CONSUMPTION OF PEARL MULLET

As surroundings of Lake Van became residential areas for local villagers, they had started consuming pearl mullets as one of their major table food items. Various consumption habits have been developed since then. There are two major ways to consume the pearl mullet today which can be summarized as fresh consumption and storage consumption. Unfortunately, we do not have enough background information about the past consumption levels of these two different methods. But we can say that 70% of total consumption today is done when fish is fresh, and 30% of it is done after being stored in various ways.

If we consider the high nutrition value of fish meat as compared with other types of meat, we can develop a better understanding of fish consumption. The nutrition values of pear mullet in comparison to both other types of meat and to some other types of fish meat are given at Table 1 and Table 2 respectively.

Table 1. The comparising of nutrition value of pearl mullet and other meats (g/100 g)

Pearl mullet		**Red meat**		**Chicken meat**	
Protein ratio hing	18	Protein ratio hing	18	Protein ratio hing	19
Oil ratio low	4	Oil ratio high	18	Oil ratio low	8
Kalori low	108	Oil ratio high	234	Kalori low	148

Tablo 2. The comparising of nutrition value of pearl mullet and other fish

Nutrition elements (g/100 g)	**Pearl mullet**	**Trout**	**Horse mackerel**
Protein	18	18	21
Oil	4	11	10
Water	73	79	75
Energy	108	171	174
Price, YTL	1	5	10

Fresh consumption of pearl mullet: Almost all pearl mullets caught at non-

spawning period are consumed whey they are fresh. Buying truckloads of fish from local fishermen daily, wholesalers later distribute them to retailers at provincial or district centers. At various selling points in such centers these retailers sell fish to consumers. Fresh fish is consumed by household members with or without oil either by frying or cooking in tandouri or ovens. Almost all traditional ways of cooking involves no cleaning of the fish. In other words, fish is consumed with its internal organs after cooked. Since fish was caught only during the reproduction period in the past, it used to be consumed without taking the eggs out, so this can be considered as the main logic behind such a habit of consumption. As urban culture has socially developed and as the number of publications on pearl mullet consumption has also increased in recent years, we can now observe that fish are usually cleaned out to a greater extent before home-cooking. Another way of consuming pearl mullet when fresh is to cook it in rectangular pans made out of galvanized iron sheets or made of 16 kg sheet tin folded at the edges. During lunchtime at local markets among craftsmen or at bake houses, this method of cooking fish is quite popular. It involves salting fish in large amounts before cooking without cleaning them out. Recently, corrugated cardboards are also used instead of galvanized iron sheets or tins. Since they absorb the fish broth dribbling down while cooking, such cardboards are the most preferred tools for cooking drier fish at a shorter period of time.

Fish cooking in traditional oven

Fish in ground table

Newly cooked fish in tradional oven

How is understand of freshness of the pearl mullet?		
Properties	**Fresh**	**Not Fresh**
Skin	Colour brillant Scales clear	Colour not brillant, skin cover with excretion
Eyes	Clear and brillant	Pupil dull and cover with excretion
Gills	Red, smell like marine	Light red, yellow or grey, smell steale meat
Gill covers	Closed	easily openable or open
Ventral side	Shining, hard	Colourless, dull, soft, not flexible, slushed
Muscles	Compact, flexible, not keep fingermark	Soft, not flexible, keep fingermark
Smell	Sea or seaweed	Clearly steale meat

The appearence of the fresh and not fresh pearl mullet

Storage consumption of pearl mullet: Due to the fact that the pearl mullet is a migratory fish, it had been more consumed after being stored in various ways in the past. The major aspect of storage consumption is buying salted fish. Generally fish are desiccated after being salted, or are buried in salt at humid environments, or are marinated in salty water. In this way, it can be stored for later consumption ranging from a couple of months to a year. In fact, there are some other ways to store fish after being salted. For example, in Gevaş Dereağzı village fish are buried in sand after being salted. Villagers claim that if being salted in this way fish can be kept for a longer period of time. Here a more detailed information will be given on salting fish. The rate of salt fish consumption in residential areas surrounding the lake is much higher than the rate available in other regions of our country. As a result, the rate of blood pressure or coronary diseases is considerably higher as well.

There is no evidence on the origin of salt fish consumption by people living around Lake Van . In 17th century, E. Çelebi wrote about details of the total fish yield after spawning migration, i.e. how they were salted in large amounts by Defterdar Ağa (District Treasurer), and were later transported to Iran , Azerbaijan and Nakhichevan. Catering for soldiers at fortresses around the lake was provided by annual profit derived from selling salt fish. There was no other written record on historical development of salt fish except the one given by E. Çelebi . As emphasized above, techniques of salting fish had started when other ways of storage was not developed yet, and it had gradually become a tradition within the local environment.

Consumption habit of salt fish is probably based on two major reasons as follows: First, the biology of fish comes into the picture. Since it cannot reproduce in salty-alkaline lake waters, it moves to rivers in shoals during the spring. The level of fish migration is so high that even today it is possible to catch fish with bare hands without using any fishing gear. Local people prefer the easy way of collecting fish as if they are almost passing by in front of their houses and later salting them for table consumption within a year. There is no extra cost or effort needed for fishing, and trading is also possible during non-spawning period. This must be the first major reason for consuming habit of salt fish among local people of the lake. Second, since lake basin is surrounded by high mountains such as Süphan, Tendurek, Nemrut, İhtiyar Şahap, etc., some transportation problems still exist during long winters. Researchers have reported that traditional habits of fish storage are widespread in those areas still difficult to transport to and from. Such transportation problems probably lead local people to store fish in the easiest and the most practical way, i.e. salting fish whenever find it. This argument is supported by the fact that fish are salted only during the spawning period but not throughout the year.

There are three traditional ways of salting fish:

The first method involves salting piles of fish in a way as commonly known, having them soaked in their own juice for a day, then taking them out to drain and later salting them again in layers at containers. **At the second method,** those fish left in salt for a day will be taken out on the next day and will be aired under the sun for half an hour or one hour at most. In this way fish with less body juice are salted again and are placed in layers at containers. **The third method involves** leaving fish in salt for a day to be soaked in their own juice, and later stringing them to dry under the sun. We can summarize these three methods mentioned above with a traditional

description of salting fish:

“Wash piles of fish first, let them drain, say an hour or so, and then put them in a washbowl. Salt them all completely, stir, and let them wait for 3 days (It is said 2 days in Gölağzı and Yalındüz). Take fish out of the washbowl which is now full of their own juice, (In Çelebibağ and Yalındüz local people wash them again at this point) and then put them in a basket, crate, bag, or colander to drain. Then sprinkle salt first at the bottom of a tin can or crate before placing fish in layers with salt in between. On top, sprinkle salt again in large amounts to cover fish layers. It is said that some people use bean leaves instead to cover fish layers around Erciş-Gölağzı neighborhood. Put one stone each both under and over the top of crate and leave it in a cold place under shadow. Do not clean out fish while salting because eggs inside are valuable. In Dereağzı village when salting fish their heads are cut off to avoid excess use of salt.”

Salt fish is consumed in traditional ways as expressed below:

“After baking bread, put sheet tin over ember still left at tandouri. Arrange fish in rows on sheet tin to cook. Or, wash salt fish first, sprinkle flour on them, break in the middle and throw them in ember at tandouri. When cooked, take them out by using a sort of iron hook as locally called as ***hesdif*** *at their breaking points. This is why we break them half in the first place. Otherwise, it will be very difficult to take fish out of tandouri when too hot. Salt fish are most preferred when cooked in tandouri but you can also fry fish in cooking oil. Clean off fish bones before frying. It is told that in Gölağzı, people fry salt fish in cooking oil as a whole. Fish is also cooked in tandouri on a skewer by stabbing through their eyes.”*

Dry salted pearl mullet market in bazaar

Is consuming salt fish healthy?

Unfortunately, it is not possible to say that the consumption of salted pearl mullets by local people around the lake is healthy enough. Results of a research study aiming to prove such claims are quite striking. (Sarı *et al*., 2004).

There are some criteria to determine whether the salted fish is fresh enough or not. TBA and TVB-N values are the most frequently used freshness indicators among others. The percentage (%) of salt extracted from tissue samples of salted fish gives us an idea for quality assessment and spoilage degree of fish products. Moderately salted fishery products should contain 13 % of salt. Heavily salted fishery products on the other hand should contain approximately 15% of salt. TBA (Thiobarbituric acid value) parameter indicates that as a result of oxidative deterioration in unsaturated fatty acids of salty fish meat, a compound called malonaldehyde is obtained. If heated, a reaction of this compound with thiobarbituric acid takes place which further gives rise to the color of red. A very good material should have a TBA value not less than 3, and a good material should contain not greater than 5. The limit of consumability ranges from 7 to 8. Salty fish products with TBA value greater than 8 can be considered as not fresh anymore (Varlık *et al*, 1993).

TVB-N (Total Volatile Basic Nitrogen) value indicates the amount of volatile basic nitrogen accumulated in body tissues due to deterioration of fish during storage. It is a useful indicator to determine the degree of spoilage when fish products are stored for a long period of time as frozen, dried or salted. Such products can be categorized according to different values of TVB-N as in the following:

Samples containing 25 mg/100g TVB-N value as "very good"

Samples containing 30 mg/100g TVB-N value as "good"

Samples containing 35 mg/100g TVB-N value as "marketable"

Samples containing TVB-N value greater than 35 mg/100g as "deteriorated"

It is known that a value between 32-36 mg/100g is good enough for inland fish. The value of consumability for such fishes as shark, rough ray, etc. with high level of urea accumulated in their bodies is around mg/100 g TVB-N (Varlık et al, 1993).

The level of concentration in all salt fish samples collected from the surrounding villages is considerably high. The main reason for excess use of salt is to prevent any deterioration. Except for those from the central Çitören Village , the percentage of salt is higher than the normally accepted levels. In such samples with high salt percentage level, the TBA value which indicates the oxidative deterioration in unsaturated fatty acids is also high. In the case of excess salt, enzymes in protein structure are denatured and any putrification will be delayed as autolysis slows down. However, salt increases the activity of oxidase enzyme which in turn increases the risk of oxidation in fats. It is for this reason that the greatest risk of salted products arises after fat oxidation (Varlık, 2004).

When we look at TBA values which indicate the degree of oxidation in unsaturated fatty acids in fish samples, it can be seen that except for those taken from Gevaş-Dereağzı Village and Erciş-Çelebibağ Town all other samples contain TBA values (5-8 mg/kg) above the normal level. Samples from Dereağzı Village contain TBA values of 4.8-4.9 mg/kg, and those from Çelebibağ Town contain TBA values of 7.67-7.98 mg/kg. All others contain TBA values ranging between 12.77-14.73 mg/kg. In this case, all samples except for those from Dereağzı Village and Çelebibağ Town can be categorized as **"Deteriorated"**.

On the other hand, when we look at TVB-N values as indicators of the volatile basic nitrogen amount in tissues, we can see that there are values much higher than normal consumption levels. The pearl mullet accumulates urea in its body in order to survive in a highly alkaline environment and to maintain the ion balance within its body (Arabacı, 1995). Considering the maximum TVB-N value of 50 mg/100 g as determined for such fishes as sharks, rough rays, etc., the pearl mullet too should be listed in the same category. As emphasized above, the maximum limit value of TVB-N for fish with high urea level is 50 mg/100 g, and those fish products containing higher values are categorized as "Deteriorated". All samples analyzed reflect very high TVB-N values. The highest TVB-N value found is 98.34 mg/100 g in fish samples taken from Muradiye-Karahan Village whereas the lowest TVB-N value is 58.25 mg/100 g in those taken from Gevaş-Dereağzı Village . In this case, excluding TBA values, if we look only at those TVB-N values of sample salt fish, such products can be categorized as "Deteriorated".

Considering microbiological analysis results of salt fish samples, we can say that there are variations among values for total microorganism, yeast-mold microorganism, coliform group microorganism, and halophilic microorganism. A

decrease in the amount of total and yeast-mold microorganisms is expected after salting. Fish meat provides more favorable environment for such microorganisms before being salted. Although coliform group microorganisms cannot usually survive in these conditions, a small amount of such microorganisms still exist in some fish samples both fresh and salted. This implies that coliform group microorganisms can be transmitted to such fish products when hygienic measures are not paid attention during the process of salting or storage.

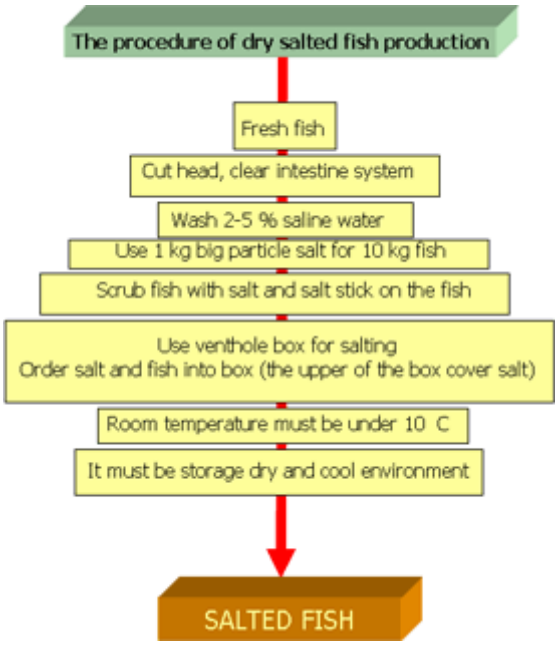
If salt level in fish meat is evaluated in relation to TBA and TVB-N values, we are faced with a critical situation considering the available methods of salting. Fish products salted by these methods are almost all deteriorated which means an open invitation for various health related problems. Various research studies proved that the high level of blood pressure among local people results from the salt fish consumption. A public health action is required to protect community health against the consumption of oversalted fish or at least to limit the existing level of consumption among local people. Therefore, it is important to develop a new way of fish salting.

Since consumption habits of traditional origin can hardly be changed, the best approach is to make such habits healthier than they are now. Given this aim, within the scope of the same research study, a new method of salting fish has been suggested as below.

Scientific method of salting pearl mullet:

The study carried out by Sarı *et al.* (2004) aimed to create a scientific method of salting fish as much similar as possible to traditional ways of it. Since it is a fact that we cannot eliminate completely the salt fish consumption among local people, we

need to improve the available salting methods through scientific approaches as much as possible. The scientifically developed method of salting fish basically involves two major changes: In the traditional way of salting, internal organs of fish are not cleaned out. Bacteria living in the digestive system of fish are major influential factors on the degree of deterioration during storage. Although fish are left to pickle in salted water for a long period of time (1-2 days), it takes a considerable time for salt to reach internal organs. This means deterioration caused by bacteria has already begun. Therefore, **it is emphasized that in scientific method of salting, we should definitely clean out the internal organs of fish.** The fact that salting by this method leads to a lower degree of deterioration and to a smaller degree of loss in nutrition values will be later explained in the following sections. On the other hand, there is no consistency in the amount of salt used in the traditional method. Some uses 4 kg of salt for 20 kg of fish while many uses 3-5 kg of salt for 5 kg of fish. If we compare the initial level of salt with the total amount used until the end of the process, we can easily say that 1 kg of salt is used for 1 kg of fish. There is no need to overuse salt which is also extremely unhealthy. It is reported that in the scientific method the amount of salt used should not exceed 15-20 % in fish tissues (Anonymous 1977, Hilderbrand 1999, Gökoğlu 2002, Varlık 2004). The best result on different amounts of salt is obtained from the sample group including 1 kg of salt used for 3 kg of fish. In this case, fish can be stored for a longer period of time without being deteriorated and high nutrition values can also be maintained.



The procedure of the dry salted method for pearl mullet

Researchers have adopted the procedure reported by Varlık (2004) and have also benefited from TS 2539 (Anonymous 1977) when improving the salting method in accordance with scientific requirements.

The newly suggested method of salting is both easy to apply due to its similarity to the traditional method, and it also ensures a salt fish production without any deterioration.

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