Turkish Traditional Fermented Plant-Products as Functional Food

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Abstract

Fermentation is one of the oldest techniques to produce microbiologically secure and long-lasting food. The significance of fermented plant food dates heaps of years again. Fermentation grew to become famous with the sunrise of civilization due to the fact it preserves food and gives it a variety of tastes, forms, and different sensory sensations. Moreover, over time, human beings have realized the dietary and therapeutic value of fermented meals and drinks, making fermented ingredients even greater popular. In this study, Turkish traditional plant-based foods' medicinal properties: table olive, turşu, vinegar, fermented carrot juice, boza (fermented millet drink), and tarhana are examined. For this purpose, an overview of functional food and fermented meals books, journals, articles, and websites was once conducted. According to the research, the aforementioned fermented plants are functional foods advisable for health.

Keywords: fermented plant-products, functional food, Turkish fermented food

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INTRODUCTION

Functional foods are becoming increasingly popular among health-conscious customers who want to improve their overall health and well-being. Food consumption is no longer restricted to satiating hunger or supplying essential nutrients. People are motivated by various health concerns, the adverse effects of unhealthy food, and a desire to live a healthier lifestyle, which has resulted in a dramatic shift in current dietary habits. To some extent, all foods are functional since they provide taste, scent, and nutritional value. Even so, foods are increasingly being studied in-depth for additional physiologic effects that may help to minimize the risk of chronic disease or otherwise improve health (Hasler, 2002).

The name "functional food" was first seen in books and articles in 1984, when the Japanese started to investigate the links between nourishment, sensory satisfaction, fortifying, and the modulation of physiological systems (Siró et al., 2008; Lindner et al., 2013). According to Gibson and Williams (2000), a product can be considered' functional' if it has been sufficiently proved to beneficially one or more particular functions in the body, beyond appropriate nutrition, in a way that enhances well-being. Functional foods are divided into two extensive categories: plant-origin and animal-origin. Fermented plant products are foods in the plant-origin category.

Fermentation is a gradual breakdown process that occurs in the absence of oxygen and results in converting complex organic compounds into simpler chemicals. Organic acids, carbon dioxide, ethanol, formic and acetic acid, polysaccharides, peptides, hydrogen peroxide, and bacteriocins are among the metabolic products produced by fermentation (Ankolekar and Shetty, 2011). According to Ercoşkun and Ertaş (2003, p. 38), many chemical, biochemical and microbiological changes occurs in fermentation process and as a result improvement of taste, smell, aroma, texture and color characteristic come true. In addition, according to Blandino et al. (2003), fermentation is a natural technique to minimize the volume of material transported, remove undesired components, improve the nutritional value and view, and create a safer product.

Studies on health effects are carried out separately, in vivo or in vitro, and each product is researched on different diseases. Such studies are necessary because research on health effects is laborious and time-consuming. It is essential to research such products in Turkish Cuisine due to the tendency of people to natural products instead of medicines and the benefits of functional fermented foods. This review attempts to describe the health advantages of the most prevalent Turkish traditional fermented plant products as well as some of the fermented products' microbiological and biochemical features. Firstly, the definition and history of functional food, fermented food and fermented plant products are described. And after, some of fermented plant products used in Turkey and their health benefits are explained.

History of fermented functional food

People who couldn’t find food in all circumstances had searched ways to preserve their food (Higman, 2012). Fermentation is one of the most ancient and cost-effective ways of food production and preservation (Prajapati and Nair, 2003; Rhee et al., 2011). Food became spoilt when bacteria developed undesirable odors or tastes in it or toxins that caused illness or death, and humankind learnt to shun it. But, humankind learnt to enjoy and seek foods with appealing scents, flavours, and textures if microorganisms produced them. According to Steinkraus (2004), this was the origin of fermented foods, which now include boza, saurkraut, wines and beers, lactic acid products like turşu and hundreds of other fermented foods. Nowadays, plant-based foods are treated in this manner to achieve the desired sensory attributes of fermented foods and better digestibility and nutritional value. Fermented plant products are nutrient-dense and have a good impact on human health. Vitamins, particularly vitamin C, dietary fiber, mineral salts, and antioxidants, are abundant (Malinowska-Pan’czyk, 2012).

Fermentation aids in the preservation and enhancement of f&b nutritional content. Fermented beverages have thus played essential roles in the development of our technology and culture, helping to the advancement and intensification of agricultural, horticultural, and food-processing skills, owing to their claimed medicinal, nutritious, and sensory advantages (McGovern et al., 2004). Hutkins (2008) indicates that fermented foods were crucial for faraway militaries and fleets because of their greater preservation longevity.

There are various arguments about the first use of the fermentation method. According to Prajapati and Nair (2003), the beginning of fermented products is gone in ancient since the flavor of fermented stuff may have been discovered by chance. Again, according to the authors, the art of fermentation originated in the Indian subcontinent, in the settlements that predate the great Indus Valley civilization back in 10.000 BC. As for Blandino et al. (2003), the earliest records appear in the Fertile Crescent (Mesopotamia) and date back to 6000 BC.

Again, the earliest evidence of these techniques, according to Lindner et al. (2013), trace back to 6000 BC. In addition, regarding the usage of fermentation, especially on drinks since Neolithic times; 7000-6600 BC in China (McGovern et al., 2004), BC 6000 in Anatolia (Vouillamoz et al., 2006) and BC 3150 in ancient Egypt (Cavalieri et al, 2003) there are archaeological researches related to use of fermentation. Table 1 lists the major turning points in the chronology of fermented foods.

Table 1: Turning Points in the Chronology of Fermented Foods

Milestone	Development - Location
ca. 10,000 B.C. to Middle Ages	Evolution of fermentation from salvaging the surplus, probably by pre-Aryans
ca. 7000 B.C.	Cheese and breadmaking practiced
ca. 6000 B.C.	Wine making in the Near East
ca. 5000 B.C.	Nutritional and health value of fermented milk and beverages described
ca. 3500 B.C.	Bread making in Egypt
ca. 1500 B.C.	Preparation of meat sausages by ancient Babylonians
2000B.C.-1200A.D.	Different types of fermented milks from different regions
ca. 300 B.C.	Preservation of vegetables by fermentation by the Chinese
500-1000 A.D.	Development of cereal-legume based fermented foods
1881	Published literature on koji and sake brewing
1907	Publication of book Prolongation of Life by Eli Metchnikoff describing therapeutic benefits of fermented milks
1900-1930	Application of microbiology to fermentation, use of defined cultures
1970- Present	Development of products containing probiotic cultures or friendly intestinal bacteria

Source: Milestones in the History of Fermented Foods, (Abdelrahman et al., 2010; Prajapati and Nair, 2003)

Turkish fermented plant-products as functional food

Nutrition is the most critical factor that affects human's physical and mental health, productivity and happiness in every division of life. In the past, nutrition with fermented food had great importance in continuing human's existence. Fermented foods have a long history of being thought to be good for human health in ways that ordinary foods aren't (Machve, 2009). Fermented plant products Table olive, turşu, vinegar, fermented carrot juice, boza (fermented millet drink) and tarhana are the most common Turkish fermented plant products. In the following pages their health benefits are examined individually.

Table olive

Table olive is mainly consumed, especially as breakfast foodstuff in Turkey. The olive is eaten up only after fermentation due to the fact fermentation gets it more digestible and decreases the stinging and cytotoxicity of its phenols (Lindner et al., 2013). Hutkins (2008) states that over 90% of all olives produced in the world are used to make oil, with approximately 7% to 10% being consumed as table olives. Table olives can be prepared in a variety of ways. In olive-producing countries, three commercial table olives are processed: kalamata olives, green olives, and black olives. The black table olives have the highest production volume in Turkey, followed by green and kalamata type olives (Ünal and Nergiz, 2003). Fermentation is required to generate a high-quality end product (Heperkan 2013; Iorizzo et al. 2016; Şanlıer et al., 2019). Olives are fermented with the help of lactic acid bacteria (LAB) and yeast. Fermentation improves the table olive's taste characteristics, creates beneficial volatile chemicals, encourages the growth of LAB, protects against harmful microorganisms, and reduces polyphenols (Şanlıer et al., 2019).

Table olives are high in a variety of critical micronutrients, essential fats, and physiologically active phytochemicals comprising polyphenols, many of which have been linked to various health advantages (Tokoşoğlu et al., 2010). They have a high concentration of monounsaturated fats, particularly oleic acid. Monounsaturated fats, according to Mateljan (2007), are vital in the cell membrane. They have a protective impact on the cells and minimize the chance of cellular inflammation and damage because they are less readily destroyed than polyunsaturated fats. According to the author, table olive is additionally a rich source of vitamin E, the bodies principal liposoluble antioxidant. In addition to vitamin E and monounsaturated fatty acids, Table olive includes several phytonutrients (polyphenolic compounds, oleuropein, and hydroxytyrosol) with significant antioxidant activity and can thus safeguard cellular health. Olives are characteristic of high oil content (12%-30%) (Malinowska-Pan'czyk, 2012). According to García-González et al. (2008), much has been said about the preventive impact of olive oil on cardiovascular illness and cancer. Furthermore, because high levels of free radicals have been linked to health disorders, including osteoarthritis, asthma, and rheumatoid arthritis, the anti-inflammatory activity components present in olives can help lower the harshness of these illnesses. Table olive is also a rich source of various other nutrients that have health-promoting properties. Digestive health promoting fibre, energy producing iron, and free radical scavenging copper are among these nutrients (Mateljan, 2007). Another study (Celik et al., 2019) found that in pregnancy, the mother's daily consumption of Turkish fermented olive can decrease the occurrence of infantile atopic dermatitis.

Turşu (fermented vegetable)

Humanity has practiced the preserving of vegetables by fermentation for 4500 years, according to Malinowska-Pan'czy (2012). It made it possible to eat vegetables out of season and on long journeys Fang (2013) states that in accordance with what archaeologists and anthropologists credit, the old Mesopotamians developed pickled items about 2400 BC. Fang said that cucumbers carried from India 4000 years ago helped start a pickling tradition in the Tigris Valley. Turşu, in its broadest meaning, refers to any vegetable or fruit maintained with salt or acid (Hutkins, 2008). Turşu is one of Anatolia's earliest merchandise of fermentation used by humans; which's name originated from the Persian phrase "torsh"; which meaning "sour" (Kabak and Dobson, 2011). With occasional variations by region, the mixture contains vinegar, salt, water, garlic and spices that drown fresh vegetables such as carrots, beets, eggplant, cauliflower, turnips and cucumber. Turşu is available in two varieties: simple and mixed (Çetin, 2013). In Turkey, cucumber, cabbage, green tomato, carrot, pepper, and garlic are frequently used to make mixed turşu (Erten and Tangüler, 2014). Also, in the preparation of turşu, ginger, parsley, mint leaf, dill leaf, and bay leaf are frequently utilized as flavoring ingredients. (Kabak and Dobson, 2011). Turşu may have many health benefits as its main ingredient is vegetables. According to Liu (2003), eating veggies is a feasible method for consumers to enhance their health and lower the risk of chronic illnesses. Riboli and Norat's (2003) research shows that eating fruit and vegetables lower risks of cancer of the oesophagus, lung, stomach, breast, bladder, and rectum. Turşu is also a good resource of micronutrients. Many research has demonstrated that nutrients like iron, copper, zinc, selenium, beta-carotene, vitamins (A, C, E), and folic acid can affect several immune system constituents, according to Huffnagle and Noverr (2008). Furthermore, they have a function in illness prevention and health promotion. Garlic is used as a flavouring agent in all kinds of turşu. According to Hasler (2002), garlic was proven in clinical research to have a moderate blood pressure-lowering impact, and a growing body of epidemiologic evidence implies a reverse link between garlic consumption and some types of cancer, particularly stomach cancer. Most notably, fermentation can give a product probiotic qualities. The LAB probiotics in turşu can help avoid cirrhosis and diarrhea. (Swain et al., 2014).

Probiotic consumption has been shown to aid in the treatment of diarrhoea, colon cancer, lactose intolerance, cholesterol, immunological function and infections, mineral absorption, blood pressure, irritable bowel syndrome, and colitis in studies (Çetin, 2013).

Vinegar

Vinegar is an old flavouring that can be used as a pickling ingredient or even a medicine due to its germicidal properties (Steinkraus, 2004). The usual course of changes in fruit liquid at ordinary temperatures is alcohol ferment by yeasts, accompanied by oxidizing the alcohol to acetic acid by bacteria. If enough acetic acid is produced, the product is vinegar. The product is described as a sauce made from sweet or amylaceous substances through an alcoholic fermentation accompanied via an acetous one (Machve, 2009). Cider vinegar and vinegar of grapes are the most preferred kinds of vinegar in Turkey. These kinds of vinegar contain several micronutrients, vitamins, enzymes and pectin necessary for a balanced diet (Muller, 2009). Vinegar helps get rid of pathogens in food. Ilkin and Karapinar's (2005) study showed that dressing salad with vinegar would reduce pathogens numbers to a low or undetectable level. Vinegar is also good for high blood pressure. Research (Kondo et al., 2001) showed that vinegar remarkably lowered blood pressure in rats than controls not given vinegar. Vinegar also helps to prevent cancer. Research on human cells by Mimura et al. (2004) showed vinegar have anti-cancer properties due to its polyphenol and acetic acid properties. Shishehbor et al. (2008) showed that vinegar (apple cider) enhanced the blood lipids in diabetic and normal rats by lowering serum triglycerides (TG), increasing serum HDL-c, and decreasing serum LDL-c. With the evidence mentioned above, it would not be wrong to say that vinegar is one of the healthiest products used in kitchens.

Shalgam juice

Shalgam Juice is a hazy, sour soft drink with a purplish red colour that is popular in Turkey's southern provinces (Erten et al, 2008). The juice is made by fermenting black carrots, turnips, bulghur flour, sourdough, salt, and freshwater with lactic acid. The anthocyanins found in the black carrot give shalgam juice its purplish-red colour (Kabak and Dobson, 2011). Because of its rich mineral, vitamin, amino acid, and phenolic content, shalgam juice is a nutritious beverage (Altay et al., 2013). Carrot, the main ingredient of shalgam juice, is high in vitamins (A-D-B-E-C-K) and minerals (potassium, calcium, iron, phosphorus and sodium). Also, carrot contains a high amount of carotenoids, mainly beta-carotene (Kun et al., 2008). Betacarotene, ascorbic acid (Vit C), and "non-nutritive chemicals" such as indoles, flavones, and isothiocyanates are all abundant in turnips the other main ingredient of Shalgam. According to Field (2000), these substances help to avoid food-related diseases and conditions like scurvy and blindness. As Krinsky and Johnson (2005) indicate, the carotenoids and other antioxidants found in carrots are essential for inhibiting and/or interrupting oxidative degradation as well as counteracting free radical activity. According to Field (2000), research has associated high-vitamin A diets with a lower risk of cancer, and studies also suggest that compounds like indoles can counteract the effects of carcinogens. Ascorbic acid is a well-known antioxidant that is claimed to protect against the growth of some malignancies and to slow the progression of the virus HIV. In addition, İncedayi et al., (2008) indicate that turnip bulb is high in cancer-fighting glucosinolates that help the natural immune detoxifying mechanisms work better. Glucosinolates work as "indirect" antioxidants, stimulating the body's inherent antioxidant defenses. Moreover, Baysal et al., (2007) state that shalgam juice helps lose weight, reduces stress and prevents the common cold.

Boza (fermented millet drink)

Boza is a sweet, somewhat bitter to slightly sour, light to dark beige, non-alcoholic beverage popular in Turkey and the Balkans (Blandino et al., 2003). The beverage is made by fermenting barley, oats, maize, millet, wheat, or rice (Botes et al., 2007). According to Akpinar-Bayizit et al., (2010), boza has been recognized for centuries in Central Asia, and it was transferred to Anatolia and Europe through migration. For authors, despite the fact that the Turks were the first ones to create boza, the subject was heavily suppressed by researchers, and boza was released to the market as a national product by other countries. In Turkey, it is typically served with cinnamon and is drank primarily throughout the winter months. As boza is high in carbohydrates and vitamins, it was used to feed the Ottoman army (Işın, 2011). Boza has been a popular drink consumed as a daily foodstuff by people of any age because of its delicious taste, aroma, and excellent nutritional benefits (Blandino et al., 2003). Boza has a protein content of 0.5–1.6%, a carbohydrate content of 12.3%, and a 75–85% moisture content (Kabak and Dobson, 2011). According to Birer (1987), it is also called liquid bread due to its many nutrient elements. Petrova and Petrov (2011) state that boza has been shown to provide many health benefits such as balancing blood pressure, enhancing milk manufacturing in lactating females and facilitating digestion. It is also vital nutrition for physically active persons because it contains vitamins A, C, E, and four different forms of B. Boza is particularly ideal for vegans and vegetarians because it is fully plant-based and a vital source of vitamins, making it an excellent alternative for dairy-based beverages. In addition, its cereal content, such as barley, oat, millet and others, helps reduce TG; thus, it lowers the chances of cardiovascular disease and paralysis (Mindell, 2009).

Tarhana

Tarhana is breakfast or meal soup typically served with bread and veggies. It is made by combining wheat flour, yoghurt, yeast and various veggies (tomatoes, onions, green peppers, and so on), salt, and spice (mint, paprika), then fermenting it for one to seven days (Daglioğlu, 2000). The mix is sun-dried and crushed to a granular size of 1 mm after fermentation. (İbanoğlu and Ainsworth, 2004). Although yoghurt gets in the mixture, tarhana is a fermented cereal (plant) product. Some other similar foods that match tarhana include "kishk" and "kushuk" in the Middle East, "trahana" in Greece, and "atole" in Scotland (Bilgiçli et al., 2006).

According to Daglioğlu (2000), it is known from the history books that tarhana was first produced by Turks who arrived in Mid-Asia, and it was transported to Anatolia, the Middle East, and the Balkans by Turkish incomers. In Turkey, tarhana is prepared at home byways that have been learned through mother or grandmother since the olden days. Tarhana tastes sour and acidic with a distinct sourdough flavor and is a high source of proteins, vitamins, and minerals, making it ideal for nourishing youngsters and the elderly (Ekinci and Kadakal, 2005).

Tarhana's composition fluctuates between the following ranges: 6.4 – 13.9 % moisture, 12.0 – 29.9 % protein, 41.8 – 77.5 % carbohydrate, 1.6 – 18.2 % fat, 0.1 – 3.1 % fibre, 0.56 – 10.4 % salt, and 1.4 – 14.2 % ash. Tarhana is high in minerals, including sodium, calcium, potassium, iron, zinc, magnesium, and copper. (Kabak and Dobson, 2011).

In addition, research made by Kilci and Gocmen (2014) showed that oat flour had another positive effect on mineral composition, improved phenolic acid composition and increased antioxidant activity of tarhana.

CONCLUSION

Fermentation is the world's oldest technique of food preservation after drying (Prajapati & Nair, 2003; Rhee et al., 2011). Fermented food products have historically become an essential part of humankind's diet and have long been thought to provide health advantages. The purpose of the current study was to determine the health effect of plant-based fermented food in Turkey. For this reason, this study investigated research on plant-based fermented foods. A growing body of data supports the idea that functional foods having physiologically bioactive constituents may promote health. Fermented foods may lower the risk of hypertension, diabetes, obesity, high cholesterol, diarrhoea, thrombosis, and other diseases (Şanlıer et al., 2019). This kind of food is given desired attributes by microorganism and enzyme activities. Functional food may be defined as a comprehensive combination of necessities plus extra dietary elements that can play a vital role in lowering health risks and increasing health. Based on the health benefits of fermented foods, they can be considered functional food. Considering such health benefits of fermented plant-based food, consuming this food should be encouraged instead of convenience food. Plant-based fermented foods have a long shelf life and are available year-round. It is essential that the health benefits of such products are used in the marketing of the products. The study contributes to our understanding of the health advantages of Turkish fermented food. A limitation of this study is that the study was conducted with a literature review. The issue of functional food is an intriguing one that could be usefully explored in further research. The synergistic effects of these foods, which contain both phyto phenolic components and probiotics, should be investigated. More information on functional foods would help us to establish a greater degree of accuracy on this matter. Thus, further research in this field would greatly help the health benefit of plant-based fermented food.

REFERENCES

Abdelrahman R. A., Adel A. M. & Smetanska I. 2010. *Food Science and Technology: Fermented Milk Products*. Nova Science Publishers, Inc. Hauppauge, NY

Akpinar-Bayizit A., Yilmaz-Ersan L. & Ozcan T. 2010. Determination of Boza's Organic Acid Composition as it is Affected by Raw Material and Fermentation. *International Journal of Food Properties, 13*(3), 648-656. doi: 10.1080/10942911003604194

Altay F., Karbancıoglu-Güler F., Daskaya-Dikmen C. & Heperkan D. 2013. A review on traditional Turkish fermented non-alcoholic beverages: Microbiota, fermentation process and quality characteristics. *International Journal of Food Microbiology, 167*(1), 44-56. doi: http://dx.doi.org/10.1016/j.ijfoodmicro.2013.06.016

Ankolekar C. & Shetty K. 2011. Fermentation - Based Processing of Food Botanicals for Mobilization of Phenolic Phytochemicals for Type 2 Diabetes Management. In *Functional Foods, Nutraceuticals and Degenerative Disease Prevention*. Hoboken, NJ, USA: John Wiley & Sons.

Baysal A. H., Çam M. & Harsa H. Ş. 2007. *Functional properties of "Şalgam Juice", a traditional fermented Turkish beverage.* Paper presented at the International Symposium on Functional Foods in Europe International Developments in Science and Health Claims.

Bilgiçli N., Elgün A., Herken E. N., SelmanTürker Ertaş N. & İbanoglu Ş. 2006. Effect of wheat germ/bran addition on the chemical, nutritional and sensory quality of tarhana, a fermented wheat flour-yoghurt product. *Journal of Food Engineering, 77*(3), 680-686. doi: http://dx.doi.org/10.1016/j.jfoodeng.2005.07.030

Birer S. 1987. Boza Yapımı ve Özellikleri (Boza manufacturing and its properties). *Gıda Teknolojisi Dergisi, 11*(5), 341-344.

Blandino A., Al-Aseeri M., Pandiella S., Cantero D. & Webb C. 2003. Cereal-based fermented foods and beverages. *Food research international, 36*(6), 527-543.

Botes A., Todorov S. D., von Mollendorff J. W., Botha A. & Dicks L. M. T. 2007. Identification of lactic acid bacteria and yeast from boza. *Process Biochemistry, 42*(2), 267-270. doi: http://dx.doi.org/10.1016/j.procbio.2006.07.015

Cavalieri D., McGovern P. E., Hartl D. L., Mortimer R. & Polsinelli M. 2003. Evidence for S. cerevisiae fermentation in ancient wine. *Journal of molecular evolution, 57*(1), 226-232.

Celik V., Beken B., Yazicioglu M., Ozdemir P. G. & Sut N. 2019. Do traditional fermented foods protect against infantile atopic dermatitis. *Pediatric Allergy and Immunology, 30*(5), 540-546. doi: https://doi.org/10.1111/pai.13045

Çetin B. 2013. Production of probiotic mixed pickles (Tursu) and microbiological properties. *African Journal of Biotechnology, 10*(66), 14926-14931.

Daglioğlu O. 2000. Tarhana as a traditional Turkish fermented cereal food. Its recipe, production and composition. *Food/Nahrung, 44*(2), 85-88.

Ekinci R. & Kadakal C. 2005. Determination of seven water-soluble vitamins in tarhana, a traditional Turkish cereal food, by high-performance liquid chromatography. *ACTA chromatographica, 15*, 289.

Ercoşkun H. & Ertaş A. H. 2003. Fermente Et Ürünlerinin Lezzet Bileşenleri ve Oluşumları (Flavor Components and Formations of Fermented Meat Products). *Gıda Mühendisliği Dergisi*, 38-44.

Erten H. & Tangüler H. 2014. Fermente Bitkisel Ürünler (Fermented Plant-based Products). In N. Aran (Ed.), *Gıda Biyoteknolojisi* (Vol. 4). Nobel Yayıncılık, Ankara

Erten H., Tangüler H. & Canbaş A. 2008. A Traditional Turkish Lactic Acid Fermented Beverage: Shalgam (Salgam). *Food Reviews International, 24*(3), 352-359. doi: 10.1080/87559120802089324

Field R. C. 2000. Cruciferous and Green Leafy Vegetables. In *The Cambridge World History of Food*. Cambridge University Press, NY.

García-González D. L., Aparicio-Ruiz R. & Aparicio R. 2008. Virgin olive oil - Chemical implications on quality and health. *European Journal of Lipid Science and Technology, 110*(7), 602-607. doi: 10.1002/ejlt.200700262

Gibson G. R. & Williams C. M. 2000. *Functional Foods: Concept to product*. Woodhead Publishing Limited, NY.

Hasler C. M. 2002. Functional foods: benefits, concerns and challenges—a position paper from the American Council on Science and Health. *The Journal of nutrition, 132*(12), 3772-3781.

Heperkan D. 2013 Microbiota of table olive fermentations and criteria of selection for their use as starters. *Frontiers in Microbiology* 4:143. doi:10.3389/fmicb.2013.00143.

Higman B. W. 2012. *How Food Made History*: John Wiley & Sons, Ltd., NY.

Huffnagle G. B. & Noverr M. C. 2008. *GI Microbiota and Regulation of the Immune System*. New York, NY, USA: Springer Science-Business Media, LLC.

Hutkins R. W. 2008. *Microbiology and Technology of Fermented Foods*. Wiley-Blackwell, Hoboken, NJ, USA.

İbanoğlu Ş. & Ainsworth P. 2004. Effect of canning on the starch gelatinization and protein in vitro digestibility of tarhana, a wheat flour-based mixture. *Journal of Food Engineering, 64*(2), 243-247. doi: http://dx.doi.org/10.1016/j.jfoodeng.2003.10.004

Ilkin Y. Ş. & Karapinar M. 2005. Effectiveness of household natural sanitizers in the elimination of Salmonella typhimurium on rocket (Eruca sativa Miller) and spring onion (Allium cepa L.). *International Journal of Food Microbiology, 98*(3), 319-323. doi: http://dx.doi.org/10.1016/j.ijfoodmicro.2004.07.011

Işın P. M. 2011. Boza, Innocuous and Less So. In *Cured, Smoked, and Fermented: Proceedings of the Oxford Symposium on Food and Cooking, 2010*. Oxford Symposium.

İncedayi B., Uylaşer V. & Çopur Ö. U. 2008. A traditional Turkish beverage shalgam: Manufacturing technique and nutritional value. *Journal of food, agriculture & environment, 6*(3-4), 31-34.

Iorizzo M., Lombardi S. J., Macciola V., Testa B., Lustrato G., Lopez F. & De Leonardis A. 2016. Technological potential of lactobacillus strains isolated from fermented green olives: In vitro studies with emphasis on oleuropein-degrading capability. *The Scientific World Journal*. doi:10.1155/2016/1917592.

Kabak B. & Dobson A. D. W. 2011. An Introduction to the Traditional Fermented Foods and Beverages of Turkey. *Critical Reviews in Food Science and Nutrition, 51*(3), 248-260. doi: 10.1080/10408390903569640

Kilci A. & Gocmen D. 2014. Phenolic acid composition, antioxidant activity and phenolic content of tarhana supplemented with oat flour. *Food Chemistry, 151*, 547-553. doi: http://dx.doi.org/10.1016/j.foodchem.2013.11.038

Kondo S., Tayama K., Tsukamoto Y., Ikeda K. & Yamori Y. 2001. Antihypertensive Effects of Acetic Acid and Vinegar on Spontaneously Hypertensive Rats. *Bioscience, Biotechnology, and Biochemistry, 65*(12), 2690-2694. doi: 10.1271/bbb.65.2690

Krinsky N. I. & Johnson E. J. 2005. Carotenoid actions and their relation to health and disease. *Molecular Aspects of Medicine, 26*(6), 459-516. doi: http://dx.doi.org/10.1016/j.mam.2005.10.001

Kun S., Rezessy-Szabó J. M., Nguyen Q. D. & Hoschke Á. 2008. Changes of microbial population and some components in carrot juice during fermentation with selected Bifidobacterium strains. *Process Biochemistry, 43*(8), 816-821. doi: http://dx.doi.org/10.1016/j.procbio.2008.03.008

Lindner J. D. D., Penna A. L. B., Demiate I. M., Yamaguishi C. T., Prado M. R. M. & Parada J. L. 2013. Fermented Foods and Human Health Benefits of Fermented Functional Foods. In C. R. Soccol, A. Pandey & C. Larroche (Eds.), *Fermentation Processes Engineering*: CRC Press, NW.

Liu R. H. 2003. Health benefits of fruit and vegetables are from additive and synergistic combinations of phytochemicals. *The American journal of clinical nutrition, 78*(3), 517-520.

Machve K. K. 2009. *Fermentation Technology*. Mangalam Publishers. Delhi.

Malinowska-Pan'czyk E. 2012. Fermented Vegetables Products. In B. M. Mehta, A. Kamal-Eldin & R. Z. Iwanski (Eds.), *Fermentation: Effects on Food Properties*. CRC Press, Boca Raton, FL.

Mateljan G. 2007. *World's Healthiest Foods : Essential Guide for the Healthiest Way of Eating*. GMF Publishing, New York, NY.

McGovern P. E., Zhang J., Tang J., Zhang Z., Hall G. R., Moreau R. A., Wang C. 2004. Fermented beverages of pre-and proto-historic China. *Proceedings of the National Academy of Sciences of the United States of America, 101*(51), 17593-17598.

Mimura A., Suzuki Y., Toshima Y., Yazaki S.-I., Ohtsuki T., Ui S. & Hyodoh F. 2004. Induction of apoptosis in human leukemia cells by naturally fermented sugar cane vinegar (kibizu) of Amami Ohshima Island. *BioFactors, 22*(1-4), 93-97. doi: 10.1002/biof.5520220118

Mindell E. 2009. *İlaç Yiyecekler* (Ş. Gülmen, Trans. Food as Medicine). İstanbul: Prestij Yayınları.

Muller M. F. 2009. *Gençlik ve Sağlık İksiri Sirke* (Elixir of youth and health: vinegar). Dharma Yayınları, İstanbul.

Petrova P. M. & Petrov K. K. 2011. Antimicrobial activity of starch-degrading Lactobacillus strains isolated from boza. *Biotechnology & Biotechnological Equipment, 25*(sup1), 114-116.

Prajapati J. B. & Nair B. M. 2003. The History of Fermented Foods *Handbook of fermented functional foods* (pp. 1-25). CRC Press Inc, New York.

Rhee S. J., Lee J.E. & Lee C.H. 2011. Importance of lactic acid bacteria in Asian fermented foods. *Microb Cell Fact, 10*(1), S5.

Riboli E. & Norat T. 2003. Epidemiologic evidence of the protective effect of fruit and vegetables on cancer risk. *The American journal of clinical nutrition, 78*(3), 559S-569S.

Shishehbor F., Mansoori A., Sarkaki A., Jalali M. & Latifi S. 2008. Apple cider vinegar attenuates lipid profile in normal and diabetic rats. *Pakistan journal of biological sciences: PJBS, 11*(23), 2634-2638.

Siró I., Kápolna E., Kápolna B. & Lugasi A. 2008. Functional food. Product development, marketing and consumer acceptance—A review. *Appetite, 51*(3), 456-467. doi: http://dx.doi.org/10.1016/j.appet.2008.05.060

Steinkraus K. H. 2004. Origin and History of Food Fermentations. *Handbook of Food and Beverage Fermentation Technology*(134), 1. Marcel Dekker Inc., New York.

Swain M. R., M. Anandharaj R. C. Ray & R. Parveen Rani. 2014 Fermented fruits and vegetables of Asia: a potential source of probiotics. Biotechnology Research International. doi:10.1155/2014/250424.

Şanlıer N., Gökçen B.B. & Ceyhun-Sezgin,A. 2019 Health benefits of fermented foods, *Critical Reviews in Food Science and Nutrition*, 59:3, 506-527, DOI: 10.1080/10408398.2017.1383355

Tokoşoğlu Ö., Alpas H. & Bozoğlu F. 2010. High hydrostatic pressure effects on mold flora, citrinin mycotoxin, hydroxytyrosol, oleuropein phenolics and antioxidant activity of black table olives. *Innovative Food Science and Emerging Technologies, 11*, 250-258. doi: 10.1016/j.ifset.2009.11.005

Ünal K. & Nergiz C. 2003. The effect of table olive preparing methods and storage on the composıtıon and nutrıtıve value of olives. *Grasas y Aceites, 54*(1), 71-76.

Vouillamoz J. F., McGovern P. E., Ergul A., Söylemezoğlu G., Tevzadze G., Meredith C. P., & Grando M. S. 2006. Genetic characterization and relationships of traditional grape cultivars from Transcaucasia and Anatolia. *Plant Genetic Resources: characterization and utilization, 4*(02), 144-158.