International Journal of Agriculture Innovations and Research
Volume 4, Issue 4, ISSN (Online) 2319-1473
Manuscript Processing Details (dd/mm/yyyy) :
Received : 20/12/2015 | Accepted on : 01/01/2016 | Published : 11/01/2016

Review of Egyptian Cereal-Based Fermented Product (Kishk)

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***Abstract* – Cereals have a noteworthy place among the dietary nutrients all over the world. Fermentation of cereal has a long history of preparing a variety of foods. And fermentation might be the most simple and inexpensive way of increasing their nutritional value, sensory properties, and functional qualities, even though they lack some basic components (e.g. essential amino acids). Cereal-based fermented products contribute to about one-third of the diet worldwide. Several types, which can be categorized by the raw materials used or the type of fermentation involved in the manufacturing process, are produced. However, scientific knowledge for some traditional foods produced locally in middle east is still poor and not thorough. Numerous traditional, cereal-based fermented foods are produced in Egypt, Kishk is the most popular of them. The aim of this paper is to provide knowledge regarding the characterization, raw materials used for production, the traditional process of making, fermentation conditions, microorganisms which are effective, modern like product nutritional characteristics of Kishk.**

***Keywords* – Cereals, Kishk, Foods, Egypt.**

Tanguler et al.,(2010) reported that Daily foods, which are essential for establishing a balanced human life, consist of various foods which have different origins and process types and reflect the taste of the region in which they were produced. Among them, products produced by fermentation have an important place.

In general, fermentation is an inexpensive process involving the use of microorganisms to carry out enzyme catalysed transformations of wide range of agricultural materials (Erten et al., 2008). It is one of the oldest and economical methods of food processing and safety **(Erbas et al., 2005)**. Although the primary purpose of fermentation was to achieve food safety, it plays at least five roles: (a) bettering the diet through a diversity of flavors, nutritional value and textures in food substrates; (b) preservation of food through lactic acid, acetic acid and ethyl alcohol; (c) biological enrichment of the substrates; (d) detoxification and destruction of undesirable substances present in raw foods such as cyanide, phytates, tannins and polyphenols during food fermentation processing; (e) lowering cooking times and fuel requirements **(Aloys and Angeline, 2009; Liu et al., 2011)**.

Fermented products derived from plant and animal materials are made in different parts of the world. Some, are made in large-scale industrial production and therefore are of significant commercial importance worldwide **(Waites et al., 2001)**. In contrast; some are minor products in global terms, although they are made commercially in some countries. Examples of these are shalgam **(Erten and Tanguler, 2010)**, tarhana **(Settanni et al., 2011)**, kefir **(Kesmen and Kacmaz, 2011)**, koumiss **(Kabak and Dobson, 2011)**, ayran, which is a yoghurt based drink, kanji **(Erten et al., 2008)** and boza **(Yegin and Fernández-Lahore, 2012)**.

There are three main kinds of food products with the name: foods based on curdled milk products like yogurt or cheese; foods based on barley broth, bread, or flour; and foods based on cereals combined with curdled milk. Fermented milk-wheat mixtures, known as Kishk in the Middle East and Tarhana in Greece and Turkey, Kishkin Egypt, kushukin Iraq, and tahanya/talkunain Hungary and Finland are important foods in the diet of many populations **(Ozdemir *et al.*, 2007)**. In addition to their well-established position in the dietary status of the people in the aforementioned countries, these products has also, promoted in Mexico**(Cadena and Robinson, 1979)** and Europe**(Berghofer, 1987)** The preceding review will address mainly on Egyptian Kishk .

Centre De Cooperation International (2015) in the Final Report Summary - AFTER (African Food Tradition Revisited by Research)Planned over 4 years between September 2010 and November 2014, AFTER has revisited traditional African products, knowledge and know-how in the light of new technologies for the benefit of consumers, producers and processors in Africa and Europe. By applying European science and technology to 10 (ten) selected African traditional food products, AFTER turned research into quantifiable and innovative technologies and products that are commercially viable in both European and African markets. The ten traditional food products studied were chosen to represent three families of foods: (1) Fermented cereal-based: Akpan, a yoghurt-like product prepared from maize gruel and Gowé, a homogenous beverage prepared from malted sorghum, millet or maize, are both originating in Benin. Kenkey, fermented dough made from maize is originating in Ghana and Kishk Sa'eedi, made from a combination of wheat and fermented buttermilk, is originating in Egypt. (2) Fermented salted fish and meat: Lanhouin, salted/dried fish spontaneously fermented, is originating in Benin. Kong, traditional smoked fish, is originating in Senegal. Kitoza, salted/dried meat, is originating in Madagascar. (3) Vegetable and fruit based functional foods: the fruit of baobab and Hibiscus sabdariffa are respectively called "bouye" and "bissap" in Senegal. Ziziphus mauritiana, fruit of the jujube tree, is called "jaabi" in Cameroon.

DEFINITION OF KISHK

Kishk considered as a traditional wheat-based fermented food. It is a dry fermented product made from Laban zeer (salted sour buttermilk) or yoghurt and bulgur(cracked and bran-free parboiled wheat) and allow the mix to ferment at ambient temperature for different periods. It consumed in Egypt and in most Arab countries **(Morcos *et al.*, 1973)**. The ancient Egyptians kept cows and buffalos for their milk, which consumed as such or processed into other products. Many drawings illustrate the milking of cows and milk processing. Egyptian fermented milks considered as one the oldest known dairy products in the world **(Abou-Donia, 1984)**. Certain soured milk products have frequently mentioned in medical prescriptions used by the ancient Egyptians **(Darby *et al.*, 1977)**.

The origin of fermented foods in the diets of humans dates back many thousands of years and usually predates the existence of written records of their production and consumption **(Campbell-Platt, 1987)**.

Abou-Donia (1984) and Kurmann *et al.* (1992) described the origin, history and manufacturing processes of Egyptian fermented milk products, namely Kishk (*Kishk Sa'eedi)*, Kishk seiamy (vegetable mixture); laban hamid;laban kerbah,laban khad;laban matrad,laban rayeb; laban zabady; laban zeer and labenh.

The traditional process of making Kishk:

During the preparation of Kishk, wheat grains boiled until soft. Cooking the wheat grains gelatinizes the starch (called Belella). The cooked wheat dried in the sun, crushed using a stone hand mill and sieved in order to remove the bran. Subsequently, the wheat flour placed in a large earth ware container and moistened with slightly salted boiling water **(El-Gendy, 1983)**.

The process traditionally established in Egyptian household and divided into two stages:

Concentrated salted sour buttermilk, called laban zeer is prepared by processing milk directly into butter. In summer, under hot weather, milk naturally coagulated because of bacterial multiplication. The coagulated milk is stored in earthware pots (zeer). The pores in the zeer's walls are semi permeable and thus the moisture liberated

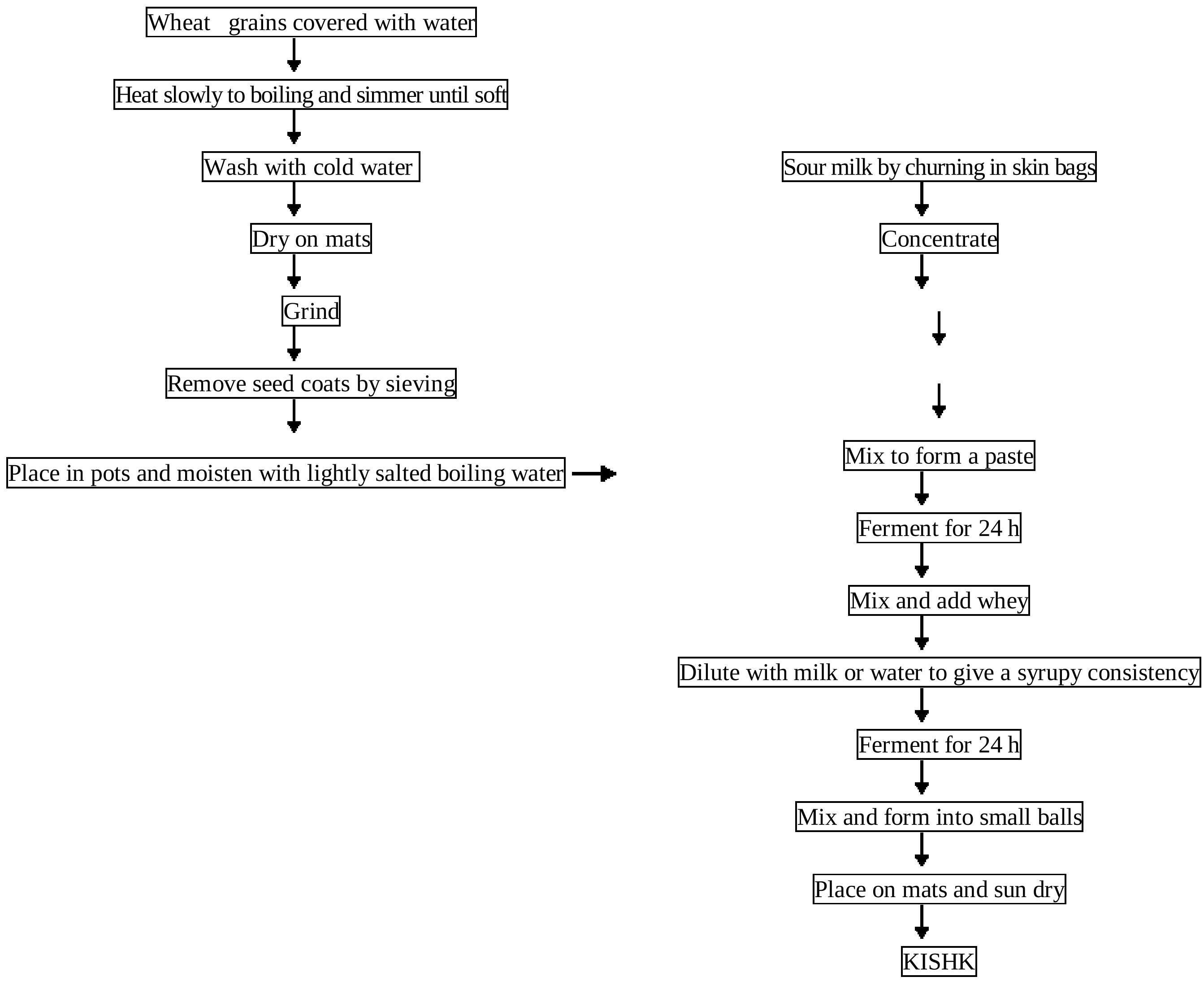

Fig.1. Flow diagram for the preparation of Kishk (Haard *et al*., 1999).

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from the milk. The sour buttermilk concentrated and salt was added (Abou-Donia, 1984). The final pH of the buttermilk reached 3.5-3.8 and titratble acidity between 1.3 and 1.6%. The concerted buttermilk thoroughly mixed with moistened wheat. Fermentation allowed to proceed forward a further 24 hours. Subsequently, the mass is thoroughly mixed, and formed into small, round or irregular pieces and dried in the sun on straw mats for 2 or 3 days (El-Gendy, 1983).

Alternatively, during the preparation of Kishk (Figure 2), wheat grains boiled until soft, dried, milled and sieved in order to remove the bran. Milk separately soured in earthenware containers, concentrated and mixed with the moistened wheat flour thus prepared, resulting in the preparation of a paste called a hamma. The home allowed toferment for about 24 hrs, following which it is kneaded and two volumes of soured salted milk are added prior to dilution with water. Alternatively, milk added to the hamma and fermentation allowed to proceed for a further 24 hours. The mass thoroughly mixed, formed into balls and dried.

Modern Kishk-Like Product

A Kishk-like product has developed using a starter culture containing *Streptococcus thermophilus* and *Lactobacillus bulgaricus* at 45°C. The use of thermophilic starter culture leads to more rapid acid production, which suppresses the growth of spoilage and potentially pathogenic bacteria. The procedure illustrated in Figure 3. The milk is heated for 80°C to destroy microorganisms that might compete with the starter culture during fermentation and then cooled to a temperature at which inoculation can be safely done without destroying cooled

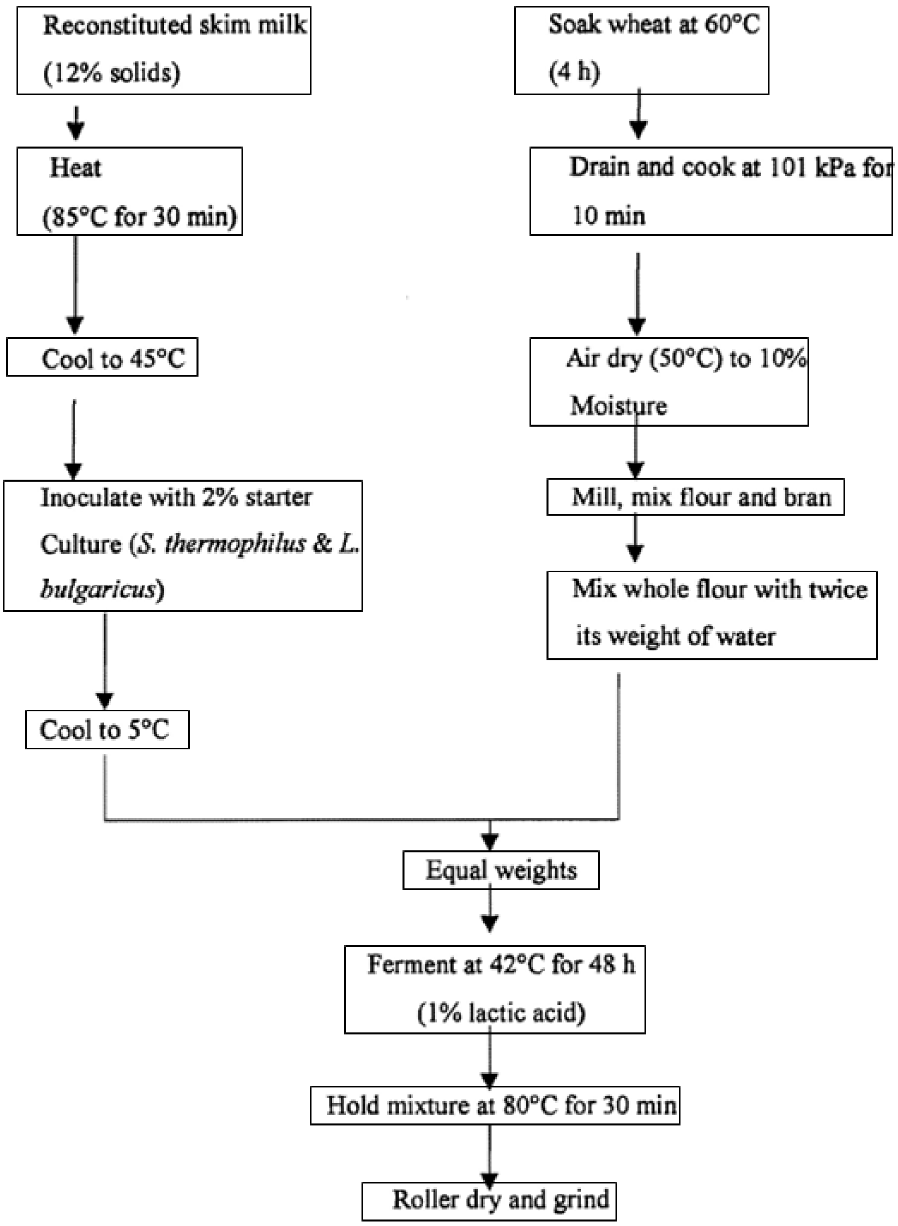

Fig. 2. Flow diagram of a method for the manufacture of a Kishk like product (Tamime and Robinson, 1985).

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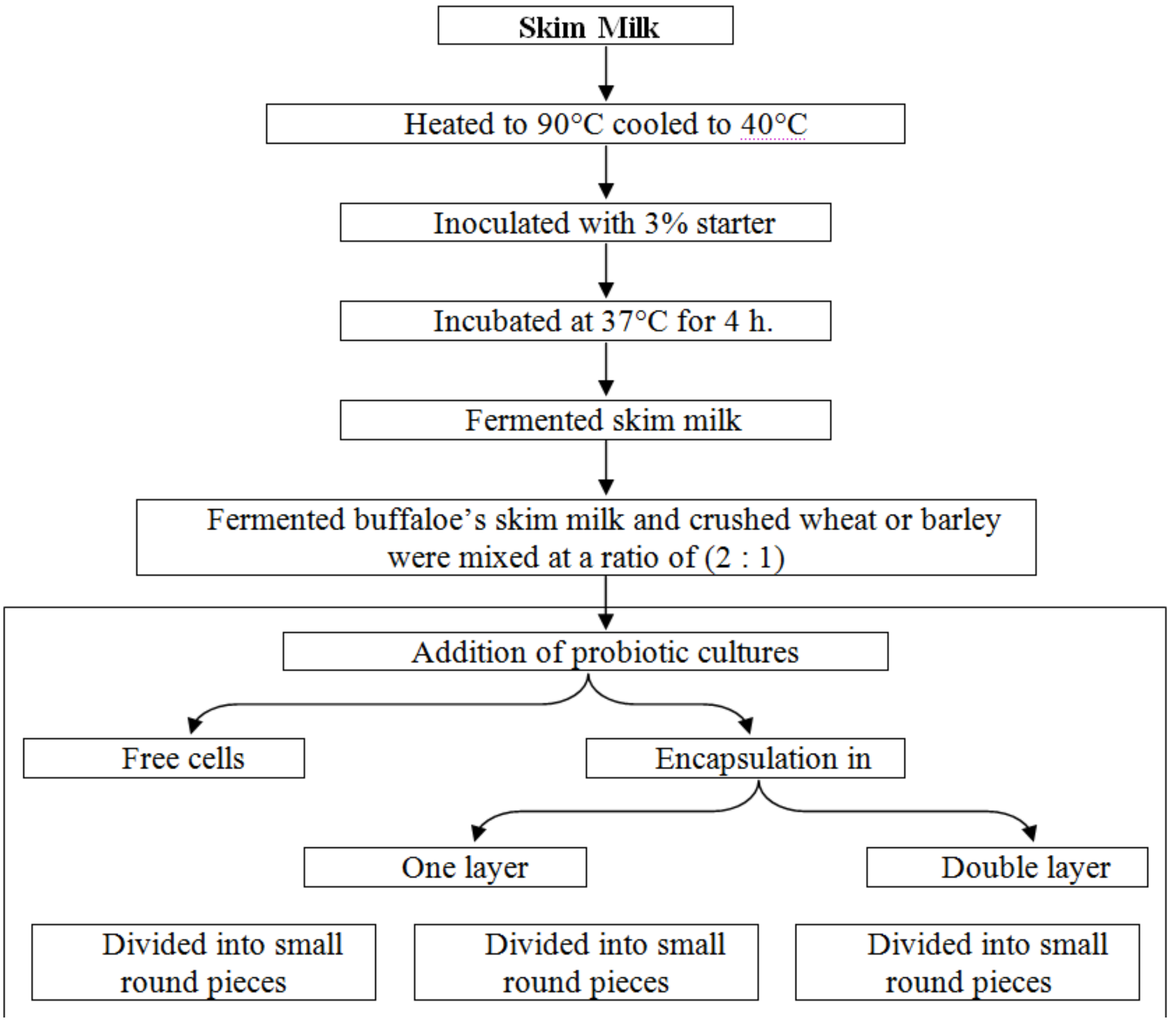
to a temperature at which inoculated can be safely done without destroying the culture. Cooking of the wheat under pressure ensures complete gelatinization of starch. The protein content of this product compared with that of the traditional product is lower (17% compared to 24%). The carbohydrate content is higher for the Kishk-like product at 71% compared to 60% in traditional product **(Tamime and Robinson, 1985)**. The main disadvantage of the Kishk-like product is that it has lower levels of lysine and threonine. This attributed to the process of roller drying that the product goes through to remove moisture.

Bahnasawy and Shenana(2004)reported a mathematical model of direct sun and solar drying of Kishk.

Nurliyani et al (2013) determine the quality of kishk made from a mixture of yogurt and sago flour with the addition of 6% sugar (sucrose) during storage at room temperature. Yogurt made from pasteurized milk using starter Lactobacillus bulgaricus and Streptococcus thermophilus, with the addition of 0 and 6% sugar and fermented at a temperature of 42o C for 6 hours. Kishk dough made by adding one part sago flour that has been roasted and 4 parts of yogurt. The mix was fermented for 24 hours at a temperature of 37o C, moulded in sphere-shaped flat and dried in an oven at a temperature of 50° C for 48 hours. Each treatment stored for 0; 21 and 42 days at room temperature with three replications. Quality evaluation of kishk includes microbiological quality (total lactic acid bacteria) and chemical quality (lactose content, acidity, pH, moisture content). The data were statistically analyzed by two way ANOVA. The results showed that the addition of sugar as much as 6% have no effect on the kishk quality during storage, with an average total lactic acid bacteria was 6.32 log CFU / g, 2.59% of lactose, 2.30% acidity, pH value was 3.69 and 10.39% of moisture content. In conclusion, kishk made from sago flour mixed with yogurt and sugar addition of 6% can be stored at room temperature for 42 days without decreasing in quality.

Kebary et al (2014) prepare symbiotic Kishk from buffalos skim milk and crushed barley (2:1) with adding free cells and immobilized (single and double layer)alginate beads from Bif,bifidum ATCC 15696 and Bif. Infantis ATCC 15697.They found that encapsulation of bifidobacteria improved their survival during storage of symbiotic kishk and adding of free and immobilized bifidobacteria inhibited the growth of moulds ,yeasts and spore forming bacteria.



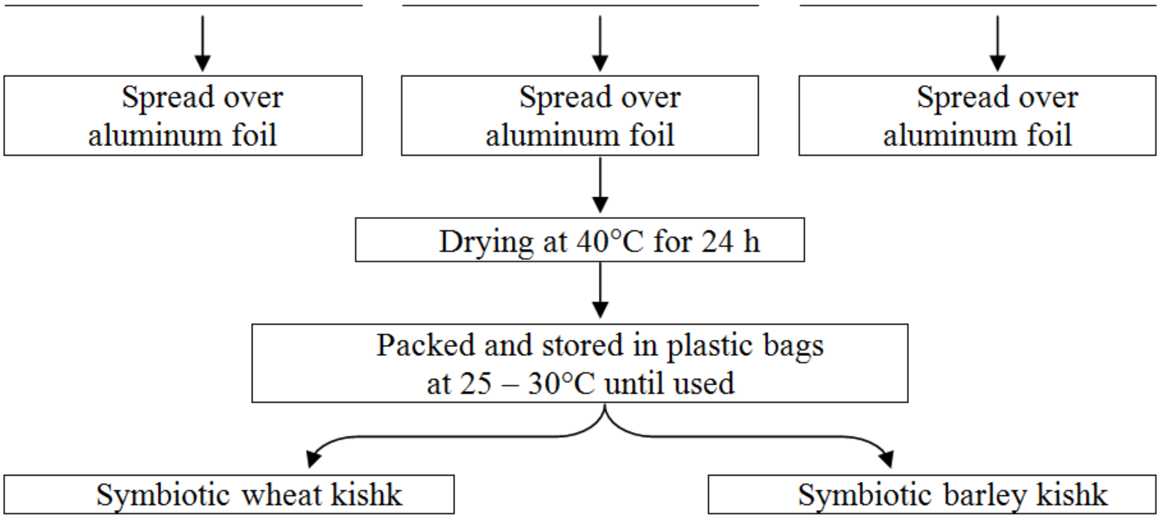


Fig.3. Manufacture of Synbiotic kishk.(Kebary et al 2014)

MICROFLORA IN EGYPTIAN KISHK

El-Sadek *et al.* (1958) determined that spore formers (*B. licheniformis*, *B. subtilis* and *B. megatherium*) were the major part of the microflora in Egyptian Kishk and counted 57 – 75%, followed by lactic acid bacteria 25 – 43% of the total bacterial flora.

Stephanopoulos *et al.* (1981) stated that Lactic acid bacteria isolated from Trahana were belonging to the genera *Lactobacillus*, *Leuconostoc*, *Pediococcus* and *Enterococcus*. *Lactobacillus plantarum* had been the most frequently found species, followed by *S. faecalis*, *L. mesenteroides* and *Lactobacillus brevis*.

Atia and Khattab (1985) revealed that Proteolytic and salt tolerant microorganisms have been detected in appreciable numbers (3.9×10^6 cfu/g) in samples of Egyptian Kishk, along with *Bacillus subtilis*, *B. polymyxa*, *B. coagulans* and *B. cereus*, while yeasts and molds were also present (9.0×10^1 and 2.5×10^3 cfu/g).

Furthermore, the microorganisms responsible for the fermentation of Kishk include *Lactobacillus plantarum*, *L. brevis*, *L. casei*, *Bacillus subtilis* and yeasts **(Beuchat, 1983 and Odunfa 1985)**.

Abou-Donia *et al.* (1991) noted that no improvement of the quality of Kishk was observed when *L. acidophilus* and *L. casei* were added to the yogurt starter.

Ismail (1993) studied the degradative enzymes and fungal flora originally isolated from Egyptian Kishk. Fungal isolates were collected on Dicloran glycerol agar and Czapek Dox agar media at 28°C and yeast starch agar at 45°C. Moisture content of Kishk samples ranged from 4.5 to 8.9%. The pH values of Kishk samples ranged from 4.14 to 5.19. These samples also possessed high of total soluble salts ranging from 2.6 to 5.1%. The most common mesophiles were members of Aspergilli, Penicillium, *Emericella* and *Rhizopus*. However, thermophilic fungal species isolated were *Malebranche sulfurea*, *Rhizomucor pusillus* and *Thermomyces lanuginosus*. All isolates tested (108) were capable of producing caseinase and catalase enzymes to varying degrees whereas 91·7% of the isolates were exhibited amylolytic activity.

Elewa and Aly (2006) investigated the microbiological examination of whey and water kishk. Results indicated that *S. thermophilus* and *L. bulgaricus* were dominant during dehydration in both of whey and water kishk in around of 8 log cfu/ml. Also, total acidic and actedione resistant yeast, spores fungi were presented during in *S. thermophilus* and *L. delbrueckii* subsp. *bulgaricus* counts which was proportional to the storage period and the temperature of storage.

Elewa and Metry (2006) used *Lactobacillus acidophilus* as probiotic bacteria in place of natural lactic acid bacteria (LAB) beside the using of soybean or burghul as cereal source and acidophilic whey, soy milk of skim milk in plant of fermented milk to produce probiotic kishk. Using of acidophilic milk and burghul reflected in highest rate of maintenance viable *L. acidophilus*. While the lowest one with using soybean flour and whey. Spore former yeast and mould counts were present averaged from log 3.9 to 5.34 and 3.1 to 3.9 cfu / g, respectively in different treatments.

Harakeh *et al.* (2009) studied antimicrobial resistance of *Listeria monocytogenes* isolated from Lebanese dairy-based food namely, Baladi cheese, Shankleesh and Kishk. *L. monocytogenes* detected in 26.67%, 13.89% and 7.23% of the Baladi cheese, Shankleesh and Kishk samples, respectively. The highest resistance in *L. monocytogenes* isolates was noted against oxacillin (93.33%) followed by penicillin (90%). The results provide an indication of the contamination levels of dairy-based foods in Lebanon and highlight the emergence of multi-drug resistant Listeria in the environment.

Zouhairi et al., (2010) evaluated the antimicrobial resistance of molecularly characterized strains of *Staphylococcus aureus* and *S. saprophyticus* isolated from 3 Lebanese dairy-based food products kishk, shanklish and baladicheese. Suspected *Staphylococcus* isolates were identified by polymerase chain reaction (29 *S. aureus* and 17 *S. saprophyticus*) and were evaluated for their susceptibility to different antimicrobials. The highest levels of contamination with staphylococci were in *baladi* cheese. Resistance rates ranged from 67% to gentamicin to 94% to oxacillin and clindamycin. The results suggest that these locally made dairy-based foods may act as vehicles for the transmission of antimicrobial-resistant *Staphylococcus* spp.

El-Nawawy *et al.* (2012) attempted to develop Kishk using different substrate, namely soy milk, fermented buffaloe skim milk and fermented buffaloe skim milk retentate and different starter cultures; *Lactobacillus acidophilus*, *Lb. rhamnosus*, *Lb. sakei* and *Streptococcus thermophilus*. The authors showed that use of *Lb. rhamnosus* or *Lb. sakei* to ferment the supplemented substrate (milk or soya) gives a healthy and safe product.

NUTRITIONAL CHARACTERISTICS OF KISHK

Hamad and Fields (1982) prepared an acceptable whey-based Kishk by mixing fermented whey with parboiled wheat at a ratio of 3:1 (v/w). Amino acid analyses free amino acids indicated that both Kishks had adequate amino acid balances for a nutritious food. The riboflavin content of the whey-Kishk was 0.14 mg/100g whereas it was only 0.08 mg/100g in the yogurt-Kishk. The niacin contents were 3.17 mg and 3.36 mg/100g of yogurt-based Kishk and whey-based Kishk, respectively.

Dried Kishk can have up to 23% protein and can have as much lysine as 310 mg/g nitrogen compared to the Food and Agriculture Organization provisional pattern of 270 mg/g nitrogen **(El-Gendy, 1983)**. Combining the two proteins in the proper proportions results in a mixture that is nutritionally superior to each one alone **(El-Sadek *et al.*, 1989)**. The high protein content of Kishk and the complementary effect, which the milk proteins exert on the lysine deficient wheat mat, take this product comparable to milk protein nutritional quality **(Hamad and Fields, 1982)**.

Damir *et al.* (1992) investigated the development of organic acids in kishk. The authors identified six organic acids, namely butyric, propionic, acetic, formic, lactic and succinic were produced fermented Kishk. Their levels increased up to the sixth day of fermentation, except succinic acid, which decreased after the fifth, and the third days of skimmed milk and Rayeb Kishk's fermentation, respectively. Lactic acid had the highest increment rate while formic acid had the lowest. The free amino acid content rose during the fermentation. These results correlated quite well with the growth of lactic acid and proteolytic bacteria as well as with acidity development during fermentation. Substituting Rayeb milk with skimmed milk in Kishk preparation produced an acceptable soup product. The development of organic acids during Kishk fermentation was in line with established values for Kishk soup acceptability.

Salama et *al.* (1992) Studied the chemical composition and microbial properties of Rayeb Kishk. The protein content decreased by 2.4 and 3.2% during the cooking of skimmed milk and Rayeb Kishk, respectively. Rayeb Kishk was higher in both volatile and non-volatile organic acids than skimmed milk Kishk. The percentage of butyric, propionic, lactic and succinic acids were decreased, but acetic and formic acids disappeared on cooking. All the essential amino acids were at levels adequate for a nutritious food in both types of Kihsk. Total and free amino acids either remained unchanged or underwent a slight drop on cooking. The number of aerobic mesophilic bacteria decreased, while lactic acid bacteria and yeasts were destroyed during cooking of Kishk. Utilization of inexpensive skimmed milk in Kishk preparation is a way of raising its protein value and consumer acceptability

Abd-el-Malek and Demerdash(1977); Steinkraus 1983a; 1996 reported that Yogurt/cereal mixtures are a another household lactic acid fermentation of considerable nutritionalimportance includes Egyptian kishk, Greek trahanas and Turkish tarhanas. These products are basically parboiled wheat/yogurt mixtures that combine the high nutritional value of wheat and milks while attaining excellent keeping qualities. The processes are rather simple. Milk is fermented to yogurt and the yogurt and wheat are mixed and boiled together until the mixture is highly viscous. The mixture is than allowed to cool, formed into biscuits by hand and sun-dried. Trahanas can be stored on the kitchen shelf for years and used as a base for highly nutritional soups. In the Egyptian kishk process, tomatoes, onions and other vegetables are sometimes combined with the yogurt and wheat in the biscuits .

Ibanoglu *et al.* (1995) evaluated the production of Tarhana, a popular fermented wheat-yogurt mixture consumed traditionally in turkey. Tarhana of different formulations (type of wheat flour, amount of yogurt and presence of salt) subjected to monitoring during fermentation. The pH and titratable acidity of Tarhana samples did not change after the third day in the course of 4-day fermentation. The final pH and acidity (percentage) of Tarhana were in the range of 4.348 and 1.8-2.3 %, respectively. The thiamine, riboflavin and vitamin B12 contents of Tarhana did not change considerably during fermentation. The addition of salt to Tarhana lowered the rate of acid formation during fermentation, leading to a higher pH. The replacement of white wheat flour with whole-meal flour resulted in an increase in the protein and vitamin. **Tamime *et al.* (1997a)** evaluated the contribution of the cereal component to the overall character of Kishk. Different wheat; barley and oats bases were prepared in a manner similar to the production of burghol. Chemical analysis revealed that the overall fiber content of the cracked barley and cracked oats were lower by 5.1 and 1.43 % than the corresponding original barley and oat, respectively. The phytic acid and β-glucan contents of cracked wheat were higher than the corresponding original wheat grain by 0.03 and 0.36%, respectively. The β-glucan content of cracked oat products was 0.26% higher than that of original oat. The concentration of copper, calcium, zinc and manganese differed significantly ($p < 0.05$) between the cereal grain and the cracked product. These differences substantiate the potential of cereal type on the nutritional content and sensory attributes of Burghol. **Ibanoglu and Ibanoglu (1997)** studied the impact of heat treatment (simmering for 10 min at atmospheric conditions) on the foaming capacity (FC) and foam stability (FS) of Tarhana, using response surface methodology with a concentration (0.5 – 1.5% dry matter

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basis) and whipping time (30 – 120 s) as independent variables. Predicting the FC and FS were developed exploring Regression equations. The results subjected to compared with those of an untreated sample. Results suggest that concentration and whipping time had a significant effect ($p \leq 0.01$) on FC and FS. The heat treatment applied causes a reduction in the foam capacity and foam stability of Tarhana when compared with an untreated sample.

Tamime *et al.* (1997 b) investigated the composition and sensory properties of Kishk prepared from wheat, oat and barley burghol (is a parboiled 'cracked' cereal). The dough (low fat yoghurt, burghol and salt) was then dried and ground to a flour. The chemical analysis (g / 100 g on dry matter basis) of the Kishk fell within the following ranges: protein 18.2-20.6, fat 6.4-10.7 and carbohydrates 62.0-68.6. The moisture content averaged 8.4%, and the fiber and β-glucan contents were higher in Kishk made with barley and oat burghol, respectively. Lactic acid constituted the major organic acid present in the products. The highest mono-unsaturated fatty acid content (~34%) encountered in oat Kishk. Appreciable quantities of Fe, Cu and Mn in all the kiosks were parallel to the original mineral composition of the specific cereal from which derived. The sensory profiles of a hot porridge-like gruel of nine samples of Kishk showed substantial differences between these products made with different cereals. Mouth- feel (grainy, sticky and slimy character) of Kishk may function differently depending on the associated with cereal matrices. Partial least squares regression models derived from the chemical composition successfully fitted, after cross-validation, for grainy, sticky and slimy character. The model for a grainy character, in particular was of predictive value.

Tamime *et al.* (1999)investigated the compositional quality of 25 commercial samples of Lebanese Kishk. The chemical analyses (dry matter basis) of the samples were within the following ranges: protein, 14.7 – 21.4%; fat, 2.6 – 11.5%; ash, 4.1 – 9.3% and carbohydrates, 61.0 – 76.8%. The moisture and salt contents ranged between 6.8 and 10.8 and 0.95 and 4.48%, respectively, and the pH averaged 3.8. Lactic and acetic acids were identified to be the major organic acids present in the Kishk samples, including an appreciable amount of propionic acid.

Toufeili *et al.* (1999) monitored the changes in phytic acid, phytase activity and HCl-extractability of Ca, Fe, Mg and Zn during fermentation of kishk formulated from bulgur (cracked and bran-free parboiled wheat) or whole wheat meal. Phytic acid and phytase activity decreased and the proportions of HCl-extractable Ca, Fe, Mg and Zn increased as fermentation progressed. The whole wheat meal kishk contained lower ($p < 0.05$) amounts of phytic acid and its Ca, Fe, Mg and Zn were more ($p < 0.05$) amenable to extraction by 0.03 N HCl than bulgur kishk. The soup prepared from whole wheat meal kishk was significantly ($p < 0.05$) more yellowish in colour, more sour, less gritty, less cohesive and contained more bran particles than the bulgur-based formulation. Both formulations were liked to a similar degree. These findings suggest that substitution of whole wheat meal for bulgur in the formulation of kishk enhances the availability of Ca, Fe, Mg and Zn without undue effects on the acceptability of the final product

Muir *et al.* (2000) investigated the effect of processing conditions and raw materials on Sensory profile and microstructure of Kishk. Differences in sensory character of Kishk were associated with cereal type and dairy base. When oat products were used as the cereal component, the Kishk samples were similar, but products made from Burghol and wheat flour differed in mouth-feel. In addition, the Kishks made with Burghol or Burghol flour wereeasily distinguished from products made from wheat flour. The length of the conditioning period only influenced the acidic character of Kishk made with a combination of Burghol and low-fat yoghurt. The starch content in the yoghurt / Burghol or wheat flour mixture decreased linearly during the conditioning period because of a-amylase activity. The microstructure of the Kishk doughs was consistent with the normal pattern of degradation of wheat starch in which much of the original granular structure retained during the conditioning period.

N **Adnan et al (1999)** investigated the nutritional properties of 25 commercial samples of Lebanese Kishk was undertaken. Profiling of the carbohydrate-based nutrients ($g.100\ g^{-1}$ on dry matter basis [DMB]) in the samples gave the following ranges: fibre 7-12, phytic acid 0.7-1.6, and β-glucan 0.1-0.6. Some Kishk samples contained appreciable amounts of polyunsaturated fatty acids, while the contents of monounsaturated fatty acids of most of the samples were considerably lower than those present in milk and other dairy products. All the Kishk samples contained appreciable quantifies ($mg.100\ g^{-1}$ [DMB]) of the major minerals (K 495, P 397, Ca 243 and Mg 123). and such product was a good source of Fe and Mn which originated from the Burghol. Sodium was present in high amounts (~1657 $mg.100\ gr^{-1}$ [DMB]). The amino acids composition of the protein from Kishk was good. Vitamins C, pyridoxine and (3-carotene were not detected in the Kishk samples, and approximately half of these samples did not contain a-tocopherol. The thiamin and riboflavin contents of Kishk were in the range of what has been reported in the literature. Kishk has a limiting vitamin factor and is not considered a good dietary source. The selenium content of the majority of the Kishk samples was good and such a product may represent a potentially good dietary source.

Tamime *et al.* (2000) studied the effect of processing conditions and raw materials on the compositional and microbiological qualities of Kishk. Kishk was made from a dough containing salt, low-fat milk (unfermented or acidified with glucono-d-lactone (GDL) or fermented with yoghurt starter culture), and either rolled oats, oat flour, parboiled cracked wheat (Burghol) or wheat flour. Then, the dough air-dried and ground to a powder. The chemical composition (g/kg on dry matter basis) of the Kishk fell within the following ranges: protein 187 – 213, fat 36 – 107, carbohydrates 639 – 721 and ash 33-64, whilst the moisture content averaged 94 g/kg. The fiber and β-glucan contents were higher in Kishk made with oat-based cereals or Burghol. Appreciable quantities of Fe, Cu, Mn and Mg were found in all Kishk samples reflecting the mineral composition of the cereal type used. Coliforms, yeasts and molds unrecovered from any of the samples at the level tested (10^{-1} dilution). The bacterial count (total viable and aerobic sporeformers) was within the range specified for skimmed milk powder. Yoghurt starter cultures recovered at high cell densities in fresh Kishk , whereas their counts declined marginally after storage for 12 months; however, no starter culture survived in store oat-based products.

Erkan *et al.* (2006) utilized barley (hulled and dehulled samples) in Tarhana formulations with relatively high β-glucan content. Chemical and sensory properties of the Tarhana samples were investigated. Although some of the β-glucan most likely destroyed during fermentation. The results indicated the possibility by using barley flours to produce Tarhana with relatively high β-glucan content. The effect of Tarhana production on the electrophtogram of protein revealed that relative band intensities of Tarhana samples were investigated. Although some of the β-glucan most likely destroyed during fermentation. The results indicated the possibility by using barley flours to produce Tarhana with relatively high β-glucan content. The effect of Tarhana production on the electrophtogram of protein revealed that relative band intensities of Tarhana samples were generally less intense than those of barley flour samples; probably due to the breakdown of proteins during fermentation. The use of barley flours affected the color and viscosity of Tarhana samples. However, the overall sensory analysis indicated that utilization of barley flours in Tarhana formulation resulted in acceptable sensory soup properties.

Elewa and Metry (2006) used *Lactobacillus acidophilus* as probiotic bacteria in place of natural lactic acid bacteria (LAB) beside the using of soybean or burghul as cereal source and acidophilic whey, soy milk of skim milk infermented milk to produce probiotic kishk. The results revealed that total solids, titratable acidity, either extract, total nitrogen, water soluble nitrogen, crude fiber, and ash contents increased during storage.

Magala *et al.* (2013) revealed that fermentation of tarhana by lactic acid bacteria and yeasts led to decrease in pH, content of reducing saccharides and citric acid, while titrable acidity and concentration of lactic and acetic acid increased. Determination of functional properties of tarhana powder showed, that salt absence and increased amount of yoghurt in tarhana recipe reduced foaming capacity and oil absorption capacity, whereas foam stability and water absorption capacity were improved. Sensory evaluation of tarhana soups showed that variations in tarhana recipe adversely affected sensory parameters of final products.

Beitane (2013) investigated the influence of flakes from biologically activated hull-less barley grain and malt extract on chemical composition of yoghurt. The addition of flakes from biologically activated hull-less barley grain and malt extract substantially increase in nutritional value of yoghurt samples. There was obtained the increase of total proteins ($p > 0.05$) and the decrease of fat ($p > 0.05$). The presence of flakes from biologically activated hull-less barley grain and malt extract in yoghurt samples supplemented significant increase of amino acids amount ($p < 0.05$) and riboflavin concentration ($p < 0.05$).

Conclusion

Cereal-Based Fermented Product have an important place in daily foods. Fermented milk-wheat mixtures, known as Kishk in the Middle East It is a dry fermented product made from Laban zeer (salted sour buttermilk) The high protein content of Kishk and the complementary effect, which the milk proteins exert on the lysine deficient wheat mat, take this product comparable to milk protein nutritional quality. Spore formers (*B. licheniformis*, *B. subtilis* and *B. megatherium*) were the major part of the microflora in Egyptian Kishk and counted 57 – 75%, followed by lactic acid bacteria 25 – 43% of the total bacterial flora.

A Kishk-like product has developed using a starter culture containing *Streptococcus thermophilus* and *Lactobacillus bulgaricus*.The use of thermophilic starter culture in modern Kishk-like product leads to more rapid acid production, which suppresses the growth of spoilage and potentially pathogenic bacteria The main disadvantage of the Kishk-like product is that it has lower levels of lysine and threonine. This attributed to the process of roller drying that the product goes through to remove moisture.

Prepare symbiotic Kishk with adding free cells and immobilized (single and double layer)alginate beads from bifidobacteria has been done. Encapsulation of bifidobacteria improved their survival during storage of symbiotic kishk and adding of free and immobilized bifidobacteria inhibited the growth of moulds ,yeasts and spore forming bacteria.

References

[1] Abd-el-Malek T, Demerdash M. 1977. Microbiology of kishk. Symposium on IndigenousFermented Foods (SIFF), Global Impacts of Applied Microbiology (GIAMV)21-27.

[2] Abou-Donia, S. A. (1984). Egyptian fresh fermented milk products. New Zealand J. Dairy Sci. and Technol., 19:7-18.

[3] Abou-Donia, S.A.; Attia, I.A.; Khattab, A.A. and El-Shenawi, Z. (1991). Formulation of dried cereal fermented milks with prolonged storage life. Egypt J. Dairy Sci., 19: 283–299. DOI: 10.1051/lait:1999436

[4] Adnan Y. Tamime, Margaret N.I. Barclay, David McNulty and Thomas P. O Connor 1999 Kishk - a dried fermented milk / cereal mixture. 3. Nutritional composition Lait 79 : 435-448

[5] Aloys N, Angeline N. 2009. Traditional fermented foods and beverages in Burundi. Food Research International, 42: 588–594.

[6] Atia, I.A. and Khattab, A.A. (1985). Microbiological and chemical studies of Kishk. Alex Sci. Exch. 6:63–71.

[7] Bahnasawy , A ; Shenana, M (2004) A mathematical model of direct sun and solar drying of some fermented dairy products (Kishk)Journal of Food Engineering 61:309 - 319.

[8] Beitane, I. (2013). The chemical composition of yoghurt enriched with flakes from biologically activated hull-less Barley grain and malt extract. World Academy of Sci., Engin. Technol., 75: 614 – 617.

[9] Berghofer, E. (1987). Use of non-European fermented foods in the Austrian market. Ernahrung, 1, 14–22.

[10] Beuchat, L. R. (1983). Indigenous Fermented foods, In: Biotechnology vol. 5, Food and Feed Production with Microorganisms; Reed G. (Ed). Verlag Chemie, Weinheim 477.

[11] Cadena, M. A. and Robinson, R. K. (1979). The acceptability of yoghurt–cereal mixtures to a rural community in Mexico. Ecol. Food and Nutr., 8, 169–174

[12] Campbell-Platt, G. (1987). Fermented foods of the world a dictionary and guide. Kent, England: Butterworths. Cited from reference Walter P. Hammes, Markus J. Brandt, Kerstin L. Francis, Julia Rosenheim, Michael F.H. Seitter and Stephanie A. Vogelmann. Microbial ecology of cereal fermentations. Trends in Food Science and Technology, 16 (2005) 4–11.

[13] Centre de cooperation international en recherche agronomique pour le developpement 2015after Report Summary Project reference: 245025 Funded under: FP7-KBBE

[14] Damir, A.A.; Salamam, A.A. and Salfwat Mohamed, M. (1992). Acidity, microbial, organic and free amino acids development during fermentation of skimmed milk, Kishk. Food Chem., 43: 265-269.

[15] Darby, W.J.; Ghalioungui, and Grivetti, L. (1977). Food: The Gift of Osiris. Vol. 2, P. 775. London, New York: academic Press.

[16] Elewa, Neimat A. H. and Metry, Wedad A. (2006). Some aspects in production and evaluation of probiotic kishk. Assuit J. Agric. Sci., 37 (2): 127 – 145.

[17] Elewa, Neimat A. H. and Aly, Salwa, A. (2006). Microbiological and biochemical aspects of kishk fermentation. Fayoum J. Agric. Res. Dev., 20 (1): 192 – 209.

[18] Elewa, Neimat A. H. and Metry, Wedad A. (2006). Some aspects in production and evaluation of probiotic kishk. Assuit J. Agric. Sci., 37 (2): 127 – 145.

[19] El-Gendy, Sh. M. (1983). Fermented food in Egypt and middle east. J. Food Protec., 45 (4): 358 – 367.

[20] El-Nawawy, M. A.; Ibrahim, Rasha; Al-Bonayan, Ameena M. and El-Beialy, Amany R. (2012). “Development of Functional Food Products” Inter. J. Dairy Sci. Res., 1 (4): 12-17

[21] El-Sadek, G. M.; Zawahry, M.R.; Mahmoud, S.A.Z.; Abd El-Motteleb, L. (1958). Chemical composition of Egyptian Kishk. Ind. J. Dairy Sci., 11:67–75.

[22] El-Sadek, G. M.; Zawahry, M. R.; Mahmoud, S. A. Z. and El-Motteleb, L. A. (1989). Chemical composition of Egyptian Kishk. Indian J. Dairy Sci., 11: 67-75.

[23] Erbas M, Certel M, Uslu MK. 2005. Microbiological and chemical properties of Tarhana during fermentation and storage as wet- sensorial properties of Tarhana soup. LWT, Food Science and Technology, 38: 409-416.

[24] Erkan, H.; Celik, S.; Bilgi, B. and Koksel, H. (2006). A new approach for the utilization of barley in food products: Barle Tarhana Food Chem. 97: 12–18.

[25] Erten H, Tanguler H, Canbaş A. 2008. A traditional Turkish lactic acid fermented beverage: Shalgam (Salgam), Food Review International, 24, 352-359.

[26] Erten H, Tanguler H. 2010. Fermente Bitkisel Urunler [Fermented plant products]. In: (Aran, N., Ed), Food Biotechnology; Nobel Yayin Dagitim, Ankara, Turkey, pp 241-277 (In Turkish).

[27] Hamad, M. A. and Fields, M. L. (1982). Preliminary evaluations of a new type of Kishk made from whey. J. Food Sci. 47: 1140-1143.

[28] Harakeh, S.; Saleh, I.; Zouhairi, O.; Baydoun, E.; Barbour, E. and Alwan, N. (2009). Antimicrobial resistance of Listeria monocytogenes isolated from dairy-based food products. Sci. of the Total Environ., 407: 4022–4027.

[29] Ibanoglu, S.; Ainsworth, P.; Wilson, G. and Hayes, G. D. (1995). The effect of fermentation conditions on the nutrients and acceptability of Tarhana. Food Chem. 53: 143 – 147.

[31] Ibanoglu, E. and Ibanoglu, S. (1997). The effect of heat treatment on the foaming properties of Tarhana, a traditional Turkish cereal. Food Res. Inter. 30: 799-802.

[32] Ismail, M. A. (1993). Degradative enzymes and fungal flora associated with the Egyptian foodstuff Kishk. Inter. Biodeterioration and Biodegradation. 31:143-157.

[33] Kabak B, Dobson AD. 2011. An introduction to the traditional fermented foods and beverages of Turkey. Critical Review in Food Science and Nutrition Journal, 51(3): 248-60.

[34] Kebary K.M.K., Kamaly K. M. , Nadia A. Abou zeid , Salem O. M. and Elham A. El-Den(2014).Synbiotic Kishk as functional food. Minufiya J. Agric. Res. Vol.39 No. 1(1): 55-68.

[35] Kesmen Z, Kacmaz N. 2011. Determination of lactic microflora of kefir grains and kefir beverage by using culture-dependent and culture-independent methods. Journal of Food Science, 76: 276-283.

[36] Kurmann, J. A.; Rasic, J. Lj. and Kroger, M. (1992). Encyclopedia of Fermented Fresh Milk Products. Van Nostrand, Reinhold, New York

[37] Liu S, Han Y, Zhou Z. 2011. Lactic acid bacteria in traditional fermented Chinese foods. Food Research International, 44: 643–651.

[38] Magala, M.; Kohajdova, Z. and Karovičova, J. (2013). Preparation of lactic acid bacteria fermented wheat-yoghurt mixtures. Acta Sci. Pol., Technol. Aliment., 12 (3): 295 – 302.

[39] Morcos, S. R. (1973). Egyptian Kishk. In K. H. Steinkraus (Ed.), Handbook of indigenous fermented foods (pp. 295–299). New York: Marcel Dekker

[40] Muir, D. D.; Tamime, A. Y. and Khaskheli, M. (2000). Effect of Processing Conditions and Raw Materials on the Properties of Kishk 2. Sensory Profile and Microstructure. Lebensm.-Wiss. U. Technol., 33: 452-461.

[41] Nurliyani and Indratiningsih, Indratiningsih and Yuki, rahmayanti (2013) Kualitas Kishk Yang Dibuat Dari Campuran Yogurt Dan Tepung Sagu (Metroxylon sp). In: peran Teknologi dan Industri Pangan untuk Percepatan tercapainya Kedaulatan Pangan Indonesia, 26-29 Agustus 2013

[42] Odunfa, S. A. (1985). African Fermented Foods. In: Microbiology of Fermented Foods, Vol 2, Wood, B.J. (ed) Elsevier Applied Science Publishers. London and New York.

[43] Ozdemir S, Gocmen D, Kumral AY. 2007. A traditional Turkish fermented cereal food: Tarhana. Food Review International, 23: 107-121.

[44] Salama, A.A.; Damir, A.A. and Safwat, M. M. (1992). Effect of cooking on nutrients, microbial and sensory properties of skimmed milk and Rayeb Kishk. Acta alimentaria, 21: 6.

[45] Settanni L, Tanguler H, Moschetti G, Real S, Gargano V, Erten H. 2011. Evolution of fermenting microbiota in tarhana produced under controlled technological conditions. Food Microbiology, 28: 1367–1373.

[46] Steinkraus KH. 1983a. Handbook of Indigenous Fermented Foods. New York, NY:Marcel Dekker. 671 pages

[47] Steinkraus KH. 1996. Handbook of Indigenous Fermented Foods. 2nd Edition Revisedand Enlarged. New York, NY: Marcel Dekker. 776 p.

[48] Stephanopoulos, O.; Litopoulou-Tzanetaki, E. and Tzanetakis, N. (1981). La flora microbienne du trahana acide. Ind. Alim. Agric., 755–757.

[49] Tamime, A .Y. and Robinson, R. K. (1985). Yoghurt: Science and Technology. Oxford; New York: Pergamon.

[50] Tamime, A. Y.; Muir, D. D.; Barclay, M. N. I.; Khaskheli, M. and McNulty, D. (1997 a). Laboratory-made Kishk from wheat, oat and barley: 1. Production and comparison of chemical and nutritional composition of Burghol. Food Res. Inter., 30: 311-317.

[51] Tamime, A. Y.; Muir, D. D.; Barclay, M. N. I.; Khaskheli, M. and McNulty, D. (1997 b). Laboratory-made Kishk from wheat, oat and barley: 2. Compositional quality and sensory properties. Food Res. Inter., 30: 319-326.

[52] Tamime, A. Y.; Margaret, N.I. Barclay; Ryszard, A. and David, M. (1999). Kishk - a dried fermented milklcereal mixture. 1. Composition of gross components, carbohydrates, organic acids and fatty acids. Lait ,79: 317-330.

[53] 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 Kishk 1. Compositional and Microbiological Qualities. Lebensm.-Wiss. u.-Technol., 33, 444-451.

[54] Tanguler H, Balıkçı EK, Erten H. 2010. Geleneksel Fermente Ürünümüz Tarhana: Üretim Yöntemleri ve Bileşimi. [Traditional Fermented Product Tarhana: Its Processing Methods and Composition]. In: The 1st International Symposium on Traditional Foods from Adriatic to Caucasus, Tekirdağ- Turkey, 15-17 April, 2010, pp. 484-485.

[55] Toufeili, I.; Melki, C.; Shadarevian, S. and Robinson, R. K. (1999). Some nutritional and sensory properties of bulgur and whole wheatmeal kishk (a fermented milk-wheat mixture). Food Quality and Preference, 10: 9 – 15.

[56] Waites MJ, Morgan NL, Rockey JS, Higton G. 2001. Industrial Microbiology: An Introduction. Blackwell Science Ltd., London, 288 pp.

[57] Yegin S, Fernández-Lahore M. 2012. Boza: A Traditional Cereal-Based, Fermented Turkish Beverage. In: (Hui, Y.H., Özgül Evranuz, E., Eds) Handbook of Plant-Based Fermented Food and Beverage Technology; Second Edition, CRC Press, Florida. pp 533-542.

[58] Zouhairi, O. I.; Saleh, I.; Alwan, N.; I. Toufeili; Barbour, E. and Harakeh, S. (2010). Antimicrobial resistance of Staphylococcus species isolated from Lebanese dairy-based products Eastern Mediterranean Health J., 16 (12): 1221–1225.