

---

## **Traditional Dried and Salted Nile Fish Products in Sudan: A review**

---

**Wadah Elsheikh**

*<sup>1</sup>Department of Meat Production, Faculty of Animal Production, Khartoum University, Khartoum, Sudan*

*Corresponding author: wadah988@gmail.com*

---

### **Abstract**

The objective of this review is to check the common methods used in drying and salting of fish preservation in Sudan and their effect on sensory, chemical and microbial indicators. Drying and salting of fish are very common in Sudan, when the other methods of preservation are not available in fish production areas. salted product (Fassiekh) are important sources of nourishment, they contain great amount of a high quality protein, the chemical and microbiological characteristics of Fassiekh shown slight differences in most of their proximate components, mineral contents and microbial characteristics, the salt concentration level resulted in an increase in crude protein and ash content than fresh fish. The sun-dried product (Kejeik) of Nile fish is a good source of proteins, minerals as well as energy, which means Kejeik has high nutritional value for healthy diet. Therefore, it becomes clear that the drying and salting process is safe to some extent and does not have a negative effect on the quality of fish products.

**Keywords:** Drying fish; salting fish, traditional foods.

---

*Review article*

*Received date: 24 December 2020*

*Accepted date: 28 April 2021*

### **INTRODUCTION**

Fish constitute in Sudan it is a very important component of the diet and often provides the much needed nutrient for Sudanese people (Mohamed et al., 2010). Sudan has the presence of a number of large water reservoirs, which contains a huge wealth of fish of severalty species and the estimated wealth was more than 110 thousand tons of fish (FAO, 1989). The Blue Nile, White Nile, River Nile, lake reservoirs behind dams and irrigation canals and the red sea these are the main sources of fish in Sudan. (FAO, 2019).

Fish are important substances in global food markets, they contain omega-3 fatty acids, high-quality protein, essential amino acids, minerals and vitamins (Kim, 2015). Fish is an extremely perishable food item it required preservation for future uses because fish is susceptible to damage as soon as it harvested, especially due to the high temperatures in Sudan and the lack of storing and distributing facilities of fresh fish in production area. many methods are followed over the world for preserving fish to extend its shelf-life, like drying, salting and smoking (Reza et al., 2007; Abolagba and Melle, 2008). Dry fish is a very favourite food item and used as a substitute of fish at the scarcity of fresh fish in many countries. (Oduor et al., 2010)

A Little is known about the nutritional quality of the dried and salted Nile fish products that is why the objectives of the present work include a review of the prevailing drying and salting methods of fish. In this review we are going to explain the methods and challenges during process in this kind of preservation methods.

## **Drying**

Drying is one of the oldest methods used to preserve food products. Drying removed water from the foodstuff, which reduces the moisture percentage to the extent that it is difficult for organisms to live to occur damage and stop the enzymes in the events of changes of chemical spam in foods (Alasod, et al 2000). Natural solar drying, manufactured solar dryers, electric ovens and microwave ovens were used for preservation. The natural solar drying method was accompanied by changes in the dried foodstuff associated with changes and different weather conditions, pollution microorganisms, dust, and insects, which may leads to a reduction in their nutritional value (Eskander, 2020). Natural solar drying method requires a large area and long drying time (Darvishi and et al 2013). Majeed and Al Halphi (2007) concluded that the decrease in moisture percentage for fish and meat was higher by using the solar dryer compared with the using natural sun drying. Dried fish and meat using the solar dryer, it was isolated from the outer environment and did not affect by any change in environmental conditions.

Sun-drying and Salting is most of the traditional methods employed to preserve fish in Sudan. Sun drying is a low cost method and the product plays an important role particularly in providing nutrition to the people in Sudan, especially in remote areas with few rainfall and seasonal water streams. The process of sun-drying a fish consists of simply laying whole fillets or strips of fillets on drying racks directly under the sun, in the open air using solar energy to evaporate the water content in the fish, and the dry product is known as “Kejeik”. (Elagba, 2010).

Sulieman (2012) studied the Quality Characteristics of Dried Fish Obtained from Eldeim Area, Central Sudan: where he prepared the fish for drying, for this, the head and fins were removed and the body was cut along the abdomen. All the viscera including the gonads were removed. Then the fish was cut along the back and the backbone and as far as possible all the ribs were removed and the meat and fat were carefully cleaned of skin. The fish drying started after preparation. After gutting the fish, it was either dried whole, or split along the spine leaving the tail connected. The fish was hung on the flakes from March -June. The fish flakes were subjected to vacuum packaging. After two months of hanging on the flakes, the fish was then matured for another month indoors in a dry and airy environment. During the drying, about 85% of the water in the fish disappeared. His results showed that the chemical analyses indicated the similarity of most of the tested chemical components of the fresh and dried fish products. For microbiological analyses, the dried fish samples were safe microbiologically.

Elegba (2013) studied the nutrient value of traditional sun dried fish in Sudan: Where she bought Sun-dried strips of fish fillet from the central fish market in Khartoum, crushed and grinded. Samples of powder of each species were weighed and freeze dried by Freeze Dryer model 230 to -40°C and the surrounding pressure was reduced to 110, using (MODULYOD) to remove water from the powder, until the samples had constant weights, The proximate constituents of the dry samples were determined by the method of the Association of Official Analytical Chemists (AOAC, 2005). The results showed that the dry product (Kejeik) of Nile fishes is of high nutritional value and good source of proteins, minerals as well as energy.

The results also indicated that dried fish contains minimal amount of heavy metals and is a useful food source for maintaining human health.

Zahra (2014) studied Nutritional Value of Kejeik: A Dry Fish Product of the Sudan: she mentioned that: during the period January-April, The fish samples had been produced by natural fermentation. In this process the fisher men are used to prepare Kejeik from fresh water Nile fish, the fish were split longitudinally, gutted and beheaded, the split fish were then hung on ropes or spread on rock or tree branches, out in the open air, under the direct sun.

When the drying process was over, the large pieces of fish are stacked together on mats, covered with another set of mats and trodden check on by fishermen, to flatten and pack the dry fish more compactly, further shade drying them follows after which the fish products were ready to be transported to the local markets. She concluded that the analyses indicated that there was non-significant difference between the Blue Nile and White Nile Kejeik samples in most of the chemical components of Kejeik samples prepared from three fish types. All Kejeik samples free from toxic metals such as mercury, arsenic and cadmium.

Suliman (2012) studied Microbial Safety of Dried Fish Meat (Kejeik) Produced in Sudan: his results pointed that Kejeik is free from harmful bacteria (pathogenic and spoilage bacteria) Acidophile bacteria such as *Escherichia coli* (E. coli), *Staphylococcus aureus*, *Salmonella*, *Listeria Monocytogenes*, *Vibrio parahaemolyticus* and *Vibrio cholerea*. The absence of harmful and pathogenic bacteria indicated safety of the Kejeik products, The variations in microbial counts of Kejeik samples from different markets and seasons could be attributed to a lack of proper procedures adopted by the Kejeik processor and/or improper hygienic in some of these areas.

## **Salting**

Salting is a physical and chemical process as a result of salt penetration of the fish's body with the forces of moisture to leave the muscles, resulting in a change in weight and is intended to preserve the fish (Eskander, 2020). The salting process leads to loss of part from the protein reducing worked lipolysis enzymes and also salting works to the decrease of numbers lipolysis bacteria through the decrease of free fatty acids after salting (Aldouri and et al, 1990). Salting by salt solution gives more regularly salting compared to dry salting if the high moisture content of the products will need more salt compared to dry products (Hilderbrand, 1999).

Salted fish (Fassiekh) are manufactured in southern Sudan and parts of White Nile, fish are grouped into boat and washed well and cut from abdomen to chest and washed for second time with water and salt within limits of 2 kg salt in order to prevent from flies exposure during salting, and then placed a few salt within the abdomen , after wounded all fish sprinkle a little salt and stir and then thrown into plastic sacks, such as sugar plastic sacks for 4 - 7 days after sprinkle amount of salt in the range of 10%, while after reaching save stage, packaging's again empty and covers floor by linoleum and then sprayed a another quantity of salt per hundred kilograms amount of 10 kilograms of salt ,and kept for another 10 days , then discharged for the second time and placed in wooden boxes intended for drying, after three days can be discharged and placed in Dryer to ventilation for 6 hours and are weighed in plastic packaging's (Hafiz, 2010).

Manufacturing Fassiekh as powder and paste in the same last manner, so Fassiekh fish is cleaned of crust , spinal and head of up party and wash and then displays to full ventilation to dry water and then hashes and also placed for ventilation for a full day or half-day as ventilation, and same way in manufacture of powder when pulp dried completely, so that it almost dry and then hashes for the second time and dried for a week in a place not exposed to dust or sun so as not to be affected by unpalatable taste. (Hafiz, 2010)

Onaheed and et al., (2018). Studied the Quality appraisalment of Fassiekh manufactured by using different fish species in El-Dueim locality, Sudan: he subjected sensory analysis (color, flavor, texture and overall acceptability) and chemical analysis (moisture, protein, ash, crude fat and fatty acids composition for Fassiekh, The score sensory evaluation of salted fish (Fassiekh) was found to be affected by the type of fish and all species of fish used in manufacturing of Fassiekh were highly accepted by the panelists. The chemical composition of Fassiekh is deviated in association with the fish species. The content of omega-6 fatty acids was high in all species compared to omega-3.

Sulieman (2012) Studied the Effect of Antimicrobial Properties of Pepper Fruits on Some Spoilage Organism of Sudanese Wet-Salted Fermented Fish (Fassiekh) Product, he concluded that, the pepper fruits can play as antimicrobial agent in conserving the Fassiekh product by lowering the total viable count, killing or inhibiting some organism that related to Fassiekh spoilage and recommend that, the hot pepper can be used in small amounts in preparation and production of Fassiekh.

The unhygienic practices of Fassiekh making and the higher number of bacterial load and staphylococci count may pose hazards to human health, the consumers should take more consideration to paste Fassiekh available in the retails, due to the higher count staphylococci species which are considered as food poisoning organism, as well as the conclude that the paste Fassiekh is more contaminated than the wet-salted than the dried salted Fassiekh.( Goja, 2013).

The salt concentration level on studied fish species resulted in an increase in crude protein and ash content than fresh fish and produced well wet-salted fermented product with reasonably long storage shelf life (Sulieman, 2012).

## **CONCLUSION**

Through this study, it appears that the use of drying and salting for fish preservation is highly effective, as is the high nutritional value and good source of proteins, minerals and energy of the dry product (Kejeik) and the salted product (Fassiekh) of Nile fish. Studies have also shown that dried fish contains small amounts of heavy metals and is a valuable source of food for the protection of human health.

## **REFERENCES**

- Abolagba O.J. & Melle O.O. 2008. Chemical composition and keeping qualities of a scaly fish tilapia, *Oreochromis niloticus* smoked with two energy sources. *Afr. J. General Agric.*, 4(2): 113-117.
- Adam Sulieman H.M. & Allaahmed A.A.A. 2012. Effect of Antimicrobial Properties of Pepper Fruits on Some Spoilage Organism of Sudanese Wet-Salted Fermented Fish (Fassiekh) Product. *World's Vet. J.* 2(1): 05-10.
- Al-Asod MB., AbdulAziz O.F. & Solaga A.B. 2000. Principles of the food industry. Second edition, Dar Al Kutub for Printing and Publishing, Mosul University.
- Al-Douri L.D., Ibrahim M.M., Badawi A.S. & Al-Aswad M.B. 1990. Chemical, bacteriological and sensory study of some salted and smoking local fish. *Mesopotamia Journal of Agriculture* 22:245-263.
- A.O.A.C. 2005. Official Methods of Analysis (18th Edn). Association of Official Analytical Chemists International, Maryland, USA.
- Darvishi H., Azadbakht M., Rezaeiasl A. & Farhang A. 2013. Drying characteristics of sardine fish dried with microwave heating. *Journal Saudi Soc Agric Sci* 12: 121–127.

- Eskander Mohammed. 2020. Drying and salting fish using different methods and their effect on the sensory, chemical and microbial indices. *Multidisciplinary Reviews*. 3. 1-7. 10.29327/multi.2020003.
- FAO 1989. Yield and Nutritional Value of the Commercially More Important Fish Species. FAO Technical Paper No.309, Rome, 187 p.
- Fishery and Aquaculture Country Profiles. Sudan 2019. Country Profile Fact Sheets. In: FAO Fisheries Division [online]. Rome. Updated 14 03 2019. [Cited 21 November 2020]. <http://www.fao.org/fishery/>
- Goja Arafat. 2013. Isolation and Identification of Staphylococci Species from Fermented Salt Fish (Fassiekh). *Researcher*. 5.
- Hafiz R.M.A. 2010. An Econometric Study for the Fisheries and Aquaculture Sector in Sudan (Doctoral dissertation, University of Khartoum).
- Hilderbrand K. S., Jr. 1999. Smoking fish at home - safely. <http://seafood.oregonstate.edu/.pdf%20Links/Smoking-Fish-at-Home-Safely.pdf> (Accessed 21 November 2020).
- Kim H., Kumar K.S. & Shin, K. 2015. Applicability of stable C and N isotope analysis in inferring the geographical origin and authentication of commercial fish (Mackerel, Yellow Croaker and Pollock). *Food Chem*, 172, 523–527.
- Majeed GH. & Al-Hilphi ARS 2007. Design of a solar dryer equipped with return and heating systems and tested in drying fish and meat. *Journal of Basrah Researchs* 3:20-30.
- Mohamed E.H.A., Al-Maqbaly R. & Mansour M.H. 2010. Proximate composition, amino acid and mineral contents of five commercial Nile fishes in Sudan. *Afr. J. Food Sci.*, 4 (10): xxx -xxx. Available online at: <https://academicjournals.org/journal/AJFS/article-abstract/535924A26108>
- Oduor-Odote P.M., Shitanda D., Obiero M. & Kituu G. 2010. Drying characteristics and some quality attributes of *Rastrineobola argentea* and *Stolephorus delicatulus*. *Afr. J. Food Agricul. Nutr. Develop.* August.
- Onaheed O., Sulieman Abdel Moneim. & Wa, M. 2018. Quality appraisalment of Fassiekh manufactured by using different fish species in El-Dueim locality, Sudan. 4. 94-104.
- Reza M.S., Bapary M.A.J., Ahasan C.T., Islam M.N. & Kamal M. 2007. Shelf-life of several marine fish species of Bangladesh during ice storage. *Int. J. Food Sci. Technolgy* doi:10.1111/j.1365-2621.2007.01613.x
- Sulieman A.E. et al. 2014. Microbial Safety of Dried Fish Meat (Kejeik) Produced in Sudan. *Food and Nutrition Sciences* 5: 606-613.
- Sulieman A.M.E., Hassan Z.M.A. & Elkhalifa E.A. 2014. Microbial Safety of Dried Fish Meat (Kejeik) Produced in Sudan. *Food and Nutrition Sciences*, 5, 606-613. <http://dx.doi.org/10.4236/fns.2014.57071>
- Sulieman Abdel Moneim E. & Waleed A.M. 2012. “Quality Characteristics of Dried Fish Obtained From Eldeim Area, Central Sudan.” *International Journal of Food Science and Nutrition Engineering* 2, (1): 1-6.
- Sulieman H & Khamis O. 2012. Effect of salt concentration level and season on chemical composition of wet-salted fermented fish species. *Online Journal of Animal and Feed Research*. 02.
- Zahra M.A. Hassan Abdel Moneim E. Sulieman & Elamin A. Elkhalifa 2014. Nutritional Value of Kejeik: A Dry Fish Product of the Sudan. *Pakistan Journal of Biological Sciences*, 17: 1115-1123.