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An Overview of Kermanshahi Oil as a Functional Food

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ABSTRACT: Kermanshahi oil is one of the most popular Iranian dairy products that is also exported annually to several countries. Kermanshah has a moderate and mountainous climate with high pastures and diverse fragrant vegetation, which has made the oil of this region unique taste and smell. Traditionally, diluted yogurt (doogh) is subsequently churned to separate the butter content. The separated butter is heated at 45-50 ˚C until its doogh separates. The final product is called "Kermanshahi oil". Although animal fats are important source of harmful substances namely cholesterol, long-chain saturated and unsaturated-trans fatty acids, Kermanshahi oil possesses a suitable fat content with particular aroma and taste. Some studies have demonstrated a decrease in cholesterol, atherogenic, and thrombogenic fatty acids of oil which play a major role in preventing and decreasing cardiovascular diseases. Besides, there is an increase in useful fatty acids such as butyric, oleic, linolenic, linoleic acids, and linoleic conjugated form in oil that participate in reducing inflammation of the digestive system and colon cancer. Oil has suitable fat contents, aroma, and taste which make it a unique product with potential health benefits, even though it is a type of animal fat.

Keywords: Cholesterol, Fatty Acid Content, Fermentation, Kermanshahi Oil, Yogurt.

Introduction

Kermanshahi oil is a by-product of yogurt which is rich in animal fat, also known as "animal oil", "roghan-e heyvani", "roghan-e dan", "Kermanshah ghee", or "roghan-e zard", but our knowledge about the history, properties, and nutritional value of this product is very poor. Oil is extracted from cow, sheep, and goat milk or a combination of all in Kermanshah, west of Iran. It is prepared in the spring and summer, which the spring type possessing a more desirable taste, flavor, and quality due to animals' feeding on fresh grass (pasture). In the Middle East, there are fat-rich fermented dairy products similar to oil such as ghee (India), samna balady (Egypt), and yayik (Turkey) (Ganguli & Jain, 1973; Mehta, 2013; Sağdıç, Dönmez, & Demirci, 2004). The production process of these products is similar with a difference in the clarification of the butter stage. For instance, the temperature used for clarification of the oil and ghee is 45-50 and 103 ˚C, respectively (Sserunjogi, Abrahamsen, & Narvhus, 1998). For this reason, bacterial death occurs in ghee samples during heat clarification while bacteria remain alive in oil samples. On the other hand, bacteria play an important role in the fat content changes of the

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product and affect the aroma, taste, and quality of the product especially during storage for a long time (Chalabi *et al*., 2018).

The aim of this study was to introduce oil, as our knowledge about its history, fat content, and effect on human health is very poor. It probably has an ancient pedigree as old as that of early human settlement, animal domestication, and milk fat processing such as yogurt.

- History of Kermanshahi oil

Kermanshah Province is in the west of Iran which is considered one of the cradles of prehistoric cultures because of its ancientness, rich culture, and Neolithic villages. The archaeological evidence shows that Kermanshah had been one of the first habitats of early humans. Ganj Dareh is a Neolithic settlement in the central Zagros mountains of Kermanshah Province. Archaeological records indicate a history of this site dating back to ca. 10000 years ago, and show intense occupation over two to three centuries (Gallego-Llorente *et al.*, 2016).

Preliminary evidence of animal domestication, specialized forms of food production devices, and early-stage in soft-ware pottery making has been found in the Ganj Dareh about 8051 BC, while it began in Greater India around 7,000 BC (Wright, 2010). It seems to reflect an increasing emphasis on sedentary life and year-round occupation in the Ganj Dareh. The sedentary life and animal domestication may have caused the storage of plant grains and milk products (Smith, 1990). It is suggested that milk products were incorporated into the human diet about 10000–5000 BC, with the domestication of milk-producing animals. Archaeological evidence pointing to the first evidence of goat domestication in the world was found in the Ganj Dareh (Zeder & Hesse, 2000). The earliest evidence to date for the processing of milk fats comes from the Early Neolithic of the seventh millennium BC in northwestern Anatolia, the sixth millennium BC in eastern Europe, the fifth millennium BC in Africa, and the fourth millennium BC in Britain and Northern Europe (Isaksson & Hallgren, 2012). It seems that those who lived in the Ganj Dareh began milk fat processing earlier than others (ninth millennium BC). Therefore, it is possible that milk fat processed products, such as cream, butter, or oil, date back to the same time (eighth millennium BC). As mentioned, the people of Ganj Dareh have been in this region for two to three centuries. It is suggested that people migrated to other parts of Iran or outside Iran for reasons including population growth, lack of pasture, bad weather conditions, and so on (Gallego-Llorente *et al.*, 2016). Hence, it has led to the transfer of knowledge, lifestyle and, food production skills like milk fat processing to people elsewhere.

- Oil preparation method

To prepare oil traditionally, milk is first poured into metal containers or clay ones (in some areas) called “Lanjin” or “Taghar” (Figure. 1A), followed by the addition of starter culture and storage at room temperature to yield yogurt. Next, an equal volume of cold water is added to the yogurt to turn it into doogh (diluted yogurt). Doogh is then transferred into “Mashk” (goat or sheep tanned skin) and churned (Figure. 1B), which results in aggregation of butter (Figure 1C). For better separation of butter, the stirred doogh should be kept refrigerated overnight or should add cold water/ice for better separation and aggregation of butter. Butter is then separated (Figure 1D) and heated at 45 to 50 ˚C to let its doogh separate. The final product is called

"Kermanshahi oil" (Figure 2A). For long storage, it is traditionally kept in "Khik" or "Hizeh" (goat or sheep untanned skin) (Figure 2B) the longer it is kept there, the better the taste and flavor. In order to enhance the flavor and therapeutic qualities, a fragrant herb called Chavil (*Ferulago angulata*) is sometimes added (Figures 2C and 2D). This herb is green to dark green, with a pleasant flavor, belonging to *Apiaceae* (Rafieian-Kopaei, Shahinfard, Rouhi-Boroujeni, Gharipour, & Darvishzadeh-Boroujeni, 2014).

Fig. 1. A. Lanjin or Taghar, B. Mashk, C. Butter in doogh, D. Separated butter

A. Taghar is a relatively large earthenware vessel in which liquids such as water and yogurt or grains such as wheat and barley are poured. It has also been used to grind Kashk.

B. Mashk is a leather container made of sheep, goat, and calf tanned skins that is used to transport water, doogh, oil, etc. among tribes and nomads.

C. Doogh is a yogurt diluted which is subsequently churned to separate the butter content.

D. The separated butter.

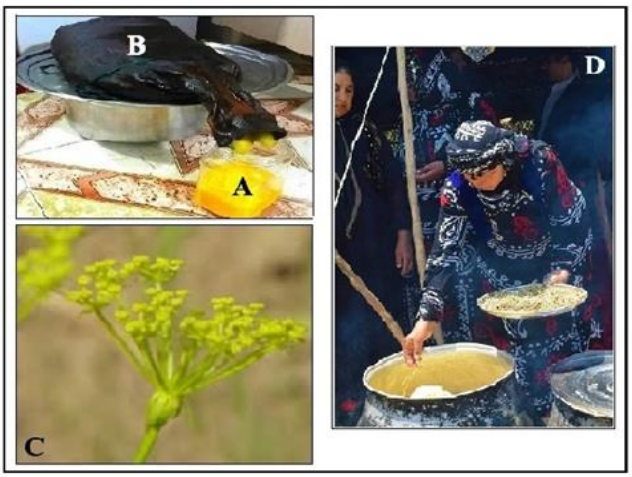

Fig. 2. A. Kermanshahi oil, B. Khik, C. Chavil or Chonour, D. Adding Chavil

A. Kermanshahi oil is the butter which is heated at 45 -50 ˚C until its water separates.

B. Khik or khig is a leather container made of goat and calf untanned skins that is used to store oil.

C. Chavil or Chonour is green to dark green, with a pleasant flavor, belonging to *Apiaceae.*

Chavil Adding to enhance the flavor of oil.

- Fat contents and fat quality of oil

The fatty acid and cholesterol contents of oil have been determined by gas chromatography and high-performance liquid chromatography (HPLC) methods, respectively. Studies show that oil, produced traditionally, due to the activity of bacteria create beneficial changes in the fatty acid profiles therefore its long-chain saturated fatty acids such as stearic acid (C18), palmitic acid (C16), myristic acid (C14), lauric acid (C12), elaidic acid (C18:1t n7), and cholesterol level of oil are fewer than those of milk and other unfermented animal fats (Bahrami Gh & Piravi Vanak Z, 2009; Mostafaie, Bahrami, & Chalabi, 2018). Besides, there is also a significant increase in the number of useful fatty acids in oil such as oleic (C18:1c n9), linoleic (C18:2), and linolenic (C18:3 n3) acids as well as their conjugated forms (Aulisa *et al.*). Besides, studies have indicated that the number of short-chain fatty acids especially butyric acid (C4) in oil is twice that of milk (Chalabi *et al.*, 2018; Nelson & Cox, 2000). The major fat quality indices of food which are used to determine the nutritional value of food include indices of thrombogenicity (IT) and atherogenicity (IA), the ratio of monounsaturated fatty acids to polyunsaturated fatty acid (MUFA/PUFA), the ratio of PUFA to saturated fatty acids (PUFA/SFA), and omega-6 to omega-3 ratio (n6/n3) (Ulbricht & Southgate, 1991). A study on the health indices of oil has shown that its IT, IA, and MUFA/PUFA indices were relatively smaller than those of milk while its PUFA/SFA and n6/n3 levels fell within the standards defined by the World Health Organization (Chalabi *et al.*, 2018). It can ultimately be concluded that Kermanshahi oil as a fatty foodstuff possesses proper health value.

- Effect of oil on human disease

- Oil fatty acids and heart diseases

As mentioned, levels of C12-C18, C18:1t n7 as a major trans-fatty acid of oil, and the cholesterol are significantly low while there is a significant increase in the content of C18:1c n9, C18:2, C18:3 n3, CLA, and C4.

Animal fats such as lard, butter, and cream are rich in long-chain saturated fatty acids, which can increase the risk of cardiovascular diseases and even mortality rate (Briggs, Petersen, & Kris-Etherton, 2017). Diets that include atherogenic (C12 to C16) and thrombogenic (C14 to C18 especially C16 and C18) can enhance the development of cardiovascular diseases (Paszczyk, Polak-Śliwińska, & Łuczyńska, 2020). C16 is capable of accompanying high levels of serum cholesterol and LDL, and long-chain thrombogenic saturated fatty acids such as C18 can speed up clot formation and platelet aggregation leading to thrombosis (Muller, Lindman, Brantsaeter, & Pedersen, 2003).

- The cholesterol of oil and cardiovascular diseases

Animal fats are an important source of cholesterol which is found in all human body cells. Excessive consumption of foods high in cholesterol leads to its accumulation in the blood and ultimately clot formation in the vessels and atherosclerosis (WHO Joint Consultation FAO Expert, 2003). Despite its origin as animal fat, oil contains half of the cholesterol level of butter due to fermentation, low heating during clarification, and bacterial activity. Studies have shown that long-term consumption of oil results in blood fat reduction, an increase in HDL-C level, a decline in blood cholesterol level, and a consequent drop in cardiovascular diseases which can be because of the presence of probiotic

bacteria especially *Lactobacillus* in oil (Fabian, Majchrzak, Dieminger, Meyer, & Elmadfa, 2008).

- ***Oil fatty acids and non-alcoholic fatty liver disease***

Each fatty acids plays a major role in our health; for example, nowadays a common disease around the world is Non-alcoholic fatty liver disease (NAFLD), against which C18:1c n9 plays a protective role. Incorrect dietary habits such as consuming fats high in long-chain saturated fatty acids especially C16 can lead to NAFLD. C16 causes lipotoxicity in hepatocytes and in advanced conditions can lead to cryptogenic cirrhosis and liver cancer. Studies have shown that rat diets containing C18:1c n9 play a protecting role against hepatic lipotoxicity resulting from palmitic acid (X. Chen *et al.*, 2018; Cheon & Cho, 2014). Since Kermanshahi oil is high in C18:1c n9 and low in C16, it seems that oil as a product rich in fats does not have harmful effects on human health. Besides, studies have indicated that the number of short-chain fatty acids especially C4 in oil is twice that of milk (Mostafaie *et al.*, 2018). Several studies have pointed to the anti-inflammatory effect of C4 on the digestive system as well as its positive effects on fighting multiple sclerosis (T. Chen, Noto, Hoshino, Mizuno, & Miyake, 2019).

- ***Chavil and human health***

As mentioned earlier, the herb called Chavil, native of west of Iran, is used in the traditional preparation of oil. This herb and similar ones are used in traditional medicine as sedatives for their monoterpene compounds. *F. angulata* is also used for the treatment of such conditions as hemorrhoids, wound healing, snake stings, and digestive pains. As the herb also possesses anti-anxiety, anti-depression, and anti-oxidant properties for Alzheimer's patients, its addition to the oil enhances its nutritious qualities (Bagci, Aydin, Mihasan, Maniu, & Hritcu, 2016).

Conclusion

Although oil is a dairy product rich in fats, the activity of microorganisms under stress conditions causes changes that lead to its proper fat content. Undoubtedly, the quality of Kermanshahi oil is much higher than the other types of fatty foods due to bacterial activity and the unique species of herbs native to the Zagros mountains and their fragrant contents. In traditional medicine and ancient medical books, the consumption of this product for the prevention and treatment of diseases has largely been emphasized. In ancient medicine such as the Iranian, Chinese, and Ayurveda medicine, oil has been the basis of some medicinal compounds and those ointments used for the treatment of burns and skin lesions. Based on the studies carried out so far and from the perspective of traditional medicine, Kermanshahi oil plays a major role in maintaining the health of individuals and their stamina, endurance, vitality, and skin complexion.

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