DOI: https://doi.org/10.21323/2618-9771-2025-8-1-16-21

Received 24.09.2024
Accepted in revised 16.02.2025
Accepted for publication 19.02.2025

Available online at https://www.fsjour.com/jour
Original scientific article
Open access

KNOWLEDGE, PERCEPTION, AND CHALLENGES OF ADOPTING A GLUTEN-FREE DIET IN THE REPUBLIC OF MOLDOVA: A CROSS-SECTIONAL STUDY

Dinu Turcanu, Rodica Siminiuc*

Technical University of Moldova, Chisinau, Republic of Moldova

KEY WORDS:
gluten-related disorders, dietary adherence, nutritional awareness, food accessibility, public health strategies

ABSTRACT

Gluten-related disorders (GRD), including celiac disease, are managed through a strict gluten-free diet (GFD), the only established treatment. However, widespread awareness and understanding of GFD remains limited, particularly in countries like the Republic of Moldova, where celiac disease prevalence is under-researched. The primary objective of this study is to assess the knowledge, perceptions, and challenges associated with the adoption of a gluten-free diet (GFD) among the Moldovan population. A stratified sampling method was employed to collect 778 responses via an online questionnaire distributed across social media and educational platforms. The questionnaire assessed respondents' knowledge of gluten and GFD, perceptions of wheat and gluten, and purchasing behavior regarding GF products. Data were analyzed using descriptive statistics and ANOVA to explore differences across education levels and professional domains. Of the respondents, 77.3% could correctly define gluten, yet only 16.1% achieved a knowledge score above 50% regarding gluten-containing products and hidden gluten sources. Education level significantly influenced GFD knowledge ($p < 0.05$), with respondents holding postgraduate degrees demonstrating higher knowledge scores. Perceptions of gluten and wheat were predominantly neutral among GFD followers and non-followers. However, 21.1% of GFD followers perceived maintaining the diet as highly difficult, primarily due to limited availability and high costs of GF products.The study revealed a significant gap in knowledge of gluten and GFD in the Moldovan population, despite general awareness. Education level and profession were critical determinants of understanding. There is a clear need for targeted educational programs and improved access to GF products to enhance GFD adherence and management of GRD in Moldova. Public health interventions must prioritize raising awareness and addressing the economic barriers associated with GFD.

FUNDING: This work was supported by National Agency for Research and Development (NARD), [grant numbers 23.70105.5107.05], "Exploratory analysis of food security in the Republic of Moldova based on metrics of sustainable and nutritional quality (SNuQ) of food products" which runs at the Technical University of Moldova www.utm.md.

Поступила 24.09.2024
Поступила после рецензирования 16.02.2025
Принята в печать 19.02.2025

https://www.fsjour.com/jour
Научная статья
Open access

ИНФОРМИРОВАННОСТЬ, ВОСПРИЯТИЕ И ТРУДНОСТИ ПРИ ПЕРЕХОДЕ НА БЕЗГЛЮТЕНОВУЮ ДИЕТУ В РЕСПУБЛИКЕ МОЛДОВА: ПЕРЕКРЕСТНО-СТАТИСТИЧЕСКОЕ ИССЛЕДОВАНИЕ

Цуркану Д. Н., Симинюк Р. И.*

Технический университет Республики Молдавия, Кишинев, Республика Молдова

КЛЮЧЕВЫЕ СЛОВА:
безглютеновая диета (БГД), информированность и восприятие, проблемы питания, осведомленность о питании, перекрестно-статистическое исследование

АННОТАЦИЯ

Заболевания, вызываемые глютеном (ЗВГ), включая целиакию, лечатся с помощью строгой безглютеновой диеты (БГД), единственного установленного метода лечения. Однако общая осведомленность и понимание сути БГД до сих пор не получили широкого распространения, особенно в таких странах, как Республика Молдова, где большинство случаев заболеваний целиакией изучено в недостаточной степени. Основная цель этого исследования — оценить информированность, восприятие и трудности, связанные с переходом на безглютеновую диету (БГД) среди населения Молдовы. Был применен метод стратифицированной выборки, в результате которого через онлайн-анкету, опубликованную в социальных сетях и на образовательных онлайн платформах, были получены 778 ответов. Анкета оценивала информированность респондентов о глютене и БГД, оценивала их восприятие пшеницы и глютена, изучала покупательское поведение в отношении безглютеновых (БГ) продуктов. Данные анализировались с использованием описательной статистики и дисперсионного анализа вариантов ANOVA для выделения различий в ответах в зависимости от уровня образования и областей профессиональной занятости. Из общего числа респондентов 77,3% смогли правильно определить глютен, но только 16,1% достигли уровня осведомленности выше 50% в отношении продуктов, содержащих глютен и скрытых источников глютена. Уровень образования значительно повлиял на знания о БГД ($p < 0,05$), при этом респонденты, имеющие ученые степени, продемонстрировали более высокие баллы знаний. Восприятие глютена и пшеницы было преимущественно нейтральным как среди лиц, соблюдающих БГД, так и лиц, не придерживающихся таковой. Однако 21,1% приверженцев БГД считали поддержание диеты крайне сложным, в первую очередь из-за ограниченной доступности и высокой стоимости БГ продуктов. Исследование выявило значительный пробел в знаниях о глютене и БГД среди населения Молдовы, несмотря на общую осведомленность о нем. Уровень образования и профессия были критическими детерминантами понимания сути. Имеется очевидная потребность в целевых образовательных программах и улучшенном доступе к БГ продуктам для повышения уровня распространенности соблюдения БГД и планированию и возможности придерживаться БГД в Молдове. Меры вмешательства в области общественного здравоохранения должны быть направлены на повышение уровня информированности и на устранение экономических барьеров, связанных с БГД.

FOR CITATION: **Turcanu, D., Siminiuc, R.** (2025). Knowledge, perception, and challenges of adopting a gluten-free diet in the Republic of Moldova: A cross-sectional study. *Food Systems,* 8(1), 16–21. https://doi.org/10.21323/2618-9771-2025-8-1-16-21

ДЛЯ ЦИТИРОВАНИЯ: **Цуркану, Д. Н., Симинюк, Р. И.** (2025). Информированность, восприятие и трудности при переходе на безглютеновую диету в Республике Молдова: перекрестно-статистическое исследование. *Пищевые системы*, 8(1), 16–21. https://doi.org/10.21323/2618-9771-2025-8-1-16-21

ФИНАНСИРОВАНИЕ: Данная работа подготовлена при поддержке Национальным агентством по исследованиям и разработкам (NARD) [гранты № 23.70105.5107.05] в рамках проекта «Исследовательский анализ продовольственной безопасности в Республике Молдова на основе показателей стабильного качества и питательности пищевых продуктов (SNuQ)», проводимого в Техническом университете Молдовы www.utm.md.

1. Introduction

Food insecurity is a growing concern, contributing to negative health outcomes and an increased risk of chronic diseases [1]. This is particularly true for individuals with gluten-related disorders (GRD), where food insecurity amplifies nutritional deficiencies, further complicating their required gluten-free diet (GFD) [2,3].

Globally, various strategies and interventions have been implemented to ensure food security and proper nutrition for individuals with GRD [4–7]. These include nutritional education policies and front-of-package labeling using color codes to indicate the nutritional properties of food, helping consumers, especially those with gluten intolerance, make informed choices. Medical and celiac associations advocate for the protection and expansion of federal programs to ensure that individuals with GRD are shielded during food crises [6,8,9].

In the Republic of Moldova, research on the prevalence of celiac disease is limited, and the information regarding its incidence, as well as other GRDs, is decentralized and often contradictory, being stored in various medical institutions [10–12]. Between 2010 and 2016, the incidence of celiac disease in children showed a continuous increase, ranging from 3 to 19 cases annually [10,13–15]. Currently, the national registry for celiac patients includes 67 individuals (adults and children) with a confirmed diagnosis and a disability status, but it is estimated that the actual number is significantly higher [10]. The GFD remains the sole therapeutic strategy for diseases related to gluten consumption [16,17]. However, adherence to a GFD can be challenging, as gluten is a common ingredient in most foods [18,19]. The risk of accidental exposure to gluten is substantial, as gluten or traces of it are present in approximately 80% of food products.

In the Republic of Moldova, there is no local production or certification for GF products, and public or private catering services for individuals with GRD are nonexistent [20]. The involvement of nutritionists and dietitians in creating balanced menus is limited or absent in public food services. Imported GF products are available only in limited quantities and at high prices, while the availability of social and nutritional support services is still in its early stages. National-level studies focusing on interventions to improve these aspects and, consequently, enhance the autonomy of individuals following a GFD are needed [16]. A crucial aspect of managing nutritional therapy for individuals with GRD is increasing public awareness [21].

This research stems from the need to improve public health, ensure food security, and optimize the management of gluten-related disorders. The aim of this study is to assess the knowledge and awareness of consumers in the Republic of Moldova regarding the GFD and to identify influencing factors, thus enabling the implementation of assertive interventions.

2. Objects and methods

2.1. Questionnaire

The questionnaire was designed to assess the level of knowledge, perceptions, and behaviors related to the GFD among the population of the Republic of Moldova. The instrument was developed based on the validated model from the Syracuse University Institutional Review Board (IRB) and adapted to the local context. The questionnaire was distributed online through social media and the official platforms of educational institutions. Data collection took place between April and June 2022.

The questionnaire included 15 questions structured into four categories: demographic characteristics, knowledge about gluten and GFD, perceptions, and behaviors related GF food consumption. Demographic characteristics included five questions concerning gender, age, place of residence, education level, and professional domain. The level of knowledge was assessed through four questions about what gluten is, products and ingredients containing gluten, and sources of information about the GFD. The questions were formulated with dichotomous (correct/incorrect) and multiple-choice answers. Perception was assessed through three questions using a five-point Likert scale to measure the level of agreement or disagreement with statements related to wheat, gluten, and the difficulty of adhering to a GFD. The questionnaire also included three questions, with multiple-choice options: two questions regarding adherence to GFD and the main reasons for following it, the behavior of purchasing GF products, and one question to identify sources of information about the GFD.

2.2. Sampling and data collection

Stratified sampling was used to ensure the representativeness of various demographic groups, including geographic areas (urban/rural), education levels, and age categories. The sample size was estimated at 384 respondents, applying the formula of Krejcie and Morgan, 1970 [22]:

$$N\min = \frac{Np\left(a^2 f\left(1-f\right)\right)}{Np \times e^2 a^2 \times f\left(1-f\right)},$$

$$n = \frac{X^2 NP\left(1-P\right)}{d^2\left(N-1\right) + X^2 P\left(1-P\right)}, \quad (1)$$

$$n = \frac{3.84 \times 2\,604\,000 \times 0.5\left(1-0.5\right)}{0.52\left(2\,604\,000-1\right) + 3.84 \times 0.5\left(1-0.5\right)} =$$

$$= 383.94 = 384.$$

n — the number of individuals required for the survey; N — the population number in the Republic of Moldova as of 01.01.2022 (N = 2.604.000); P — the population proportion used to obtain the maximum sample size (assumed to be 0.5); X^2 — the value of chi-square for 1 degree of freedom at the desired confidence level (for α=0.05 for a 95% confidence level, it is 1.96^2=3.84); d — the degree of precision expressed as a proportion (0.05).

A total of 778 questionnaires were validated.

2.3. Data Processing

All response options (except for demographic characteristics) were coded into numerical values to facilitate the calculation of aggregate scores for the level of knowledge. The maximum score for respondents' knowledge was set at 22 points. The questions for this criterion were scored as follows: correct answer=1, incorrect answer=–1. The collected data were processed using descriptive analysis and the ANOVA test (Single Factor).

2.4. Limitations

Voluntary participation and the online distribution of the questionnaire may introduce selection bias, excluding certain demographic groups, such as individuals without internet access. There is also the risk of self-reporting bias, where respondents might overestimate or underestimate their knowledge level or dietary behaviors. Due to the sampling methods and the aforementioned limitations, the results may not be fully generalizable to the entire population of the Republic of Moldova. The questionnaire captured a single moment in time, without assessing long-term changes in knowledge or behaviors.

3. Results

3.1. Demographic characteristics of respondents

Of the total 778 respondents, 40% (n=308) follow a GFD for various reasons. The majority of respondents (70.3%) were women, while men accounted for 29.7%. The age distribution showed that 49.6% of participants (n=386) were between 18–34 years old, and respondents aged 35–44 represented 19.3%. Regarding the place of residence, 91% of participants were from urban areas (Table 1).

The respondents' education level showed that 37.4% (n=291) had a university degree, 20.7% (n=161) had a master's degree, 18.2% (n=141) had completed high school, followed by respondents with a PhD (9%, n=70) and secondary school graduates (8.6%, n=67). According to the field of activity, about 16.7% (n=130) of participants were employed in education, 13% (n=101) in information technology, 10.1% (n=79) in medicine, and only 4.9% (n=38) in the food industry. Of the total respondents, 27.3% (n=213) were not employed in any specific field of activity, and 12.8% (n=100) worked in fields that were not listed in the questionnaire.

3.2. Level of knowledge about gluten and the gluten-free diet

On average, the respondents' knowledge scores were modest. Approximately 77.3% of respondents (n=602) were able to correctly define what gluten is, but only 16.1% (n=128) scored above 50% on questions about gluten-containing products and sources of gluten in foods. Education level influenced knowledge about gluten. Those with a master's degree had

Table 1. **Demographic characteristics of the respondents**
Таблица 1. **Демографические характеристики респондентов**

No. o.	Criteria	Respondents					
		Total		Non GFD		GFD	
		n	%	n	%	n	%
	Total respondents	778	100	470	60	308	40
	Gender						
1.	Male	230	29.7	155	20	75	10
2.	Female	548	70.3	315	40	233	30
	Age categories						
	Up to 17 years	150	19.3	108	14	42	5
1.	18–34 years old	386	49.6	219	28	166	21
2.	35–44 years old	141	19.4	87	11	64	8
3.	45–54 years old	64	8.2	41	5	23	3
4.	Over 55 years	28	3.6	15	2	13	2
	Residence						
1.	Urban	709	91.0	427	55	281	36
2.	Rural	70	9.0	43	6	27	3
	Training level						
1.	Middle school	67	8.6	41	5	26	3
2.	High school	142	18.2	88	11	54	7
3.	College	22	2.8	15	2	7	1
4.	University	291	37.4	176	23	114	15
5.	Masters	161	20.7	88	11	73	9
6.	PhD	70	9	49	6	21	3
7.	Other	26	3.3	13	2	13	2
	The field of activity						
1.	Education	130	16.7	79	10	51	7
2.	Researcher	12	1.5	11	1	1	0
3.	Housewife	10	1.3	4	1	6	1
4.	Construction	20	2.6	11	1	9	1
5.	Acquisitions	6	0.8	3	0	3	0
6.	Administrative	46	5.9	19	2	27	3
7.	Logistic	10	1.3	4	1	6	1
8.	Car transport	6	0.8	4	1	2	0
9.	Agriculture	8	1	4	1	4	1
10.	Information technologies	101	13	58	7	43	6
11.	Food industry	38	4.9	27	3	11	1
12.	Medicine	79	10.1	45	6	33	4
13.	I am not employed	213	27.3	146	19	67	9
14.	Other	100	12.8	55	7	45	6

the highest average scores (8.23 ± 3.69), followed by university graduates (8.03 ± 4.48) and PhD holders (7.67 ± 4.81). Respondents working in medicine achieved an average score of 9.59 ± 4.02, followed by those in the food industry (7.31 ± 3.67) and education (7.14 ± 3.97) (Table 2).

The *F*-values are relatively high, indicating that there are significant differences between the mean scores across the three education levels and fields of activity, compared to the variation within the groups. The *p*-values (much lower than the standard significance threshold of 0.05) suggest that there are significant differences between the mean scores obtained based on education level and field of activity. Both education level and field of activity significantly influence the scores obtained in the questionnaire.

An attempt was made to determine whether there is a difference in the level of knowledge between respondents who follow a GFD and those who do not. The results showed that the scores of the respondents were nearly identical: the score for those following a GFD was 7.3 ± 4.02, while the score for those not following a GFD was 7.401 ± 4.58. Only 7.9% (n = 61) of respondents following a GFD and 8.7% (n = 67) of those not following a GFD showed a knowledge level above 50% (score greater than 11). Most respondents (n = 59 for GFD and n = 107 for non gluten free diet (NGFD) had scores between 5.1 and 7.0 (Table 3).

Table 3. **Level of knowledge of respondents who follow a GFD and those who do not follow a GFD**
Таблица 3. **Уровень знаний респондентов, придерживающихся БГД, и респондентов, не соблюдающих БГД**

Knowledge Intervals		Number of respondents by score range			
Total		**GFD**		**NGFD**	
Mean ± St. Dev		**7,3 ± 4,02**		**7,401±4,58**	
Kurtosis		**0,112**		**–0,419**	
Skewness		**–0,173**		**0,224**	
		F **= 1,36289796; *p*-value = 0,25826854**			
%	**n**	**%**	**n**	**%**	**n**
–27.3 …0	–6…0	2.1	16	2.4	19
0.5 …13.6	0.1…3.0	6.3	49	8.6	67
14.1…22.7	3.1…5.0	5.8	45	6.7	52
23.2…31.8	5.1…7.0	7.6	59	13.8	107
32.3…40.9	7.1…9.0	5.7	44	10.7	83
41.4…50.0	9.1…11.0	4.4	34	9.6	75
50.5…59.1	11.1…13.0	3.1	24	5.7	44
59.5…68.2	13.1…15.0	3.0	23	1.9	15
68.6…77.3	15.1…17.0	1.0	8	0.8	6
77.7…86.4	17.1…19.0	0.8	6	0.3	2
86.8…100	19.1…22	0.0	0	0.0	0
Total		**39.6**	**308**	**60.4**	**470**

Table 2. **The level of knowledge of respondents by level of training and field of activity**
Таблица 2. **Уровень знаний респондентов в зависимости от уровня образовательной подготовки и сферы деятельности**

	Knowledge intervals		Number of respondents by score range													
					Education level						Field of activity (employment)					
			Total		University degree		Master's degree		PhD degree		Food industry		Medicine		Education	
					F **= 14.65289; *p*-value = 0.000049**						***F*** **= 11.8849; *p*-value = 0.00039678**					
	Mean ± St. Dev.		**7.34 ± 4.24**		**8.03 ± 4.48**		**8.23 ± 3.69**		**7.67 ± 4.81**		**7.31 ± 3.67**		**9.59 ± 4.02**		**7.14 ± 3.97**	
	Kurtosis		**–0.11**		**–0.40**		**0.34**		**–0.39**		**–0.04**		**–0.78**		**0.76**	
	Skewness		**0.03**		**0.08**		**–0.14**		**–0.24**		**0.10**		**–0.14**		**–0.16**	
	%	**N (22 max)**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
1.	-27.3 …0	-6…0	**35**	**4.5**	8	1	1	0	8	1	1	0	1	0	7	1
2.	0.5 …13.6	0.1…3.0	**116**	**14.9**	8	1	18	2	6	1	4	1	4	1	13	2
3.	14.1…22.7	3.1…5.0	**97**	**12.5**	32	4	15	2	7	1	6	1	9	1	21	3
4.	23.2…31.8	5.1…7.0	**166**	**21.3**	58	7	32	4	14	2	9	1	14	2	32	4
5.	32.3…40.9	7.1…9.0	**127**	**16.3**	38	5	37	5	9	1	8	1	6	1	23	3
6.	41.4…50.0	9.1…11.0	**109**	**14.0**	44	6	26	3	11	1	6	1	15	2	17	2
7.	50.5…59.1	11.1…13.0	**68**	**8.7**	34	4	18	2	6	1	2	0	15	2	10	1
8.	59.5…68.2	13.1…15.0	**38**	**4.9**	19	3	10	1	6	1	1	0	11	1	4	1
9.	68.6…77.3	15.1…17.0	**14**	**1.8**	1	0	1	0	1	0	0	0	0	0	0	0
10.	77.7…86.4	17.1…19.0	**8**	**1.0**	7	1	1	0	0	0	0	0	0	0	1	0
11.	86,8…100	19,1…22	**0**	**0**												

3.3. Perception and difficulty in adopting a GFD

15.3% (n=119) of respondents following a GFD and 23.1% (n=180) of those not following a GFD had a neutral perception of both wheat and gluten. Only 8.2% (n=64) of GFD followers disagreed (including strongly disagreed) with the statement "Wheat is good for me," and 17.1% (n=133) disagreed with the statement "Gluten is good for me" (Table 4).

Table 4. **Perception of gluten and wheat by respondents following a GFD and those not following a GFD**

Таблица 4. **Восприятие глютена и пшеницы респондентами, соблюдающими БГД, и респондентами, не соблюдающими БГД**

		GFD		NGFD	
Wheat perception	Mean ± St. Dev	0.33 ± 1.21		0.77 ± 1.13	
	Kurtosis	−0.700		−0.406	
	Skewness	−0.206		−0.499	
		n	**%**	**n**	**%**
	Strongly disagree	29	3.7	23	3.0
	Disagree	35	4.5	16	2.1
	Neutral	119	15.3	180	23.1
	Agree	55	7.1	79	10.2
	Strongly agree	70	9.0	172	22.1
Gluten perception	Mean ± St. Dev	**− 0.25** ± 1.21		0.45 ± **1.08**	
	Kurtosis	−0.877		**−0.435**	
	Skewness	0.164		**−0.221**	
	Strongly disagree	57	7.3	23	3.0
	Disagree	76	9.8	49	6.3
	Neutral	90	11.6	187	24.0
	Agree	58	7.5	114	14.7
	Strongly agree	27	3.5	97	12.5
	Correlation coefficient	*0.52*		*0.53*	

Only 21.1% of those following a GFD considered its adoption to be very difficult, while 28.9% remained neutral regarding the difficulty (Figure 1).

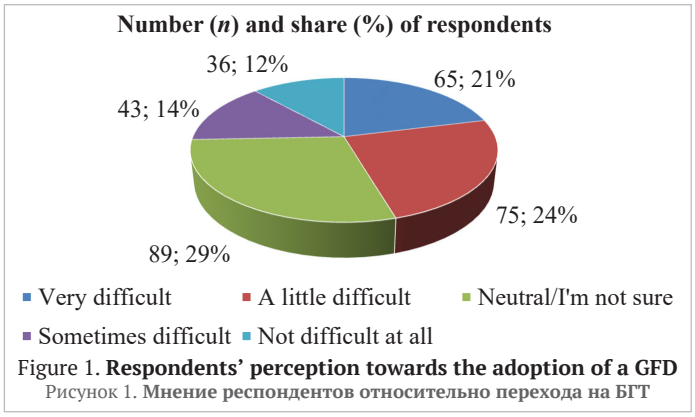

Figure 1. **Respondents' perception towards the adoption of a GFD**

Рисунок 1. **Мнение респондентов относительно перехода на БГТ**

3.4. Sources of information

The primary sources of information about the GFD were the internet and social media (61.7%), followed by consultations with doctors (16.1%) and nutritionists (14.8%). These results highlight the importance of reliable and rigorous sources of information, given the prevalence of unverified information online (Table 5).

Table 5. **Respondents' sources of information on gluten and GFD**

Таблица 5. **Источники информации респондентов о глютене и БГД**

Source of information	Follow a GFD		Not following a GFD		Total	
	n	%	n	%	n	%
From the doctor	62	7.97	63	8.1	125	16.1
From the dietician/nutritionist	62	7.97	53	6.8	115	14.8
Research (academic journals. thesis/research project)	36	4.63	48	6.2	84	10.8
Family and friends	32	4.11	37	4.8	69	8.9
Internet/TV/News/social media	205	26.35	275	35.3	480	61.7

3.5. Purchasing behavior of GF products

Among those following a GFD, 73.4% (n=226) purchase their products from supermarkets and local stores, while 45.1% (n=142) prefer to prepare GF foods at home due to the high costs and limited variety of available products. Additionally, 39.9% (n=123) buy products from specialized stores, while 7.1% (n=22) receive food from abroad (Figure 2).

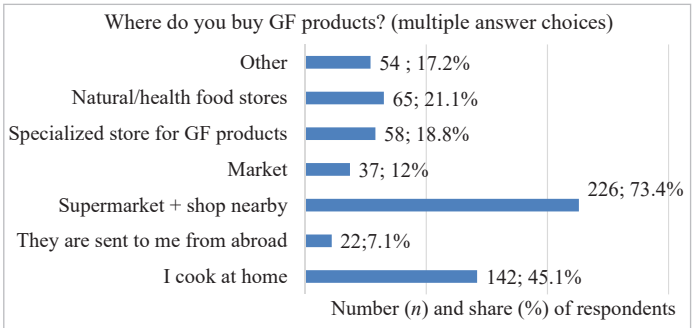

Figure 2. **The purchase behavior of GF products of the respondents who follow a GFD**

Рисунок 2. **Покупательское поведение при принятии решения о покупке БГ продуктов среди респондентов, придерживающихся БГД**

4. Discussions

The survey results regarding the demographic characteristics of the respondents provide a clear picture of the socio-demographic groups involved in the study. A significant proportion of respondents were women (70.3%), which may reflect a general trend where women are more likely to participate in studies related to diet and health. These results are consistent with other studies (both cross-sectional and longitudinal panel studies) where systematic gender differences in survey participation are commonly observed [23,24]. Gender differences in participation in diet-related studies can influence both the interpretation and applicability of the results, suggesting that it is important to analyze gender-specific eating behaviors in more detail [25,26]. The age distribution shows that nearly half of the respondents (49.6%) were between 18 and 34 years old. This trend suggests that young adults are more receptive to online surveys and topics related to diet and health, possibly due to a greater interest in preventing chronic conditions and adopting restrictive diets such as the GFD [27,28]. Respondents over the age of 45 were less represented in the survey, which may indicate either a lack of interest in the GFD among this age group or barriers to accessing online platforms [29,30]. Another important aspect is the distribution of respondents based on their place of residence. The overwhelming majority of participants came from urban areas (91%), highlighting a possible unequal dissemination of information about celiac disease and the GFD between urban and rural environments. Access to nutrition information and resources is often limited in rural areas, which could affect awareness and the adoption of specific diets [29,30].

Although the GFD is recognized as a treatment for celiac disease, widespread awareness of the specific requirements of this diet remains insufficient among the general public and in certain professional sectors. The survey results indicate a significant variation in knowledge levels about gluten and the GFD among participants. While 77.3% of respondents were able to provide a correct definition of gluten, only 16.1% scored above 50% on the knowledge test. This highlights important gaps in understanding which foods contain gluten and identifying appropriate products for a GFD. This discrepancy suggests that, although there is a general awareness of the term "gluten", essential details about hidden sources of gluten and GF products remain unclear to a significant portion of the population. These findings are consistent with previous research, which has shown that consumers worldwide have varying levels of knowledge about gluten and GF products [28]. Studies have demonstrated that, particularly in countries where celiac disease is not frequently diagnosed or publicly discussed, education about the GFD is limited. As a result, even individuals following the diet may apply it incorrectly [25].

Another significant finding is the clear relationship between education level and knowledge about gluten. A large proportion of respondents have higher education (37.4% with a university degree and 20.7% with a master's degree), suggesting that education level directly influences awareness and understanding of the GFD. These findings are supported by existing research, which shows that individuals with higher educational attainment are more likely to adopt specific diets, such as the GFD, either for health reasons or due to increased awareness of food-related issues [3]. The results obtained from the ANOVA test showed significant differences between the mean scores for the three education levels (University, Master's, PhD), confirming the hypothesis that education level

plays a crucial role in the ability to correctly identify gluten-containing foods [3,30]. Individuals working in fields such as the food industry, medicine, and education showed varying performance, although the overall knowledge level remained relatively low. The differences may reflect varying levels of knowledge or professional experience, as well as different access to educational resources and specialized training in each field. These results highlight the need for greater involvement of professionals in educating the public about the GFD, both for patients diagnosed with celiac disease and for those following this diet for other reasons [4]. The survey results regarding respondents' perception of gluten, wheat, and the difficulty of adopting a GFD provide important insights into general attitudes toward these topics. Most respondents had a neutral perception of both wheat and gluten, among those following a GFD and those who are not.

The perception of wheat and gluten was analyzed using a five-point Likert scale. Only 8.2% of those following a GFD and 17.1% of those not following such a diet expressed strong or total disagreement with the statement "Wheat is good for me". This result suggests that a negative perception of wheat and gluten is more prevalent among those following a GFD, though still at a relatively low level. These findings are consistent with previous studies, which have shown that negative perceptions of gluten and wheat are largely influenced by diagnosis and personal experiences related to symptoms caused by gluten consumption [25]. For respondents not following a GFD, the neutral perception of gluten and wheat suggests a lack of understanding of the potential impact gluten can have on sensitive individuals. Conversely, this group may view gluten and wheat as natural parts of their regular diet, without being aware of the dietary implications of these foods for people with gluten sensitivity [30].

An important aspect of this study was the respondents' perceptions regarding the difficulty of adopting and maintaining a gluten-free diet (GFD). Approximately 21.1% of respondents who follow a GFD reported that maintaining this diet is "very difficult," while 28.9% had a neutral perception. These findings highlight the significant challenges faced by individuals on a GFD, particularly regarding access to gluten-free products and their high costs [16]. According to other studies, adhering to a GFD is often associated with feelings of frustration and difficulties in meal management, especially due to the widespread presence of gluten in most processed foods [28].

Furthermore, the perception of difficulty may be linked to the insufficient variety of GF products available in local markets, a problem exacerbated in countries where demand for GF products is limited and support infrastructure for those with GRD is underdeveloped [4]. In Moldova, these obstacles are amplified by the lack of supportive policies for individuals who require a gluten-free diet, as highlighted in other studies that examined the challenges of accessing gluten-free products in low- and middle-income countries [12,31].

A significant finding of the survey is that 61.7% of respondents reported the internet and social media as their main sources of information about GFD. Although these sources are accessible and fast, they are not always reliable, and the information can be incomplete or inaccurate. Previous studies have shown that consumers relying on online sources may adopt inappropriate diets, being unaware of the correct nutritional needs [32,33]. This suggests the need to provide consumers with access to scientifically validated information, as well as to increase the role of healthcare professionals in educating the public about TACG and GFD [3]. Furthermore, only 16.1% of respondents mentioned doctors as their primary sources of information, indicating an insufficient level of involvement from medical staff in educating patients about celiac disease and the GFD. This highlights an opportunity for healthcare systems to improve education about GFD and provide clear, practical information to patients [16].

5. Conclusions

This study has provided important insights into the knowledge gaps, perceptions, and challenges related to the gluten-free diet (GFD) among the Moldovan population. Despite a general awareness of the term "gluten", critical details such as identifying hidden sources of gluten and understanding the correct implementation of a GFD remain unclear for a majority of the population. The findings demonstrated that education level significantly influences the degree of knowledge, with individuals holding higher education degrees displaying a better understanding of GFD.

The challenges in adopting a GFD, including the high costs and limited availability of gluten-free products, were also highlighted, particularly in a context where public support and national infrastructure for individuals with gluten-related disorders (GRD) are lacking. Given the growing awareness of celiac disease and the need for a GFD among specific population groups, this study underscores the importance of implementing educational programs and establishing policies to ensure better access to gluten-free products in Moldova.

The significance of this research for Moldova lies in its potential to shape future public health strategies and policies. It reveals the need for more accessible educational resources regarding GFD, improved public awareness, and economic measures that ensure access to gluten-free products. By addressing these gaps, Moldova can improve the quality of life for individuals with celiac disease and other gluten-related disorders, thus enhancing food security and nutritional health across the country.

REFERENCES:

1. FAO, IFAD, UNICEF, WFP and WHO. (2022). The State of Food Security and Nutrition in the World. FAO. Rome, 2022. https://doi.org/10.4060/cc0639en
2. Al-Toma, A., Volta, U., Auricchio, R., Castillejo, G., Sanders, D. S., Cellier, C. et al. (2019). European Society for the Study of Coeliac Disease (ESsCD) guideline for coeliac disease and other gluten-related disorders. *United European Gastroenterology Journal*, 7(5), 583–613. https://doi.org/10.1177/2050640619844125
3. Ma, C., Singh, S., Jairath, V., Radulescu, G., Ho, S. K. M., Choi, M. Y. (2022). Food insecurity negatively impacts gluten avoidance and nutritional intake in patients with celiac disease. *Journal of Clinical Gastroenterology*, 56(10), 863–868. https://doi.org/10.1097/MCG.0000000000001646
4. Pinto-Sanchez, M. I., Silvester, J. A., Lebwohl, B., Leffler, D. A., Anderson, R. P., Therrien, A. et al. (2021). Society for the Study of Celiac Disease position statement on gaps and opportunities in coeliac disease. *Nature Reviews Gastroenterology and Hepatology*, 18(12), 875–884. https://doi.org/10.1038/s41575-021-00511-8
5. Siqueira, R. L. D., Freitas, D. M. D. O., Fernandino, S. S. G., Cruz, P. S., Oliveira, C. B. D., Fraga, L. N. et al. (2022). The Brazilian State has assured the human right to adequate food for people with celiac disease? *Research, Society and Development*, 11(9), Article e36111931742. https://doi.org/10.33448/rsd-v11i9.31742
6. Bilaver, L. A., Das, R., Martinez, E., Brown, E., Gupta, R. S., Love, M. (2021). Addressing the social needs of individuals with food allergy and celiac disease during COVID-19: A new practice model for sustained social care. *Social Work in Health Care*, 60(2), 187–196. https://doi.org/10.1080/00981389.2021.1904323
7. Hanci, O., Jeanes, Y. M. (2019). Are gluten-free food staples accessible to all patients with coeliac disease? *Frontline Gastroenterology*, 10(3), 222–228. https://doi.org/10.1136/flgastro-2018-101088
8. Center for Science in the Public Interest. (2023). The food labeling modernization act 2023. Retrieved from https://www.cspinet.org/sites/default/files/2023-04/FLMA%20Factsheet_2023.pdf Accessed August 24, 2024.
9. Falcomer, A. L., Luchine, B. A., Gadelha, H. R., Szelmenczi, J. R., Nakano, E. Y., Farage, P. et al. (2020). Worldwide public policies for celiac disease: Are patients well assisted? *International Journal of Public Health*, 65(6), 937–945. https://doi.org/10.1007/s00038-020-01451-x
10. Raba, T., Bologa, L., Revenco, N., Tcaciuc, E., Corlăteanu, A., Nicu, O. et al. (2022). *Celiac disease in children: Current concepts of diagnostic management.* National Conference with International Participation "Interdisciplinary child management", Chisinau, 2022. Retrieved from https://ibn.idsi.md/sites/default/files/imag_file/110–119_5.pdf Accessed August 15, 2024. (In Romanian)
11. Siminiuc, R. (2024). Exploratory analysis of nutritional security in the Republic of Moldova. Habilitation Dissertation. Chisinau, Technical University of Moldova, 2024. Retrieved from https://repository.utm.md/bitstream/handle/5014/27299/Teza-doctor-habilitat-Rodica-SIMINIUC.pdf?sequence=5&isAllowed=y Accessed August 15, 2024. (In Romanian)
12. Țurcanu, D. (2023). Nutritional security of people with gluten-related disorders in the Republic of Moldova. Doctoral Dissertation. Chisinau, Technical University of Moldova, 2023. Retrieved from http://repository.utm.md/bitstream/handle/5014/23531/Teza-Doctor-Dinu-Turcanu.pdf?sequence=4&isAllowed=y Accessed August 15, 2024. (In Romanian)
13. Siminiuc, R., Țurcanu, D. (2020). Certain aspects of nutritional security of people with gluten-related disorders. *Food and Nutrition Sciences*, 11(11), 1012–1031. https://doi.org/10.4236/fns.2020.1111072
14. Ion, M., Clichici, D. (2016). Celiac disease in children. National clinical protocol for children PCN-167. Ministry of Health of the Republic of Moldova, 2016. Retrieved from https://repository.usmf.md/bitstream/20.500.12710/10406/1/Boala_celiaca_la_copil_Protocol_clinic_national_PCN_167.pdf Accessed August 16, 2024. (In Romanian)
15. Clichici, D. (2018). Assessment of clinical, serological and morphological features of early diagnosis of celiac disease in children. Doctor Dissertation. Chisinau, State University of Medicine and Pharmacy "Nicolae Testemitanu, 2018. Retrieved from http://www.cnaa.md/files/theses/2018/53650/autoferat-clichici-diana-06.06.18.pdf Accessed August 16, 2024. (In Romanian)
16. de Oliveira, D. C. L., da Silva, V. M. B., da Silva, L. M. C. (2022). Challenges in adhering the gluten-free diet. *Research, Society and Development*, 11(2), Article e34411226008. https://doi.org/10.33448/rsd-v11i2.26008 (In Poriugal)
17. Dolinšek, J., Dolinšek, J., Rižnik, P., Krencnik, T., Klemenak, M., Mijatov M. A.K. et al. (2021). Life with celiac disease. National Institute for Maternal and Child Health "Alessandrescu-Rusescu". Bucharest, 2021. Retrieved from https://www.

interreg-danube.eu/uploads/media/approved_project_output/0001/48/9d1dbf5e30a5329690faefee43147bd67750ea6a.pdf Accessed August 16, 2024. (In Romanian)
18. Aspasia, S., Emmanuela-Kalliopi, K., Nikolaos, T., Eirini, S., Ioannis, S., Anastasia, M. (2022). The gluten-free diet challenge in adults with coeliac disease: The Hellenic survey. *PEC Innovation*, 1, Article 100037. https://doi.org/10.1016/j.pecinn.2022.100037
19. Siminiuc, R., Țurcanu, D. (2023). Technological approaches applied in the design of gluten-free bakery products. *Czech Journal of Food Sciences*. 41(3), 155–172. https://doi.org/10.17221/180/2022-CJFS
20. Siminiuc, R., Țurcanu, D. (2023). Challenges and trends in gluten-free product development Echim ART, 2023. Retrieved from http://repository.utm.md/bitstream/handle/5014/23556/Provocari-tendinte-dezv-produse-fara-gluten-Monografie.pdf?sequence=1&isAllowed=y Accessed August 16, 2024. (In Romanian)
21. Taşkin, B., Savlak, N. (2021). Public awareness, knowledge and sensitivity towards celiac disease and gluten-free diet is insufficient: A survey from Turkey. *Food Science and Technology*, 41(1), 218–224. https://doi.org/10.1590/fst.07420
22. Krejcie, R. V., Morgan, D. W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement*, 30(3), 607–610. https://doi.org/10.1177/001316447003000308
23. Becker, R. (2017). Gender and survey participation an event history analysis of the gender effects of survey participation in a probability-based multi-wave panel study with a sequential mixed-mode design. *Methods, Data, Analyses*, 16(1), 3–32. https://doi.org/10.12758/MDA.2021.08
24. Tan, J., Yoshida, Y., Ma, K. S.-K., Mauvais-Jarvis, F., Lee, C.-C. (2022). Gender differences in health protective behaviours and its implications for COVID-19 pandemic in Taiwan: A population-based study. *BMC Public Health,* 22(1), Article 1900. https://doi.org/10.1186/s12889-022-14288-1
25. Lebwohl, B., Sanders, D. S., Green, P. H. R. (2018). Coeliac disease. *The Lancet*, 391(10115), 70–81. https://doi.org/10.1016/S0140-6736(17)31796-8
26. Leonard, M. M., Sapone, A., Catassi, C., Fasano, A. (2017). Celiac disease and nonceliac gluten sensitivity: A Review. *JAMA*, 318(7), Article 647. https://doi.org/10.1001/jama.2017.9730
27. Świercz, A., Żurek, U., Tołwiński, I., Kędzierska, Z., Antkowiak, K., Dadas, K. et al. (2023). Does a gluten-free diet result in nutritional deficiencies? — A review of literature. *Journal of Education, Health and Sport*, 34(1), 140–153. https://doi.org/10.12775/JEHS.2023.34.01.012
28. Vici, G., Belli, L., Biondi, M., Polzonetti, V. (2016). Gluten free diet and nutrient deficiencies: A review. *Clinical Nutrition*, 35(6), 1236–1241. https://doi.org/10.1016/j.clnu.2016.05.002
29. Jildeh, T. R., Castle, J. P., Abbas, M. J., Dash, M. E., Akioyamen, N. O., Okoroha, K. R. (2021). Age significantly affects response rate to outcomes questionnaires using mobile messaging software. *Arthroscopy, Sports Medicine, and Rehabilitation*, 3(5), e1349–e1358. https://doi.org/10.1016/j.asmr.2021.06.004
30. Laszkowska, M., Shiwani, H., Belluz, J., Ludvigsson, J. F., Green, P. H. R., Sheehan, D. et al. (2018). Socioeconomic vs health-related factors associated with google searches for gluten-free diet. *Clinical Gastroenterology and Hepatology*, 16(2), 295–297. https://doi.org/10.1016/j.cgh.2017.07.042
31. Siminiuc, R., Țurcanu, D. (2022). Food security of people with celiac disease in the Republic of Moldova through prism of public policies. *Frontiers in Public Health*, 10, Article 961827. https://doi.org/10.3389/fpubh.2022.961827
32. Chen, Y., Wang, P., He, Y., Jiang, F., Liu, H., Liu, Y. et al. (2022). Gender differences in the association between lifestyle behaviors and mental health among psychiatrists in China. *Journal of Affective Disorders*, 318, 196–203. https://doi.org/10.1016/j.jad.2022.08.089
33. Letamo, G., Keetile, M., Navaneetham, K., Medupe, K. (2022). Gender differences in dietary behaviours, health-related habits and prevalence of non-communicable diseases in Botswana. *Journal of Biosocial Science*, 54(6), 1067–1077. https://doi.org/10.1017/S0021932021000572

AUTHOR INFORMATION	СВЕДЕНИЯ ОБ АВТОРАХ
Affiliation	**Принадлежность к организации**
Dinu Țurcanu, Doctor, Associate Professor, Department of Food and Nutrition, Technical University of Moldova bd. Ștefan cel Mare, 168, Chișinău, Moldova, MD-2004 Tel.: +373–78–90–80–70 E-mail: dinu.turcanu@adm.utm.md ORCID: https://orcid.org/0000-0001-5540-4246	**Цуркану Дину Николаевич**, доктор, профессор, Кафедра пищевых продуктов и питания, Технический Университет Молдовы Республика Молдова, Кишинев, бул. Штефан чел Маре, 168, MD-2004 Тел.: +373–78–90–80–70 E-mail: dinu.turcanu@adm.utm.md ORCID: https://orcid.org/0000-0001-5540-4246
Rodica Siminiuc, Doctor, Associate Professor, Department of Food and Nutrition, Technical University of Moldova bd. Ștefan cel Mare, 168, Chișinău, Moldova, MD-2004 Tel.: +373–69–57–91–20 E-mail: rodica.siminiuc@adm.utm.md ORCID: https://orcid.org/0000-0003-4257-1840 * corresponding author	**Симинюк Родика Ивановна**, Доктор, профессор, Кафедра пищевых продуктов и питания, Технический Университет Молдовы Республика Молдова, Кишинев, бул. Штефан чел Маре, 168, MD-2004 Тел.: +373–69–579–120 E-mail: rodica.siminiuc@adm.utm.md ORCID: https://orcid.org/0000-0003-4257-1840 * автор для контактов
Contribution	**Критерии авторства**
Authors equally relevant to the writing of the manuscript, and equally responsible for plagiarism.	Авторы в равных долях имеют отношение к написанию рукописи и одинаково несут ответственность за плагиат
Conflict of interest	**Конфликт интересов**
The authors declare no conflict of interest.	Авторы заявляют об отсутствии конфликта интересов.