

## QUANTITATIVE RESEARCH FOR CONSUMER PERCEPTIONS ON VEGETAL PROTEIN-RICH, NUTRITIONALLY BALANCED PRODUCTS

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### Abstract

*The modern lifestyle, with life being so busy with jobs, kids, and other activities, brings changes in eating habits, which has led to a significant reduction in daily number of traditional meals. Therefore, the market for protein-rich products, originally developed to increase the muscle mass of athletes, is growing supporting those who choose to replace traditional main meals as well as welcoming vegan and vegetarian consumers, whose number is constantly increasing. To meet the current demands of consumers, regarding the increase in the availability on the local market of healthy, minimally processed, protein-enhanced and last but not least nutritionally balanced products, which can be consumed by as many categories of consumers as possible, a study was carried out to establish consumer preferences for salty snack products with a high vegetable protein content. It involved the development of a questionnaire followed by its distribution in the online environment. The results obtained regarding the consumer preferences, allowed us to further establish the main characteristics and attributes of the desired product.*

**Key words:** consumer preferences, minimal processing, plant protein.

### INTRODUCTION

The eating habits of people have influences on both human health and the future of the planet, in terms of sustainability.

The high consumption of animal products has significant negative effects on the human health and the environment and is recommended to be reduced, thus encouraging the consumption of fresh and ecological vegetables and fruits, minimal processed (Van Loo et al., 2020). Furthermore, consumers are increasingly demanding food that is more sustainable and nutritious in order to improve or maintain their health and to contribute also to the environment protection.

Plant-based meat alternatives are being developed to meet consumer demands, thus the market has grown exponentially in recent years (Sha & Xiong, 2020; McClements & Grossmann, 2021).

Research and development of meat alternatives focuses on the production of sustainable products that recreate conventional meat with all its physical aspects (texture, appearance, taste, etc.) (Kyriakopoulou et al., 2021; Kurek et al., 2022).

Due to the negative effects related to the environment, and in order to align with the requirements of the European Union, circular economy must be applied, and in this sense the food industry sector from Romania managed to increase the use of by-products and valorize them into new food ingredients and products (Althumiri et al., 2021). Furthermore, several studies were performed in terms of by-products valorisation and application. For example, a study carried out in Portugal demonstrated that the by-products derived from the processing of green coffee (pulp, peel, mucilage, etc.) can be further used because of their high potential value for the development of active food packaging materials, and not discarded (Oliveira et al., 2021). Naik et al. (2023) investigated the valorisation of coconut mesocarp and their results showed that the processing of this by-product could lead to the obtaining of fibre rich products, minimising coconut processing waste. A group of researchers from the University of Castilla - La Mancha, Spain have shown that chia by-products obtained from the extraction of seed oil can be used to develop new biodegradable films for the food industry, specifically defatted chia flour can be used in the production of edible

films with improved characteristics (Muñoz-Tebar et al., 2021). In Thailand, a Food and Nutrition Program at Chulalongkorn University analyzed unripe papaya by-products. A large volume of waste and by-products of unripe papaya is generated annually, so this study analysed the potential usage of these by-products as functional ingredients in pancakes, and the results were promising (Waralee et al., 2021).

In most areas where waste and by-products are obtained, the food industry is searching new ways to reuse or recover them. Grain waste from the beer industry represents about 85% of the total side products, thus catching the attention of many researchers for new ways to valorize them. He et al. (2023) stated that brewer's spent grain by-product is rich in proteins and fibers, also containing lipids, phenolic compounds and minerals. In Italy and Ireland these wastes were analyzed and the results obtained aroused the interest of specialists in the bread industry and beyond. Researchers at the University of Foggia, Italy, investigated by-products from the brewing industry and their use as functional ingredients in bread making. The results obtained showed significant increase in the phenolic content and insoluble and soluble dietary fibers of enriched bread. At the same time, a study conducted at the University College Cork in Ireland, showed that grain waste obtained from the brewing industry can serve as a raw material for the production of protein isolate and can be compared to pea and soy proteins in terms of essential amino acids content (Baiano et al., 2023; Jaeger et al., 2023). In order to align with the current trends regarding the development of new plant-based products that respect the principles of a circular economy, the present paper analyzed the consumer preferences towards salty snack-type products, enriched in vegetable protein in order to assure nutritionally balanced products.

## **MATERIALS AND METHODS**

Quantitative research allows the collection of information about a certain subject, using statistical methods. In the present study, the online survey (CAWI - Computer-Assisted Web Interviewing) was used (Quantitative research, 2023). The main advantages of using this method would be the quick receipt of answers from the participants (online), reduced analysis

time, ease of correcting errors in a questionnaire and low cost. The method also has disadvantages, one being the reduction of the size of the population that can be surveyed due to the lack of access to the internet connection, the main participants being young people (Online Survey, 2023).

The study was carried out in 2022, between November and December and consisted of interviewing a number of 205 people. The interview was carried out by distributing a questionnaire designed on the basis of scientific literature and the requirements of the established objectives (Kotler, 1972; Honkanen, 2006). The questionnaire includes a number of 21 questions divided into two sections: 13 questions related to consumption behavior, 8 questions for creating the demographic profile and a third section consisting of a multidimensional scale for measuring consumer preferences for salty, vegetable snack-type products, with a high protein content and nutritionally balanced. The questions used in designing the questionnaire are closed dichotomous questions, questions with choice answers and open questions. Dichotomous closed questions are those to which only two answers can be given "yes" or "no", "man" or "woman". The questions with optional answers called semi-open are those that have a limited number of answers that are specified, and open questions are those to which the respondents can answer using their own words (ASE – Online library, 2021). In order to establish the consumer's perception towards snack-type, salty, high-protein and nutritionally balanced vegetable products, a set of 18 statements with a five-point Likert-type metric scale was used (total disagreement/disagree/undecided/agree/total agreement). The age segment of the respondents was between 18 and 65 years.

## **RESULTS AND DISCUSSIONS**

The developed questionnaire was completed by a number of 205 respondents. Following the processing of the answers in the section related to personal information, we can define the demographic variables in terms of gender, age, marital status, last form of education, presence of minors and the number of people in the household, employment status and monthly

income. Analysing the obtained data, it can be seen that the survey participants are mostly women (76.1%) (Figure 1).

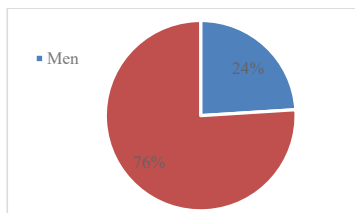


Figure 1. The gender of respondents

Regarding the distribution of the respondents according to gender and age, we can say that the majority segment is represented by 18-24 years old, both for women (40%) and men (13.17%) (Table 1).

Table 1. Distribution of respondents by age depending on gender

Age	Men	Women	Grand Total
18-24 years	13.17%	40.00%	53.17%
25-34 years	4.88%	11.22%	16.10%
35-44 years	2.93%	7.80%	10.73%
45-57 years	2.44%	11.71%	14.15%
58+ years	0.49%	5.37%	5.85%
<b>Grand Total</b>	<b>23.90%</b>	<b>76.10%</b>	<b>100.00%</b>

Table 2. Distribution of respondents by gender and marital status

Marital status	Men	Women	Grand Total
<b>Married</b>	4.88%	25.85%	30.73%
<b>Unmarried</b>	19.02%	50.24%	69.27%
<b>Grand Total</b>	<b>23.90%</b>	<b>76.10%</b>	<b>100.00%</b>

Also, from the marital status point of view, the majority of respondents (69.27%) are unmarried, respectively 50.24% women and 19.02% men (Table 2).

Regarding the distribution of respondents by gender and education, most of them (62.93%) have higher education (Table 3).

Table 3. Distribution of respondents by gender and study

Last school graduated	Men	Women	Grand Total
Vocational school/post-secondary school	0.00%	1.46%	1.46%
High school or less	8.29%	27.32%	35.61%
Higher education	15.61%	47.32%	62.93%
<b>Grand Total</b>	<b>23.90%</b>	<b>76.10%</b>	<b>100.00%</b>

With a percentage of over 72%, respondents declared that they have no children under the age of 18 in their household and approximately 28% of them have minors in their care. Regarding the number of people in the household, it can be observed that the highest percentage of 27.80% is represented by households with 2 people, followed by those with 3 and 4 people (Table 4).

Table 4. The presence of minor children and the number of people in the household

Minor children <18 years			
Row Labels	Men	Women	Grand Total
Yes	2.93%	24.88%	27.80%
No	20.98%	51.22%	72.20%
<b>Grand Total</b>	<b>23.90%</b>	<b>76.10%</b>	<b>100.00%</b>
Number of people in the household			
Row Labels	Men	Women	Grand Total
1	4.88	5.37	10.24
2	5.37	22.44	27.80
3	6.83	20.49	27.32
4	3.90	19.02	22.93
5	1.95	5.85	7.80
6	0.98	1.46	2.44
7	0.00	1.46	1.46
<b>Grand Total</b>	<b>23.90</b>	<b>76.10</b>	<b>100.00</b>

Table 5. The relationship between earned income and employment status

Row Labels	Full time (>40 h/week)	Part time (10-39 h/week)	Not working (inclusive <9 h/week)	Student
< 2000 RON	1.46%	2.44%	3.41%	10.24%
> 7001 RON	15.61%	0.49%	0.98%	4.88%
2001-3500 RON	8.78%	2.93%	1.95%	13.17%
3501-5000 RON	10.24%	0.49%	0.98%	6.83%
5001-7000 RON	9.27%	0.98%	0.49%	4.39%
<b>Grand Total</b>	<b>45.37%</b>	<b>7.32%</b>	<b>7.80%</b>	<b>39.51%</b>

Regarding the relationship between the employment status and income declared by the respondents (Table 5) it is highlighted the majority (45.37%) have a full-time job and among them a percentage of 15.61% achieve incomes over 7000 RON per month. Among the 39.51% students participating in the study, a percentage of 13.17% have an income between 2001-3500 RON per month.

Further, the results obtained after processing the responses of the 13 questions related to

consumption behaviour are presented. With a percentage over 82%, the respondents consumed in the last 12 months protein bars, dairy products with high protein content and protein-enriched snacks from vegetable sources, purchased from supermarket (Figure 2 and Figure 3).

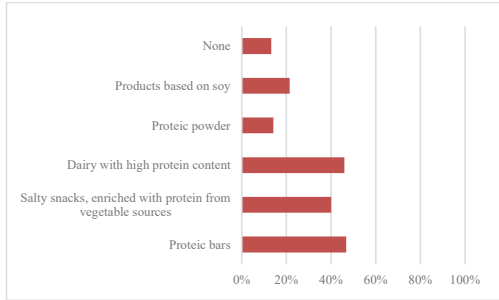


Figure 2. Products consumed in the last 12 months

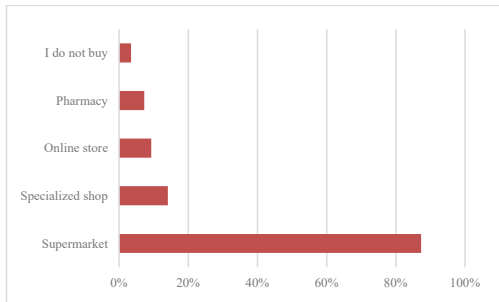


Figure 3. The place to buy salted protein snacks

The main source of information about salty snack-type products enriched with vegetable protein is the internet (~46%), followed by the selling place (34%) and family and friends (24.4%) (Figure 4).

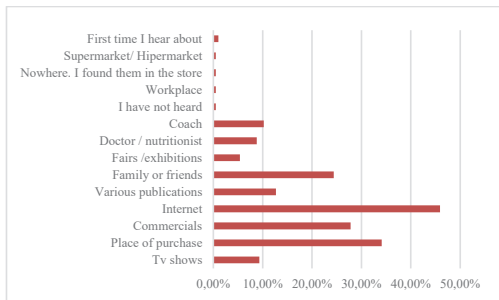


Figure 4. Information sources

Regarding the favourite combination of vegetables most wanted to be found in a salty snack product enriched with vegetable protein,

the respondents have chosen mushrooms, peas, eggplant, asparagus and beans.

Further, most of the respondents (42.9%) consume vegetable, salty, protein-rich, minimally processed products occasionally, about 37% of them consume these kinds of products once per month or less often and 18% of the respondents consume them regularly (Figure 5).

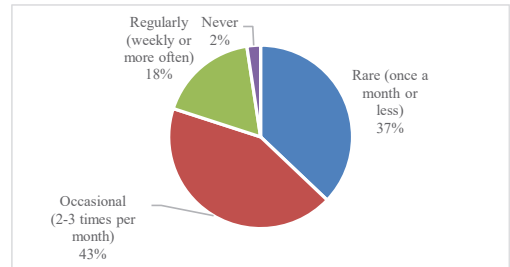


Figure 5. Frequency of consumption

Table 6 shows that regardless of age, 43% of respondents occasionally consume salty snack products enriched with vegetable protein, while 2% mentioned that they don't eat these types of products.

Table 6. Frequency of consumption of enriched products depending on age

Row Labels	18-24 years	25-34 years	35-44 years	45-57 years	58+ years	Grand Total
Never	3%	0%	0%	3%	8%	2%
Occasional (2-3 times per month)	43%	42%	41%	45%	42%	43%
Rare(once a month or less)	33%	42%	41%	41%	42%	37%
Regularly (weekly or more often)	21%	15%	18%	10%	8%	18%
<b>Grand Total</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

A percentage of 36.6% of respondents fully read the information on product labels, 5.8% of them never read them, while 57.6% read the information partially (Figure 6).

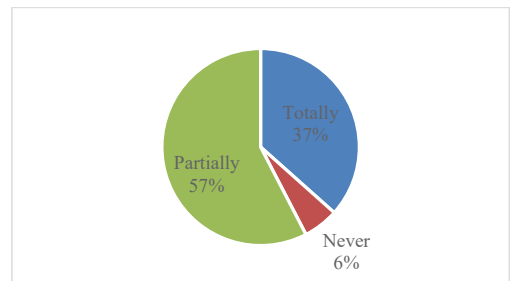


Figure 6. How the information on the label is used by the consumer

The distribution by age of the answers regarding the use of the information on the product label can be seen in Table 7. Regardless of age, more than half of the respondents, respectively 58%, partially read the information on the product label at the first purchase, while at the opposite pole (6%) are those who never read the label.

Table 7. Distribution of answers regarding the use of the label according to age

Row Labels	18-24 years	25-34 years	35-44 years	45-57 years	58+ years	Grand Total
Totally	28%	33%	68%	45%	50%	37%
Never	8%	3%	0%	3%	8%	6%
Partially	64%	64%	32%	52%	42%	58%
<b>Grand Total</b>	<b>100.00%</b>	<b>100.00%</b>	<b>100.00%</b>	<b>100.00%</b>	<b>100.00%</b>	<b>100.00%</b>

Correlating the level of education of the respondents with the desire for information on the purchased products, we can say that those with higher education read the information on the product label in percentage of 41% and partially in a proportion of 55% (Table 8).

Table 8. Distribution of answers regarding the use of the label depending on education level

Row Labels	Vocational school	High school	University	Grand Total
Totally	33%	29%	41%	37%
Never	0%	10%	4%	6%
Partially	67%	62%	55%	58%
<b>Grand Total</b>	<b>100.00%</b>	<b>100.00%</b>	<b>100.00%</b>	<b>100.00%</b>

Regarding the circular economy concept, a percentage of 57.6% of the respondents do not know it's definition, of which 47.8% are women and 9.76% are men (Table 9).

Table 9. Knowledge about the circular economy concept

Circular economy			
Row Labels	Yes	No	Grand Total
Men	14.15%	9.76%	23.90%
Woman	28.29%	47.80%	76.10%
<b>Grand Total</b>	<b>42.44%</b>	<b>57.56%</b>	<b>100.00%</b>

Even if the knowledge about circular economy concept is scarce between the respondents,

82.4% of them (of which 63.41% are women), are open to consuming products in which plant residues have been integrated (Table 10).

Table 10. Distribution of consumption of products in which vegetable residues have been integrated according to gender

Row Labels	Men	Women	Grand Total
Yes	19.02%	63.41%	82.44%
No	4.88%	12.68%	17.56%
<b>Grand Total</b>	<b>23.90%</b>	<b>76.10%</b>	<b>100.00%</b>

72.20% of the respondents, of which 56.10% were women, answered that they know that the food waste resulting from the use of vegetables and fruits (peels, seeds, sheaths, pulp, etc.) still contains valuable nutritional compounds such as vitamin C or antioxidants (Table 11).

Table 11. Information regarding the content of food waste

Row Labels	Men	Women	Grand Total
Yes	16.10%	56.10%	72.20%
No	7.80%	20.00%	27.80%
<b>Grand Total</b>	<b>23.90%</b>	<b>76.10%</b>	<b>100.00%</b>

For measuring the degree of acceptability of consumers towards vegetable salty snack-type products, with high protein content and nutritionally balanced, a multidimensional scale was used, and the respondents of this study had to express their agreement or disagreement with some statements of other consumers. In Table 12, the responses of the study participants are presented and processed.

For evaluating the degree of satisfaction of the respondents, the following calculation formula was applied:

$$(GS\%) = \frac{\sum_{i,j} N_i \cdot P_j}{\sum N_i} \times 100$$

where:

GS% - degree of satisfaction expressed as a percentage

$N_i$  - the number of responses to the criterion  $i$

$P_j$  - the score assigned to each answer.

Table 12. The results of the study for the evaluation of the degree of acceptability

No.	Statements:	Totally disagree	Disagree	Indecise N/A	Agree	Totally agree	GS%
		1	2	3	4	5	
1	The consumption of vegetable products in which vegetable remains are integrated (peels, seeds, sheaths, pulp, etc.) resulting from the use of vegetables, contributes to the maintenance of human health	13	34	64	68	26	65.85
2	The consumption of such food products contributes to the protection of the environment	14	14	42	94	41	73.07
3	Vegetable, salty, protein-enriched food products are tastier than conventional products	7	13	32	82	71	79.22
4	For a healthy diet, I consume vegetable, salty, protein-enriched food products	18	38	61	61	27	64.00
5	I need more information about such products	12	34	94	50	15	62.15
6	The offer of vegetable, salty, protein-enriched, nutritionally balanced products from Romania is diversified	30	47	73	40	15	56.39
7	The quality/price ratio of these products is correct	19	19	38	101	28	69.76
8	Vegetable, salty, protein-enriched, nutritionally balanced products are recommended for athletes	32	68	78	19	8	50.54
9	I can't afford to buy such products	18	50	63	55	19	60.68
10	Some buy such products only because they are expensive	13	17	55	96	24	69.85
11	I tried such products out of curiosity	6	26	59	67	47	72.00
12	I have not heard of any campaign to promote these products	25	45	85	38	12	56.78
13	I get full faster when I consume such products	10	27	66	65	37	68.98
14	Such salty vegetable snack products with a high protein content are a quick alternative to main meals	7	21	67	73	37	70.93
15	Foods are recommended to be consumed in their integral form	19	39	68	62	17	61.85
16	The more a product is processed, the more it can lose vitamins, minerals or fibers from its composition	10	27	92	54	22	64.98
17	Vegetable products, salty, rich in proteins, nutritionally balanced are indicated in vegetarian or vegan diets	18	37	91	48	11	59.71
18	Consumers are paying more attention to the impact of food production and processing on health and the environment	11	17	53	44	80	76.10

## CONCLUSIONS

Regarding the obtained demographic information, out of a total of 205 respondents, 156 (76.1%) were young women, over 50% of them aged between 18 and 34, unmarried, without minor children, graduates of higher education programs and coming from families consisting of a maximum of 4 people. Approximately 40% of the women participating in the study work full-time and their monthly net income is over 2000 RON. Related to consumption behavior, the respondents are open to new things, that is, they would consume a

product in the composition of which food waste was integrated, respecting of course the rules regarding food safety, knowing that this resulting fruit and vegetable waste still contain valuable nutritional compounds. They also consume protein-enriched products 2-3 times a month, which they read about on the internet and buy from the supermarket. The respondents partially read the information on the label but would like to find mushrooms, peas, eggplant, asparagus and beans in the composition of such a product. The respondents agree that they contribute to environmental protection by consuming vegetable products in which vegetable residues are integrated and that these products are tastier than conventional ones. Some respondents consume such products out of curiosity and agree that they represent a quick alternative to meals. However, the respondents of this study do not fully agree that these products are not recommended only for athletes and in vegetarian diets. Furthermore, there isn't a diversified offer of this kind of products and also there are no campaigns to promote them. The GSM % value (average degree of satisfaction of the respondents) was of 65.71% and was calculated as the arithmetic mean of all GS% values obtained. This value shows satisfactory results regarding the 18 affirmations for which the respondents gave their opinions.

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