A TURKISH FERMENTED CEREAL-BASED FOOD: TARHANA

Abstract

Fermented foods are globally manufactured by several methodologies employing a range of basic ingredients and microorganisms. Fermentation further contributes to an overall enhancement in the longevity, consistency, flavor, and fragrance of the end product. The production of several indigenous or traditional fermented foods and drinks continues to be a domestic craft in contemporary times. These items are manufactured inside residential households, rural communities, and small-scale industrial settings. Cereal grains are well recognized as a significant dietary source of proteins, carbs, vitamins, minerals, and fiber, serving as a crucial nutritional resource for individuals around the globe. Fermented foods derived from widely consumed grain varieties, including rice, wheat, maize, and sorghum, have gained significant recognition across many regions globally. Certain substances are used as pigments, flavor enhancers, liquid consumables, and options for breakfast or light meals, while a select handful serve as primary dietary staples. Tarhana is a culturally significant fermented food product that has a prominent place in the culinary traditions of Anatolia, the Middle East, and the Balkans. Its consumption plays a vital role in the nutritional practices of Turkish civilization. Tarhana, also known as Trahanas, is a traditional food that is created by the combination of wheat flour, sheep's milk yogurt, yeast, and a diverse range of cooked vegetables and spices such as tomatoes, onions, salt, mint, and paprika. This mixture is then left to ferment for a period of 1 to 7 days. The fermented substance undergoes a drying process and is then preserved in the shape of biscuits. Tarhana has emerged as a customary regional cuisine. Tarhana is a significant culinary

Authors

Prof. Dr. Seval Sevgi Kırdar
Department of Food Processing,
Burdur Mehmet Akif Ersoy University,
Burdur Food Agriculture and Livestock Vocational School,
Burdur, Türkiye.
skirdar@mehmetakif.edu.tr

element within traditional Turkish cuisine. It is a fermented grain-based product that is created by the combination of yogurt, yeast, a variety of vegetables, and spices. The mixture is then left to undergo fermentation, followed by a process of drying and grinding. The primary objective of this research is to provide people with information about the extensive use of tarhana in relation to human health. Additionally, the study intends to explore the many varieties of tarhana and provide a valuable contribution to the existing literature on this subject matter.

Keywords: Turkish Culture, Traditional product, Fermented Cereal Turkish Food, Tarhana.

I. INTRODUCTION

Fermented foods and beverages have a crucial role in dietary culture. Each group around the globe has a unique culinary or dietary culture that serves as a representation of their origin and sociocultural characteristics. The culinary traditions of many societies exhibit unique and distinctive characteristics that may be attributed to various circumstances, including geographical location, environmental conditions, individual dietary preferences, and the accessibility of specific plant or animal resources. Traditional fermented foods are defined as food products that have been used for an extensive period, surpassing the existence of recorded historical documentation. These foods have significant importance in promoting the overall health and welfare of many populations throughout various regions, particularly those residing in the Near East, Southeast Asia, India, the Far East, and Africa [1].

Eating habits and the production and consumption of food are seen as fundamental components that shape the cultural fabric of societies. These behaviors, referred to as food culture or culinary culture, manifest as items that are created during winter preparations or as products that are made using various combinations and typically possess distinct characteristics. The vast range of possibilities in Anatolia has played a significant role in defining the emerging goods, mostly due to the prominence of agriculture and cattle as the major sources of production and sustenance [2].

Various fermented items derived from grains have been developed throughout human nutrition history. The products generated via fermentation exhibit a diverse range of features and find use in several domains. Several instances may be provided, as follows: Leavened baked goods derived from dough leavened with sourdough and yeast, African gruels fermented with lactic acid bacteria (LAB), such as ogi made from cereals or fufu made from cassava, alcoholic beverages including beer, sake, and spirits, acid-fermented drinks such as boza (Turkey), berliner weiβe (Germany), kwass (Russia), or mahewu (South Africa), and food products fermented with LAB and yeast, such as tarhana (Turkey) [3,4]. The digestibility and nutritional value of tarhana, which is a traditional Turkish food, increase with fermentation. The taste, smell, and aroma desired by the consumer are formed, and besides this, tarhana gains the feature of being a product that can be preserved for a long time without spoiling (Tamer et al., 2007).[5] Tarhana has an acidic, sour taste and is an important source of protein and vitamins. It can be defined as a functional food due to the physiological elements it contains, such as probiotics, prebiotics, and indigestible carbohydrates [6].

Traditional fermented foods prepared from the most common types of cereals (such as rice, wheat, corn, or sorghum) are well known in many parts of the world. Some are used as colorants, spices, beverages, and breakfast or light meal foods, while a few of them are used as main foods in the diet. The preservation of "traditional foods" up to the present day has significant value as it provides valuable insights on the identity, customs, and ways of life of a particular community. The Turks, originating from Central Asia and subsequently migrating to various continents, have effectively preserved numerous traditional products by assimilating the diverse cultures they encountered and settled among. One notable example is the Tarhana culture. Tarhana is one of the ways of storing yogurt prepared for the winter season in our country [7,8]. Tarhana, which takes its place among local Turkish soups, can be counted among the indispensables of Turkish cuisine due to its high nutritional content and long shelf life, as well as being the ancestor of today's instant soups [2]. Although the basic

production method is the same in almost every country and region, tarhana, which does not have a standard production method, can be produced in different compositions by adding different foodstuffs depending on the tradition, customs, nutritional habits, and sometimes the variety of grains or vegetables [9].

Although the basic production of tarhana, which does not have a specific production method, is the same in most regions, it can also be consumed in different compositions by adding different foods, depending on the traditions, customs, and nutritional habits, and sometimes the variety of products such as legumes and vegetables [10,11]. Although the basic production stages are similar to each other, there are different types of tarhana production according to the region within the borders of Turkey [12].

Tarhana, which has an important place in the nutrition of society, especially in the nutrition of children and the elderly in Turkey, is still widely produced at home due to its economic and easy nature. However, changes in lifestyle due to urbanization have increased interest in tarhana because it is an easily prepared food [13].

Tarhana is a staple meal in the Turkish diet, renowned for its nutritional value and cultural significance [7]. It is widely consumed due to its high protein content and abundance of essential vitamins and minerals, which contribute to the overall health and well-being of individuals within this vibrant culture. Tarhana, a traditional Turkish fermented cereal food with a sour, acidic taste and yeast flavor, is produced principally by mixing wheat flour, yoghurt, yeast, vegetables (tomatoes, onions, green pepper, and paprika), salt, and spices (mint, thyme, dill, tarhana herb, etc.). S. cerevisiae and LAB (Streptococcus thermophilus, Lb. lactis, Lc. diacetylactis, Lb. bulgaricus, Lb. acidophilus, Leuc. cremoris, and Lb. casei) are the most important fermentative microorganisms. Studies on tarhana fermentation showed a significant increase in the riboflavin, niacin, pantothenic acid, ascorbic acid, and folic acid contents of the product [14]. Ozdemir et al. [4] reported that since tarhana is a good source of B vitamins, minerals, organic acids, and free amino acids with improved digestive properties, and since it is a product of yeast and LAB fermentation, it may be considered a functional and probiotic food. Tarhanalike products are known as trahana in Greece, kishk in Egypt, kushuk in Iraq, and tahanya or talkuna in Hungary and Finland.

II. HISTORY OF TARHANA

The word root of tarhana comes from the words "terhime" and "terhuvane" in Persian. Tarhana is used as a soup made by mixing cracked wheat with milk or yogurt and then drying it [13]. The word "tar" is used in Yakut Turkish, which means yoghurt prepared in summer and stored for winter. In Mongolian, there is the word "tarag," meaning sour milk in curd [15]. In Divanü Lügati't Türk, the word "tar" is used for tarhana, meaning yoghurt that is kept from summer to winter. Tarhana is mentioned as "tarhanah" in the works of Egyptian, Mamluk, and Kipchak Turks [13]. It is reported that tarhana, known as "terine" during the reign of Mehmet the Conqueror, was prepared with cheese and eggs. It is known that Mehmet the Conqueror drank tarhana with cheese in Afyonkarahisar, where he stayed for nine days during the Uzun Hasan Expedition in 1473 [16, 17]. Once, while a ruler was on one of his expeditions, he was a guest in a poor man's house. Confused about what to serve in distress, the peasant woman quickly boiled a soup, and the ruler loved the soup offered to him and

praised the hosts and said, "What soup is this?" When asked, it is told among the people that the woman who prepared the soup said, "It is Dar Hane soup [18,19].

In the history of Turkish culinary culture, tarhana is called Terhane. It is a soup made on winter days. After cooking, it is mixed with butter, fried bread, cream, or good tulum cheese and eaten in the morning. There are three types; Someone boils a small amount of bulgur in water with some spices and finds its full consistency, then pours some verjuice or milk on it and kneads. It is cut into small pieces, boiled, and eaten as needed. In another way, the boiled wheat, called "tattoo," is kneaded with yoghurt, and vegetables such as tarragon, mint, and parsley are added. Then it is cut into small rounds and dried. It is boiled and eaten with meat or minced meat, as needed. However, the best of these is to boil a fat sheep thoroughly in a cauldron, remove the bones, strain it through a clean strainer, grate enough stuffed zucchini into that water and boil it again, then add the dough and knead with this water, add milk as needed, dry it, and store it. Cream is added when eaten [20].

Tarhana is a traditional food item that has been known and loved by the Turks since the time they lived in Central Asia, and it was introduced by the Turks and Mongols who migrated from Central Asia to other parts of the world and started to be consumed widely in these countries [21]. Tarhana is a food product obtained by drying, grinding, and sifting after mixing and kneading wheat flour, cracked wheat, semolina, or their mixture with yogurt, pepper, salt, onion, tomato, flavoring, fragrant and harmless herbal substances, and fermenting. 2004). Tarhana is a fermented food produced by lactic acid fermentation [21]. Pre-digestion of the nutrients in the tarhana structure with bacterial cultures during fermentation increases the nutritional value of tarhana by providing easier digestibility [22, 23]. It is accepted that tarhana came to Anatolia by the Turks and Mongols who migrated from Central Asia and spread to eastern countries including Iraq, Iran, and its close neighbors during the Ottoman Empire, and to western countries such as Greece, Hungary, and Finland via Rumeli [13].

III. TARHANA VARIETIES

Tarhana, known as "kishk" in Egypt, is prepared by adding boiled chicken to a mixture of sour milk and wheat. Kushuk in Iraq is prepared by adding turnips to the milk-sour dough mixture [24]. Known in Greece as trahanas," it is mainly produced from curd cheese and wheat flour, which is formed by lactic acid fermentation from sheep and goat milk [25]. Tarhana, known as Hungarian "tahonya", is prepared by mixing white flour with eggs as much as it can handle after cleaning. The mixture is kneaded, dried, and passed through a sieve. Finland's "talkuna" mixes other grain flours such as oats, barley, rye, and peas. It is baked and dried with the addition of very little salt. It is stored in pouches as it is dry and very thin [26].

According to the Dictionary of the Turkish Language Association (2022), tarhana is defined as a soup made from the product in which tomatoes, peppers, mint, parsley, onions, yogurt or milk, and wheat are added and first fermented, followed by drying and crumbling.

According to the Turkish Standards Institute (TSE) (2004), tarhana is "wheat flour/cracked wheat, semolina or a mixture of these products, yoghurt, pepper, tomato, onion, salt, and flavorings from various herbal products mixed and kneaded after being left for

fermentation. It is defined as a food with a very high nutritional value obtained by grinding and sifting. In the standard numbered TS 2282, the characteristics of tarhana are specified. In the same standard, four types of tarhana are defined as "flour tarhana", "goce tarhana", "semolina tarhana" and "mixed tarhana". These tarhana types were determined depending on the use of wheat flour, crushed semolina, and semolina in their production. Semolina is used instead of flour in the production of semolina tarhana. In the production of mixed tarhana, at least two types of wheat flour, cracked wheat, and semolina are used [27].

1. **Flour Tarhana:** Flour tarhana, which is generally produced in the Aegean Region, is produced by using other food products other than cracked wheat and semolina [28]. Flour Tarhana: It is a type of tarhana obtained by blending yoghurt, pepper, salt, onion, tomato, and flavoring herbal products that are not harmful to health, kneading with wheat flour and leaving it for fermentation, then drying, grinding, and finally sifting [29]. This tarhana, which has a very long storage period, can be stored for a year or two without spoiling [26, 30].

2. **Goce Tarhana:** Breaking or splitting wheat, whose outer shells are separated with wooden mallets in mortars, is called Göce. Goce Tarhana is a plain form of tarhana is obtained by mixing, kneading, and fermenting, then drying, grinding, and sifting wheat flour, yoghurt, pepper,salt, onion, and tomato, and flavoring harmless herbal ingredients without adding wheat flour or semolina [29].

3. **Semolina Tarhana:** Semolina Tarhana: It is a type of tarhana obtained by drying, grinding, and sifting after mixing, kneading, and fermenting, semolina, yoghurt, pepper, salt, onion, tomato, flavor, and aroma-harmful herbal foods, without using wheat flour or wheat crackers [30, 31].

4. **Mixed Tarhana:** Mixed tarhana: It is a type of tarhana obtained by mixing, kneading, and fermenting at least two types of wheat flour, cracked wheat, and semolina, together with yoghurt, pepper, salt, onion, tomato, various flavors and aromas, and harmless herbal substances, drying, grinding, and sifting [29].

    - **Tarhana Varıeties Produced In Türkiye:** According to Certel et al. [32], Tarhana may be manufactured in either a dry form, such as nuggets, biscuits, or powder, or in a wet form. It has the ability to be preserved for extended periods of time when the right conditions are maintained. According to Dalgic and Belibagli [33], refrigerated temperatures may preserve wet tarhana for a duration of up to 6 months. On the other hand, Blandino et al. [34] found that dry tarhana can be kept for 1-2 years without exhibiting any indications of degradation. Tarhana soup may be cooked with either dehydrated or rehydrated tarhana. It is often ingested during midday or evening meals, typically in conjunction with bread and vegetables. According to Erbas et al. [35] Tarhana is often eaten locally as a snack in its dried form, either as a thin coating or as nuggets. However, it is not typically consumed in powdered form. There are 20 different types of tarhana in Turkey. While 18 of these tarhanas are consumed in the form of soup, only 2 of them are consumed as dessert. These tarhanas are known by different names in each region(Table 1) [36].

One of the best-known tarhana varieties is Uşak tarhana. The difference between Uşak tarhana and tarhana made in other regions is that the fermentation time is longer and more vegetables are added without cooking [37,38]. Another variety, Afyon Goce Tarhana, is obtained by mixing yoghurt, vegetables, and spices with cracked wheat (goce) and fermenting, then drying and grinding [39, 40]. In the production of Çorum tarhana, which is made with traditional methods in Çorum, only strained yoghurt, cracked cracked wheat, flour, and salt are used [15, 41]. In the production of traditional Beyşehir (Konya) tarhana, buttermilk, goce, water, milk, and butter obtained from strained yogurt are used instead of yogurt [17, 42]. Cranberry (Kiren) tarhana is produced by using cranberries instead of vegetables during tarhana production in the Western Black Sea region. Cranberry Tarhana is obtained by mixing flour, milk, salt, and cranberries and drying them in small pieces. This tarhana is generally used in soup preparation [43,44]. Other tarhana varieties produced in Turkey; Top tarhana, Thrace tarhana, Ak tarhana, Gediz tarhana, mince tarhana, Göçmen tarhana, Kastamonu fresh tarhana, Sivas tarhana, turnip tarhana, beet tarhana, milk tarhana, dough tarhana, meat tarhana, grape tarhana, and sweet tarhana [36]. Tarhana varieties produced in Turkey are shown in detail in Table 1.[45, 46] While Kahramanmaraş tarhana was produced at home using only traditional methods, it has been industrialized to meet the demands of consumers [47]. Maraş tarhana is obtained from a mixture of beaten-full-fat yogurt with salt, optionally thyme, and black cumin in a ratio of 1:1. According to the consumption patterns of Maraş tarhana, There are different varieties, such as dried slabs for snacks, semi-dry (firik), soup, and roasted or crispy on a sheet [48].

- **Manufacturing Process of Tarhana:** Tarhana production is often carried out using a standardized process consisting of four primary stages: (a) dough mixing, (b) fermentation, (c) drying, and (d) grinding.

According to Ozdemir et al. [4], other cereal and legume flours may be used in the manufacturing process of tarhana, in addition to wheat flour. The composition and proportions used in the making of tarhana may vary, however, the primary constituents consistently include grains and either stirred or set yoghurt. The techniques often used for large-scale manufacture of tarhana include the direct approach and the sour dough method, [13, 49,50] (Daglioglu, 2000; Maskan and İbanoglu, 2002, Tangüler).

Table 1: Tarhana Varieties Produced in Turkey

Tarhana Name	Region	Used materials	Consumption Type
Ak (White)Tarhana	Kütahya	Yeast, tomato yoghurt, red pepper, flour, onion, hot pepper, salt, mint.	Minced meat is added to the butter melted in the pan and roasted. After the soup is prepared, it is poured over and consumed.
Top (circular) Tarhana	Isparta	Salt, water, yoghurt, dill, mint, parsley, pounded wheat	Tarhana, which is put in warm water about 10 hours ago, is boiled with boiled chickpeas and black-eyed peas for one hour. Then, heated oil and tomato paste are added to this soup and it is made ready for presentation.
Kıymalı (with minced meat) Tarhana	Trakya Yöresi	Yogurt, fresh baker's yeast, red pepper paste, tomato, milk, minced meat, salt, cheese, onion, flour, tarhana made from a small amount of past years	The soaked tarhana is mixed with tomato paste and minced meat and cooked. It is consumed with pickles in the winter season.
Göçmen(immigrant) Tarhanası	Marmara Bölgesi	Baker's yeast, yoghurt, wheat flour, tomato, green pepper, tomato paste, curd cheese, various spices, salt and egg.	Tarhana is dissolved in water. It is then boiled without adding oil. After it takes the form of soup, milk and cheese are added and consumed.
Kızılcık/Kiren Tarhanası	Kastamonu, Kütahya, Bolu, Bursa, Zonguldak	Cranberry, barley or wheat flour, salt.	It is consumed in the form of soup with butter, garlic, onion and various spices.
Ege/Un Tarhana	Ege Bölgesi	Flavoring herbs, yogurt, flour, tomatoes, onions and peppers.	It is prepared in the summer season and consumed as a soup.
Göce Tarhanası	Ankara, K. Maraş, Muğla, Aydın	Halved wheat, cracked wheat, yoghurt, water, salt, bag yoghurt/strained and ayran.	It is consumed by keeping it in water for about 1 or 2 hours and then cooking.
Şalgamlı(with turnip) Tarhana	Maraş	Boiled chickpeas, turnip, Maraş tarhana,	While the Maraş tarhana is cooked, the turnips are peeled and chopped. It is

			then boiled and thrown into the soup. Boiled chickpeas are added and then cooked until boiling. Garlic, chili pepper, mint, olive oil sauce is made and consumed in this way.
Trakya (Thrace) Tarhanası	Kırklareli, Edirne, Tekirdağ	Yogurt, red peppercorns, onion, tomato, tomato paste, flour, buy herb seeds, sourdough, salt, spices, broth, butter, cheese, dill, mint, black pepper,	It is prepared and filled into containers during the summer months. It is consumed in the form of soup. After it is cooked, the butter is melted and poured over it.
Gediz Tarhanası	Gediz	Sourdough flour, yoghurt, onion, mint, red pepper and salt taken from the tarhana,	Tarhana is in fine powder form and is consumed in the form of soup in the winter season.
Kastamonu Yaş Tarhana	Kastamonu, Eskişehir, Çankırı	Wheat flour, yogurt, tomatoes, chopped cucumber, chopped quince, garlic, red pepper, green pepper, onion, dill seeds, parsley, dill, basil and various spices.	It is prepared in the summer. The containers are filled. The soup is made. Black pepper is consumed heavily.
Maraş Tarhanası	Maraş	Yogurt, thyme, cracked wheat, black cumin, water and salt.	It is consumed in various ways, in dry, semi-dry and fully dried form, as a snack or soup, dipped in hot broth or head water, soaked and fried with onions in oil, fried in oil or in the oven, grilled or fried on hot hair.
Beyşehir Tarhanası	Konya	Ayran, goce, butter, milk and water obtained from strained yoghurt.	It is consumed fresh or as a soup. It can also be consumed as a snack by adding walnuts by roasting.
Et (meat) Tarhanası	Karaman	Meatballs, fine bulgur, minced meat, potatoes, spices, tomato paste, salt, water	It is cooked on the grill or on hot hair and consumed with ayran.
Sivas Tarhanası	Sivas	Red pepper paste,	Chickpeas and dried tarhana

		tomato, green pepper onion, parsley, yoghurt, mint, spices/basil upon request, carrot, cumin, dill, egg, chickpea, oil and yeast, quince, apple, pear,	are soaked the day before. After the soup is cooked, mint with butter fried is added and consumed.
Pancarlı(with beet) Tarhana	Kastamonu (İnebolu)	white tarhana, beetroot	Chopped and boiled beetroot is cooked with white tarhana.
Tatlı Tarhana	Malatya	Node, gendume or döğme juniper, and grape must.	It is consumed fresh with unsalted butter and crushed walnuts. Those that are dried as pieces in the winter are softened with hot water and consumed by boiling.
Süt(milk) Tarhanası	Çanakkale (Gelibolu)	Half of wheat, milk, salt, pepper	It is used in the region for oven ravioli, wrapping and stuffing, or for making pilaf.
Üzüm(Grape) Tarhanası	Tokat	White or black grape must, molasses, fine wheat crumb	It is consumed only as dessert in the region..
Hamur (dough) Tarhanası	Gölhisar	Cumin, wheat flour, coarsely ground black cumin, quince, mint, red pepper, water, salt	Consumed with mint and garlic yoghurt

The direct approach involves the chopping and blending of onions using a blender. Subsequently, the mixture is combined with wheat flour, durum wheat semolina, tomato paste, red pepper paste, lentil flour, vegetable oil, salt, baker's yeast, yoghurt, and citric acid. The combination is subjected to a kneading process lasting 15 minutes, resulting in the formation of dough. Water or yogurt serum may be added as needed during this process. The dough that has been acquired is evenly distributed onto a stainless steel tray, reaching a thickness of around 1–1.5 cm. Subsequently, the dough is put through a fermentation process at a temperature range of 30–40 oC, typically maintained at 35ºC, for a duration of 5 days. The development of the distinctive taste, flavor, and odor of tarhana occurs during the process of dough fermentation [4,13, 35, 49,50].

The sourdough technique encompasses three distinct manufacturing formulas. Each item has varying quantities and types of constituents. The use of baker's yeast is not often employed in the sourdough process. In the first step of each technique, the components specified in the recipe are combined, followed by a subsequent process of kneading. The dough that is acquired is evenly distributed onto a tray made of stainless steel and thereafter subjected to fermentation at a temperature range of 40–

42 ºC [13]. The duration of fermentation for tarhana may vary between 1 and 7 days, depending upon the specific characteristics sought [5]. The primary agents involved in the production of lactic acid, ethanol, carbon dioxide, and other fermentation byproducts during the process of fermentation include the bacteria Lactobacillus delbrueckii subsp. bulgaricus and Streptococcus thermophilus, as well as the yeast Saccharomyces cerevisiae [13]

IV. CHEMICAL COMPOSITION AND NUTRITIONAL QUALITY OF TARHANA

Tarhana, which is known as a functional food, has been included in the prebiotic food class due to its high free amino acid content, protein digestibility, amino acid bioavailability, and nutritional richness, as well as being a healthy, nutritionally high, disease-reducing, and satisfying food [35].

The proximate composition of tarhana is shown in Table 2. Fermented cereal-based gruels have also been reported to improve the nutritional quality, protein digestibility, and bioavailability of amino acids. The practical nutritional importance of tarhana is the improvement of a basic cereal protein diet by adding dairy protein in a highly acceptable form. As wheat flour has a low lysine and threonine content, yogurt is added in order to increase protein quality. The approximate amino acid compositions (mg/100 g) of tarhana are given in Table 3.[4].

The composition of tarhana exhibits variations within the specified ranges: The composition of the sample analyzed by Siyamoglu [26] consisted of moisture ranging from 6.4% to 13.9%, protein ranging from 12.0% to 29.9%, carbohydrate ranging from 41.8% to 77.5%, fat ranging from 1.6% to 18.2%, fiber ranging from 0.1% to 3.1%, salt ranging from 0.56% to 10.4%, and ash ranging from 1.4% to 14.2%. According to Ozdemir et al. [4] it can be seen that this particular source has favorable bioavailabilities of protein, vitamins, and minerals such as calcium (Ca), magnesium (Mg), and potassium (K).

Ibanoglu et al. [16] determined that the thiamine, riboflavin, and vitamin B_{12} contents of tarhana samples did not change significantly during fermentation. However, in anothers study’s, the fermentation resulted in significant increases in riboflavin, niacin, pantothenic acid, ascorbic acid and folic acid contents of the tarhana samples. The author concluded that fermentation had an increasing effect on the water-soluble vitamin content of tarhana, while drying had a decreasing effect.

The microorganisms primarily responsible for the fermentation of tarhana, which imparts its characteristic taste and flavor, are Lactobacillus delbrueckii subsp. bulgaricus (commonly known as yogurt bacteria) and Saccharomyces cerevisiae (commonly known as baker's yeast). This fermentation process involves the production of lactic acid, ethanol, carbon dioxide, and various other organic compounds [13].

Table 2: Vitamin and mineral content of tarhana **[51]**

Minerals and Vitamins	**Average of value (mg/100g)**
Calcium	109
Iron	3,6
Sodium	634
Potassium	114
Magnesium	78
Zinc	1,8
Copper	450
Manganase	612
Vitamin B_1	0,01
Vitamin B_2	0,08

Tablo 3: Content of amino acids in Tarhana **[13, 52]**

Aminoasit	**Avarage (mg/100g)**
Lisin	581
Histidin	610
Arginin	555
Aspartik asit	1440
Treonin	856
Serin	1130
Glutamik asit	5305
Prolin	6094
Glisin	457
Alanin	570
Sistin	164
Valin	851
Metionin	324
Izolosin	654
Losin	1152
Tirozin	392
Fenilalanin	733

Flavonoids in the diet are considered to be one of the most significant anticarcinogens. They show a wide range of biochemical and antiallergic effects. The most important biological effect of flavonoids is their availability to act asantioxidants, which affect oxygen free radicals and lipid peroxidation. Oxygen-free radicals and lipid peroxidation might be involved in pathological conditions such as atherosclerosis, cancer, and chronic inflammation. Food-derived flavonoids, such as quercetin, caempherol, and myricetin, have antimutagenic and anticarcinogenic effects in vitro and also in vivo. Quercetin is the major flavonoid found in tarhana. [39]

V. TARHANA REGISTERED GEOGRAPHICAL SIGN

Geographical indications refers to the name of a local product that is fundamentally differentiated from its counterparts and owes this difference to the region from which it originates. In this sense, geographical indication is defined as a sign indicating a product that is identified with the region, area, region or country of origin in terms of its distinctive quality, reputation or other characteristics. Protected Geopraphical Indication(PGI), Protected Designation of origin(PDO), and Traditional Specialty Guaranteed are the three mechanisms that have been identified by regulation 1151/2012 as beng available to protect the quality and origin of food products wthin the European Union(TSG). Both the PGI and PDO programsa re concerned directly with the country of origin of food goods [53].

Products with a protected designation of origin (PDO) owe their quality or characteristics to the geographical environment, including its natural and human factors. These products must always be produced, processed and prepared in the specific geographical region from which they take their name.Products with a protected geographical indication (PGI) have a particular quality, reputation or other characteristic attributable to a geographical origin. They are produced, processed or prepared in the geographical area from which they take their name.Traditional specialities guaranteed (TSG) are products with specific features which differentiate them from other foods in the same category. They are produced from traditional raw materials or feature a traditional composition or method of production or processing [53].

Geographically indications tarhanas in Türkiye; Amasya Squeezed Tarhana, Bolu Cranberry Tarhana, Cide Tarhana, Gaziantep Şirin Tarhana, Gediz Tarhana, Kütahya Cranberry Tarhana, Malatya Tarhana, Maraş Tarhana, Muğla Göce Tarhana, Uşak Tarhana. Those who are at the application stage; Akyurt lump tarhana, Ermenek meat tarhana, Ermenek dry tarhana, Fethiye tarhana, Konya tarhana, Kurşunlu tarhana, Tokat tarhana and Tokat grape tarhana (Table4) [54].

Table 4: Geographical İndication Registered Tarhanas

Amasya Sıkma Tarhana 	**Definition:** It is tarhana produced by cooking the dough obtained with a mixture of cracked split, strained yoghurt, egg, wheat flour, salt, and milk in a wood fire and drying it after being shaped by hand squeezing. Each piece of squeezed tarhana weighs about 50 g. **Distinctive feature:** The dough of Amasya Squeezed Tarhana is white when cooked and turns yellow after drying in the sun. It is in solid form. Its taste and smell are sour.

Cide tarhanası 	**Definition:** Bread wheat flour, the seed parts of plants known as fenugreek, buyotu, or boyotu, whose Latin species name is Trigonella foenum-graceum, the aerial parts and/or seed parts of plants known as dill, whose Latin species name is Anethum graveolens, garlic, yoghurt, parsley, mint, It is a tarhana prepared by mixing and kneading basil, thyme, tomato, red capia pepper, onion, salt, and optionally hot red pepper, tomato paste, and celery stalks in accordance with the technique, fermenting the obtained dough, and then drying and grinding/crushing this dough. **Distinctive feature:** Thanks to the components used in it, it has a red and orange color and tones, is in the form of fine granules without clumping, has a bright appearance, contains vegetable and spice pieces, and has an intense, sour flavor.
Bolu Cranberry Tarhana 	**Definition:** It is obtained by mixing the puree of cranberry fruit grown in Bolu with hard-red bread wheat flour and edible iodized salt in certain amounts and then kneading. **Distinctive feature:** Cornus mascula-type cranberry fruit from the Cornaceae family grown in the region is used in the production of Bolu Cranberry Tarhana. In order for the color of the product to be similar to the pink-red color, it should be dried on a cloth area in a shaded environment.
Gaziantep Şirin Tarhana 	**Definition:** Gaziantep Şirin Tarhana is a dessert produced by drying the dense mixture obtained by boiling grape juice or grape molasses with very finely ground uncooked hard wheat called “raw bagel” in the geographical border.
Gediz Tarhana 	**Definition:** Gediz Tarhana is a granular tarhana made by drying the dough obtained with a mixture of wheat flour, full-fat yogurt, red capia pepper, red hot pepper, onion, salt, and mint. **Distinctive feature:** Gediz Tarhana is orange in color and has a sour taste. The product is in granular form.

Kütahya Cranberry Tarhana 	. **Definition:** mature cranberry (Cornus mas L.) fruits are mashed and boiled; It is a tarhana with a pinkish color, prepared by freeing the dough obtained by kneading by adding wheat flour and salt. **Distinctive feature:**The most important feature of Kütahya Cranberry Tarhana is that the cranberry puree is cooked during its preparation. With the cooking of the puree, the raw smell of the wheat flour added afterwards is removed. Thus, the unique color, taste, and aroma of Kütahya Cranberry Tarhana are formed. Kütahya Cranberry Tarhana turns pink-purple when cooked. It has a sour taste and aroma.
Malatya Tarhana 	**Definition:** Malatya Tarhana is a local type of tarhana prepared by adding yoghurt, fresh yeast, water, salt, and flour to wheat grains, sprinkled with water at regular intervals, beaten for about two hours, partly separated from their bran, aerated in the sun, and boiled. **Distinctive feature:**: The dried form of Malatya Tarhana is in the form of squeezing.
Maraş Tarhanası 	**Definition:** White wheat is used in the production of Maraş Tarhana, and its core (gluten content) should be weak, coarse-grained, plump, and not too hard, and it should also be clean and pure. In the production of Maraş Tarhana, yogurt is not added directly during the cooking phase. Yogurt is mixed with wheat batter (split), cooked at 95 °C with water, cooled to 60 °C, and left for fermentation for 8–12 hours. After fermentation, thyme can be used between 0.1-0.3%, and optionally 5-20% black cumin, 20-30% walnut kernel, almond kernel, pepper, spice, etc. are added, mixed, and laid out in the raw. Not cooking the yogurt and adding thyme and other ingredients to it gives Maraş Tarhana its distinctive features. **Distinctive feature:**: The wicker woven with reed sticks at the geographical border is dried by laying on exhibitions called avalanches or plastic avalanches.

Muğla Göce Tarhanası 	**Definition:** It is a type of tarhana prepared with cracked (split) wheat, tarhana grass, and strained yoghurt. In the content of Muğla Göce Tarhana, Dried leaves (Echinophora tenuifolia L. subsp. sibthorpiana (Guss.) Tutin, (Apiaceae) are used in accordance with the technique of goce and tarhana grass obtained by breaking medium-thick hard wheat. **Distinctive feature:** Muğla Göce Tarhana is also produced in the form of circles (ashes or balls) with a hole in the middle. Traditionally, it is served by making soup with black-eyed peas, dried red pepper, and bone-in beef or mutton ribs.
Uşak Tarhana 	**Definition:** Uşak Tarhana is a granular type of tarhana, that is prepared with a mixture of wheat flour, full-fat yoghurt, red pepper, onion, tomato, and mint, It is fermented for at least 21 days, then laid on a clean cloth, periodically reduced in size, and dried in the shade. **Distinctive feature:**The basic elements that differentiate the flavor are: the rate of vegetables (red pepper, onion, and tomato) used in its preparation with the long fermentation step carried out in the natural climatic conditions of Uşak is high, and it is used without cooking.

VI. CONCLUSION

Cereals and meats are important foods in Turkish cuisine. Soup is an indispensable dish on the Turkish table. Traditional-prepared tarhana soup is a very nutritious meal due to the foods used in its production (sour yogurt, flour, wheat, vegetables, meat, chickpeas, etc.). Tarhana production in many parts of Turkey, according to the materials used, varies from region to region. Tarhana, a well recognized food in Turkey with significant culinary significance, is typically ingested in the form of soup. Despite variations in composition and manufacturing procedures, many forms of tarhana have several basic qualities. ‘Tarhana’ is a good source of B vitamins, minerals, organic acids, and free amino acids, which make it healthy for children, the elderly, and medical patients.

As one of the food storage methods, it can be stored and consumed for a very long time, and in this respect, it is both a healthy and economical product. As with many other traditional products, the sustainability of tarhana is possible with some protective and promotional activities. In this direction, various festivals are editable. The spread of such festivals is effective in the protection and recognition of local tarhana species and in product diversification by adhering to basic standards. With festivals, both species are protected, and festivals, which are alternative tourism types; economic, socio-cultural, environmental, and destination aspects, contribute positively to marketing.

REFERENCES

[1] J.P. Tamang, K. Kailasapathy, "*Fermented foods and beverages of the World"*. CRC press. 2010, pp445.
[2] D. Yönel, Ş. Karagöz, Ö.Ü.M. Güllü, "Production and varieties of Tarhana". *Tourism Research*. IWACT 2018 International West Asia Congress Of Tourısm Research, 2018, pp.193-204.
[3] W.P. Hammes, M.J. Brandt, K.L.Francis,J.Rosenheim, M.F.H. Seitter, S.A.Vogelmann, "Microbial Ecology of Cereal Fermentations", Trends in Food Science and Technology, vol 16, 2005, pp.4–11
[4] S.D. Ozdemir, D. Gocmen, A.Y. Kumral, "A traditional Turkish fermented cereal food: Tarhana." Food Reviews International, vol 23, 2007, pp.107–121.
[5] C.E. Tamer, A. Kumral, M. Aşan İ. Şahin, "Chemical compositions of traditional Tarhana having different formulations", Journal of Food Processing and Preservation, vol 31, 2007, pp.116-126
[6] Ç. Yıldırım, N. Güzeler, "Tarhana Cipsi", Nevşehir Bilim ve Teknoloji Dergisi TARGİD, Special Issue,2016, pp.1-8.
[7] İ. Altun, "Kahramanmaraş-Elbistan'da Geleneksel Olarak Yapılan Tarhana ve Tarhana Çorbası". Iğdır Üniversitesi Fen Bilimleri Enstitüsü Dergisi, vol 5, 2015, pp.45-49
[8] H. Erinç, S. Çiftçi, "Maraş Tarhanası Üretiminde Kefir Kullanımının Son Ürün Üzerine Etkileri". Food, vol 43, 2017, pp.114-121.
[9] B. Ögel, "Türk Kültür Tarihine Giriş, Türklerde Yiyecek Kültürü", Vol:4, 1978, Kültür Bakanlığı Yayınları, Ankara
[10] M. Erbaş, M. Certel, M.K. Uslu, "Yaş ve Kuru Tarhananın Şeker İçeriğine Fermantasyon ve Depolamanın Etkisi". Food, 29 (4), 2004, pp.299-305.
[11] A. Hançer, "Besinsel Liflerin Tarhana Üretiminde Kullanımı", 2010, (Master thesis)
[12] Ö. Şimşek, S. Özel, A.H. Çon, "Ev ve İşletme Tipi Uşak Tarhanası Hamurlarında Fermantasyon Sürecine Ait Mikrobiyolojik ve Kimyasal Özelliklerin Karşılaştırılması", Gıda, vol 37, 202, pp.341-348
[13] O. Daglioglu, "Tarhana as a Traditional Turkish Fermented Cereal Food, Its Recipe, Productionand Composition". Nahrung, vol 44, 2000, pp. 85–88.
[14] R. Ekinci, "The effect of fermentation and drying on the water-soluble vitamin content of tarhana, a traditional Turkish cereal food". Food Chemistry , vol l90, 2005, pp. 127–132.
[15] M.B. Güler, A. Konar, "Çukurova yöresi tarhananın üretim yöntemleri ve bileşimleri", MKÜ Ziraat Fakültesi Dergisi, vol 4,1999, pp.13-24.
[16] S. Ibanoglu, P. Ainsworth, G. Wilson, G.D. Hayes, "The Effects of Fermentation Conditionson the Nutrients and Acceptability of Tarhana". Food Chemistry, 53, 1995, pp.143–147
[17] S.Şimşek, M.O.Martinez, O.Dağlıoğlu, K.G.Güner, Ü. Geçgel, "Physicochemical Properties of Starch from a Cereal-Based Fermented Food (Tarhana)", Journal of Nutrition and Food Science, vol 4, 2014, pp.1-6.
[18] D. Önay, "Geleneksel Fermente Gıdalarımızdan Tarhana ve İnsan Sağlığı Üzerindeki Önemi", II. Geleneksel Gıdalar Sempozyumu, 27-29 Mayıs, Van, pp.625-629, 2009.
[19] Anonim, 2014 "Ulubey Yemekleri Tarhana Çorbası" http://ulubey.brinkster.net/tarhana.html
[20] N. Karagözlü, B.Ergönül, C.Karagözlü, "Microbiological Attributes of Instant Tarhana During Fermentation and Drying", Bulgarian Journal of Agricultural Science, vol 14(6), 2008, pp.535-541.
[21] A. Temiz, P. Pirkul, "Tarhananın Fermantasyonunda Kimyasal ve Mikrobiyolojik Değişmeler". Gıda, vol 15, 1990, pp.119-126
[22] S. Özbilgin, "The Chemical and Biological Evaluation of Tarhana Supplemented with Chickpea and Lentil" Ph. D. Thesis.,Cornell Uni.,Ithaca. 1993.
[23] İ. Saldamlı, "Beslenme Açısından Fermente Süt Ürünleri". Gıda, vol 8, 1983, pp. 297-311.
[24] F.F.Alnoury, C.L.Duitschaever, "The Use of Pure Cultures For The Preparation Kushuk", Journal of Institution of Canadian Science and Technology Alimentary, vol 7, 1974, pp.228-229.
[25] S. Evangelos, G. Lazos, G.Aggelousis, M. Bratakos, "The Fermentation of Trahanas : A Milk –wheat Flour Combination", Plant Foods For Human Nutrition, vol. 44,1993, pp.45-62
[26] B.Siyamoğlu, "Türk Tarhanalarının Yapılışı ve Terkibi Üzerine Bir Araştırma". Ege Üniversitesi Ziraat Fakültesi Yayınları 1961.
[27] TSE, "Tarhana Standardı (TS 2282)". Türk Standartları Enstitüsü, Ankara. 2004.
[28] A.Öney, "Bayat Ekmeklerin İnstant Tarhana Çorbası Üretiminde Kullanılması". (Yüksek Lisans Tezi). Selçuk Üniversitesi Fen Bilimleri Enstitüsü, Konya. 2004.
[29] H. Esimek, "Tarhananın besinsel lif içeriği ve antioksidatif özelliklerinin belirlenmesi" (Master's thesis, İnönü Üniversitesi Fen Bilimleri Enstitüsü). 2010.
[30] M.Özçam, E.Obuz, "Kahramanmaraş Cips Tarhanasının Kimyasal ve Tekstürel Özellikleri", III. Geleneksel Gıdalar Sempozyumu 2012,pp. 501-502

[31] H. Soyyiğit, "Isparta ve Yöresinde Üretilen Ev Yapımı Tarhanaların Mikrobiyolojik ve Teknolojik Özellikleri". (Master's thesis, Süleyman Demirel Üniv. Fen Bil. Enst).2004.
[32] M. Certel, M.Erbaş, M.K.Uslu, M.O.Erbaş, "Effects of fermentation time and storage on the water-soluble vitamin contents of tarhana". Journal of the Science of Food and Agriculture, vol 87, 2007, pp.1215-1218.
[33] A.C. Dalgıç, K.B. Belibağlı, "Hazard analysis critical control points implementation in traditional foods: a case study of Tarhana processing". International Journal of Food Science and Technology, vol *43*, 2008, pp.1352-1360.
[34] A. Blandino, M.E. Al-Aseeri, S.S. Pandiella, D.Cantero D, C. Webb, Cereal-based fermented foods and beverages. Food Research International, vol 36, 2003, pp.527–543.
[35] M. Erbaş, "Yeni Bir Gıda Grubu Olarak Fonksiyonel Gıdalar". Türkiye, vol 9, 2006, pp.24- 26.
[36] F. Coşkun, "Tarhananın tarihi ve Türkiye'de tarhana çeşitleri". Gıda Teknolojileri Elektronik Dergisi, vol 9, 2014, pp.69-79.
[37] S. Kaya, S. Ibanoglu, A. Kaya, "Moisture Sorption Characteristics of Tarhana, A Fermented Turkish Cereal Food". Journal of Food Quality, vol *22*, 1999, pp. 95–100.
[38] İ.H. Kaya, B.Kördikanlıoğlu, Ö.Şimşek, "Uşak Tarhanasının Fermantasyon Özellikleri", 4.Geleneksel Gıdalar Sempozyumu, pp.179, 2014.
[39] S. Karakaya, S.N. El, "Quercetin, Luteolin, Apigenin and Caempherol Contents of Some Foods". Food Chemistry, vol *66*, 1999, pp. 289–292.
[40] O.Tomar, G. Akarca, "Geleneksel Afyonkarahisar Göce Tarhanasının Kimyasal ve Mikrobiyolojik Özellikleri", 4.Geleneksel Gıdalar Sempozyumu, pp.590, 2014
[41] S.Türksoy, B. Kabak, "Geleneksel Çorum Tarhanasının Üretimi ile Bazı Özelliklerinin Belirlenmesi", 4.Geleneksel Gıdalar Sempozyumu, 17-19 Nisan, Adana, pp.719, 2014.
[42] N. Aktaş, M.A.Cebirbay, N.Işık, "Geleneksel Beyşehir Tarhanası", II. Geleneksel Gıdalar Sempozyumu, pp.660-663, 2009.
[43] M.A.Cebirbay, N.Aktaş, "Geleneksel Kızılcık (Kiren) Tarhanası", 4.Geleneksel Gıdalar Sempozyumu, pp.615-618, 2014.
[44] İ. Çınar, "Bolu'nun Kiren (Kızılcık) Tarhanası", 4.Geleneksel Gıdalar Sempozyumu, pp.843, 2014.
[45] A.N.Uslu, İ. Yılmaz, "Coğrafi İşaretli Bir Ürün Olarak Bolu Kızılcık Tarhanası". Uluslararası Türk Dünyası Turizm Araştırmaları Dergisi, vol 7, 2022, pp.94-105.
[46] A. Badem, "Tarhana, a very old traditional fermented cereal turkish food". In Of the International E-Conference on Advances in Engineering, Technology and Management, 2020, pp. 8-13.
[47] A.L. İnanç, A.S. Çolakoğlu, "Endüstriyel Ölçekte Üretilen Maraş Tarhanasının Fiziksel ve Kimyasal Özellikleri", 4.Geleneksel Gıdalar Sempozyumu, pp.842, 2014
[48] A. Çakır, G.Çakır, C. Kolukırık, "Trakya Tarhanası Çeşitlerinden Biri Olan Kıymalı Tarhana ve Sunumu". I. Uluslararası Adriyatik'ten Kafkas'lara Geleneksel Gıdalar Sempozyumu, pp. 436-437, 2010.
[49] M. Maskan, Ş. İbanoglu, "Hot air drying of cooked and uncooked tarhana dough, a wheat flour-yogurt mixture",. Eurepean Food Research Technology, vol 215, 2002, pp.413-418.
[50] H.Tangüler, "Traditional Turkish fermented cereal based products: Tarhana, boza and chickpea bread.", Turkish Journal of Agriculture-Food Science and Technology, vol *2*, 2014, pp.144-149.
[51] S.Yücecan, K. Kayakırılmaz, S. Başoğlu, M.Tayfur, "Tarhananın Besin Değeri Üzerine Bir Araştırma", Türk Hijyen ve Deneysel Biyoloji Dergisi, vol 45,1988, pp. 47-51.
[52] F.P. Çakıroğlu, "Geleneksel Tarhananın Modern Yolculuğu". 38. Icanas Uluslararası Asya ve Kuzey Afrika Çalışmaları Kongresi 2007, pp. 349-360. Ankara..
[53] S.S.Kırdar, "Turkey's Geographical Indications Dairy Products". Food Health and Technology Innovations, vol 5, 2022, pp.382-388.
[54] TÜRKPATENT, 2023. https://ci.turkpatent.gov.tr

