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Omega -3 and Omega-6 Fatty Acids Potential of Smoked and Boiled Catfish (*Clarias gariepinus*)

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Boiled and smoked catfish (*Claria geriepinus*) were evaluated in order to know omega-3 and omega-6 fatty acids potential of these processed fishes. Samples were analyzed for their fatty acids using modified AOAC methods and gas chromatography (gc). Findings shows that linoleic (&!-6), alpha-linolenic (&!-3) and gamma-linolenic were significantly higher in boiled catfish and covered respectively 9.0351^{e-7}, 9.56501^{e-5} and 2.76276^{e-5} area when subjected to gas chromatography compared to the smoked cat fish. Also, both saturated and unsaturated fatty acids were present in appreciable amount in the processed samples. Therefore, catfish can serve as a potential source of essential fatty acids to human nutrition particularly in Nigeria where cat fish consumption is growing popular.

Key words: Cat fish, Fatty acids, Omega-3 and Omega-6.

INTRODUCTION

Catfish (*Claria geriepinus*) is an extensive freshwater fish, found virtually all over the world. It is a lean and highly nutritious fish that is rich in Vitamins, protein, and minerals, and has little or no saturated fat and is low in carbohydrate[1].Catfish is sometimes eaten raw, but it is usually treated by various processes such as boiling, grilling, baking, frying smoking and oven drying before consumption. Heating (boiling, grilling, baking, and frying) is applied to food to enhance its flavour, tastes and to inactivate some pathogenic microorganism and increase its shelf life[2]. On the other hand, the use of microwave oven for drying has increased greatly during recent decades[3].

Omega 3 and 6 fatty acids are polyunsaturated fatty acids (PUFA), meaning they contain more than one is double bond. Although humans and other mammals can synthesis saturated fatty acids and some mono-saturated fatty acid from carbon groups in carbohydrates and protein. It has been estimated that the ration of omega-6 to omega-3 fatty acid in the diet of early human was 1:1[4] but the ration in the typical western diet is now almost 10:1 due to increased use of vegetable oils rich in linolenic acid as well reduced fish consumption[5].

Different cooking methods on proximate and mineral composition of catfish have been studied[6]. Drying is one of the oldest methods of preservative components of cell membranes. When incorporated into phospholipids, they affect cell membrane properties such as fluidity, flexibility, permeability and the activity of membrane bound enzymes. It plays important roles in vision and nervous system function. Drying of fish could extend the keeping quality thereby increasing the availability of fish year round, concerns have been raised about the appearance, texture, flavour, and importantly loss of some essential nutritional compositions. Therefore, this study seeks to determine the amount of saturated fatty acids and omega-3 & 6 fatty acids potential in smoked & boiled catfishes.

MATERIALS AND METHODS

Two freshly harvested catfish (*Clariageriepinus*) were obtained from a nearby

fish farm. The mean weight and length of the fish were 250-300g and 25-30cm respectively. The fish samples were washed with clean water to remove dirt, and were shared into two parts. One part was boiled in water and the other halve was smoked. The samples were dehydrated and blended separately using a kitchen blender; they were kept in labelled airtight containers andwere analyzed in the laboratory. The crude fat analysis was obtained by following the ether extraction method and fatty acids were analysed using gas chromatogram[7].

RESULTS

The result in table 1 indicates the amount of saturated fatty acid in boiled and smoked catfish. Findings show that palmitic and Arachidic where significantly higher in boiled catfish which covered 1.92845^{e-5} and 7.44878^{e-7} amount/ Area when compared to smoked catfish which covered 1.92734^{e-5} and respectively.

The result in table 2 shows the amount of unsaturated fatty acid in boiled and smoke catfish. The study shows that linoleic, Alpha-linolenic and Arachidonre where significantly higher in boiled catfish which covered 9.03517^{e-7}, 9.56501^{e-5} and 1.73060^{e-4} amount/area when compared to smoked catfish which covered 6.41263^{e-4}, 5.45144^{e-5} and 1.59797^{e-4} respectively.

Fatty acid chromatogram for the processed catfish

Fatty acid chromatogram of the extracted fat content from boiled and smoked catfish are show in table 1 and 2. With reference to table 1 and 2 the fatty acids of the extracted fat content of clariasgariepinus are generally composed of saturated fatty acid and unsaturated fatty acid. Gas chromatogram illustrate that the boiled and smoked catfish samples have the common fatty acids such as oleic, arachidonic, eicosapentaenoic acid, stearic and docosahexaenoic acid.

DISCUSSION

Although the result of this analysis work shows that alph-linoleic (&!-3) and linolenic (&!-6) of unsaturated fatty acid in boiled catfish is higher than that of smoked catfish. It was observed that about three quarter of the body weight of the catfish consist of water and therefore, an urgent step must be taken for its protection against destructive agent like microorganisms. In this study, more fat content were rapidly removed in the fish when subjected to smoking than boiling. This observation is in agreement with the finding of Andrew, (2001) (8) that boiled catfish generally achieved the required moisture content in food earlier and more uniformly than smoked catfish.

Table 1: Gas chromatogram results of saturated fatty acids in boiled and smoked catfish

Common name	Carbon formula	Boiled (Amount/Area)	Smoked (Amount/Area)
Caproic	C6:0	0.00000	0.00000
Caproic	C8:0	0.00000	0.00000
Capric	C10:0	0.00000	0.00000
Lauric	C12:0	4.64322 $^{e-5}$	4.30003 $^{e-5}$
Myristic	C14:0	9.78057 $^{e-4}$	4.74835 $^{e-4}$
Pentadecylic	C15:0	8.22668 $^{e-6}$	4.59646 $^{e-6}$
Palnimitic	C16:0	1.92845 $^{e-3}$	1.92734 $^{e-3}$
Margaric	C17:0	2.65239 $^{e-5}$	2.54674 $^{e-5}$
Stearic	C18:0	1.20874 $^{e-3}$	2.36820 $^{e-4}$
Arachidie	C20:0	7.44878 $^{e-7}$	5.70717 $^{e-7}$
Behenic	C22:0	5.76659 $^{e-6}$	2.23294 $^{e-6}$
lignoceric	C24:0	7.22028 $^{e-6}$	1.29261 $^{e-6}$

Table 2: chromatogram results of unsaturated fatty acid in boiled and smoked catfish

Common name	Carbon formula	Boiled (Amount/Area)	Smoked (Amount/Area)
Myristoleic	C14:1 (cis-9)	4.34204^{e-6}	2.4238 $^{e-6}$
Palmitoleic	C16:1 (cis-9)	7.82730^{e-4}	5.97354 $^{e-4}$
Vaccenic	C18:1 (cis-6)	9.66579^{e-4}	8.09725 $^{e-4}$
Stearicitoleic	C18:1 (trans-6)	5.39279^{e-7}	3.81037 $^{e-7}$
Elaidic	C18:1 (trans-9)	1.49829^{e-7}	4.80480 $^{e-8}$
Oleic	C18:1 (cis-9)	3:23394^{e-3}	3.28443 $^{e-3}$
Valeric	C18:1 (trans-11)	8.21651^{e-6}	5.54596 $^{e-6}$
Propionic	C18:2 (trans-9,13)	2.79405^{e-4}	3.14087 $^{e-4}$
Linoleic (&!-3)	C18:2 (cis-9,12)	9.035176^{e-7}	6.41263 $^{e-7}$
Gamma-limolenic	C18:3 (cis-6,9,12)	2.76277^{e-5}	2.64087 $^{e-5}$
Alpha-linolenic(&!-3)	C18:3 (cis-9,12,15)	9.56501^{e-5}	5.45144 $^{e-5}$
Eicosenoic	C20:1(cis-11)	2.26248^{e-4}	2.25002^{e-4}
Paullnic	C20:1 (cis-11,14,17	1.12356^{e-5}	1.82586 $^{e-6}$
Gondoic	C20:2(cis 11,14)	3.53100^{e-7}	1.90335 $^{e-7}$
Mead	C20:3(cis-8,11,14)	5.76659^{e-5}	4.87239 $^{e-5}$
Arachidonic	C20:4 (cis-5,8,11,14)	1.73060^{e-4}	1.59797 $^{e-4}$
Eicosapentaenoic	C20:5 (cis-3)	5.15254^{e-5}	7.27426 $^{e-5}$
Erucic	C22:1 (cis-13)	5.07896 $^{e-5}$	4.20583 $^{e-5}$
Adrenic	C22:2 (cis-13,16)	6.61270 $^{e-5}$	4.59760 $^{e-5}$
Dihomo Gamma-linolenic	C22:3(cis-3)	5.18960 $^{e-5}$	8.13085 $^{e-5}$
Docosahexaenoic	C22:6 (cis-4,7,10,13,16,19)	4.78013 $^{e-1}$	1.10945 $^{e-1}$
Nervonic	C24:1 (cis-15)	6.17562 $^{e-5}$	4.10152 $^{e-5}$

Although unsaturated fats can replace saturated fat in the diet and Trans unsaturated fat should be avoided. Replacing saturated fats with unsaturated fats helps to lower the levels of total cholesterol and low density lipoprotein (LDL) cholesterol in the blood. Foods containing unsaturated fats include avocado, nuts and vegetable oils and unsaturated fats are conventionally regarded as healthier than saturated fats. Omega-3 are found in fish and fish oils and their health benefits are being more fully explored.

Finally the result obtained in this study showed that there were significant influences of the two processed sample on the saturated and unsaturated fatty acid of catfish. Boiling could provide a relative nutritional stability of fish but report of microbial/pest invasion and health implications are serious drawbacks to its uses. The study provides possible application of smoking as an efficient drying process for fish, although its continued use in poor-resource communities in the developing countries is also limited. Thus, the knowledge obtained will improve the capacity of boiled and smoked catfish to its processing methods for fish.

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