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The Nutritional Value of Two Fermented Milk/Cereal Foods Named 'Greek Trahanas' and 'Turkish Tarhana' : A Review

Aikaterini Georgala*

Laboratory of Dairy Research, Department of Food Science and Technology, Agricultural University of Athens, Iera Odos 75, 11855, Athens, Greece

Abstract

Fermented foods are an important part of diets in many parts of the world and are known from ancient times. Traditional fermented cereal foods are widely used in the diet of people in the Middle East, Asia, Africa and some parts of Europe. The technology of making these products as well as the type of milk and cereal used are of the main factors that influence their nutritional value. Nutritional and safety benefits have been attributed to fermented foods which are an important part of people diets. 'Trahanas' in Cyprus and Greece and 'Tarhana' in Turkey are two of the oldest traditional fermented milk/cereal foods and very nutritive foods due to the nutritional properties of wheat and milk/yoghurt. This work is a review on the nutritional value of these products.

Keywords: Tarhana; Trahanas; Fermented milk cereal foods; Nutritional value

Introduction

Fermentation is carried out to enhance taste, aroma, shelf-life, texture, nutritional value and other favourable properties of foods. Various fermentations have been used traditionally and worldwide to prepare and preserve food. Nutritional and safety benefits have been attributed to fermented foods [1-5].

Fermented foods are an important part of diet in many parts of the world and are known from ancient times. Traditional dried fermented milk/cereal foods are widely used in the diet of people in the Middle East, Asia, Africa and some parts of Europe [6]. These products have high nutritive value and interesting organoleptic characteristics. There are similar products with different names such as 'Kishk' in Egypt, Syria, Lebanon and Jordan, 'Kushuk' in Iraq, 'Tarhana' in Turkey, 'Trahanas' in Cyprus and Greece, 'Tarhonya/Talkuna' in Hungary and Filand. Methods for preparation of such products vary from place to place but cereals and fermented milks are always the major components [7-9].

Tarhana is the dry form of yoghurt-cereal mixture. It represents an important part of the diets of many people in Turkey as it is one of the oldest and most popular fermented cereal foods of Turkey [10]. Production method and recipe of tarhana may have some differences from region to region [10]. Tarhana has an acidic and sour taste with a yeasty flavour and is mainly used for soup making [11]. However, tarhana can also be consumed as a snack after being dried to thin layer or nugget, not to be ground. Tarhana has an acidic and sour taste with yeasty flavour and it is used for soup making [11]. Soup can be prepared from wet or dry tarhana.

Tarhana is produced by mixing cereal flour (mainly wheat flour), yoghurt, baker's yeast (*Saccharomyces cerevisiae*) and a variety of cooked vegetables (tomatoes, onions, green peppers and red peppers), salt and spices (mint, thyme, dill, tarhana herb etc.) followed by lactic and alcoholic fermentation for one to seven days [6,8,10,12,13]. The fermented slurry is then air-dried and used in soup making, giving a product with high nutritional contents of proteins and vitamins [9]. Regional diversity of the amount and type of ingredients, as well as the processing techniques, affect chemical compositions, nutritional content and sensory attributes of tarhana [10,14].

Tarhana is a good source of B vitamins, minerals, organic acids and free amino acids which make tarhana healthy for children, the elderly and medical patients. The use of barley flour gives a 'Tarhana' with high glucan content while wheat bran gives Tarhana with increased fibre content and antioxidant properties. Trahanas is one of the most popular fermented milk-cereal products of Greece which is produced during summer mainly from whole fresh ewes', goats' milk or a mixture of them. Sometimes instead of milk, a pulp of vegetables is used and the product taken is called nistisimos trahanas. For the production of trahanas fresh milk is allowed to be acidified for some days either spontaneously or by adding a culture of yoghurt. It is stirred every day until it reaches the desired acidity. Then it is heated and some ground wheat and salt are added gradually. Sometimes eggs are also added and the final product is called sour trahanas with eggs.

The ratio of milk to wheat used in trahanas production is usually 3:1 or 4:1. The mixture is heated thereafter to the boiling point and cooled down. The paste taken is cut in finger sized pieces and subsequently sundried. When it is dry enough, it is stored in a cool place. Sometimes instead of sour milk, sweet milk is used for the production of sweet trahana.

Trahanas is a product with high dietary fibre content mainly due to the wheat used for its production. Greek 'Trahanas' is a very nutritive food as it is a good source of proteins, minerals etc. and is used largely for feeding people. This work is a review on the nutritional value of tarhana and trahanas products.

The Nutritional Value of Tarhana Product

The amount and type of ingredients used in tarhana production may affect its nutritional content and sensory attributes [13]. Cereal flours, yoghurt and a variety of vegetables are the primary ingredients used in tarhana production and therefore a good source of B vitamins, minerals, organic acids and free amino acids which make tarhana healthy for children, the elderly and medical patients [10].

The main reason for variation in protein content of tarhana may be

***Corresponding author:** Aikaterini Georgala, Laboratory of Dairy Research, Department of Food Science and Technology, Agricultural University of Athens, Iera Odos 75, 11855, Athens, Greece, Tel: +30 2105294644; Fax: +30 2105294672; E-mail: georgala@aua.gr

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the type and amount of yoghurt used in tarhana preparation [15,16] or the different cereal and legume flour used [17,18]. The type of yoghurt used affects some properties of tarhana. Stirred yoghurt gives better acidity characteristics to tarhana while set yoghurt increase protein content. Generally, for the production of tarhana yoghurt is mixed with wheat flour in a ratio 1:2. However, there are also tarhana recipes in which yoghurt ratio is equal to flour. The ratio of yoghurt to wheat flour is subject to the availability of milk in that particular season and in that particular region.

Daglioglu [10] studied the composition and nutritive value of tarhana. The nutrient content of tarhana depends upon yoghurt and flour ratios as well as other ingredients in the recipe. Tarhana is considered to be a useful high-protein dietary supplement with average 15-16% protein content. Flour is known to be a poor source of the essential amino acids, particularly lysine and threonine. However, the combination of flour and yoghurt proteins makes tarhana a precise amino acid source. The calcium content of tarhana is affected by flour and yoghurt rate in the recipe as well as by the type of yoghurt used. Tarhana is a good source of calcium, iron and zinc as well as some other minerals. The rate of iron in tarhana samples is depended of the amount of flour used in tarhana making.

Soybeans are known to have high protein content (400g/kg) and due to the fact that they contain a lysine level that exceeds human requirements, the supplementation with soy protein is an excellent way to correct the lysine deficiency in some products such as wheat and corn [19]. Oner et al. [18] study the use of soybeans in the traditional fermented food named tarhana. Tarhana was produced from yoghurt and wheat flour which was replaced totally or partially with soybean flour. Despite the different sources used, a highly nutritional product was obtained. The addition of soybean flour improves the nutritional value of tarhana to a great extent.

Kose and Cagindi [17] examined the use of different cereal flours (wheat, rye, maize and soybean flour) in the production of tarhana. New products were made by cereals flours other than wheat flour or mixtures of them with wheat flour. These types of tarhana were compared for their chemical properties with wheat flour tarhana. The addition of soybean flours increased both ash and protein values while the addition of maize flour decreased them. Also, the addition of rye flour seemed to increase the ash value of the final product. On the contrary, the addition of maize flour seems to decrease the protein content of tarhana samples.

Apart from having a nutritive value comparable to wheat, barley is unique among cereals containing high concentrations of b-glucan which is known to have the effect of cholesterol lowering effect [20,21], regulating blood glucose level and insulin response in diabetics [22] and even reducing risk of cancer [23]. Erkan et al. [24] examined the use of barley flours in tarhana production. One hulless and two hulled barley flours were used to produce tarhana samples. Barley flour was used to produce a new food with high b-glucan content. The results showed that barley flour can be used alone or together with wheat flour in tarhana production. Although some of the b-glucan may be destroyed during fermentation, the results indicated that barley flours can be used to produce tarhana with relatively high b-glucan content.

Buckwheat (BW) has major potential as food ingredient, especially for functional and clinical food industry. Buckwheat (BW), pseudo-cereal, protein consists of well-balanced, amino acids with high biological value. Buckwheat is a good source of many essential minerals, polyunsaturated fatty acids, vitamins B1, B2 and E and flavonoid rutin [25,26]. BW does not contain gluten and it is a major ingredient in a daily diet of the celiac patients [25]. The functional components of BW reduce high blood pressure, prevent edema and hemorrhagic diseases and decrease the permeability of the vessels and reduce the risk of arteriosclerosis. Bilgicli [27] studied the effect of buckwheat flour supplement (Buckwheat flour ratio %, 20%, 40%, 60%, 80% and 100%) on the chemical properties of tarhana. Compared to wheat flour, buckwheat flour had higher content of ash, fat, cellulose, mineral and phytic acid as it is produced from the whole groat. Especially, Mg, K, P and Zn content of BW flour was found to be rich compared to the wheat flour.

Wheat bran can be used in food products especially for its high fiber content and antioxidant properties [28-30]. The nutritional value of wheat germ proteins is comparable to animal proteins and the germ provides three times as much protein, fifteen times as much sugar and six times as much mineral content as wheat flour. However, the poor stability of wheat germ restricts its uses [31].

Bilgicli et al. [32] studied the effect of wheat germ/bran addition on the chemical and nutritional quality of tarhana, a fermented wheat flour-yoghurt product. Tarhana was supplemented with wheat germ and wheat bran in order to enrich the nutritional status of the final product. Wheat flour used in tarhana production was replaced with 10%, 25% and 50% wheat germ or bran based on the weight of the wheat flour used. Tarhana samples enriched with wheat germ or bran were compared with a control sample (0% wheat germ or bran). The results of the chemical composition and nutritional value of tarhana showed that increasing wheat germ/bran level in tarhana sample resulted in an expected increase in crude protein, ash and mineral content of tarhana samples. On the other hand, they had greater amounts of phytic acid in comparison to wheat flour.

Tarakci et al. [14] examined the hypothesis that yoghurt could be replaced with whey concentrate and white wheat flour could be replaced, either partially or totally, with corn flour, in tarhana made with baker's yeast. The effect of flour type (wheat flour or corn flour) and yoghurt + whey (YW) combinations on the chemical and mineral composition of tarhana was examined. Tarhana samples with added corn flour (CF) had the lowest protein level and the highest ash level. Also, tarhana with added corn flour has the highest fiber concentration due to the existence of crude fiber derived from the bran content of corn flour. The mineral analysis showed that in general replacing yoghurt by whey did not significantly affect the mineral composition of tarhana samples. Concerning the type of flour used, tarhana with added wheat flour had higher calcium (Ca) content than the other two samples. However, as a result of the bran material, P, Zn, Mg and Fe contents were higher in tarhana samples with added corn flour.

Spices like mint, thyme, dill and tarhana herb are used as flavouring agents in tarhana production in different areas of Turkey. Tarhana herb originates from West Asia and belongs to the *Apiaceae* family. Tarhana herbs grow naturally in Turkey and other regions of the Mediterranean. The leaves of tarhana herb are used as a spice in tarhana, pickles and meatballs in various regions of Turkey [33].

The fermentation of tarhana is a result of the action of a mixed population of microbes. Although many micro-organisms may be present, principal organisms are lactic acid bacteria from yoghurt and *Saccharomyces cerevisiae* from baker's yeast [34]. These organisms are responsible for the production during fermentation of lactic acid, ethanol, carbon dioxide and some other organic compounds like aldehydes and ketones, thus giving tarhana its characteristic flavour [12,10]. Degirmencioglu et al. [35] studied the influence of tarhana herb (*Echinophora sibthorpiana*) on fermentation of tarhana. Tarhana

herb (*Echinophora sibthorpiana)* (TH) is used as a spice in tarhana. It has a pleasant flavour and stimulates growth of some microorganisms. Concerning microbial populations it can be said that tarhana herb (*Echinophora sibthorpiana*) prevented the decrease in the counts of lactic acid bacteria and in the populations of yeast during the first two days of fermentation.

Tarhana is a very nutritive food because of nutritional deficiency in wheat mostly eliminated by yoghurt and vice versa. Its nutritional value increased by fermentation. The amounts and types of ingredients and fermentation conditions may vary from place to place in Turkey affecting chemical composition and nutritional content of Tarhana. Added ingredients as well as fermentation time and storage conditions had significant effects on the chemical composition and nutritional value of tarhana. Tarhana is a good source of total minerals (Ca, Mg and K) with good (Ca, Mg and K) bioavailability. The use of different flours also affects the mineral content and other properties of tarhana. The use of barley flours showed that barley flour can be used to produce tarhana with relatively high glucan content. The chemical composition of tarhana was affected by the use of soybean, corn and maize flour. Wheat germ and wheat bran were successfully incorporated into tarhana formulation. The use of baker's yeast, barley malt and microbial phytase affects the nutrients and phytic acid content of tarhana. Fermentation and drying had an effect on the water- soluble vitamin contents of tarhana. Variations occur in organic acid and fatty acid composition of tarhana during fermentation and storage. Lactic acid appeared to be the dominant organic acid during tarhana fermentation. Differences in gross composition were found between sun-dried and frozen tarhana samples.

The Nutritional Value of Trahanas Product

Trahanas is one of the most popular fermented milk-cereal products of Greece which is produced during summer mainly from whole fresh ewes', goats' milk or a mixture of them. Acidified (sour) milk or sweet milk is used and the final products are called sour or sweet trahanas, respectively. Sometimes instead of milk a pulp of vegetables is used and the product is called nistisimos trahanas.

Georgala et al. [36] examined 40 trahanas samples for their gross composition, fatty acid and mineral composition. The most significant differences were found to be in the amount of total saturated fatty acids (TSFAs) and total unsaturated fatty acids (TUFAs) and the mineral calcium.

The mean composition of trahanas made without milk and called 'nistisimos' was : moisture 11.1, total solids 88.9, total carbohydrates 70.5 g/100g product, protein 11.9, fat 2.9, dietary fiber 1.4, ash 2.5, salt 1.6 g/100g dry matter.

The mean composition of the three categories of trahanas made with milk and called 'sour', 'sour with eggs' and 'sweet' was : moisture 9.8, total solids 90.2, total carbohydrates 67.6 g/100 g product, protein 15.3, fat 3.9, dietary fiber 1.5, ash 3.2 and salt 1.9 g/100 g dry matter.

The moisture content of nistisimos trahanas varied from 7.60 to 13.18% and of trahanas made with milk from 5.65 to 13.83%. The variation in moisture content of trahanas samples is probably due to the ingredients used in the formulation and the technology used for its production.

Due to the variation in moisture values it was decided to convert the analytical data to a Dry Matter Basis (DMB). The total solids content of nistisimos trahanas was between 86.82% and 22.40% while the total solids content of trahanas made with milk was between 86.17% and 94.35%.

The mean content of trahanas samples made with milk was higher than the protein content of nistisimos trahanas. In nistisimos trahanas protein content varied from 11.20 to 13.2 g/100 g dry matter while in trahanas made with milk the protein content varied from 12.53 to 21.56 g/100 g dry matter.

The ash content of nistisimos trahanas was between 0.93 and 4.90 g/100 g dry matter while the ash content of trahanas made with milk (sour, sour with eggs and sweet) was between 1.10 and 6.41 g/100 g dry matter. The highest ash content was found in sour trahanas made with eggs. The different flours usually used by producers for trahanas making are mainly responsible for the great variation in ash content between trahanas samples.

The salt content of nistisimos trahanas ranged from 0.18 to 4.20 g/100 g dry matter while the salt content of trahanas made with milk ranged from 0.19 to 5.10 g/100 g dry matter. The variation in salt content observed in trahanas samples is mainly due to the fact that different amounts of salts are added by trahana makers during the process of its production.

Concerning dietary fiber, its content in nistisimos trahanas was between 0.91 and 2.42 g/100 g product while in trahanas made with milk (sour, sour with eggs and sweet) between 0.64 and 3.32 g/100 g product. Trahanas seems to be a product with high dietary fiber content which is mainly due to the wheat used for its production. The variation in dietary fiber content found in trahanas samples is due to the wheat flour used each time for its production.

The total carbohydrates content of nistisimos trahanas ranged from 65.84% to 72.00 % while that of trahanas made with milk from 50.42% to 73.99%. Wheat germ and wheat flour are known to be good sources of carbohydrates so the high concentration of carbohydrates in trahanas samples is mainly due to the use of wheat at its production.

The fat content of nistisimos trahanas was between 0.05 and 7.93 g/100 g dry matter with a mean value of 2.89 g/100 g dry matter. The fat content of trahanas samples made with milk (sour, sour with eggs and sweet) was between 0.82 and 12.09 g/100 g dry matter with a mean value of 2.90 g/100 g dry matter. A great variation in fat content among trahanas samples was observed. This was mainly due to the different ingredients used for trahanas production.

Between trahanas made without milk and trahanas made with milk the most significant differences were found to be in the amount of saturated and unsaturated fatty acids and the mineral calcium. Trahanas is a very nutritive food as it is a good source of proteins, minerals and other components that is why used largely for feeding people.

Conclusion

'Tarhana' is a good source of B vitamins, minerals, organic acids and free amino acids which make tarhana healthy for children, the elderly and medical patients. The use of barley flour gives a 'Tarhana' with high glucan content while wheat bran gives a 'Tarhana with increased fibre content and antioxidant properties. Wheat flour and fresh acidified ewes or/and goats' milk are the main ingredients used in Greek 'Trahanas' production. Instead of milk a pulp of vegetables could be used for the production of 'Nistisimos Trahanas'. The use of wheat germ/wheat flour results in high concentration of carbohydrates. 'Trahanas' is a product with high dietary fiber content mainly due to the wheat used for its production. 'Trahanas' with milk has a high concentration of saturated fatty acids and 'Nistisimos' a high content of unsaturated ones. 'Trahanas' made with milk is a good source of

calcium and other minerals. Greek 'Trahanas' is a very nutritive food as it is a good source of proteins, minerals etc. and is used largely for feeding people.

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