

An Alternative Gastronomic Product Obtained from Beans and Red Lentils: Hummus

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Abstract

Hummus, widely consumed in the Mediterranean and Middle East, is an appetizer made of chickpeas, lemon juice, tahini, garlic, olive oil, and various spices. The main ingredient of this appetizer variety is boiled chickpea, the most significant feature of which is its nutritional and filling nature. The preparation process for hummus, which involves a variety of legumes, is time-consuming and calorically rich. This study aimed to determine the sensory characteristics of hummus derivatives prepared from different legumes. In line with the objectives of this study, three different products were designed using different legumes (chickpeas, red lentils, and beans). A hedonic scale was used for sensory analysis of the prepared products, and this scale was applied to 11 panelists separately for each product. Upon examining the obtained data, it was found that hummuses made with red lentils had a greater preference. Additionally, research has revealed that products made with red lentils have certain advantages regarding time and nutrition.

Keywords: Beans, Red Lentils, Hummus, Gastronomic Product

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INTRODUCTION

At the end of the twentieth century, the world population, which was six billion, reached eight billion in the first quarter of the twenty-first century (TUIK, 2023). The rapid increase in world population has led to inadequate and inefficient use of resources, resulting in an increased demand for food (Oğan, 2022). Legume products rich in proteins play a significant role in meeting the demand for food. In addition to their high protein content, legume products are generally high in carbohydrates, low in fat, and possess nutritional properties (SPO, 2023). The highest production of field crops worldwide has been focused on cereals. Following cereals, legume products have followed this trend. Gulumser (2016:292), in his study citing Akcin (1988), classifies products used as legumes as "beans (*Phaseolus vulgaris* L.), chickpeas (*Cicer arietinum* L.), lentils (*Lens culinaris* Medik, *Lens esculenta* Moench.), broad beans (*Vicia faba* L.), broad beans (*Vigna sinensis* L.), and peas (*Pisum sativum* L.)".

Therefore, legume products can be classified as dry beans, chickpeas, lentils, peas, mung beans, cranberry beans, or broad beans, depending on their production and consumption. Dry beans are the world's most widely produced grain legumes, followed by chickpeas and lentils (SPO, 2023). Consequently, the use of dry beans, chickpeas, and lentils as legume grain products has become widespread worldwide.

Middle Eastern and Mediterranean cuisines stand out for their use and consumption of grain legume products. Chickpeas are at the forefront of such products. Chickpea, a word of Arabic origin, humus (حمص), means chickpea. Humus, in the Türk dictionary, is a "dish prepared with well-mashed chickpeas, spices, and tahini." (TLA, 2023). Humus, a traditional dish, is made and consumed in many countries, including Arab countries, such as Iraq, Syria, Israel, Türkiye, Greece, and Armenia.

It is widely used in the Hatay and Mersin regions of Türkiye. The presence of a geographically marked product called Tarsus Hummus, specific to Mersin Province, is the leading indicator of this phenomenon. Although there is a commitment to traditional kitchen products, many factors are essential, such as creating new products, product development, enhancing flavors, and adding alternative features. In this study, we aimed to determine the sensory characteristics of the substitute products obtained from beans and lentils. In this way, an alternative product is obtained from these products and evaluated from a gastronomic perspective. In this context, the research aims to compare the sensory analysis of the hummus product made with beans and red lentils using the sensory analysis technique.

CONCEPTUAL FRAMEWORK

Regarding worldwide field crop production, grain groups have taken the lead. The second-most produced group of products, after grains, are legumes. Legumes are essential in human nutrition because of their protein (22%) and carbohydrate (7%) contents (Marinangeli & Jones, 2011; Sarioğlu & Velioğlu, 2018; FAO, 2023). However, these mentioned ratios can vary depending on factors such as the type, maturity, gender, and cultivation conditions of the plant. Legumes contain essential nutritional features, including low calorie content, low fat, high fiber, valuable micronutrients, and antioxidant properties (Lopez-Amoro's, Hernandez & Estrella, 2006). Dry beans, chickpeas, and lentils are the most commonly produced legumes globally. The leading countries in dry bean, chickpea, and lentil production are India, Canada, Myanmar, China, Türkiye, Australia, the USA, Mexico, and Brazil (SPO, 2023).

The United Nations Food and Agriculture Organization (FAO) has declared February 10th as "World Pulses Day," underscoring the global significance of legumes. Türkiye is a significant player in global legume production, producing over a million tons of primary chickpeas, dry beans, and lentils (Anadolu Agency, 2023).

Akçin (1988) has highlighted the need for protein-rich foods to sustain vital human activities and nutrition. Therefore, legumes have emerged as a valuable food source for humans. Owing to their nutritional properties, efforts have been made to expand the use of grain legumes either alone or in combination with other food products (Amarowicz, 2010). Legumes have been used as staple foods in ancient civilizations. In addition to their nutritious and healthy characteristics, their low price makes them essential for the modern diet. Furthermore, it is possible to mention a dietary pattern focused on grains and legumes in underdeveloped and developing countries (Sarioğlu and Velioğlu, 2018).

Beans, Lentils, Chickpeas, and Hummus Beans rank first in cultivation area and legume production worldwide (SPO, 2023). Sirat (2020:245) mentioned that bean production occurs in five regions: "Southern and Eastern Africa, Southeast and Western Europe, North, Central and South America, and East Asia." Fresh, canned, and dry beans were obtained. Its high protein content can address deficiencies in animal proteins, which contain a significant amount of protein (22-34%) (Abacı and Kaya, 2018). Lentils, one of the first cultivated plants worldwide, are single-year-old legumes. Lentil grains, such as beans, are rich in protein (25-28%). Owing to its cultivation in arid regions, it is a valuable product for both producers and regional economies. In Türkiye, red lentils (Southeastern Anatolia Region) and green lentils (Central Anatolia Region) are two varieties of cultivated lentils (Aydoğan, Karagül & Gürbüz, 2008; SPO, 2023; FAO, 2023). Chickpeas, the second most produced grain legume globally after beans, also known as "chana, gram, Bengal gram, garbanzo," is produced in kabuli and desi. Most (80%) of chickpea production is desi, with Kabuli widely produced in Türkiye. Like beans and lentils, chickpeas are a significant source of protein (20%). Therefore, these grain legumes can be considered significant, healthy, and economical protein sources for a balanced diet (Akçin, 1988) (see Table 1).

Table 1. Average Composition of Beans, Chickpeas and Lentils

<i>Components</i>	<i>Beans (dermason)</i>	<i>Chickpea (cob)</i>	<i>Lentil</i>
Energy (kcal)	281	334	299
Protein(g)	21.75	18.56	23.00
Carbohydrate(g)	29.42	41.35	36.62
Oil(g)	1.35	5.33	0.92
Total Dietary Fibre (g)	32.17	23.03	25.99
Ca (mg)	141	99	64
Fe (mg)	4.71	5.92	7.77
P (mg)	367	397	415
Vitamin B1 (mg)	0.796	0.572	0.159
Vitamin B2 (mg)	0.181	0.164	0.148
Niacin (mg)	4.141	3.146	4.613

Source: Sarioğlu & Velioglu (2018) *Values given are for 100 g of edible food.

Legumes hold a significant place in Turkish culinary culture. One such product is Hummus, made using chickpeas as its main ingredient. Hummus is a dish prepared by finely crushing chickpeas with spice and tahini. It is a traditional dish with these features and is made and consumed in many countries, including Arab countries, Iraq, Syria, Israel, Türkiye, Greece, and Armenia. It is widely used in the Hatay and Mersin regions of Türkiye. On November 1, 2017, it was certified by the Turkish Patent and Trademark Office under the name "Tarsus Hummus" as Protected Geographical Indication (PGI) in the dishes and soups group, based on the application of the Tarsus Chamber of Commerce and Industry (Türk Patent, 2023). In recent years, hummus has become a popular dish because of its harmony with different recipes and its ability to appeal to every palate. Hummus, bearing the characteristics of a type of appetizer, is generally served with lemon juice, garlic, salt, red pepper, cumin, and olive oil added to chickpeas and tahini.

MATERIAL and METHOD

This study used a sensory analysis technique to compare the sensory analysis of hummuses made from beans and red lentils. Two products (beans and red lentils) and a control product (chickpeas) were cooked simultaneously.

The research was conducted in the sensory analysis laboratory of the Gastronomy and Culinary Arts Department of Iskenderun Technical University between December 10-20, 2023. The sample group consisted of trained panelists who received sensory analysis training and were experts in this field. Presentations were made in portions to taste the products, and a panel environment was created during the sensory analysis process. Panelists were selected from among experts familiar with hummus culture. Eleven people participated in the application process, one of whom was the panel leader, and the others were panelists (Koppel, 2014). Although at least 80 people are required for consumer tests in sensory analysis, 10-20 panelists are considered sufficient for difference tests (Onoğlu and Elmacı, 2019; Sipos et al., 2021).

Considering the standards, the panelists were asked to evaluate the products cooked in different stoves. The objective sensory evaluation was ensured by not providing information about the products to the panelists. The sensory analysis used a sensory evaluation scale regarding the quality criteria. The sensory analysis scale, which specifies the distinctive features of each cooked food, was evaluated by panelists. The sensory evaluation measures a person's senses in response to a stimulus and involves three types of senses: qualitative, dimensional, and hedonic (pleasure). Thus, sensory evaluations are related to stimuli and response reactions (Gönül, 1983).

During sensory evaluation, the panelists were asked to examine the products regarding taste, smell, texture, and appearance. The sensory analysis used a 1-5 liking scale, and the panelists were asked to score each criterion. The products were evaluated in terms of four aspects using a hedonic scale: smell, texture, taste (appearance of a product), and overall liking. The hedonic scale assesses the panelists' preferences or liking/disliking situations (Onoğur and Elmacı, 2019). This scale was analyzed in different dimensions using spider web diagrams and graphs by averaging. Prior to the panel test, several sensory evaluation conditions were required. These are:

- The panelists had not eaten anything in the last three hours.
- The panelists had no sensitivity or allergic reaction to the products.
- The panelists participated in a previous sensory evaluation and attended a short training session.
- All panelists were experts in the field.
- Water was used after the evaluation of each product.
- The panelists did not use perfumes, scented creams, or colognes.

A 5-point scale was used in the sensory analysis scale to be filled out by the panelists; the level of "Appearance, Smell, Texture, Taste, and Overall Liking" of the product was asked. The relevant descriptors in the sensory analysis scale were scaled as follows:

1: "Strongly Disagree," 2: "Disagree," 3: "Neither Agree nor Disagree," 4: "Agree," 5: "Strongly Agree."





Table 2. Sociodemographic characteristics of the participants

Participants	Gender	Age	Educational Level	Occupation
P1	Male	26	Bachelor's Degree	Teacher
P2	Female	32	High School	Housewife
P3	Male	29	Bachelor's Degree	Teacher
P4	Male	51	High School	Housewife
P5	Male	42	Postgraduate Degree	Academician
P6	Female	33	Associate degree	Technician
P7	Female	27	Bachelor's Degree	Doctor
P8	Male	46	Bachelor's Degree	Doctor
P9	Male	43	High School	Worker
P10	Female	39	Bachelor's Degree	Engineer
P11	Female	41	High School	Housewife
P12	Male	42	Postgraduate Degree	Academician

Among the participants in the table, there were many differences in gender, age, and education level. First, when the gender distribution was examined, it was observed that there were six male and five female participants. This gender diversity implies that participants might have had different perspectives and experiences. In terms of age, the participants had a wide age range. This age distribution, ranging from 27 to 51 years, implies age-related differences in experiences within the group. Determining the average age can help us better understand the group dynamics. In terms of educational level, participants with different educational backgrounds ranging from high school to undergraduate, master's, and doctoral levels were present. Educational diversity indicates various areas of expertise and knowledge within a group. Looking at the participants' professions, it was observed that there were participants from different professions, such as teachers, homemakers, academics, technicians, doctors, engineers, and workers. This diversity of professions indicates a wide range of experience and expertise within the group (see Table 2).

Table 3. Humus formulation and preparation images

Product Code	Pulses Amount (gr)	Tahini (gr)	Lemon (ml)	Cumin (gr)	Garlic (gr)	Water (ml)	Salt (gr)	Olive Oil (ml)	Chilli Pepper (gr)
Chickpea	240	70	80	10	10	105	15	15	6
Beans	235	70	80	10	10	105	15	15	6
Lentil	250	70	80	10	10	95	15	15	6

<i>Chickpea</i>			<i>Lentil</i>
<i>Beans</i>			<i>Hummus Products</i>

The quantities of ingredients used in this recipe reflect a similar approach for the three legume types. First, 240 g of legumes, 70 g of tahini, 80 ml of lemon juice, 10 g of cumin, 10 g of garlic, 105 ml of water, 15 g of salt, 15 ml of olive oil, and 6 g of red pepper flakes were used (see Table 3).

Similarly, the Bean recipe exhibits noticeable similarities. A delicious mixture was obtained using 235 g of beans, 70 g of tahini, 80 ml of lemon juice, 10 g of cumin, 10 g of garlic, 105 ml of water, 15 g of salt, 15 ml of olive oil, and 6 g of red pepper flakes.

Lentils also feature a similar list of ingredients. A rich flavor profile was achieved using 250 g of lentils, 70 g of tahini, 80 ml of lemon juice, 10 g of cumin, 10 g of garlic, 95 ml of water, 15 g of salt, 15 ml of olive oil, and 6 g of red pepper flakes.

The preparation and presentation stages of the hummus products, including visuals, are presented in Table 3. While each recipe contained the same components, they were carefully prepared with balanced ingredients to bring out the unique flavors of the legumes. Thus, it is evident that each recipe is interconnected with similar elements yet possesses distinctive flavor profiles.

Table 4. Mean nutritional values and total preparation times of pulse products

Product Code	Energy (Kcal)	Protein (gr)	Oil (gr)	Carbohydrate (gr)	Fiber (gr)	Starch (gr)	Preparation Time (min)
<i>Chickpea</i>	334	18,56	5,33	41,35	23,03	30,98	493
<i>Beans</i>	281	21,75	1,35	29,42	32,17	21,64	381
<i>Lentil</i>	322	25,81	1,57	41,94	18,67	40,95	33

Chickpeas had an energy content of 334 kcal and a high protein ratio (18.56 g). It is also rich in fiber and can have positive effects on the digestive system. However, the preparation time was quite long compared to the other samples (493 min). Beans with low fat and high fiber contents have emerged as a healthy choice. In particular, its fiber ratio (32.17 gr) can support the digestive system and provide a long-lasting feeling of fullness. The preparation time was shorter than that of chickpeas (381 min).

Lentils with the highest protein content (25.81 g) stood out and had a short preparation time of only 33 min. Additionally, its high starch content provides energy-providing features. Lentils, which can be cooked in a shorter time than other legumes, are a practical choice. This table offers options for individuals with different nutritional needs and preparation-time preferences when determining their dietary habits and meal planning (see Table 4).

RESULTS

Graph 1 shows the arithmetic mean values for the odor parameters of hummus made from beans, chickpeas, and red lentils (undesirable odor, garlic odor, cumin odor, and tahini odor). The average values of these parameters are expected to be in the range of 2–4.

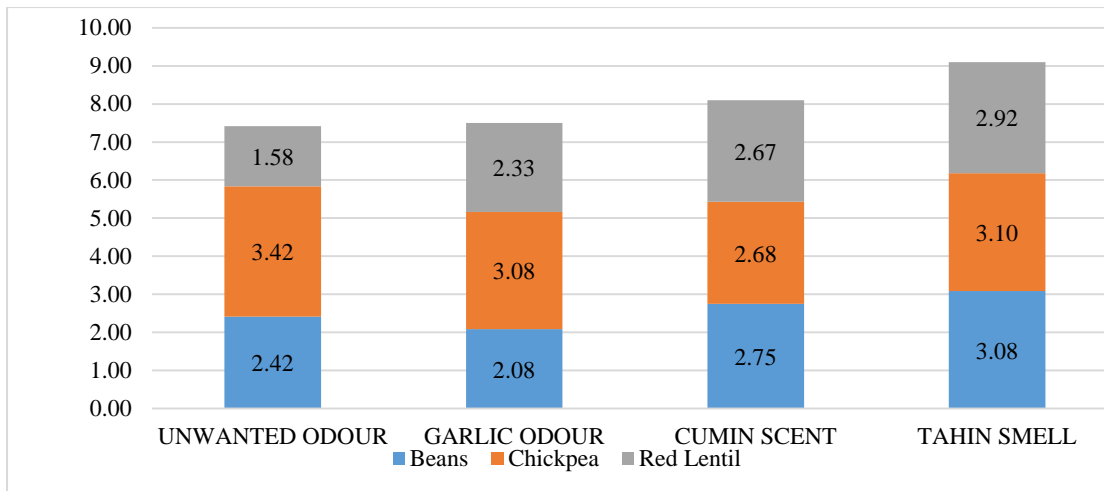
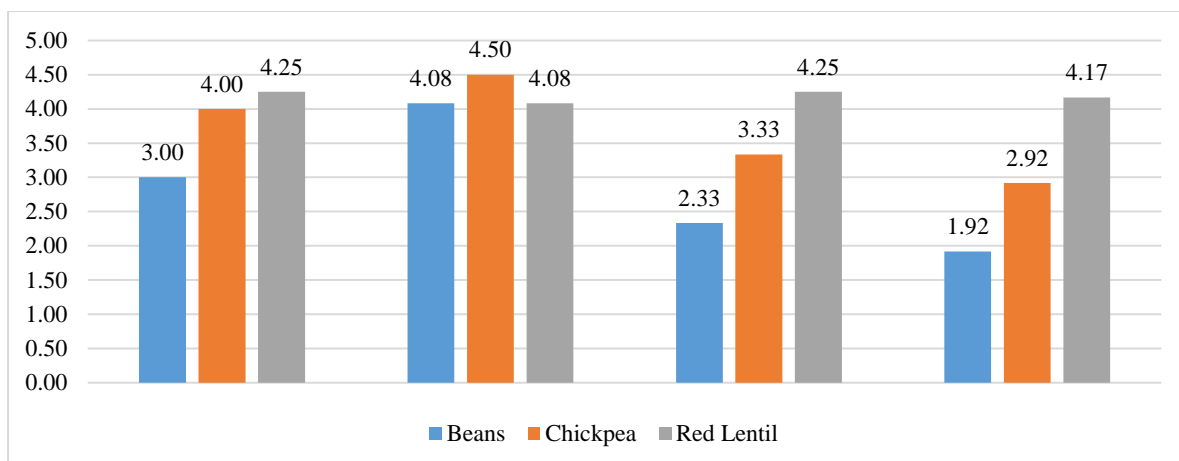


Figure 1. Sensory evaluation results regarding the aroma of hummus product

In Graph 1, the arithmetic mean values related to the aroma parameters of different legume types, such as beans, chickpeas, and red lentils, were determined: unwanted odor ($X=2.47$), garlic odour ($X=2.50$), cumin scent ($X=2.70$), and tahin scent ($X=3.03$). Four different aromas were identified for each legume and evaluated on a specific scale. Unwanted Odor: Compared to beans, chickpeas, and red lentils, chickpeas have a higher value, with scores of 2.42 for beans, 3.42 for chickpeas, and 1.58 for red lentils. Among the three legume types, chickpeas had the highest unwanted odor value. Garlic Scent: Chickpeas had the highest value compared to beans and red lentils. Beans scored 2.08, chickpeas scored 3.08, and red lentils scored 2.33. Once again, chickpeas were identified as having the highest garlic scent value among the legumes. Cumin Scent: Among beans, chickpeas, and red lentils, beans had the highest value. Beans scored 2.75, chickpeas scored 2.68, and red lentils scored 2.67. Beans have the highest cumin scent value among these three legume types, although chickpea and red lentil values are quite close. Tahini Scent: Chickpeas scored the highest compared with beans and red lentils. Beans = 3.08, chickpeas = 3.10, and red lentils = 2.92. Chickpeas had the highest tahini scent. Therefore, chickpeas generally receive higher scores than others in unwanted odor, garlic scent, and tahini scent, whereas beans stand out for cumin scent.

Red lentils usually had lower values than the other two legume types. These evaluations can be used to compare the sensory olfactory profiles of legumes. As a result of the evaluation, it was found that in the case of hummus, the average desired value of descriptors is close to "3"/"neither agree nor disagree" (max. $X=2.68$), indicating that compared to other products, red lentils have fewer unwanted odors. Graph 2 provides arithmetic mean values for spreadability, lumpiness, consistency, and homogeneity changes in the texture of hummus products from beans, chickpeas, and red lentils. These average values were expected to be in the range of 3–5.



*From left to right; spreadability, granularity, consistency, and homogeneity

Figure 2. Sensory evaluation results of humus product textures

Examining Graph 2 determined the average values regarding spreadability, granularity, consistency, and homogeneity changes in the textures of different legume types, including beans, chickpeas, and red lentils. The average values are as follows: spreadability ($X=3.75$), granularity ($X=4.22$), consistency ($X=3.31$), and homogeneity ($X=3.00$). The sensory features of the products were evaluated based on the following four criteria: spreadability, granularity, consistency, and homogeneity.

Spreadability: Red lentils (4.25) obtained the highest score, whereas chickpeas (4.00) and beans (3.00) received lower scores.

Granularity: Chickpeas scored the highest (4.50), whereas beans (4.08) and red lentils (4.08) showed similar granularity levels.

Consistency: Red lentils achieved a significantly higher score (4.25) compared to others, chickpeas (3.33) were rated with moderate consistency, and beans had the lowest consistency score (2.33).

Homogeneity: Red lentils received the highest score (4.17), chickpeas had moderate homogeneity (2.92), and beans had the lowest homogeneity score (1.92).

These evaluations provided important information for understanding the sensory characteristics of each product. Red lentils excel in spreadability, consistency, and homogeneity, while chickpeas stand out in granularity. Beans, on the other hand, are generally evaluated with lower scores. The average values of each product closely align with the desired/expected value (3.57).

Graph 3 presents the average values for the flavor parameters of the humus product, including undesired taste, sourness, acidic taste, spiciness, bitterness, saltiness, sesame flavor, sweetness, oiliness, and aftertaste. The average values for these parameters are expected to be within the range of 1–5.

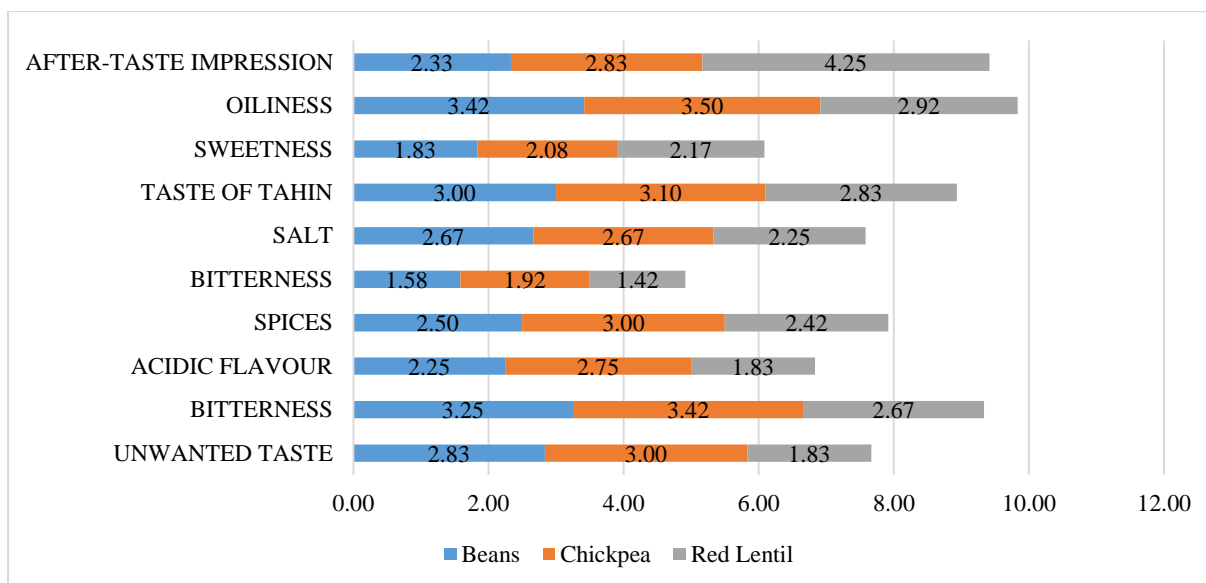


Figure 3. Sensory evaluation results related to the taste of hummus products.

In Graphic 3, the arithmetic mean values for the taste parameters of different legume types, such as beans, chickpeas, and red lentils, are determined to be unwanted taste ($X=2.56$), sourness ($X=3.11$), acidic flavor ($X=2.28$), spiciness ($X=2.64$), bitterness ($X=1.64$), saltiness ($X=2.53$), tahini flavor ($X=2.98$), sweetness ($X=2.03$), oiliness ($X=3.28$), and post-taste impression ($X=3.14$). The graphic shows the sensory analysis results of the three different legume types. Ten different criteria and evaluation scores were used for the analysis. Unwanted Taste: Beans scored 2.83, chickpeas scored 3.00, and red lentils scored 1.83. This assessment shows that red lentils show more favorable results regarding unwanted tastes than others. Sourness: Chickpeas scored 3.42, beans scored 3.25, and red lentils scored 2.67. In this case, chickpeas had the highest sourness scores. Acidic Flavor: Beans scored 2.25, chickpeas scored 2.75, and red lentils scored 1.83. The red lentils, which had the lowest score, differentiated themselves in terms of their acidic flavor. Spiciness: Chickpeas scored 3.00, beans scored 2.50, and red lentils scored 2.42. Chickpeas ranked the highest in terms of spiciness. Bitterness: Red lentils scored 1.42, chickpeas scored 1.92, and beans scored 1.58. Red lentils, with the lowest scores, had a lighter taste profile than the others. Saltiness: Beans and chickpeas scored 2.67, and red lentils scored 2.25. Tahini Flavor: Chickpeas scored 3.10, beans scored 3.00, and red lentils scored 2.83. Chickpeas slightly lead to a tahini flavor compared with the others. Sweetness: Red lentils scored 2.17, chickpeas scored 2.08, and beans scored 1.83. Red lentils had the highest sweetness score. Oiliness: Chickpeas scored 3.50, beans scored 3.42, and red lentils scored 2.92. Chickpeas stand out in oiliness compared to the others. Post-taste Impression: Beans scored 2.33, chickpeas scored 2.83, and red lentils scored 4.25. Red lentils obtained a higher score on post-taste impressions than others.

This sensory analysis table, containing ten criteria used to compare various flavor characteristics of three different legume products, highlights red lentils as a preferable option in terms of the first criterion, "unwanted taste." Chickpeas excel in sourness and exhibit an acidic profile. Additionally, in the "acidic flavor" criterion, red lentils exhibited a lighter flavor profile than others. Chickpeas stand out in the "spiciness" criterion, indicating more pronounced spiciness than other legumes. Regarding "bitterness," red lentils, with the lowest score, suggest a milder taste profile. In the "post-taste impression" criterion, red lentils scored higher than the others, implying a prolonged flavor experience.

On the other hand, in the "oiliness" criterion, chickpeas received a slightly higher score than the other legumes. In conclusion, these observations demonstrated that each legume type possesses unique sensory characteristics. The panelists considered these diverse features based on their preferred flavor profiles. Graphic 4 presents the arithmetic mean values for the hummus product's visual parameters (brightness, color, homogeneous appearance). The expected average values of these parameters were 3–5.

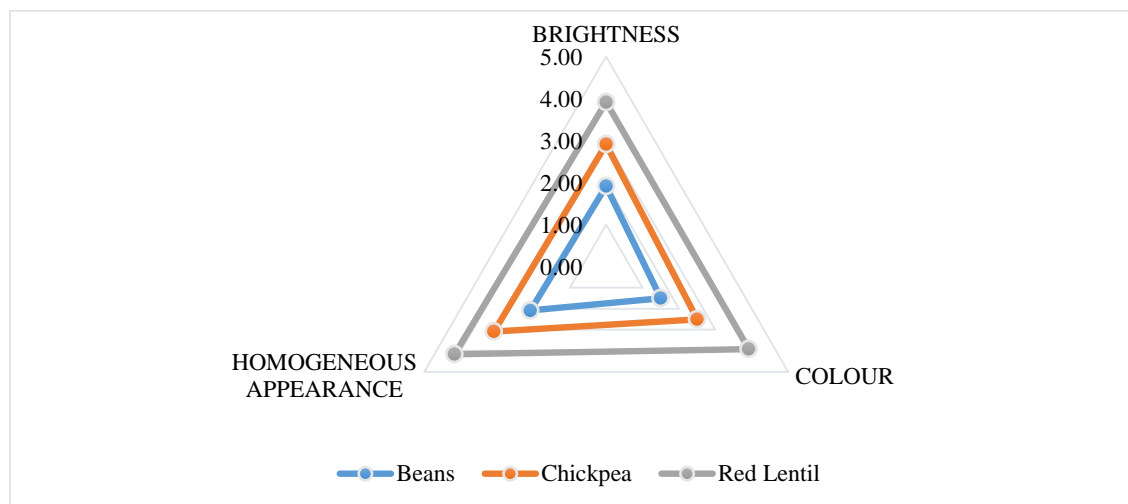


Figure 4. Sensory evaluation results related to the appearance of hummus products.

In Graph 4, the average values for the image parameters of different legume types, namely beans, chickpeas, and red lentils, are represented as brightness ($X=2.92$), color ($X=2.64$), and homogeneous appearance ($X=2.78$). Brightness: Beans, 1.92; chickpeas, 2.92; and red lentils, 3.92. This indicates that the red lentils have a higher brightness level than the others. Color: Beans 1.50, chickpeas 2.50, and red lentils had color scores 3.92. These results reveal that red lentils have a more distinct and saturated color than the other two products. Homogeneity: Beans and chickpeas score 2.08, while red lentils score 4.17.

This suggests that the elements within the red lentils were distributed more evenly, displaying a homogeneous appearance. In conclusion, these results can provide essential information to consumers or producers who wish to compare and prefer the visual and structural characteristics of products. For instance, a consumer may choose a product with higher values in brightness and color. In contrast, a producer may evaluate various production processes to enhance the homogeneous appearance of their products.

Graph 5 shows the arithmetic mean values for overall liking levels regarding the appearance, smell, texture, and taste of the produced hummus products. The expected range for these overall liking levels was 2–4.

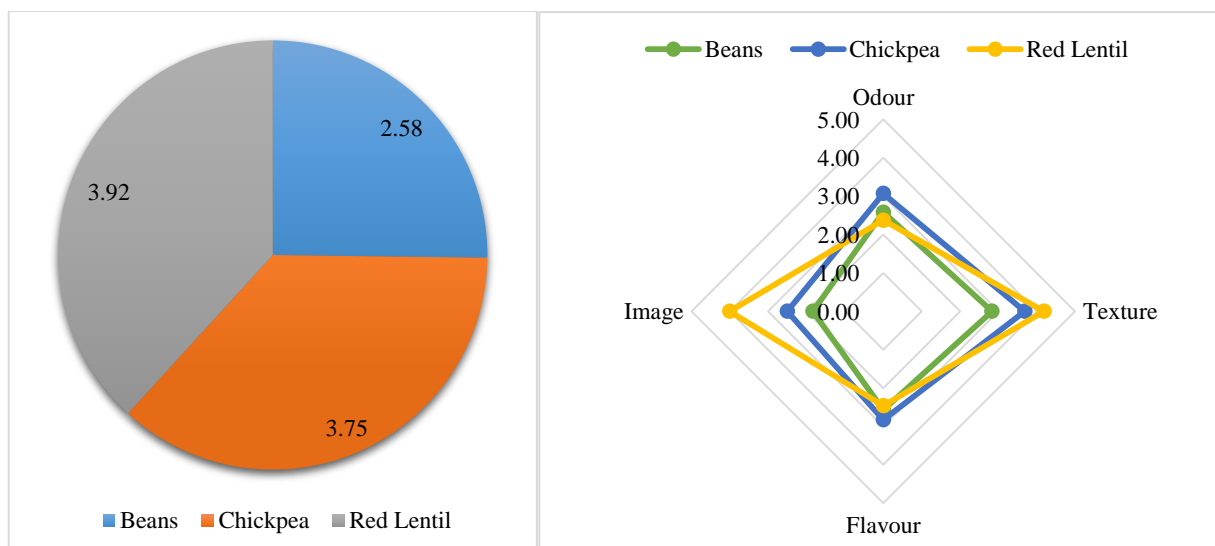


Figure 5. Sensory evaluation results for general liking level.

When Graphic 5 was examined, the average values of the appearance/image, aroma/odour, texture, and taste of bean, chickpea, and red lentil products from hummus products were as follows: bean ($X=2.58$), chickpea ($X=3.75$), and red lentil ($X=3.92$). Accordingly, in terms of aroma, texture, and taste, red lentils are more liked than others, whereas beans have received less preference. These results indicate that the average values of appearance, aroma, texture, and taste of the respective products in terms of overall liking were in an unexpected range. In this context, it can be stated that a product made using red lentils can be used as a substitute for hummus made initially with chickpeas.

The evaluations showed the perception differences between the types for each feature. Regarding aroma, the beans had a moderate value of 2.58 points. Chickpeas achieved the highest aroma score (3.07 points), whereas red lentils had the lowest aroma score (2.38 points). When examined in terms of texture, beans have the lowest texture score of 2.83 points. Chickpeas received a moderate value of 3.69 points, while red lentils had the highest texture score of 4.19. In terms of taste, chickpeas received the highest score of 2.83, whereas beans and red lentils were determined to have medium and low taste values of 2.57 and 2.46 points, respectively. Finally, red lentils stood out in the appearance feature, with the highest score of 4.00. Beans had a moderate score of 2.50, and chickpeas had the lowest appearance score of 1.83.

CONCLUSION

The use and consumption of legumes such as dry beans, chickpeas, and lentils are widespread worldwide. The kitchens where these legumes are most commonly used are in the Middle East and the Mediterranean region. Among the legume varieties, beans, chickpeas, and lentils are the most preferred. In the kitchen, many aspects are essential, such as creating innovative products, developing products, enhancing product flavors, providing alternative product features, and creating substitute products. This study aimed to compare the sensory analysis techniques of the aroma, color, flavor, and texture of products made using beans and red lentils. In this study, two products (beans and red lentils) were prepared in addition to chickpea hummus (control hummus). The products were evaluated by 11 panelists, experts in four aspects: aroma, texture, flavor (visual appearance of a product), and overall liking.

It was observed that red lentils are prepared more quickly and easily than others in the preparation time of products obtained from chickpeas, beans, and red lentils. Chickpeas stand out in unwanted odor, garlic odor, and tahini odor, whereas beans stand out in cumin odor. The red lentils had low values in terms of aroma characteristics. Therefore, hummus products made from red lentils have a neutral aroma. Red lentils stand out in spreadability, consistency, and homogeneity, whereas chickpeas stand out in lumpiness. Beans, however, were generally evaluated with lower scores. Therefore, it can be said that the texture properties of the hummus product made from red lentils are better. Products obtained from chickpeas, beans, and red lentils also exhibit unique taste characteristics. Therefore, although each product has its unique taste, red lentils stand out in terms of taste. Again, it was found that red lentils were visually superior to the other products.

Finally, the ranking of chickpea, bean, and red lentil products in terms of overall liking levels for appearance, aroma, texture, and flavor was determined as red lentils, chickpeas, and beans. The study's results revealed that red lentils can be used as a substitute for chickpeas used in hummus. It has also been determined that using red lentils provides some advantages to consumers and producers regarding time and functionality. Future studies aimed at enhancing the functionality of meals made with substitute products will contribute to the literature and menu planners. In addition, it is anticipated that the study will constitute a resource for other research in terms of product development using alternative products in kitchens.

CONFLICT of INTEREST

The authors have no financial or personal conflicts of interest that could influence the content or interpretation of the research presented in this paper. The research was conducted in an unbiased manner and the results are reported objectively. In the research, the conceptual framework and fieldwork were carried out jointly by the authors. Therefore the contribution rates of the authors are equal and there is no conflict of interest between them.

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The study was conducted in accordance with ethical principles, and we thank the participants for their voluntary participation and contributions.

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