Jomat

Journal of Multidisciplinary Academic Tourism

https://doi.org/10.31822/jomat.2026-11-1-89

2026, Vol. 11 (1): 89-99 • ISSN: 2645-9078

Research Paper

Traditional flavor the use of Hatay kömbe with gluten-free teff and amaranth flours

Ünalcan Kutal[1] ✉, Yılmaz Seçim[2], Ayşe Büşra Madenci[2]

[1]Malatya Turgut Özal University, Malatya, Türkiye

[2]Necmettin Erbakan University, Konya, Türkiye

Abstract

Hatay kömbe holds a distinctive and significant position within the rich cultural heritage of Turkish cuisine, is a traditional product passed down through generations. However, shifts in modern dietary preferences and the increasing awareness of gluten intolerance suggest that this traditional recipe can be adapted to gluten-free alternatives. In this study, teff and amaranth flours were used in the production of gluten-free Hatay kömbe, aiming to preserve the traditional flavor while making it suitable for consumption by individuals with celiac disease. The gluten-free kömbe samples were subjected to sensory analyses, in which panelists were asked to evaluate the samples in terms of color, taste, smell, softness, chewiness, and overall acceptability. As a result of the study, the sensory analysis outcomes of the gluten-free Hatay kömbe produced with teff and amaranth flours were examined. Based on the evaluations of the panelists, it was determined that the kömbe prepared with amaranth flour received the highest score in terms of overall acceptability, while the one prepared with teff flour received the lowest score. Particularly in terms of color, taste, and smell, the kömbe made with amaranth flour stood out, although differences were observed in softness and chewability. The findings reveal that gluten-free alternatives can be developed while preserving traditional flavors and achieving satisfactory sensory outcomes.

Keywords

Keywords: Kömbe, Gluten, Gastronomy

Publication Timeline

Submitted: 23-06-2025 | Revision 1: 05-10-2025 | Revision 2: 27-10-2025 | Accepted: 09-12-2025 | Published: 19-04-2026

Ethics & Conflict of Interest

Conflict of Interest
The authors declare no conflict of interest.

Ethics Committee
Malatya Turgut Özal University, Social and Human Sciences Research Ethics Committee

Approval Date
2024-12-06

Decision No
E-35841939-050-268462

Author Contributions

Author Name	Email	ORCID	Contr. %	Roles
Ünalcan Kutal (Lecturer) ✉ (corresponding)	unalcan.kutal@ozal.edu.tr	0000-0002-1268-0950	33%	Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Resources, Data Curation, Writing - Original Draft, Writing - Review & Editing, Visualization, Supervision, Project administration, Funding acquisition
Yılmaz Seçim (Assoc. Prof.)	ysecim@erbakan.edu.tr	0000-0002-9112-7650	33%	Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Resources, Data Curation, Writing - Original Draft, Writing - Review & Editing, Visualization, Supervision, Project administration, Funding acquisition
Ayşe Büşra Madenci (Assoc. Prof.)	bmadenci@erbakan.edu.tr	0000-0001-9987-6771	33%	Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Resources, Data Curation, Writing - Original Draft, Writing - Review & Editing, Visualization, Supervision, Project administration, Funding acquisition

Artificial Intelligence Usage Statement

The authors declare that the generative AI tool ChatGPT was used in a limited capacity during manuscript preparation. Specifically, it assisted in drafting descriptive text related to the presentation of sensory evaluation results reported in Figure 7 and Figure 8 of the study. The AI tool was not used to generate data, analyses, references, or scientific conclusions. All academic, ethical, and legal responsibility for the content of the manuscript remains entirely with the authors, who verified the accuracy and integrity of all materials.

1. Introduction

Turkish cuisine has hosted a captivating culinary heritage throughout history, shaped by the interaction of various cultures, its geographical location, and the rich diversity of ingredients. Hatay kömbe, reflecting the rich heritage of Turkish cuisine, has held a significant place in traditional culinary culture for generations with its unique flavor. Today, changing dietary habits, health concerns, and specific needs necessitate the development of alternatives to traditional recipes. Influenced by diverse cultures due to its geographical location, Hatay cuisine presents a distinctive gastronomic richness. Hatay Kömbe is a traditional delicacy that has been prepared in the region for many years for special occasions, weddings, and family gatherings. However, to reach a wider audience, there is a need to adapt the recipe in accordance with contemporary dietary habits. Yet, changes in modern lifestyles and eating habits have raised the question of how this traditional flavor can be adapted to meet new needs.

Wheat flour has been one of the main ingredients in traditional Hatay kömbe recipes. However, increasing awareness of gluten intolerance, celiac disease, and diverse dietary preferences has brought about a reassessment of wheat-based regional products and the exploration of alternative sources. In recent years, nutrient-rich gluten-free flours such as teff and amaranth have been increasingly used in the production of various gluten-free products. In this study, teff flour and amaranth flour were selected among the gluten-free alternatives. Teff flour stands out with its high iron, calcium, magnesium, and fiber content, and due to its low glycemic index, it is considered a suitable option for both healthy individuals and those with celiac disease. Amaranth flour, on the other hand, was preferred for its high protein content—particularly its richness in lysine—as well as its value in terms of calcium, magnesium, and phosphorus. Both flours, with their functional properties, contribute to improving the water retention capacity and structure of the dough, providing successful results in terms of taste, aroma, and texture in baked goods such as kömbe. Furthermore, their qualities as ancient grains, their nutritional diversity, and their contribution to cultural sustainability make them prominent alternatives (Gebru, at al., 2019, Zharkov, at al., 2014). However, other gluten-free options such as rice flour, corn flour, quinoa flour, chickpea flour, and almond flour are also available. These flours were chosen for their nutritional value and functional properties, and the study remains open to the use of different gluten-free flours in future applications (Demirtaş & Ray, 2022).

Teff flour is derived from teff, a traditional grain from Ethiopia. Compared to wheat flour, it has a higher content of protein, iron, and calcium (Jubete, Arendt, & Gallagher, 2009). Furthermore, its gluten-free nature makes it an excellent alternative for individuals with celiac disease or gluten intolerance (Serin & Akbulut, 2017, p. 193). Amaranth flour, on the other hand, is known for its high protein, fiber, and antioxidant content. Due to its richness in minerals such as iron, calcium, and magnesium, amaranth flour stands out as an excellent alternative to address common mineral deficiencies encountered in the diets of individuals with celiac disease (Yamani & Lannes, 2012).

This study aims to investigate the potential use of teff and amaranth flours in the production of traditional Hatay kömbe and to develop kömbe in a way that makes it consumable by individuals with gluten sensitivity. Determining the appropriate ratios of teff and amaranth flours to be used in kömbe production, evaluating their health effects in detail, and analyzing their impact on sensory characteristics constitute the main framework of the study.

2. Literature Review

Hatay Province And Culinary Culture

Hatay is a unique region located in southern Turkey, rich in history and cultural heritage. This area, with its fertile lands, Mediterranean climate, and historical depth, hosts not only natural beauties but also a rich culinary culture. Hatay cuisine offers a mosaic of flavors shaped by its geographical, historical, religious, and cultural diversity (Kaypak & Uçar, 2019). Hatay is a region rich in geographical and ecological diversity; its location and climate have enhanced the agricultural and livestock potential, enriching its culinary culture. Bordering the Mediterranean Sea, Hatay is home to various seafood as well as numerous fresh vegetables and fruits. Local products ensure that fresh and organic flavors reach the tables. Historically, Hatay has been influenced by many civilizations throughout its existence. From the Sumerians to the Romans, Byzantines, Seljuks, and Ottoman Empires, its historical background has shaped the richness and diversity of Hatay cuisine (Ejder, 2021). This historical heritage forms the unique character of Hatay's culinary tradition.

Hatay is also notable for its religious and cultural diversity, being a mosaic where different religious groups live together. The traces of Islam, Christianity, and other religions are reflected in its culinary culture. This diversity not only results in dishes unique to different beliefs but also contributes to the formation of a shared culinary culture, enriching Hatay's gastronomy. Hatay cuisine is famous for its rich mezes, various spices, and carefully prepared main dishes. The use of local ingredients is one of the most important features distinguishing Hatay cuisine from others. Mezes such as kısır,

muhammara, and hummus are traditional flavors commonly found on Hatay tables. Regional products frequently used in dishes, like pomegranate molasses and pomegranate syrup, form the foundation of the culinary culture (Onur, 2021).

Tourists visiting Hatay within the scope of gastronomy tourism have the opportunity to discover the region's unique flavors. Hatay cuisine boasts 25 geographically registered products, some of which include Kömbe, Antakya Künefe, Antakya Paper Kebab, and Altınözü olive oil (Akmeşe, 2024). A geographical indication is a trademark registration that shows a product is produced, processed, or created in a specific geographical region. These indications emphasize that products arise influenced by the unique climate, soil, and traditional production methods of a specific area. Geographical indications not only signify the quality of a product but also reflect the culture, history, and traditions of its region. Geographically indicated products possess characteristics and qualities unique to a specific geographical area. These features usually result from the climate, soil structure, and traditional production methods of that region. This means the products can only be cultivated or produced in that particular region and carry its cultural heritage. Geographical indications not only contribute to the economic development of a particular region but also provide producers in that region with a fair competitive advantage (Şahin, 2012). These indications give consumers assurance regarding the quality and authenticity of products from a specific geographical region, enabling them to be confident about the origin of the products. Geographical indications also often encourage cooperation among producers in a specific region. This cooperation helps protect traditional production methods and contributes to the sustainability of the regional economy. At the same time, it supports agricultural producers and artisans, strengthening local communities (Gökovalı, 2007).

Hatay Kömbe

Hatay Kömbe is a type of sweet cookie that stands out as an important element of Turkish cuisine. This unique flavor, particularly known for its distinctive production method and original aroma in the Hatay region, reflects a deep-rooted culture, craftsmanship, and refined taste. The dough of Hatay Kömbe is prepared using a special formula that skillfully combines delicacy and flavor. One of the key elements that creates the unique taste of Hatay Kömbe is its special spice blend. Cinnamon, allspice, clove, nutmeg, ginger, mahlab, and mastic gum not only impart an intense flavor to the kömbe but also contribute to its characteristic brown color (Turkish Patent and Trademark Office, 2022).

Hatay Kömbe is produced in three different varieties: plain, date-filled, and walnut-filled. The plain kömbe is in the shape of a round disc with serrated edges and is particularly crispy. The date-filled kömbe has a domed, oval shape and a slightly softer texture thanks to the dates. The walnut-filled kömbe is shaped like a semicircular disk. The preparation of Hatay Kömbe represents a skillful blend of traditional craftsmanship and modern taste. The kömbe is shaped using special wooden molds and baked in ovens. It is not only a sweet cookie but also a part of Hatay's rich cultural heritage (Turkish Patent and Trademark Office, 2022). Table 1 shows the ingredients and their quantities used in the preparation of Hatay Kömbe.

Table 1. Ingredients and Quantities of Hatay Kömbe

Ingredients	Quantity
Flour	1–1.5 kg
Cream / Butter / Margarine	350–500 g
Vegetable Oil	150–250 ml
Milk	100–150 ml
Water	100–150 ml
White Sugar	200–500 g
Kömbe Spice Mix	1–1.5 tablespoons
Baking Powder	0.75–1 tablespoon
Date Paste	10 g
Crushed Walnuts	10 g
Sesame Seeds	A sufficient amount for sprinkling on top

Source: Turkish Patent and Trademark Office, 2022

Table 2. Spices Used in Hatay Kömbe and Their Quantities

Ingredients	Quantity
Ground Cinnamon	200–250 g
Allspice	200–250 g
Clove	200–250 g
Nutmeg	50–70 g
Ginger	50–70 g
Mahlab	50–70 g
Mastic Gum	40–60 g

Source: Turkish Patent and Trademark Office, 2022

In the preparation of Hatay Kömbe, cream or butter/margarine, vegetable oil, milk, water, granulated sugar, baking powder, and the kömbe spice mix are added to a bowl and mixed until a homogeneous mixture is obtained. Flour is

gradually added and kneaded until a soft dough that does not stick to the hands is achieved. For shaping, pieces about the size of a large walnut are taken from the rested dough and rolled into balls. Each piece is slightly flattened, filled with date paste or walnuts, and then sealed. Traditional wooden molds are used to shape the kömbes. The shaped kömbes are baked in a preheated oven at 160–180°C for about 25–30 minutes, until their tops are golden brown (Özdemir & Güngör, 2016).

Figure 1. Hatay Köbe

Source: Turkish Patent and Trademark Office, 2022

Gluten-Free Nutrition: Gluten Free Flour Options

Celiac disease, which has become an increasingly common health issue today, significantly affects individuals' daily dietary habits and preferences. This condition arises due to the body's hypersensitivity to cereal products containing a protein called gluten. For individuals with celiac disease, the consumption of gluten can lead to digestive system problems and other health complications. Therefore, a gluten-free diet is a vital requirement for these individuals to maintain their health and quality of life. Transitioning to a gluten-free diet is a significant turning point for those diagnosed with celiac disease. The first step involves learning to avoid gluten-containing foods and accurately reading food labels. Individuals with celiac disease must be particularly cautious not only in their daily routines but also when choosing what to eat. Avoiding gluten-containing foods can be challenging when dining out or attending social events. However, an increasing number of restaurants and markets now offer specially prepared gluten-free products to accommodate this need (Çukurova Development Agency, 2020, Simón, at al, 2023, Suárez-González, at al, 2021). Gluten-free flour varieties allow individuals with celiac disease to diversify their recipes. Among these flours are healthy alternatives such as rice flour, coconut flour, almond flour, and quinoa flour. These flours may result in different textures and flavors compared to traditional recipes when preparing bread, cookies, cakes, and other baked goods in a gluten-free diet (Yıldırım, 2020). Some types of gluten-free flours and their uses are listed in Table 3.

Table 3. Types of Flour, Their Uses, and Characteristics

Flour Type	Usage	Characteristics
Rice Flour	Ideal for bread, cakes, cookies, and sauces	Gluten-free and a light type of flour
Coconut Flour	High in fiber with a mild flavor profile	Used in gluten-free bread, desserts, and coconut-containing recipes
Almond Flour	High in protein and healthy fats	Commonly preferred for cakes, cookies, tarts, and gluten-free bread
Corn Flour	Made by grinding corn and gluten-free	Used for tortillas, cornbread, and fried chicken coating
Quinoa Flour	Contains complete protein and is nutritious	Used in gluten-free bread, cookies, and breakfast cereals
Flaxseed Flour	High in fiber and omega-3 fatty acids	Used in smoothies, cakes, cookies, and breads
Whole Grain Rice Flour	Contains the entire rice grain, rich in fiber and nutrients	Used in whole grain bread, cakes, and other baked goods
Tapioca Flour	Good binder and provides elasticity	Used in sauces, soup thickeners, desserts, and bread making
Potato Flour	High starch content	Preferred for gluten-free bread, cookies, and pastries
Buckwheat Flour	Gluten-free and whole grain	Used for crepes, galettes, bread, and pasta

Source:(Mutlu, Tontul, Candal, & Erbaş, 2019)

In recent years, teff and amaranth flours have also been frequently used in the production of gluten-free products. Teff flour is primarily a source of carbohydrates, which are mostly complex in structure and help regulate energy levels by slowing digestion. Its protein content is higher compared to other grains; combined with its rich amino acid profile, teff flour becomes an important nutritional source, especially for vegetarian and vegan diets. Additionally, teff flour is rich in fiber, which aids in regulating the digestive system, improving digestive health, and increasing the feeling of fullness. Teff contains essential minerals such as iron, calcium, magnesium, and phosphorus; among these, iron is critically important for blood health. Teff flour also provides B vitamins (especially B6 and B9), vitamin E, and other vitamins, offering a nutrient-dense option (Shumay & Katleen, 2017).

Amaranth flour has a higher protein content compared to many other grains and is particularly rich in essential amino acids. It is also rich in carbohydrates, mostly complex carbohydrates, which help maintain balanced blood sugar levels. Its high fiber content supports digestive health, regulates bowel movements, and enhances satiety. Amaranth contains

healthy fats, especially omega-6 and omega-3 fatty acids. It is also a good source of important minerals such as iron, calcium, magnesium, phosphorus, and potassium, as well as vitamins B1 (thiamine), B2 (riboflavin), B3 (niacin), B6 (pyridoxine), and vitamin C (Alvarez-Jubete et al., 2010; Yamani & Lannes, 2012).

3. Methodology

Purpose and Model of the Study

This study aimed to produce a gluten-free version of Hatay kömbe by using alternative gluten-free flours instead of wheat flour. In the control sample, rice flour and corn starch were used, and preliminary trials indicated that the optimal product quality was achieved at a 50% substitution rate. Accordingly, four formulations were prepared: Control (K: 50% rice flour + 50% corn starch), AU (50% amaranth flour + 25% rice flour + 25% corn starch), TU (50% teff flour + 25% rice flour + 25% corn starch), and AU+TU (25% amaranth flour + 25% teff flour + 25% rice flour + 25% corn starch). The remaining ingredients were standardized for 1 kg of dough based on the table values as follows: 1–1.5 kg flour, 350–500 g cream/butter/margarine, 150–250 mL vegetable oil, 100–150 mL milk, 100–150 mL water, 200–500 g white sugar, 1–1.5 tablespoons kömbe spice mix, 0.75–1 tablespoon baking powder, 10 g date paste, 10 g crushed walnuts, and a sufficient amount of sesame seeds for topping.

Production of Gluten-Free Hatay Kömbe

Within the scope of the study, a gluten-free control sample was produced using rice flour and corn starch. Based on preliminary trials, it was decided to include amaranth and teff flours at a 50% ratio in the formulation. Accordingly, different kömbe formulations were prepared containing 50% amaranth flour, 50% teff flour, and a combination of 25% amaranth + 25% teff flour. The experimental design for the production of the samples is shown in Table 4, and images of the samples are presented below.

Sensory Analysis

Sensory evaluation was conducted with 12 volunteer students from the Culinary Arts associate degree program at Malatya Turgut Özal University. Prior to the analysis, panelists received a 30-minute training session that included the purpose of the study, instructions on the use of the 5-point hedonic scale (1 = very poor, 5 = excellent), sensory parameters to be evaluated (color, taste, aroma, softness, chewiness, and overall acceptance), tasting sequence, palate-cleansing methods (water and bread), and the principles of impartial evaluation. Additionally, a 15-minute practical pre-test was conducted to ensure consistency in scale usage among panelists. Sensory evaluations were carried out individually under controlled conditions.

Ethical Approval

Ethical approval for the data collection process was obtained from the Social and Human Sciences Research Ethics Committee of Malatya Turgut Özal University with the decision/number E-35841939-050-268462, dated 06.12.2024.

Table 4. Experimental Design for Kömbe Sample Production

Ingredient	C (Control)	AF (Amaranth Flour)	TF (Teff Flour)	AF + TF (Amaranth + Teff)
Rice Flour	50%	25%	25%	25%
Corn Starch	50%	25%	25%	25%
Amaranth Flour		50%		25%
Teff Flour			50%	25%

Source: Authors elaboration

Figure 2. Gluten-Free Control
Source: Authors elaboration

Figure 3. 50% Amaranth Flour
Source: Authors elaboration

Figure 4. 50% Teff Flour
Source: Authors elaboration

Figure 5. 25% Amaranth Flour and 25% Teff Flour
Source: Authors elaboration

Data Analysis

The sensory analysis was conducted with 12 participants in two replicates, and the data were analyzed using the SPSS 15.0 statistical software. The comparison of sensory parameters among the Hatay kömbe samples was performed using Duncan's multiple range test.

4. Results

The results of the variance analysis (ANOVA) for the sensory evaluation values of the control Hatay kömbe sample prepared with rice flour and corn starch, as well as the samples produced using amaranth flour and teff flour, are presented in Table 5. The Duncan's Multiple Range Test results for the sensory evaluation parameters are shown in Table 6.

Table 5. ANOVA Results of Sensory Evaluation Scores for Hatay Kömbe Samples

Parameter	Source of Variation	Sum of Squares	df	Mean Square	F	Sig.
Color	Between Groups	0.794	3	0.265	16.282	0.010
	Within Groups	0.065	4	0.016		
	Total	0.859	7			
Taste	Between Groups	2.140	3	0.715	6.794	0.048
	Within Groups	0.420	4	0.105		
	Total	2.560	7			
Odor	Between Groups	2.114	3	0.705	7.516	0.040
	Within Groups	0.375	4	0.094		
	Total	2.489	7			
Chewiness	Between Groups	0.974	3	0.325	9.617	0.027
	Within Groups	0.135	4	0.034		
	Total	1.109	7			
Softness	Between Groups	1.670	3	0.557	6.748	0.048
	Within Groups	0.330	4	0.083		
	Total	2.000	7			
Overall Acceptance	Between Groups	1.704	3	0.568	9.667	0.026
	Within Groups	0.235	4	0.059		
	Total	**1.939**	**7**			

Source: Authors elaboration

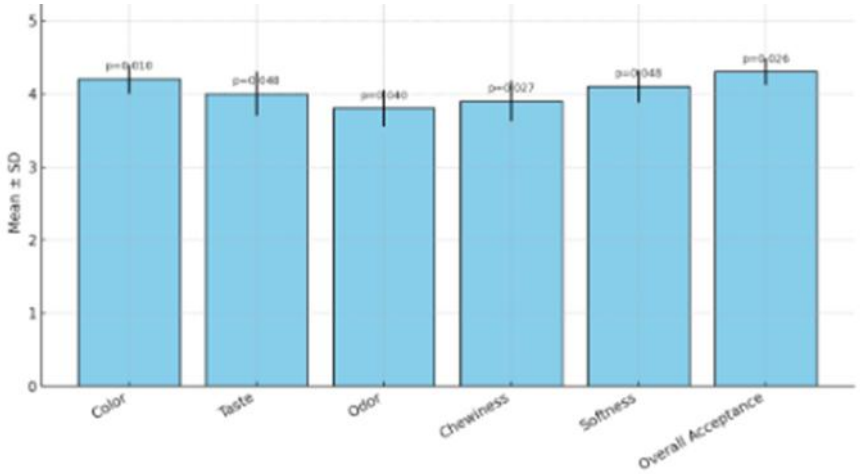

Figure 6. Sensory evaluation scores of Hatay Kömbe samples (mean ± standard deviation).

Source: Authors elaboration

The sensory evaluation results of Hatay kömbe samples are presented in Table 5 and Figure 6. According to the ANOVA analysis, statistically significant differences ($p<0.05$) were identified among the groups for all parameters (color, taste, odor, chewiness, softness, and overall acceptance).

Color exhibited the highest F value ($F=16.282$, $p=0.010$), indicating that the visual properties of the kömbe samples were distinctly perceived by the panelists. Significant differences were also observed in taste ($p=0.048$) and odor ($p=0.040$), suggesting that the sensory profiles of the products could be influenced by formulation. Similarly, chewiness ($p=0.027$) and softness ($p=0.048$) results demonstrated that the structural properties of the kömbe play an important role in consumer preference. The overall acceptance parameter ($F=9.667$, $p=0.026$) revealed that differences emerged in the holistic evaluation of the products by consumers.

These results indicate that the sensory attributes of Hatay kömbe samples can be influenced by recipe variations, production conditions, or the raw materials used. The high significance observed particularly in color and overall acceptance highlights the importance of considering both visual and holistic appreciation criteria in product development processes. The findings provide valuable insights for the industrial standardization of traditional products and their development in line with consumer expectations.

Table 6. Duncan's Multiple Range Test Results for the Sensory Evaluation Parameters of Hatay Kömbe Samples

Sample	Color	Taste	Odor	Softness	Chewiness	Overall Acceptance
C	3.90^{b}	3.35^{b}	3.30^{b}	4.10^{a}	3.60^{a}	3.55^{b}
AF	4.50^{a}	4.35^{a}	4.25^{a}	3.65^{ab}	3.85^{a}	4.50^{a}
TF	3.80^{b}	2.95^{b}	3.25^{b}	3.10^{b}	3.05^{b}	3.25^{b}
AF+TF	4.45^{a}	3.75^{ab}	4.35^{a}	2.95^{b}	3.05^{b}	3.75^{b}

Note: Superscript letters (a, b) indicate statistically significant differences ($p<0.05$) between the mean values within each column based on Duncan's multiple range test.
Source: Authors elaboration

When the samples were evaluated in terms of color, the highest score was observed in the sample prepared with amaranth flour. From a statistical perspective, the sample prepared with a mixture of amaranth and teff flours was also liked as much as the amaranth-only sample. Regarding taste, the most favored sample was again the one prepared with amaranth flour, similar to the color parameter. The addition of amaranth flour to the formulation also had a positive effect on aroma. While the odor score of the sample containing only amaranth flour was 4.25, the sample prepared with both amaranth and teff flours scored 4.35; statistically, there was no significant difference between these two samples. The control sample received lower scores for odor, as was the case for color and taste.

When examining the softness of the samples, it was found that the inclusion of different flours in the formulation caused a decrease in softness scores, with the highest value observed in the control sample. In terms of chewiness and overall acceptance, the sample made with amaranth flour received the highest appreciation among the gluten-free kömbe samples. The sample with amaranth flour received an overall acceptance score of 4.50, followed by the amaranth-teff flour mixture sample with 3.75, and lastly the teff flour sample with a score of 3.25. The differences between the samples were found to be statistically significant in terms of both chewiness and overall acceptance.

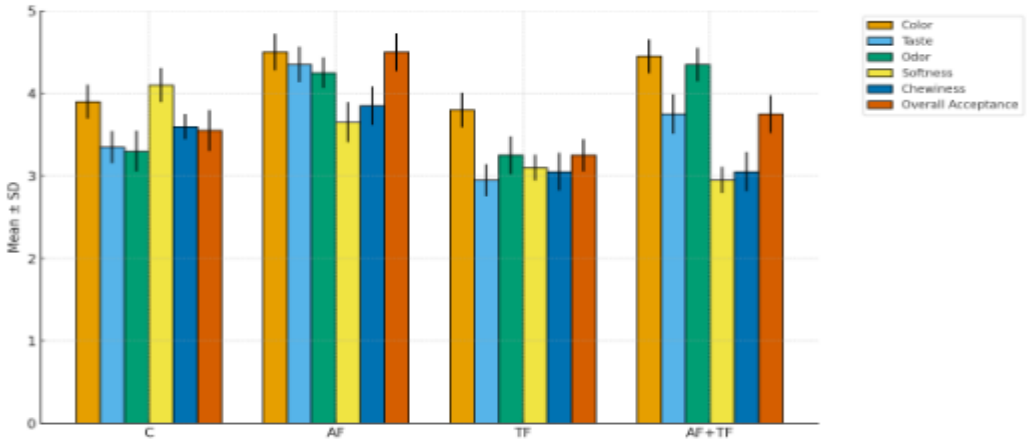

Figure 7. Sensory evaluation parameters of Hatay Kömbe samples (mean ± standard deviation).

Different letters within each parameter indicate significant differences ($p < 0.05$) according to Duncan's multiple range test.
Source: Authors elaboration

The results of Duncan's multiple range test for the sensory evaluation parameters of Hatay kömbe samples are presented in Table 6 and Figure 7. According to the findings, AF and AF+TF samples achieved the highest scores in terms of color, while C and TF samples received lower scores. In terms of taste, the AF sample had the highest level of acceptance, whereas the TF sample showed the lowest mean value. For odor, AF and AF+TF samples stood out, while C and TF samples were rated lower. Regarding softness, the C sample obtained the highest value, whereas the AF+TF sample had the lowest score. In terms of chewiness, C and AF samples were rated higher, while TF and AF+TF samples showed lower scores. For overall acceptance, the AF sample had the highest mean score, whereas the TF sample was identified as the least accepted group. These results indicate that the AF formulation was the most favored by panelists in terms of sensory attributes, while the TF formulation was the least preferred.

Table 8. Summary of the ANOVA Results for the Sensory Evaluation Scores of Hatay Kömbe Samples

Parameter	F Value	p Value	Statistical Significance ($p < 0.05$)	Significance Among Groups
Color	16.282	0.010	Significant	AF and ATF are different from C and TF.
Taste	6.794	0.048	Significant	AF has the highest score, TF the lowest.
Odor	7.516	0.040	Significant	AF and ATF are different from C and TF.
Chewiness	9.617	0.027	Significant	AF has the highest score, TF and ATF have lower scores.
Softness	6.748	0.048	Significant	AF has the highest score, TF the lowest.
Overall Acceptance	9.667	0.026	Significant	AF has the highest score, TF the lowest.

Notes: C: Control (Rice flour + Corn starch), AF: 50% Amaranth Flour, TF: 50% Teff Flour, ATF (AF+TF): 25% Amaranth Flour+ 25% Teff Flour
Source: Authors elaboration

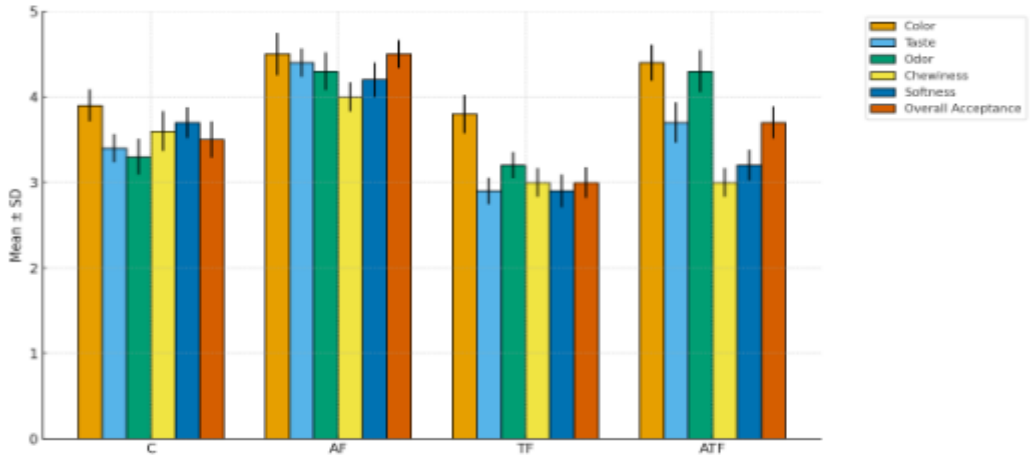

Figure 8. Sensory evaluation scores of Hatay kömbe samples (mean ± standard deviation).

Statistical differences among groups are summarized in Table 8 ($p < 0.05$).
Source: Authors elaboration

According to the findings, the type of flour used in Hatay kömbe samples created significant differences in sensory attributes ($p<0.05$). In particular, the addition of amaranth flour (AF) resulted in the highest scores for color, taste, odor, softness, and overall acceptance. In contrast, the samples prepared with teff flour (TF) received the lowest scores in these attributes. The amaranth and teff flour blend (AF+TF) achieved higher scores compared to TF alone but did not reach the performance of the AF sample. These results indicate that amaranth flour makes a substantial contribution to improving the sensory quality of Hatay kömbe, while the positive effect of teff flour remains limited.

5. Results and Recommendations

In this study, Hatay kömbesi prepared with teff and amaranth flours presents a healthy and delicious alternative as a modern interpretation of a traditional flavor. With the increasing diversity in dietary preferences and the prevalence of gluten intolerance, interest in recipes made with alternative flours has significantly grown. In this context, kömbes prepared with teff and amaranth flours serve as a bridge between individuals who follow a gluten-free diet and those seeking traditional flavors.

In the study, in addition to the original recipe of the geographically indicated Hatay kömbesi, four different kömbe variants were prepared using rice flour, corn starch, teff flour, and amaranth flour. During the preparation of the products, it was observed that formulations containing rice flour, corn starch, and amaranth flour absorbed more water. The prepared products were evaluated in terms of overall acceptance, color, taste, aroma, softness, and chewiness.

Analyses revealed that, considering all sensory tests, the most liked product was the kömbesi made with amaranth flour, receiving an average score of 4.50, while the least liked product was the one prepared with teff flour, scoring 3.25. Looking at the average values; the amaranth flour kömbesi received the highest scores for color (4.50), taste (4.35), and chewiness (3.85); the kömbesi prepared with a mixture of amaranth and teff flour scored the highest for aroma (4.35); and the control sample received the highest average score for softness (4.10).

The findings of this study indicate that preparing Hatay kömbesi with different types of flour creates noticeable differences in sensory properties. In particular, samples produced with amaranth flour (AF) achieved the highest scores in terms of color, taste, aroma, chewiness, and overall acceptance, suggesting that amaranth flour can serve as a sensory quality-enhancing ingredient in kömbesi formulations. Similarly, Baltakesmez and Mısır (2025) reported increased aroma and overall acceptance in kömbesi cookies prepared with Kavılca flour, supporting the idea that alternative flours can enhance consumer preference for traditional products. Furthermore, in a study by Topaloğlu Günan et al. (2025), gluten-free kömbes prepared with sprouted flours showed significant differences in color and overall acceptance compared to the control group, with chickpea flour-based formulations being particularly preferred. The high acceptance of amaranth flour in this study similarly demonstrates a positive relationship between the functional properties provided by alternative flours and consumer preference.

On the other hand, the lower scores observed in kömbes prepared with teff flour (TF) suggest that low-gluten flours may negatively affect the product's texture and structural properties. This finding parallels the increased hardness observed in Kavılca flour by Baltakesmez and Mısır (2025). Indeed, when gluten's contribution to structural properties is limited, products tend to have a harder, denser, or chewier texture. Additionally, as emphasized by Topaloğlu Günan et al. (2025), alternative flours tend to darken product color, which is attributed to Maillard reactions and the contribution of phenolic compounds. This aligns directly with the increased color observed in kömbes containing amaranth flour in this study. Therefore, when the current findings are evaluated alongside the literature, it can be stated that amaranth flour may enhance the sensory quality of Hatay kömbesi, whereas teff flour provides limited structural and sensory benefits.

Aloğlu (2021), in the study titled "Use of Teff (Eragrostis tef) Flour in Bread Production and the Effect of Transglutaminase Enzyme," aimed to produce a functional bread by adding teff flour, which is rich in nutrients and essential amino acids, to wheat flour. To prevent volume reduction caused by teff's gluten-free nature, the transglutaminase (TG) enzyme was used. However, TG cross-linked flour proteins, restricting dough expansion, and instead of increasing, decreased bread volume. TG did not demonstrate the expected positive effect in both wheat flour and teff–wheat flour mixtures. Nevertheless, breads containing teff flour were darker than those made with wheat flour, but received similar scores in sensory evaluation.

In Alp's (2022) study, "Production of Cakes Using Roasted Amaranth Flour and Stevia," different ratios of raw and roasted amaranth flour were used instead of wheat flour to produce gluten-free, functional cakes, and the effects of replacing sugar with stevia were investigated. Amaranth flour improved the nutritional value of the cakes but negatively affected volume and baking properties. Stevia partially mitigated these adverse effects. Texture analysis showed improvement in all properties except external and internal stickiness, while sensory evaluation gave the highest score to the control group. The findings suggest that amaranth flour can be used in gluten-free cake formulations, and stevia provides a low-calorie alternative.

In Türk's (2022) study, "Gluten-Free Cracker Production and Storage Under Modified Atmosphere Conditions," the effects of amaranth flour and modified atmosphere packaging (MAP) were investigated in gluten-free crackers. Compared to the control group produced with potato flour and starch, crackers made with amaranth flour had significantly higher fat, protein, dietary fiber, amino acid, and mineral contents ($p<0.05$). Additionally, amaranth-based crackers were darker, more porous, and less hard. In sensory analysis, they scored higher than the control in taste, crispiness, and overall acceptance.

Recommendations based on this study:

- Investigating the effects of other frequently used gluten-free grains and seeds (e.g., quinoa, rice, oats, chia seeds, etc.) on kömbe can offer a broader perspective.
- Studies could focus on enhancing the nutritional value of kömbe by incorporating nutrient-dense ingredients such as nuts, seeds, or dried fruits, creating healthier alternatives.
- To preserve traditional flavors while meeting modern dietary needs, it is essential to retain local ingredients and enrich them with health-promoting components.
- Consumer expectations, preferences, and feedback play a crucial role in product development. Surveys, taste tests, and feedback collection efforts can guide product design.
- Considering local culture, traditions, and eating habits during product development can enhance the social and cultural acceptance of the product, facilitating better interaction with the target audience.
- Supporting the innovation process in gluten-free product development may lead to the creation of new and creative recipes, contributing to greater variety and appeal in gluten-free offerings.
- Using organic, sustainable, and healthy ingredients can improve both the health benefits and environmental impact of the product. Focusing on eco-friendly materials is a valuable strategy in this context.
- Proper marketing and promotion of the product should effectively communicate its health benefits, traditional and local value, and unique features to consumers.

References

Akmeşe, K. A. (2024). Geographically indicated districts in gastronomy tourism: The case of Hatay. Social Sciences Studies Journal (SSSJournal), 10(3), 462–476.

Aloğlu, H. (2021). Use of teff (*Eragrostis tef*) flour in bread production and the effect of transglutaminase enzyme on production. *Kırklareli University Journal of Engineering and Natural Sciences, 7*(1), 107–121. https://doi.org/10.34186/klujes.947592

Alp, O. (2022). Use of roasted amaranth flour and stevia in cake production (Doctoral dissertation). Harran University, Şanlıurfa.

Alvarez-Jubete, L., Arendt, E., & Gallagher, E. (2010). Nutritive value and chemical composition of pseudocereals as gluten-free ingredients. *International Journal of Food Sciences and Nutrition, 60*(4), 240–257. https://doi.org/10.1080/09637480902950597

Büyükzeren, Ş. (2019). Investigation of the possibility of using some legume flours in the gluten-free production of Konya tandır bread (Master's thesis). Necmettin Erbakan University, Konya.

Çukurova Kalkınma Ajansı. (2020). Adana gastronomy strategy. Ministry of Industry and Technology, https://www.cka.org.tr/uploads/document_center_v/adana-gastronomi-stratejisi-386.pdf?utm_source

Demirtaş, N., & Ray, C. U. (2022). Use of local dishes of Hatay cuisine in restaurant menus with tourism enterprise certificates: The case of Antakya. *Turan: Center for Strategic Studies, 14*(53), 115–125. https://doi.org/10.15189/1308-8041

Ejder, M. H. (2021). *Hatay cuisine in Turkish gastronomy culture and the use of salted yogurt in dishes* (Master's thesis, Başkent University, Institute of Social Sciences).Gökovalı, U. (2007). Geographical indications and economic impacts: The case of Turkey. *Journal of Economics and Administrative Sciences.*

Jubete, A., Arendt, K., & Gallagher, E. (2009). Nutritive value and chemical composition of pseudocereals as gluten-free ingredients. *International Journal of Food Sciences and Nutrition.* https://doi.org/10.1080/09637480902950597

Kaypak, Ş., & Uçar, A. (2019). A perspective on the food culture of Antakya city. *Journal of Academic Value Studies*, 190–202.

Mutlu, C., Tontul, S. A., Candal, C., & Erbaş, M. (2019). Use of some cereal-like products in gluten-free cake production. *Food: The Journal of Food,* 770–780. https://doi.org/10.15237/gida.GD19073

Onur, N. (2021). Gastronomy tourism and Hatay flavor route. *Journal of Tourism Economics and Business Research.*

Özdemir, F., & Güngör, B. (2016). Traditional Hatay dishes as a cultural value at risk of being forgotten and suggestions for preserving this cultural heritage. *Journal of Tourism and Gastronomy Studies*, 190–199. DOI: 10.21325/jotags.2016.30

Serin, Y., & Akbulut, G. (2017). Celiac disease and current approaches to gluten-free diet therapy. *Turkish Intensive Care Association Journal, 2*(3), 192–200. doi: 10.5336/healthsci.2016-53640

Shumay, H., & Katleen, R. (2017). The rising ancient cereal: What do we know about its nutritional and health benefits? *Plant Foods for Human Nutrition*, 335–344.

Şahin, K. (2012). Hatay culinary culture and dishes. Hatay Governorship

Türk, A. (2022). Gluten-free cracker production and modified atmosphere packaging (MAP) storage (Master's thesis). Pamukkale University, Denizli.

Turkish Patent and Trademark Office, (2022). Geographical indication: Hatay kömbesi. Hatay Tradesmen and Craftsmen Chambers Union.

Yamani, V., & Lannes, S. (2012). Applications of quinoa (*Chenopodium quinoa Willd*.) and amaranth (*Amaranthus spp*.) and their influence on the nutritional value of cereal-based foods. *Food and Public Health,* 265–275.

Yıldırım, E. (2020). Çölyak Hastalığı ve Glutensiz Besleme. *Genel Sağlık Bilimleri Dergisi,* 2(3), 175-187. https://izlik.org/JA42AE73ND