

The fermenting of fish and fish by-products: fish sauces in ancient medicine and cuisine.

By Sally Grainger



Many people are familiar with the idea that the ancient Romans used fish sauces in their cuisine but not many people realise that the most valued and expensive form of fish sauce was made from, what was perceived by the Romans themselves, as rotten or fermented fish viscera. This special sauce, known as *garum*, was valued by the elite but it was also used in ancient medicine. Why on earth would anyone ferment fish viscera?

Figure 1 An artist's impression of the process of making *liquamen* fish sauce.

What could possibly be beneficial or desirable in such a practice? It is a very interesting question and one I have spent many years trying to understand. I will share with you my thoughts and ideas on this issue in the hope that it can illuminate the related issue of fermenting cod liver. I will look at the possibility that a form of fermented fish oil would have been familiar to fish sauce manufacturers and therefore possibly also familiar to ancient Greek and Roman doctors. The traditional date for the introduction of the processing of fish liver oils is Viking c. 900 AD. Documented evidence is even later so we are unable to do more than speculate from the complex disparate pieces of evidence both literary, archaeological and empirical.

Ancient fish sauces

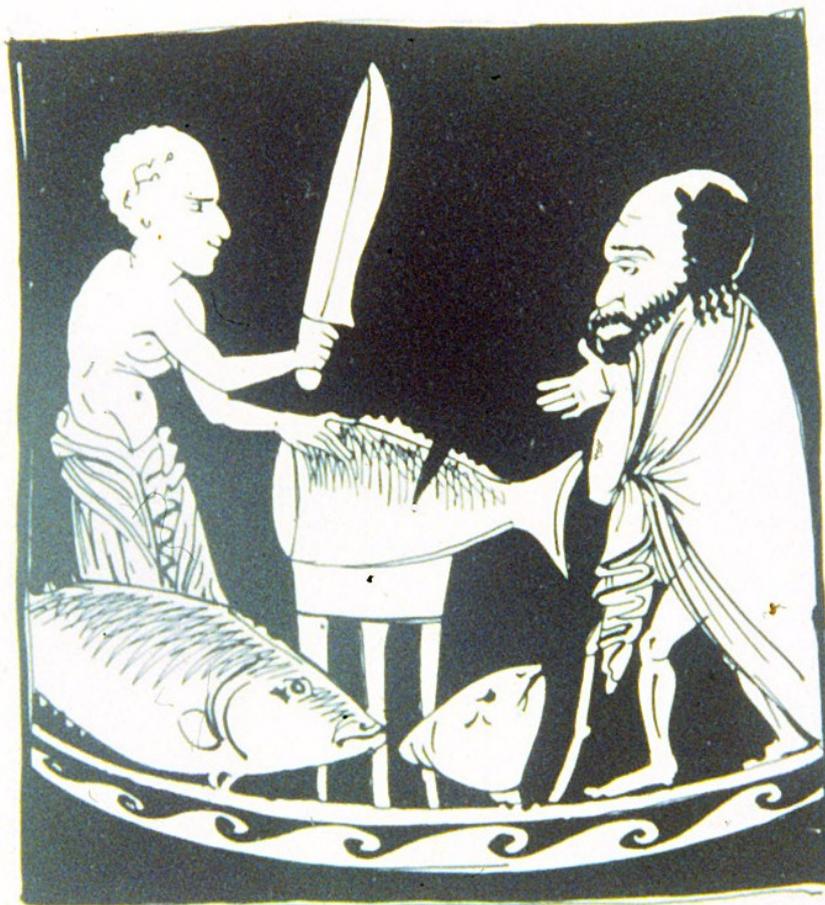
Ancient coastal societies of the Mediterranean and Aegean relied heavily on fish. In 4th century BC Sicily, the larger species were consumed by an elite who wrote the first gastronomic literature telling us how much they valued the fresh mullet, bream, tuna and shark and numerous other species at their banquets. The first ancient fish sauce

that we read about was an unfermented brine derived from the long term storage of salted fish, particularly tuna, and this was initially a valued sauce used at elite banquets as a salty dip.

The rest of the population of the Greek Islands and Italian coastal regions had to be content with smaller species such as sardine and anchovy and juvenile forms of bream and mullet. Once caught, either by one man with a small net or vast seine nets pulled onto the beach, these smaller fish often under 20 cm, and as small as 5 cm, begin to decay within hours in the heat of the day. You either ate them then and there or preserved them with salt using traditional skills and knowledge of preserving that undoubtedly went back thousands of years. Archaeologists have found large dumps of fish bones that must be a residue of a form of fish sauce in many parts of the Greek Islands, from as early as the 2nd millennium BC. The tiny ones can be cooked and eaten without gutting on the spot – we have all eaten whitebait - but the larger size would need to be processed differently if the final product was going to be safe to eat. To gut or not to gut, that is the question? It was simply impractical to individually gut the vast quantities that they caught and it seems that they developed a style of preserving that involved fermenting using relatively low salt, which in essence is allowing lactic acid producing bacteria (LAB) to thrive and generate acid which kills the nastiest bacteria. They clearly didn't understand this but long tradition provided empirical knowledge of the best way to do it. We have to make a guess as to the process they used. It is not clear whether a solid or sauce product was the first process to be used. A traditional technique which was still being used in Cornwall as late as the 1950's involved the whole fish being piled up into a mound in layers of fish and salt. The salt would draw out the water content of the fish, which would drain away, and also dehydrate the flesh and internal organs.¹ Under these conditions pathogenic bacteria cannot grow - they need moisture - but lactic acid producing bacteria rather like a little salt and they thrive too. The fish are being fermented and salted in one and the result is entirely safe, and for those brought up on the taste, quite delicious! It's pungent and slightly 'off' in the way that some of the finest French cheeses have more than a whiff of the farmyard about them! It may be guessed that most food at this time was pretty dull and any product that could offer this *umami* punch of flavour was desirable and became the taste experience that people sought.

This traditional Cornish technique may also have been applied using wooden vessels such as barrels, and wooden buckets with holes in them. The brine would run away through holes or the barrel slats. The origin of the ancient Mediterranean liquid fish sauce, rather than a semi dried and compressed fish, seem to me to be the result of a happy mistake. One day the brine did not drain away as it should. Maybe the staves of the barrel were too tight or the holes of the wooden vessel got bunged up. It was then left in a corner and forgotten and magic occurred? Over, what is later determined to be about 4 months, the fish turned to a liquid and produced a deep dark sauce full of *umami* flavour enhancing qualities that we all know and love today.² This sauce is not technically fermented as it is the enzymes in the intestinal organs of the fish that

breakdown the fish muscle tissue into particles which subsequently under autolysis convert the protein into a dissolvable form. It is clear that some LAB play a part too though this depends on the levels of salt used and how it is processed. These sauces were very nutritious and as with the sauces of Southeast Asia today, may have served as the main source of protein in the diet of those that consumed them. We first hear about this sauce from Greek writers. Later Latin writers call this first sauce a *liquamen*, not a *garum*! It seems to have been an everyday product used by the masses in their largely vegetarian foods and not valued by the elite. However by the 1st century AD the entire multi-cultural Mediterranean region had developed an exclusive cuisine based around the idea of fish sauce of multiple varieties and they all functioned as a substitute for salt in daily and special cooking adding that *umami* kick. How this occurred is very difficult to determine from the literary record but I have a theory ...



The uses of this Greek fish sauce in cooking spread north into Italy as the Romans themselves conquered south. The elite of Italy wanted to differentiate themselves from everyone else and sought special fish sauce products which the manufacturers obliged them with! Larger fish such as mackerel, otherwise used as a solid salted fish product were turned into a sauce and it was found that these fish did not dissolve easily.

Figure 2 A vase painting of a Greek fish monger selling tuna in the market.

It was undoubtedly understood that the viscera was responsible for the liquefaction so they added additional enzyme rich viscera to speed up the dissolving process. The additional viscera transformed the sauce, dispelled some of the 'fishiness' and providing a different kind of concentrated *umami* which is the taste of the amino acid

L-glutamate and was provided by fermenting the iron rich blood components of the intestines and the organs such as liver, kidneys, etc. They clearly wanted these flavours and one can easily imagine the manufacturers saying ‘why don’t we just use the viscera and blood and see what kind of sauce we get? We can give them what they want and its stuff we normally throw away. It’s good business!’

This is how I imagine the black and bloody *garum* was born. The ancients don’t tell us how it became a product and what ever the motivation, this sauce became the most expensive commodity in Roman trade. It functioned as a table sauce which the

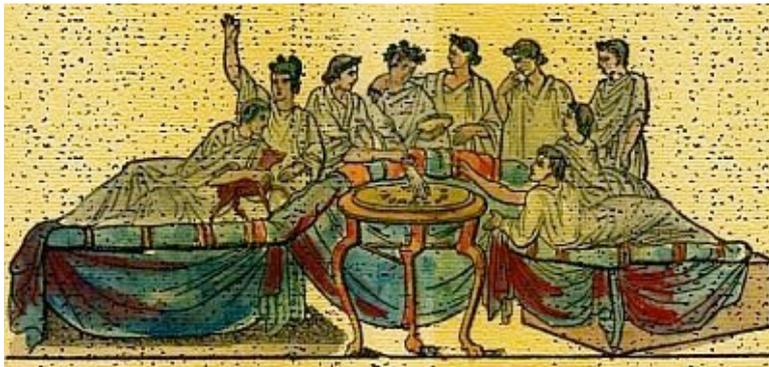


Figure 3 Wall painting of Roman dining scene.

gourmet and his guests could use themselves, pouring it onto cooked food and even possibly making dips by blending with wine and spices at table, in the same way that they made dining room ‘theatre’ out of the process of blending wine and water to drink.

The poets raved about it and Martial can say “take lordly *garum* made from the blood of a still breathing mackerel.” The gourmet Apicius devised a *garum* from the viscera of mullets and then as a theatrical piece had other mullet cooked/killed in that same sauce. The gourmet at diner would entertain his guests with the provenance of the *garum* he had acquired, it had to be Spanish and the best came from Cartagena which was known for its excellent mackerel. Yet *garum* was also a speciality sauce that every local fishery could make from what ever fish guts they caught.



Behind the scenes, in the kitchen, the commonplace small whole-fish sauce, now called *liquamen* to distinguish it, was being used as a cooking sauce. Rarely was *garum* used in the kitchen – Apicius’ mullet drowning was a exception - while good quality *liquamen* now also made from mackerel was often used at table too. It does become confusing! Pliny the Elder

also refers to a fish sauce made just from mullet livers, but it is described as an *allec*: a sauce that was a thick paste resembling anchovy or ‘Gentlemen’s relish’. The paste was made with salt like fish sauce and was undoubtedly very nutritious and high in oil. Sadly we do not know whether this product was fermented for a long period or simply formed into a paste. The Roman elite undoubtedly consumed it and had no need for the extra nutrition!

Figure 4 Spanish mackerel used to make *garum* and *liquamen*.

This, in a nutshell, is my take on the origin of fish sauce in Roman and Greek cuisine. It is not a well documented picture and there are some elements of this 'story' that I could not write in an academic publication. The evidence is simply too weak and one has to make too many leaps of common sense and educated guesses. Ancient writers do not talk very much about commonplace things like fish sauce and the people who made, traded and used these products rarely had the leisure to write.³

Does garum produce and oil and if it does can we find evidence for it?

Garum was also made from larger fish, particularly tuna which yielded a substantial amount of organ meat and blood which made huge quantities of sauce to accommodate the growing market for gourmet dining in Rome. Tuna fishing occurred in very specific places in the Mediterranean as the fish moved between spawning grounds. In the case of tuna *garum* this is the seas around the Straits of Gibraltar, between Cadiz in the west and Cartagena in the east. A well organised system of lookouts ensured that when the tuna were seen the boats could be launched. There would also have been random catches, lucky catches of tuna everywhere and the job



of many a young child was to watch for tuna and call out so that the men could set sail and catch just one or two as they past by. It was possible to make a tuna *garum* in a small local way and coastal communities would benefit both from selling on the salted meat and *garum* but also in consuming them themselves. The bones that are only

associated with bleeding and eviscerating tuna were found in the bottom of a large baggy pot in Jordon from 1st century AD, close to the coast and in a modest settlement too. The tuna were of the largest size 200 cm and it is clearly evidence of *garum* production among ordinary people. Tuna of this

Figure 5 A small sardine *liquamen* fish sauce with a layer of oil on the surface.

size would have had a substantial size of liver estimated at often 1lb in weight. The process of fermenting fish sauce whether it be *liquamen* or *garum* does generate an oil on the surface as you can see from the small layer on this vessel of sardine *liquamen* fish sauce.

My experiments using sardine and mackerel of c. 10-24 cm yielded a small and limited amount of oil, not sufficient in my view to justify its harvesting. It's a dark pungent oil and according to a modern fish sauce manufacture, it is not utilised in the product though it may have commercial value. The larger the fish used for a *liquamen*, the more oil would have been produced, but I am doubtful that the yield of oil even from large mackerel justified the harvesting of that oil as a product. It is different with *garum* as the yields of oil would have been greater and particularly so with tuna viscera.

Tuna liver does not yield large amounts of oil relative to say cod, but the oil itself is nutritionally of a much higher value as the vitamin A content is greater even than cod, though it is considered difficult to extract the oil from tuna livers. Modern techniques involve forms of enzyme and alkali fermentation.⁴ The fact that *garum* was fermented will have maximised the yield of oil, and we can say that fermentation has always been necessary to break apart the hepatic cells walls of fish liver so that the oil can flow. We cannot be certain that the oil from *garum* was taken and consumed as there is no documentary evidence to support a recognised market for the oil from *garum* production. We do not even hear of casual consumption by the local manufacturer. I realise this is contrary to what has been said before, but I am confined to reporting the evidence as I see it. It is quite clear from the evidence that it was the water based fish sauce that was the primary purpose of fermenting fish viscera and any oil that did rise to the surface was as a secondary and unmentioned consequence of the production process. We may say that, given the yield was high enough, it could have been utilised in some way. Given its very high nutritional value I would hazard a guess that those that did consume it, benefitted greatly from it. I think one can say that the oil generated from the local *garum* from Jordon was not wasted though, as has been noted, fish oil and darker liver oils were used for lighting and other practical purposes and it may not have been consumed.

If we could ascertain the yield of oil from a given batch of tuna *garum* sauce, we might have a clearer idea as to whether the ancients harvested this oil and consumed it, as larger quantities would definitely indicate justification for gathering the product. To be certain, an experiment is necessary to manufacture a tuna *garum* according to the ancient recipes and the oil measured and compared to modern extraction techniques. Sadly, I live no where near tuna fisheries and the chances of getting access to the tuna viscera would be very difficult in this modern day of regulations even if I did!

The sauces, both *liquamen* and *garum*, were potentially highly nutritious too and we are certain the diet of the less well off Roman was improved by the consumption of fish

sauces. I recently was able to obtain a Japanese fermented squid viscera sauce and found it had up to 4 times the nitrogen of modern fish sauce. It was a saturated protein solution and one could have lived quite happily on it with a little rice. The diet of poorer people in the communities of modern South East Asian are often limited to vegetables and rice with fish sauce, which is sadly quite low in nutrition as it is overly processed and very high in salt. Scientist have been trying to increase the nutrition of the sauces that these people consume by reducing salt and actually adding extra viscera from larger fish in precisely the same way as the Romans did. In Thailand, scientists are even now using ancient fish sauce techniques to manufacture a sauce made entirely from tuna viscera, which has been shown to be a saturated protein solution ideal for improving the health of those with a poor diet. More important though, is the fact that the finished sauce had 10% fat, which is very likely to have been liver oil.⁵ There is a recognition that fish organ meat has value and the communities cannot and should not waste it, though they are culturally attuned to consuming what many of us would consider unsuitable as food. In rural coastal China, one can find a fermented sauce made entirely from fish viscera that is sold unfiltered in plastic pop bottles on street stalls! I have only seen this product via a TV documentary, but there is every expectation of a layer of oil. Many people in the West would balk at such a product because we don't experience deprivation and we don't value our resources.

The ancient fisheries of Northern Europe

Atlantic cod is not a Mediterranean fish and would not have figured in ancient Roman fisheries, though other *gadidae* such as whiting, rockling, ling, and hake would have been available. Ancient groups in the Roman world from northern waters of Europe would undoubtedly have taken many types of *gadidae*, but from bone evidence from the pre-Roman period in Britain, it is clear that fish played very little part of the British diet. Archaeologist still find this very strange and attribute it to cultural and taboo issues. Even in the height of the Roman period in Britain, fish did not play a significant role in the diet. It was the Viking age, 900 AD, and Christian meat abstinence, before fish became an important part of the diet.

There are some interesting exceptions though. A unique site at Portland in Dorchester on the Dorset south coast revealed vast quantities of fish bones from many mature species including bream (>70 cm) and Atlantic cod (*Gadus morhua* L. >100cm), which is unique in an iron age Roman Britain site and rare before 1000 AD⁶. This find indicates a systematic exploitation of the waters to catch this deep sea fish at a very early time in Britain's fishing history.⁷ One has no details beyond the bones to indicate what they were doing with this fish, salting it probably, and trading a lot of it. This region of Roman Britain uses lots of, what archaeologists call, 'Roman material culture': the paraphernalia of living the Roman way of life such as villas with mosaics, wine drinking, fine glass ware and pottery and it is likely that a knowledge and desire to consume elite fish sauces was also established in nearby towns and elite villas.

Therefore, there would have been a market for Roman style sauces derived from local fish. Given the long tradition of utilising fish organ meat in Roman culture in Rome, it seems reasonable to propose that they would have attempted to make a fish sauce from such large quantities of fresh cod viscera. Equally they may have cooked the liver and other organs as fish offal. It certainly wasn't thrown away as it was too valuable to do that. A *garum* made from cod would have been a very different proposal and we may justly recognise that a substantial amount of oil would have been generated over the 3 months that they fermented the *garum*. The oil would have been investigated and likely utilised in some way. Written text from Roman Britain are completely absent at this time and so we cannot corroborate this, but we have something concrete to suggest the idea that cod liver oil may have been discovered, by accident, before the Viking age. It's a logical conclusion of the evidence though it must remain conjecture.

Fish in Roman medicine

The medicinal pharmacopeia available to the Romans and Greeks were extensive. They used a complex system of magical medicine which, with our modern knowledge, we would say was nonsense and also a style of treatment based around diet. All foods had characteristics that could contribute to the balance of the four humours (blood, black bile, yellow bile, phlegm) and the four characteristics (wet and dry, hot or cold) and achieving a balance was the key to a healthy life. Fish was cold and wet logically and could aid a temperament that was hot and dry. It's a little more complex than that, but this is not the place. Fish sauces were used medicinally more often to adjust a diet, so foods are recommended to be consumed with fish sauce and oil or wine as a dressing. They were also used for all manner of made up medicines for humans and animals. Pliny recommends *garum* for many ear complaints, and we also hear of many eye complaints being treated with fish sauces. This is actually quite a good idea as a simple brine is often recommended today for itchy and sore eyes as it would have had an antibacterial action. This is clearly what the main medicinal purpose of fish sauce was for the ancient. The residue from fish sauce production is recommended for burns, but it is only effective apparently if the patient does not know what is being used. It is hard to imagine that the patient would not know from the smell!

Fish played a small role in all manner of medicaments, but it must be said that cod liver oil does not appear to be a product in the record of Greek and Roman medicine. It is also clear that it was possible to obtain fish oil from the flesh and bones of fish, as well as the liver, and this general fish oil may have had a role in ancient medicine. It is not made clear and we have to be aware that this oil may have had more practical uses such as light and lubrication. It has been proposed that the ancient Spanish fishermen harvested an oil from milled fish. Mill stones have been found at fishery sites to contain associated fragments of many small fish and the proposal is that a fish bone flour or fertiliser as well as an oil was extracted from the process.⁸ Pliny the elder, the natural historian and encyclopaedist from the 1st century AD, gathered many medicines

together and refers to fish oil when he says ‘... all river and sea fish, the fats melted in the sun and mixed with honey are good for the eyes’ (32.69). Eyes figure quite a lot with fish it seems, as you may have already heard of the story of Tobit and his eye salve. We will get to that. Pliny gets closest to liver oil when he says ‘the liver of horse mackerel is used to treat parotid swellings’ (32.89.1). There is no other indication of how it is prepared, sadly. He also gets close with ‘some (people) roast dolphin fat (*pinguitudo*: though one manuscript says *iecur*: liver instead) in earthenware until the oil flows and it is used as an ointment for leprous sores (32.27). ‘A depilatory (for removing hair) is prepared from the blood, gall, and liver of the tuna, either fresh or preserved; as also from pounded liver of the same fish, preserved with cedar resin’. This is rather interesting as Pliny has flagged up that a preserved, i.e. a salted, tuna liver was available. We can see that the distinction between fish oil generally and that derived from liver may not be fully recognised at this time.

Pliny also makes mention of fish being burnt up in a sacred fire into an oily ash, which is then turned into a poultice or salve. (32.33). In the story of Tobit [Tobias] and his big fish, a similar process is involved. The angel tells Tobit to save the liver, heart and gal bladder as they have medicinal powers. Yet when he asked how these organs might be useful, the angel says that the fish organs should be burnt in a sacred fire and the smoke from that fire would cast away evil spirits. The gal bladder turns out to be a very useful eye salve.

‘The ‘white film’ that ‘scaled off from the corners of his (Tobit’s father’s) eyes’ corresponds to the exudate of a purulent conjunctivitis. In ancient, as well as, recent times, the prevalent blinding conjunctivitis in the Middle East was due to *Chlamydia trachomatis*. In the inflammatory stage of trachoma, blindness is due to pannus formation, the overgrowth of the cornea by vessels from the limbus. In the case of Tobit, the rapidity of the cure was miraculous, but the use of fish bile was probably based upon a common practice at the time—a practice that may in fact have aided the resolution of pannus and the restoration of vision’.⁹

A pattern of external treatment with all kinds of fish and fish oils is becoming clear too, and this is often the case with ancient medicine: that internal conditions are less well understood and there are therefore fewer treatments.

Conclusion

We have been looking at how the unwanted rubbish of fish butchery became that famous rotten *garum* of the rotten Romans. There is evidence that some Romans actually doubted the validity of the *garum* market, considered the product the result of putrefaction which of course it *appears to be*, and thought those who liked it to be fools.

Seneca writing in the mid 1st century can say “Do you not think that the so-called “*garum sociorum*”, the costly extract of poisonous fish, burns up the stomach with its salted putrefaction?” Such a view is understandable, of course, being that the process of fermenting is very closely allied to decay, as is of course the production of bread, wine and beer and who would do without those? The decay is **not** out of control and that is the key to understanding the process. When man takes control of the environment in which these things happen, the process ceases to be decay and becomes magical transformation. The ancients were not scientists, but they did not need to be as these techniques were derived from time honoured empirical knowledge, passed down through the generations from the remote past. Modern research has undoubtedly affirmed that fermenting all kinds of food stuffs, but particularly fish, has the effect of releasing and maximising nutrition, as well as, flavour. There is little doubt that when we follow these techniques today we are returning to a more natural ecologically sound form of food processing.

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Sally Grainger is a widely published food historian and archaeologist based in Southern England. She trained as a professional chef before embarking on an academic career with the publication of the *Classical Cook Book* by British Museum Press in 1996.

Since then, she has edited the Latin culinary text *Apicius* and adapted many of the recipes in it for the modern kitchen (Prospect Books, 2006). In addition, she has published a range of academic papers, specialising in recent years in research into the trade in fish sauces across the ancient Mediterranean world. She occasionally returns to her roots and prepares Roman banquets for clients such as the Getty Villa in Los Angeles and the British Museum.

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