Uzbekistan

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Abstract **Objective:** This research focused on evaluating the nutritional habits and shortcomings in patients with chronic gastrointestinal illnesses (CGIDs) living under the high-temperature conditions of Surkhandarya, Uzbekistan. The aim was to design a dietary intervention that accommodates local traditions, seasonal availability, and cultural acceptability. **Methods:** From January 2022 through December 2023, a survey was carried out on 330 individuals suffering from ailments like chronic gastritis, duodenitis, peptic ulcers, and gallbladder disorders. A 24-hour dietary recall method was used repeatedly throughout all four seasons. Nutritional intake was compared to national dietary guidelines and the Recommended Dietary Allowances (RDA). Quality of life assessments utilized the SF-36 questionnaire. **Results:** Most patients showed inadequate consumption of calories, proteins, vitamin C, calcium, fiber, and fluids. Their average daily energy intake was 1750 kcal, and protein intake was 58 grams both notably under the RDA. Although seasonal food variety slightly improved diets, deficiencies persisted. Inadequate water intake and high sodium consumption were common. Patients with better nutritional scores reported higher SF-36 health outcomes. **Conclusion:** Individuals with CGIDs in warm climates are prone to nutritional deficits that negatively impact their well-being. There's a pressing need for cost-effective, season-sensitive diet plans tailored to the regional lifestyle. The study introduces a model approach to improving gastrointestinal health through localized nutritional strategies.

Keywords Chronic gastrointestinal diseases, Clinical nutrition, Hot climate challenges, Dietary insufficiencies, Seasonal adaptation, Uzbekistan health, SF-36 metrics, Public nutrition strategy

1. Introduction

Chronic gastrointestinal diseases (CGIDs) are widespread non-communicable conditions that deeply affect individuals' daily functioning and overall life satisfaction. In regions with high temperatures, like Surkhandarya in Uzbekistan, these illnesses are more problematic due to the combined impacts of environmental, nutritional, and social factors [12]. The development and course of diseases like chronic gastritis, duodenitis, and peptic ulcers are particularly influenced by dietary habits and climate conditions.

A wide range of epidemiological research indicates that poor nutrition is a leading contributor to the emergence and worsening of CGIDs [5,6,7]. Inadequate intake of vital nutrients—especially protein, vitamins C and A, calcium, and iron—is associated with weakened mucosal integrity, higher vulnerability to Helicobacter pylori infection, and slower tissue repair. Additionally, the availability of food and hydration practices fluctuate with the seasons in hot areas, which can trigger more frequent or severe disease episodes [2,3,4].

Although the significance of diet in maintaining gastrointestinal health is widely acknowledged, there remains a scarcity of data on the actual dietary habits of CGID patients in Uzbekistan, especially in areas facing extreme weather changes. This lack of tailored dietary advice has resulted in broad, unspecialized nutritional guidance. Considering the variety in regional food traditions, there's a strong need to establish therapeutic diets that are both adaptable and seasonally aligned.

This research aims to analyze the everyday dietary patterns of CGID patients living in hot climates and to formulate a refined dietary model that reflects their cultural food preferences, seasonal changes, and medical requirements. These insights are intended to enhance both clinical practices

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Received: Apr. 30, 2025; Accepted: May 20, 2025; Published: Oct. 13, 2025
Published online at http://journal.sapub.org/ajmms

and broader public health nutrition strategies across the region.

2. Materials and Methods

The research was carried out between January 2022 and December 2023 in the Surkhandarya region, targeting adult patients diagnosed with chronic gastrointestinal disorders (CGIDs), such as chronic gastritis, duodenitis, peptic ulcers, and gallbladder dysfunction. Participants were selected through purposive sampling from outpatient services and gastroenterology units within regional medical centers. Eligible participants were over 18 years of age, had a CGID diagnosis confirmed via endoscopy or ultrasound, and provided informed consent for participation in the dietary study.

A mixed-methods design was employed to collect data, combining structured interviews with detailed quantitative assessments of nutritional intake. Participants' actual food consumption was documented using a seasonally segmented 24-hour dietary recall method, applied repeatedly across all four seasons—winter, spring, summer, and autumn. Food intake for each month was recorded over ten days: three at the beginning, four in the middle, and three at the end. This schedule ensured a comprehensive reflection of regular eating patterns.

Nutrient composition was determined based on standardized national food composition tables. These were then compared with Recommended Dietary Allowances (RDA) approved by Uzbekistan's Ministry of Health (Order No. 0007-20, 2020) [11]. The analysis specifically focused on daily intake levels of calories, proteins, fats, carbohydrates, dietary fiber, water, vitamins A and C, iron, calcium, and sodium.

Dietary adequacy was evaluated by calculating the percentage of nutritional requirements fulfilled for each nutrient. Both deficiencies and surpluses were classified according to World Health Organization (WHO) nutritional standards. Additionally, information on eating frequency, portion sizes, food preparation techniques, and the use of enriched or traditional foods was gathered.

To assess participants' quality of life, the SF-36 health survey was administered, evaluating domains such as physical functioning, general health, vitality, emotional wellness, and social interactions. These scores were then compared with those from a control group of healthy individuals matched for age and gender, allowing for analysis of the relationship between nutrition quality and perceived health.

All statistical analyses were performed using Microsoft Excel 2019. Descriptive statistics were used to summarize the nutritional intake data, and t-tests were conducted to determine significant seasonal and demographic differences, with statistical significance set at $p<0.05$. Ethical approval was granted by the Institutional Bioethics Committee of the Tashkent Medical Academy, Termiz Branch. All participants signed informed consent prior to their involvement in the study.

3. Results

The study included 330 confirmed CGID patients, with 58% being women and 42% men, ranging in age from 21 to 74 years. Analysis of the seasonal food consumption data revealed a consistent shortfall in caloric intake, protein, dietary fiber, calcium, and vitamin C across various age and gender groups.

On average, participants consumed 1750 kcal per day, representing roughly 70–88% of the recommended dietary amount. Protein consumption averaged 58 grams daily, with 67% of individuals not meeting the standard requirements. Nutritional gaps were more significant among women and patients over 50. Additionally, carbohydrate and fat consumption leaned heavily toward refined foods, lacking both fiber and complex carbs. The analysis revealed the following: calorie deficiency or excess intake, protein deficiency, vitamin or mineral deficiency, excessive fat and sugar consumption. Patients often have deficiencies in energy, protein, and vitamins (table 1). To support recovery, it is recommended to design a proper diet, increase meal frequency, and raise fluid intake.

Table 1. Actual Nutritional Indicators of Elderly Individuals (1-day analysis)

№	Indicators	Actual Intake	Recommended Norm	% Coverage	Comments
1	Calorie (energy), kcal	1750	2000–2500	70–88%	Low, but acceptable
2	Protein, g	58	50–75	77–116%	Within norm
3	Fat, g	65	70–100	65–93%	Near norm
4	Carbohydrates, g	230	250–350	66–92%	Low, but acceptable
5	Fiber, g	18	25–30	60–72%	Not sufficient for intestines
6	Liquid (water), ml	1500	2000–2500	60–75%	More water recommended
7	Vitamin A, mcg	600	700–900	67–86%	Near norm
8	Vitamin C, mg	55	65–90	61–85%	Acceptable
9	Iron, mg	10	8–18	56–125%	Within norm
10	Calcium, mg	750	1000–1200	62–75%	Slightly low, important for bones
11	Sodium (salt), g	4.8	≤5	96%	Acceptable

Table 2. Winter-Spring Season Average Daily Intake vs. Recommendations

№	Food Type	Average Daily Intake	Recommended Intake	Comments
1	Bread and cereals	250 g	300–350 g	Low, energy source
2	Meat (beef, chicken)	60 g	70–100 g	Protein source, insufficient
3	Milk and dairy	300 ml	400–500 ml	Important for calcium, too low
4	Vegetables	200 g	300–400 g	Lacking protective nutrients
5	Fruits	120 g	200–300 g	Vitamin C deficiency
6	Eggs	0.5 pcs	1 pc	Protein and vitamin D source
7	Liquid (water)	1300 ml	2000–2500 ml	Less intake in cold weather

Table 3. Summer-Autumn Season Average Daily Intake vs. Recommendations

№	Food Type	Average Daily Intake	Recommended Intake	Comments
1	Vegetables	350 g	300–400 g	Normal, detoxifying
2	Fruits	280 g	200–300 g	Vitamin C and antioxidants
3	Liquid (water)	2000 ml	2000–2500 ml	Sufficient in heat
4	Bread and cereals	220 g	300–350 g	Slightly low, may not fully meet energy needs
5	Meat (beef, chicken)	50 g	70–100 g	Protein source, insufficient
6	Milk and dairy	250 ml	400–500 ml	Risk of calcium deficiency

Table 4. Caloric and Nutrient Intake vs. Recommended Norms

№	Indicator	Average Intake	Recommended Norm	% Coverage	Comments
1	Calorie (energy), kcal	1750	2000–2500	70–88%	Acceptable for low activity, but low for working individuals
2	Protein, g	58	55–75	77–105%	Within norm
3	Fat, g	65	70–90	72–93%	Close to norm
4	Carbohydrates, g	230	250–350	66–92%	Slightly low, key for energy
5	Fiber, g	18	25–30	60–72%	Needed for intestinal function

During the winter-spring season, dietary habits of the elderly often change due to the availability of seasonal foods. Cold weather, shorter daylight hours, and reduced physical activity alter the body's need for energy, vitamins, and minerals. The following table presents the actual average daily intake of basic food products among the elderly (aged 51+) during winter and spring (table 2).

In winter-spring, many elderly consume insufficient amounts of vegetables, fruits, protein, and water. This leads to deficiencies in vitamin C, calcium, and iron. Diet enrichment and increased use of seasonal vegetables/fruits and fluids are recommended.

In summer and autumn, dietary habits of older adults change seasonally. Due to the heat, the body requires more fluids and light meals in summer, while in autumn, increased availability of produce boosts consumption of vegetables and fruits. The following table shows food consumption patterns for people aged 51+ during these seasons (table 3).

In summer-autumn, elderly individuals consume more vegetables and fruits, which is beneficial for detox and vitamin intake. However, protein, calcium, and dairy product consumption is insufficient. To meet energy demands, lean meats, dairy, and eggs should be added to the diet, and sugary products should be limited.

For adults (aged 18+), assessing how well their daily diet meets the body's energy requirements is crucial. Caloric sufficiency refers to the total calorie intake through food in relation to the body's energy needs, which vary by gender, age, physical activity, and health status.

Overall calorie intake among adults is lower than recommended for healthy individuals. Prolonged deficiency may lead to fatigue, weakened immunity, and protein-calorie malnutrition. Adjusting the diet to include more balanced sources of carbs, fats, and fiber and increasing caloric intake is recommended. For adults (18+), a balanced ratio of protein, fats, and carbohydrates is essential for proper body functioning, energy supply, and a healthy lifestyle. The table 5 compares the actual nutrient ratios with recommended standards.

The nutrient ratios in adult diets align with recommendations. However, maintaining balance is crucial:

- Prioritize quality fats (vegetable oils),
- Choose digestible protein sources (animal & plant-based),
- Opt for complex carbohydrates (whole grains).

The following table (6) compares average daily intake of essential nutrients in adults with physiological norms. This helps assess risks of nutrient deficiencies or excesses.

Table 5. Nutrient Distribution and Caloric Contribution

№	Nutrient	Amount (g)	% of Calories	Recommended %	Comments
1	Protein	58 g	13.3%	10–15%	Within norm
2	Fat	65 g	33.4%	25–35%	Near norm
3	Carbohydrate	230 g	52.6%	50–60%	Within norm
№	**Nutrient**	**Amount (g)**	**% of Calories**	**Recommended %**	**Comments**

Note: Caloric values are calculated as: 1 g protein = 4 kcal, 1 g carbohydrate = 4 kcal, 1 g fat = 9 kcal

Table 6. Daily Nutrient Intake vs. Physiological Requirements

№	Nutrient	Actual Intake	Recommended Norm	% Coverage	Comments
1	Calorie (energy), kcal	1750	2000–2500	70–88%	Low for physically active people
2	Protein, g	58	55–75	77–105%	Normal, elderly need high-quality proteins
3	Fat, g	65	70–90	72–93%	Slightly low, affects energy supply
4	Carbohydrates, g	230	250–350	66–92%	Important energy source
5	Fiber, g	18	25–30	60–72%	Important for digestion, insufficient
6	Calcium, mg	750	1000–1200	62–75%	Important for bones, deficiency observed
7	Iron, mg	10	8–18	56–125%	Normal, higher needs in women
8	Vitamin A, mcg	600	700–900	67–86%	Important for immune system
9	Vitamin C, mg	55	65–90	61–85%	Key for antioxidant defense
10	Vitamin D, mcg	5	10–15	33–50%	Low, requires sunlight or supplements
11	Magnesium, mg	270	300–400	67–90%	Influences blood pressure & muscle function
12	Liquid (water), ml	1500	2000–2500	60–75%	Insufficient in hot weather

Most nutrients in adult diets are close to recommended levels. However, deficiencies in calcium, vitamin D, fiber, and water are notable, potentially weakening bones, lowering immunity, and causing digestive issues. A balanced diet, nutrient-rich foods, and dietary supplements (if needed) are recommended.

Further analysis of micronutrient intake showed that 74% of patients failed to meet calcium recommendations, and 69% consumed under 50 mg of vitamin C daily. Iron intake was relatively sufficient, especially among males, while 52% of participants surpassed WHO's sodium intake recommendations, largely due to traditional high-salt cooking methods [1]. In terms of hydration, 63% of the group did not consume enough fluids, with winter showing the lowest water intake. Only 34% drank more than 1.5 liters of water per day.

The SF-36 quality of life evaluations demonstrated that patients with better nutritional balance reported significantly higher levels of physical activity (average score: 68.2 vs. 53.1, $p=0.03$) and perceived general health (62.5 vs. 49.8, $p=0.04$) than those with poorer diets. Mental and social well-being were also positively linked to regular eating habits and adequate fluid intake.

Comparisons by season revealed some improvements in diet variety during summer and autumn, thanks to greater availability of fruits and vegetables. However, nutritional deficiencies in energy and protein persisted even during these periods. In conclusion, the results underscore a widespread issue of unbalanced nutrient consumption among CGID patients in Surkhandarya, made worse by climate-related shifts in food availability. These insights support the development of customized nutritional solutions.

4. Discussion

The outcomes of this research clearly illustrate the connection between inadequate dietary intake and poorer health conditions in individuals living with chronic gastrointestinal diseases (CGIDs) in high-temperature environments. The widespread lack of energy, protein, calcium, vitamin C, and water intake among the majority of patients points to serious nutritional deficiencies that could intensify the progression of gastrointestinal disorders and slow down recovery [7,8,9,13,14].

The hot weather in Surkhandarya adds to the problem through increased fluid loss, heightened metabolic needs, and decreased appetite—all of which contribute to malnutrition among CGID patients. Compounding this issue, the seasonal availability of fresh foods, particularly in winter and early spring, restricts nutritional intake further. These challenges emphasize the necessity for continuous access to affordable and nutrient-rich foods throughout the year.

Regular observations of low fiber consumption alongside high sodium intake suggest a diet overly dependent on processed grains and salty foods. Such habits can disrupt gut motility, damage the balance of intestinal microbiota, and elevate the risks of hypertension and metabolic complications. Therefore, nutrition education promoting varied diets and reduced salt usage is critically important for this population.

Additionally, the positive link between adequate nutrition and improved SF-36 quality of life scores underlines the

comprehensive impact that proper diet has on both physical and psychological well-being. Patients who received enough essential nutrients experienced significantly greater physical ability and overall life satisfaction. This supports the integration of personalized dietary guidance into standard CGID treatment, especially in outpatient and primary care settings.

Comparable studies from other warm climate regions, including rural India and sub-Saharan Africa, have similarly pointed out the importance of diet modification in managing gastrointestinal illnesses. These current findings are consistent with global data and strengthen the argument for localized dietary plans that consider environmental, social, and economic realities.

5. Conclusions

The research highlighted significant nutritional shortfalls in caloric and essential nutrient intake among individuals suffering from chronic gastrointestinal diseases in the hot-climate region of Surkhandarya, Uzbekistan. Most participants consumed less than the advised amounts of energy, protein, vitamin C, calcium, fiber, and water. These dietary insufficiencies were found to be linked with a decline in quality of life and possibly contributed to worsening disease conditions.

To address these issues, the following measures are proposed:

Design and distribution of seasonal therapeutic meal plans that incorporate culturally accepted and locally accessible foods.

Launch of public health initiatives aimed at promoting proper hydration and reducing high salt consumption.

Incorporation of personalized nutritional assessments and dietary counseling into standard treatment protocols for CGID patients.

Support for year-round availability of fresh produce through community gardening projects or food support services.

Improving nutritional intake in hot climate regions is more than just treating disease—it forms the basis of proactive health management and long-term wellness. This study lays the groundwork for policy reforms, clinical advancements, and future research focused on refining therapeutic nutrition in environmentally demanding areas.

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