Check Point Threat Extraction secured this document Get Original

CHEMICAL COMPOSITIONS OF TRADITIONAL *TARHANA* HAVING DIFFERENT FORMULATIONS

CANAN ECE TAMER[1,3], AYŞEGÜL KUMRAL[1], MÜGE AŞAN[2] and İSMET ŞAHİN[1]

[1]*Food Engineering Department*
University of Uludag
Faculty of Agriculture
16059 Görükle-Bursa, Turkey

[2]*Turkish Ministry of Agriculture and Rural Affairs*
General Directorate of Protection and Control
06100 Ankara, Turkey

Accepted for Publication October 4, 2006

ABSTRACT

Cereal-based fermented foods play an important role in the diets of many people in Asia, Africa, the Middle East and some parts of Europe. Containing cereal and animal-based nutrients, richer with fermentation products, produced with yeast and lactic acid bacteria, tarhana is a type of soup having a delicious and desired taste. It is a good source of protein and vitamins and therefore is used largely for feeding children and the elderly. Because there is no standard production method, the nutritional properties of tarhana strictly depend on ingredients and their ratios in the formulation. In this research, the compositions of 21 tarhana samples collected from different locations in Turkey were examined. Moisture, ash, salt, protein, crude fat, acidity degree and reducing sugar values of the samples changed between 9.35 and 66.4, 1.36 and 9.40, 0.62 and 9.01, 6.77 and 28.55, 0.43 and 15.78, 1.7 and 40.7, and 0.22 and 1.85%, respectively. The nutritional importance of tarhana is the improvement of the basic cereal protein diet by adding dairy protein in a highly accepted form. Like tarhana, indigenous fermented foods that enhance health properties should receive much more attention that they deserve.

PRACTICAL APPLICATIONS

Tarhana is a traditional Turkish soup taking an important part of the Turkish diet, with high nutritional quality and long shelf-life properties. Its

[3] Corresponding author. TEL: +90-224-442-89-70-76/408; FAX: +90-224-442-80-77; EMAIL: etamer@uludag.edu.tr, cananece@yahoo.com

Journal of Food Processing and Preservation **31** (2007) 116–126. *All Rights Reserved.*
© 2007, The Author(s)
Journal compilation © 2007, Blackwell Publishing

production methods differ by locations and the ingredients used in the recipe. Even with its widespread consumption, the composition of traditional tarhana has not been investigated adequately. This study was conducted to determine chemical compositions of traditionally produced tarhana samples collected from different locations.

INTRODUCTION

It is generally admitted that the expression "traditional food" refers to a product with specific raw materials, and/or with a recipe known for a long time, and/or with a specific process (Cayot 2007). As a traditional Turkish food that has been produced and consumed since ancient times, *tarhana* is a popular soup taking an important part of the Turkish diet, with high nutritional quality and long shelf-life properties without any deterioration. It can be defined as a cereal-based fermentation product, mixture of wheat flour, yogurt, and other ingredients such as bakers' yeast, tomato, onion, paprika, salt, spices and seasonings. It is mainly used in the form of a thick soup after reconstituting with water followed by simmering (Dağlıoğlu 2000; Bilgiçli *et al.* 2006).

There are some other products similar to tarhana such as *kishk* (sour milk–wheat mixture with boiled chicken stock) in Syria, Jordan and Egypt (Youssef 1990), *kushuk* (milk–sour dough mixture with turnips) in Iraq (Alnouri and Duitschaever 1974), *tahonya/talkuna* in Hungary and Finland (Hafez and Hamada 1984), *trahana* in Greece and *atole* in Scotland (Tamime *et al.* 2000).

In tarhana production, yogurt, chopped and cooked onion, tomato and pepper were added to necessary amount of flour together with fresh or dried parsley and peppermint, which were already cut and sorted. Then the dough is kneaded until it reaches a bread dough consistency and let to ferment in ambient temperature in a closed container. The duration of fermentation is changed from 1 day to 1 week according to the desired properties. If the desired taste of the product is much sour, the duration of fermentation is prolonged (Aşan 2003). Lactic acid bacteria in yogurt and yeast are responsible for acid formation during fermentation and the leavening effect (İbanoğlu *et al.* 1999). After maturation, the dough is divided into small pieces and these small pieces are let to sun-dry. However, the natural drying exposure to direct sunlight should not be desired because the color gets pale and the quality of the product is decreased. When the dough easily crumbles without sticking to the hand, it is sieved and dried to reduce moisture (Aşan 2003).

The low pH (3.8–4.4) and moisture content (6–9%) make the tarhana a poor medium for pathogens and spoilage microorganisms; tarhana is not hygroscopic and it can be stored for 2–3 years without any sign of deteriorations (Salama *et al.* 1992).

When tarhana is produced from hulled wheat, wheat is boiled and softened at first, then other processes are applied. If the potato or chickpea is used while producing tarhana, they are initially boiled and softened before adding to the dough. Tarhana, produced from hulled wheat, is put into a pot made out of clay without any air pocket, or it is stored in a cool place without drying. The protective effect of lactic acid and salt is used in storing without drying. Moreover, no preservatives are added (Aşan 2003).

Tarhana is a very nutritive food because of nutritional deficiency in wheat mostly eliminated by yogurt and vice versa (Erbaş *et al.* 2005). Traditionally produced tarhana is an appetizer, in addition to its nutritional composition. By the way, it is consumed by babies and sick people for its nutritious, recovering, digestive and antimutagenic properties (Karakaya and Kavas 1999).

The number of studies on tarhana has been increased in recent years. Most of them examined the effect of kneading on viscosity and foaming property of tarhana (İbanoğlu *et al.* 1996, 1999; İbanoğlu and İbanoğlu 1997), and some of them examined the additives used in tarhana production (Ainsworth *et al.* 1999; İbanoğlu and Öner 1999). Moreover, the composition of tarhana and its nutritional value were examined. Because there is no standard production method, the nutritional properties of tarhana strictly depend on ingredients and their ratios in the recipe (Erbaş *et al.* 2005). The protein, carbohydrate and lipid components of tarhana mix are subjected to partial digestion and hydrolysis by lactic acid bacteria and yeast during fermentation, resulting in a product with improved digestive properties (Türker and Elgun 1995). The fermentation results in significant increases of riboflavin, niacin, pantothenic acid, ascorbic acid and folic acid contents of tarhana, but no significant differences with thiamine and pyridoxine (Ekinci 2005). Pirkul (1988) examined the amino acids content of the commercial types of tarhana. These tarhana samples involved adequate amount of nine essential amino acids except triptophane. Tarhana is a good source of calcium, iron and zinc as well as some other minerals. Flour and yogurt ratio in recipe or the type of yogurt affects the calcium content (Yücecan *et al.* 1988).

The present paper has attempted to illustrate the composition of some well-known tarhana samples collected from different locations in Turkey.

MATERIALS AND METHODS

Materials

For the material, 21 different tarhana samples were used. The origins and the ingredients of the samples are given in Table 1.

TABLE 1.
ORIGINS AND INGREDIENTS USED IN THE PRODUCTION OF TARHANA SAMPLES

Sample no.	Origin (location)	Ingredients	Status
1	Burdur	Flour, yogurt, tomatoes, salt, peppermint	Dried/ground
2	Bolu	Flour, yogurt, tomato paste, pepper, onion, salt, peppermint	Dried/ground
3	Afyon	Flour, strained yogurt, potatoes, tomato paste, pepper, tomatoes, onion, salt	Dried/ground
4	Eskişehir	Flour, yogurt, tomatoes, red pepper, onion, salt, peppermint	Dried/ground
5	Bolu	Flour, cornelian cherry	Dried/ground
6	Eskişehir	Flour, strained yogurt, egg, salt	Dried/ground
7	Eskişehir	Cracked and hulled wheat, flour, strained yogurt (produced from whole milk), milk, egg	Dried/ground
8	Eskişehir	Hulled wheat, flour, strained yogurt, salt	Dried/ground
9	Eskişehir	Flour, yogurt, tomatoes, red pepper (cooked), salt, peppermint	Dried/ground
10	Kütahya	Flour (cooked), bread dough, strained yogurt, tomatoes, red pepper, onion	Dried/ground
11	Eskişehir	Hulled wheat, semolina, yogurt, milk and egg (cooked semolina is added after other materials are boiled)	Dried/ground
12	Eskişehir	Flour, yogurt, tomatoes, red pepper, hot pepper	Dried/ground
13	Eskişehir	Flour, yogurt (produced from whole milk), milk, egg	Dried/ground
14	Tokat	Not defined	Dried/ground
15	Eskişehir	Flour, strained yogurt (produced from whole milk), tomatoes, red and green pepper, onion, egg	Dried/ground
16	Eskişehir	Flour, yogurt, potatoes, red pepper, salt	Dried/ground
17	Eskişehir	Not defined	Dried/ground
18	Ankara	Not defined	Dried/ground
19	Afyon	Hulled wheat, strained yogurt, chickpea, peppermint	Frozen
20	Tekirdağ	Flour, semolina (cooked with milk), yogurt, tomatoes, onion, red pepper	Dried/ground
21	Eskişehir	Not defined	Dried/ground

Analytical Methods

The AACC (1990) methods were used for the determination of moisture, ash and crude fat contents of the tarhana samples. The nitrogen content of the samples was determined by the Kjeldahl method (AACC 1990) and converted to protein content by a factor of 6.25. The acidity degree of tarhana samples was measured according to the Turkish Tarhana Standard (Anon 1981). In this standard, the acidity degree of tarhana was explained as the volume of the consumed 1N NaOH solution to neutralize the free acids in 100 g of tarhana. To evaluate the acidity degree, 50 mL 67% neutralized ethyl alcohol was added to 10 g of sample, then this solution was shaken in a closed container for 5 min, after that it was filtered. Next, 10 mL of the filtered solution was taken, and two to three drops of phenolphthalein indicator were added to the solution. This solution was titrated with 0.1N NaOH. The volume of the consumed 0.1N NaOH was determined. This value was multiplied by 5 and the acidity degree value was calculated. The salt content of the tarhana samples was determined by the Mohr method (İbanoğlu *et al.* 1999). Reducing sugar analysis was carried out using dinitrosalisilic acid solutions (Amodioha 1998). Ten grams of samples was diluted with distilled water to 100 mL in a volumetric flask following the addition of 5 mL Carrez I and Carrez II solutions. After filtration, 2 mL of the filtrate was mixed with the reaction solutions. The absorbance was read against the blank experiment at 540 nm and the amount of reducing sugar was calculated by the help of standard curve prepared with glucose previously. Analyses were carried out in duplicate.

Statistical Analysis

Statistical analysis of the data was performed using MSTAT-C (version 10, State University of Michigan, MI, USA) statistical software. All of the samples were dried tarhana except sample 19 (frozen tarhana), hence, sample 19 was not included in the statistical analysis.

RESULTS AND DISCUSSION

The chemical characteristics of the tarhana samples are presented in Table 2 and Fig. 1. The moisture values of the samples changed in a wide range. The highest moisture value was obtained from the sample that was frozen (no. 19). However, the moisture values of samples 10 and 15 were higher than the usual moisture value for dried foods. According to the Tarhana Standard, the maximum moisture value in tarhana should not be higher than 10% (Anon 1981). Consequently, only 20% of dried tarhana samples were found to be acceptable according to the related standard (Table 2). It was previously reported that the variation in moisture content of tarhana samples was due to the properties of ingredients used in the formulation and the drying method (Temiz and Pirkul 1991; Erkan *et al.* 2006).

The mean ash content of the samples was 4.56 ± 1.94%. When the amount of salt increased, the ash values increased directly. Moreover, in all samples salt values were less than 10% as it was signed in the standard. İbanoğlu *et al.* (1999) explained that their samples, prepared with 40 g of salt

TABLE 2.
CHEMICAL COMPOSITION OF THE TARHANA SAMPLES

Sample no.	Moisture (%)	Ash* (%)	Salt* (%)	Protein* (%)	Crude fat* (%)	Acidity* degree	Reducing sugar (%)
1	10.87	6.29	4.55	13.25	4.04	40.7	1.66
2	11.64	4.21	3.75	11.39	1.29	4.9	1.61
3	11.99	1.89	0.62	15.77	7.00	25.6	1.47
4	13.24	6.07	5.01	16.02	4.75	30.0	0.86
5	11.40	3.88	2.91	6.77	0.48	15.8	1.85
6	9.83	4.71	4.41	18.85	15.78	13.3	1.63
7	10.04	9.40	9.01	14.60	8.55	9.4	1.65
8	10.05	6.41	5.89	23.40	7.43	9.4	0.89
9	12.27	4.77	4.62	14.11	4.32	12.5	0.70
10	18.66	6.46	6.35	11.91	2.14	7.4	1.62
11	9.35	4.98	3.87	15.31	6.17	4.7	1.65
12	10.30	2.92	1.94	11.22	3.41	7.2	1.69
13	11.60	2.32	1.95	9.83	3.29	1.7	1.69
14	9.51	3.82	1.90	17.73	11.49	6.6	1.84
15	20.26	5.95	5.45	18.18	10.27	10.5	ND
16	10.82	4.00	3.82	10.86	1.38	9.0	ND
17	10.60	3.17	2.52	12.30	2.04	11.7	1.67
18	9.79	2.73	2.19	12.75	0.81	11.6	1.75
19†	66.40	3.90	2.90	25.48	4.35	12.8	0.22
20	10.40	1.36	0.65	15.83	2.35	8.4	0.43
21	10.89	5.95	5.79	28.55	5.08	ND	1.73
Minimum	9.35	1.36	0.62	6.77	0.48	1.7	0.22
Maximum	66.40	9.40	9.01	28.55	15.78	40.7	1.85
Mean	11.68	4.56	3.86	14.93	5.10	12.65	1.47
SD	2.85	1.94	2.09	4.89	4.01	9.61	0.43

* In dry matter.
† Not included in statistical analysis.
ND, not determined.

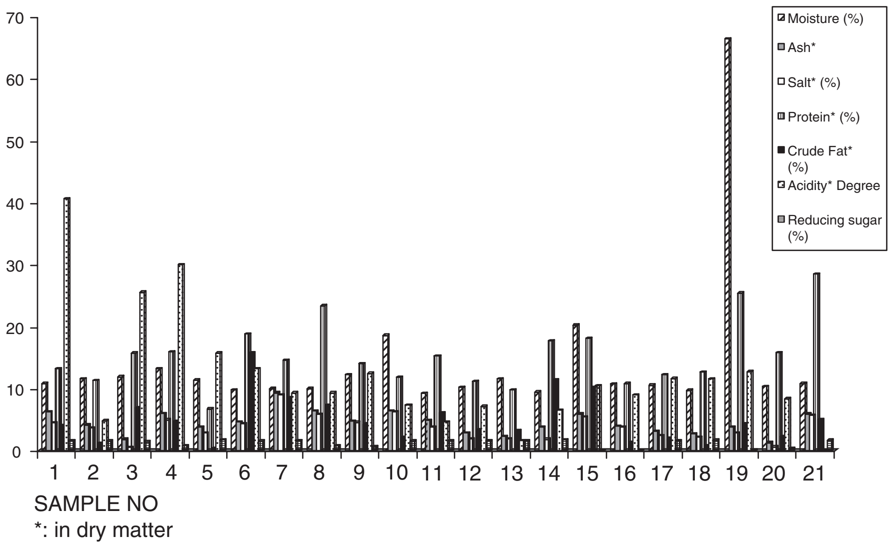

FIG. 1. CHEMICAL COMPOSITION OF THE TARHANA SAMPLES

per kg of flour, contains ash between 7.4 and 7.7%. On the other hand, the sample in which salt was not added contains an ash value of 1.8%. Köse and Çağındı (2002) determined ash values between 1.1 and 2.39%, and these values belonged to the recipe that did not include salt. Some of the samples in which salt was added gave results of lower ash values. The reason for this was related to adding low amount of salt during production. The ash values of the samples generally reached an agreement with the results of the analyses that were given before.

The protein content ranged between 6.77 and 28.55% with an overall mean concentration of 14.93 ± 4.89%. The lowest protein content (6.77%) belonged to the sample containing cornelian cherry instead of yogurt (no. 5). In 10 samples, the protein values were higher than 15% as well; in three samples, protein values exceeded 20%. Thus, in the production of these samples, more yogurt, hopefully strained yogurt was used. Truly, producers of the seven samples stated that they had used strained yogurt. Related to tarhana standard, the lower limit of protein value in tarhana should not be less than 12% (Anon 1981). According to this restriction, six samples (nos. 2, 5, 10, 12, 13 and 16) contained less protein than the limit value. Although yogurt, milk and egg were used in the formulation of sample 13, the protein content was still less than the limit value (12%). The reason for this might be due to the low amount of protein-containing ingredients used in the formulation. According to some researchers, the main reason for the variation in protein content of tarhana may be the type and the amount of yogurt used in tarhana preparation. Besides these, the properties of different cereal and legume flour samples could also affect the protein content (Erkan *et al.* 2006).

The mean crude fat content of the samples was 5.10 ± 4.01%. Sample 5 produced with cornelian cherry had the lowest crude fat value. The highest crude fat content was obtained from sample 6 in which strained yogurt was used. But in tarhana production by adding only yogurt, it was not possible to reach this high amount of crude fat. This suspicion was valid for samples 14 and 15 containing 11.49 and 10.27% crude fat, respectively. In addition to this, the protein ratios of these samples were fairly high. According to these results, it can be thought that in production of these samples, whole strained yogurt could be used or too much yogurt was added to flour during production.

Göçmen *et al.* (2003) measured crude fat content between 1.80 and 9.01% in commercial tarhana samples. İbanoğlu *et al.* (1999) determined the crude fat content between 3.5 and 4.5% in tarhana that was produced for experiment, and containing yogurt whose amount was half of the consumed flour. The results obtained in the research showed considerable similarity with these findings.

According to the tarhana standard, the acidity degree in tarhana should not be less than 15. On the other hand, it should not be higher than 40. As a result, 80% of the samples had no sufficient acidity degree. Some of these samples were let to ferment for 3 days to 1 week. Therefore, restrictions determined by the standards should be looked over.

Göçmen *et al.* (2003) determined the acidity degree among the range of 9.65–28.0 in commercial tarhana samples. Coşkun (2002) established the acidity degree in homemade tarhana between 9.6 and 19.9. Temiz and Pirkul (1990) reported that it was possible to have an acidity degree of 18 when the duration of fermentation was lengthened to 5 days. Tarhana having high acidity degree can be produced by using too much sour yogurt.

The mean reducing sugar concentration of the samples was 1.47 ± 0.43%. Finding reducing sugar in tarhana that is actually a fermentation product can be explained in three ways:

(1) In most of the samples, fermentation was insufficient.
(2) Active microorganisms in spontaneous fermentation do not have fermentative effect.
(3) In tarhana, there are some components, arising from raw materials, which react to form reducing sugar.

To see which one of the aforementioned probabilities is certainly valid, a controlled production in a laboratory scale must be applied.

In Turkey, homemade tarhana is produced in rural areas, but industrial-scale production of tarhana has increased in recent years. In different locations, the production method and recipes of tarhana may be changed (Table 1). Table 2 clearly shows that tarhana can be accepted as a nutritive food. Its nutritive properties increased and its digestion facilitated by fermentation. It also has good organoleptic qualities. The nutritional importance of tarhana is the improvement of the basic cereal protein diet by adding dairy protein in a highly accepted form. Like tarhana, indigenous fermented foods that enhanced health properties should receive much more attention that they deserve.

REFERENCES

AACC. 1990. *Approved Methods of the American Association of Cereal Chemists*, 8th Ed., St. Paul, MN.

AINSWORTH, P., FULLER, D. PLUNKETT, A. and İBANOĞLU, Ş. 1999. Influence of extrusion variables on the protein solubility of extruded soy tarhana. J. Sci. Food Agric. *79*, 675–678.

ALNOURI, F.F. and DUITSCHAEVER, C.L. 1974. The use of pure cultures for the preparation of kushuk. J. Inst. Can. Sci. Technol. Aliment. *7*, 228–229.

AMODIOHA, A.C. 1998. Effect of cultural conditions of the growth and amylolytic enzyme production by *Rhizopus oryzae*. Arch. Phytopathol. Pfl. *32*(1), 1–9.

ANONYMOUS. 1981. *TS 2282. Tarhana Standard*, The Institute of Turkish Standards, Ankara, Turkey.

AŞAN, M. 2003. Köy tipi tarhanalar üzerine bir araştırma. Uludağ Üniversitesi. Ziraat Fakültesi. Gıda Müh. Böl. Lisans Tezi. (unpublished observations) 25s.

BİLGİÇLİ, N., ELGÜN, A., HERKEN, E.N., TÜRKER, S., ERTAŞ, N. and İBANOĞLU, Ş. 2006. Effect of wheat germ/bran addition on the chemical, nutritional and sensory quality of tarhana, a fermented wheat flour-yoghurt product. J. Food Eng. *77*, 680–686.

CAYOT, N. 2007. Sensory quality of traditional foods. Food Chem. *101*, 154–162.

COŞKUN, F. 2002. Trakya'nın değişik yörelerinde üretilen ev tarhanalarının kimyasal, mikrobiyolojik ve duyusal özellikleri üzerine bir araştırma Gıda Mühendisliği Dergisi *6*(12), 48–52.

DAĞLIOĞLU, O. 2000. Tarhana as a traditional Turkish fermented cereal food, its recipe, production and composition. Nahrung *44*(2), 85–88.

EKİNCİ, R. 2005. The effect of fermentation and drying on the water-soluble vitamin content of tarhana, a traditional Turkish cereal food. Food Chem. *90*, 127–132.

ERBAŞ, M., CERTEL, M. and USLU, M.K. 2005. Microbiological and chemical properties of tarhana during fermentation and storage as wet-sensorial properties of tarhana soup. Lebensm.-Wiss. Technol. *38*, 409–416.

ERKAN, H., ÇELİK, S., BİLGİ, B. and KÖKSEL, H. 2006. A new approach for the utilization of barley in food products: Barley tarhana. Food Chem. *97*, 12–18.

GÖÇMEN, D., GURBUZ, O. and ŞAHİN, İ. 2003. Hazır tarhana çorbaları üzerine bir araştırma. Gıda *28*(1), 13–18.

HAFEZ, Y.S. and HAMADA, A.S. 1984. Laboratory preparation of a new soy-based kishk. J. Food Sci. *49*, 197–198.

İBANOĞLU, Ş. and İBANOĞLU, E. 1997. The effect of heat treatment on the foaming properties of tarhana, a traditional Turkish cereal food. Food Res. Int. *30*(10), 799–802.

İBANOĞLU, Ş. and ÖNER, M.D. 1999. Elek altı irmik ve soya ununun tarhana yapımında değerlendirilmesi. Unlu Mamuller Teknolojisi *8*(1), 24–30.

İBANOĞLU, Ş., AINSWORTH, P. and HAYES, G.D. 1996. Extrusion of tarhana: Effect of operating variables on starch gelatinization. Food Chem. *57*(4), 541–544.

İBANOĞLU, Ş., İBANOĞLU, E. and AINSWORTH, P. 1999. Effect of different ingredients on the fermentation activity in tarhana. Food Chem. *6*, 103–106.

KARAKAYA, S. and KAVAS, A. 1999. Antimutagenic activities of some foods. J. Sci. Food Agric. *79*, 237–242.

KÖSE, E. and ÇAĞINDI, Ö.S. 2002. An investigation into the use of different flours in tarhana. Int. J. Food Sci. Technol. *37*, 219–222.

PIRKUL, T. 1988. Çocuk ve risk altındaki kişilerin protein gereksinimine göre ticari tarhanaların formülasyonu. Besl. Diyet Dergisi *17*, 275–283.

SALAMA, A.A., DAMIR, A.A. and MOHAMED, M.S. 1992. Effect of cooking on nutrients, microbial and sensory properties of skimmed milk and rayeb kishk. Acta Alimentalogica *21*, 67–76.

TAMIME, A.Y., MUIR, D.D., KHASKHELI, M. and BARCLAY, M.N.I. 2000. Effect of processing conditions and raw materials on the properties of khishk. I. Compositional and microbiological qualities. Lebensm.-Wiss. Technol. *33*, 444–451.

TEMİZ, A. and PİRKUL, T. 1990. Tarhana fermantasyonunda kimyasal ve mikrobiyolojik değişimler. Gıda *15*(2), 119–126.

TEMİZ, A. and PİRKUL, T. 1991. Farklı bileşimlerde üretilen tarhanalarin kimyasal ve duyusal özellikleri. Gıda *16*(1), 7–13.

TÜRKER, S. and ELGUN, A. 1995. Sağlam, Pişirilmiş ve Çimlendirilmiş Kuru Baklagiller Eklenerek, Mayasız ve Mayalı (Saccharomyces

Cerevisiae) Şartlarında Üretilen Tarhanaların Besin Değeri. Selçuk Üniv. Zir. Fak. Dergisi *8*, 32–45.

YOUSSEF, M.M. 1990. Instantization and evaluation of some traditional Egyptian foods. Food Chem. *38*, 247–254.

YÜCECAN, S., BAŞOĞLU, S., KAYAKIRILMAZ, K. and TAYFUR, M. 1988. Tarhananın besin değeri üzerine bir araştırma. Türk. Hij. Den. Biyol. Derg *45*(1), 53–53.