EFFECTS OF PRESERVATION METHODS ON THE CONCENTRATION OF ASCORBIC ACID IN SELECTED FISHES.

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ABSTRACT

The concentration of Ascorbic acid in preserved fishes (Papyocranus Afer, Arius Latiscutatus and Lutjanus Agennes) was determined in order to ascertain the effects of preservation methods on the availability of ascorbic acid using spectrophotometric method (Spectrum Lab 22). Analysis of mean results, shows the effect of various preservation methods on the availability of ascorbic acid in different fish species and varied in the following order; U(0.36 $mg.g^{-1}$) > I (0.34 $mg.g^{-1}$) > E (0.33 $mg.g^{-1}$) > M (0.31 $mg.g^{-1}$) >Q (0.24 $mg.g^{-1}$). Comparatively, the retention capacity of preservation methods E, I, M and Q are very low compared to method U with high retention capacity. Therefore, heat oxidizes ascorbic acid in fish to other substances which bears no ascorbic acid activity.

Key words: Preservation, effect, ascorbic acid, fish

INTRODUCTION

Fish (Pisces) is any gill-bearing ectothemic aquatic vertebrate animal that lacks limbs with digits. Fishes are abundant in most bodies of water. They can be found in nearly all aquatic environment, from high mountain streams to the abyssal and even hadal depths of the deepest oceans fish as food is an important source of nutrients in human diet, (Helfman *et al.,* 2009).

Their nutritional composition include: protein with highly digestable fat, vitamins, macro/micro elements and essential amino acids (Suseno *et al.,* 2010; Stencheva *et al.,* 2010)

Ascorbic acid (AA) or vitamin C is a colourless water soluble sugar found naturally in terrestrial and aquatic animals, fruits and green vegetables (Padayatty *et al.,* 2003). Most organisms synthesis AA from glucose, while others obtain it from their diet (Clark, 2007) Ascorbic acid bear numerous physiological function such as antioxidant property (Padayatty *et al.,* 2003; Sharique and Seerat, 2009), detoxificatiron of narcotics addicts, neurotransmitters; synthesis, development and maintenance of carnitine, tyrosine, bones, cartilage, joint linings, skin, teeth, gums, blood vessles, immune system, and collagen (Prockop and Kivirikko, 1995; Peterkofsky, 1991); microsomal metabolism (Gropper *et al.,* 2008). Vitamin C also acts as an electron donor for eight different enzymes (Levine, 2000). During biosynthesis acrobatic acts as a reducing agent, donating electrons and preventing oxidation to keep iron and copper in their reduced states. Deficiency of AA result in disease condition known as avitaminosis (Padayatty, 2003)

Fish preservation is the art and science of employing physical or chemical processes with intent to prevent or delay the deterioration or spoilage of fish by insects, microbes, enzymes e.tc., so as to preserve their physical

structure with little or no change in nutritional value and food quality. Several methods have been employed in the preservation of fish, they include; salting, steaming, smoking, frying, freezing, canning e.tc.

The availability of nutrients (vitamins, trace elements, fats, and oils e.t.c) in fishes varies with species and the methods of processing/preservation (Roig *et. al.,* 1995). Therefore, this effort is aimed at determining the effects of preservation methods on the Concentration of ascorbic acid in selected fish species.

MATERIALS AND METHODS

Six fish samples of each species were used for the analysis as shown in table I below.

Table I: Three fish species showing eighteen samples with control and five preservation methods.

Fish sample / Preservation method	Reticulate knife fish *(Papyrocranus Afer)*	Rough-head sea cat fish *(Arius Latiscutatus)*	African red Snapper *(Lutjanus Agennes)*
Control **A**	B	C	D
Fried with groundnut oil **E**	F	G	H
Fried with palm oil **I**	J	K	L
Smoked **M**	N	O	P
Steamed **Q**	R	S	T
Salted **U**	V	W	X

Reticulate knif fish (*Papyrocranus Afer*) is a tropical fish found in Africa. It lives in fresh water of 6.5 to 7.5 pH and temperature range of 24 and 30^0C (Greenwood, 1988). The length and weight of the six samples (B, F, J, N, R and V) ranged from 40 to 43cm and 1.5 to 2.1kg respectively.

Rough – head sea cat fish (*Arius Latiscutatus*) is a ray-finned fish that is widely distributed in brackish and freshwater ecosystem of Eastern Africa and South to Southeast Asia (Hulley, 1998). The length and weight of the six samples (C, G, K, O, S and W) varies between 50 and 54cm and 2 and 3.5kg respectively.

African red snapper (*Lutjanus Agennes*) is an African reef associated, brackish and marine fish (Allen, 1985). The weight and length of the six samples (D, H, L, P, T and X) ranged between 3 and 3.5kg and 20 and 40cm respectively. These samples were presented as shown in table I above.

1g of each sample was digested in acidic mixture prepared from 1:1 of nitric (HNO_3) and sulphuric (H_2SO_4) acid. The samples were heated until dissolution. After cooling the mixtures were made to 100mL with distilled water.

Analysis of Ascorbic Acid

10mL of each sample was measured into a test tube, 4mL of oxalic – ethylenediamine-tetra-acetate and 1mLortho-phosphoric were added respectively. 1mL, 5% H_2SO_4, 2mL ammonium molybdate and 3mL of distilled water was added to the mixture. After 20minutes, the absorbance was measured at 760nm with spectrophotometer (Spectrum Lab 22) A blank solution was made from distilled water.

RESULTS AND DISCUSSION

Results of ascorbic acid are presented in table II, below:

Table II: Results showing ascorbic acid concentration in $mg.g^{-1}$

Fish sample / Preservation method	Reticulate knife fish *(Papyrocranus Afer)*	Rough-head sea cat fish *(Arius Latiscutatus)*	African red Snapper *(Lutjanus Agennes)*	$\bar{X}$	% LOSS
A	0.53	0.40	0.22	0.38	
E	0.47	0.32	0.19	0.33	13.16
I	0.49	0.33	0.20	0.34	10.53
M	0.45	0.30	0.18	0.31	18.42
Q	0.31	0.25	0.17	0.24	36.84
U	0.51	0.35	0.21	0.36	5.27

The concentration of ascorbic acid in table II above shows that sample B contains high concentration of ascorbic acid (0.53 $mg.g^{-1}$), with sample C and D having 0.40 $mg.g^{-1}$ and 0.22 $mg.g^{-1}$ respectively. Mean results in table II alsos show the variable effect of preservation methods on the concentration of ascorbic acid. The trends in retention of ascorbic acid after preservation reveal that method U (0.31 $mg.g^{-1}$) > I (0.34 $mg.g^{-1}$) > E (0.33 $mg.g^{-1}$) > M (0.31 $mg.g^{-1}$) Q (0.24 $mg.g^{-1}$). Conversely, the order of percentage of ascorbic acid lost also show that method Q [6.84%] > M [18.42%] > E [13.16%] I[10.53%] > U [5.27%].

The high concentration of 0.14 $mg.g^{-1}$

of ascorbic acid lost to preservation method Q could be related to the solubility of ascorbic acid in water. On the other hand, the low concentration of 0.04 $mg.g^{-1}$ and 0.05 $mg.g^{-1}$ lost to preservation methods I and E respectively could be attributed to the presence of ascorbic acid in palm oil.

The significant reduction of ascorbic acid in all the preservation methods except U shows a response to the effect of temperature on ascorbic acid during cooking/preservation. This reduction could be possible due to enzymatic (ascorbic acid oxidase) oxidation of ascorbic acid to dehydroascobic acid and then diketogulomic acid-which have no ascorbic acid activity at these preservation temperature (>70^0C) (Roig *et al.,* 1995; Allen and Burgess, 1950).

CONCLUSION

Analysis of the mean concentration of ascorbic acid and percentage loss of ascorbic acid in this research shows the effect of heat on the nutritive value of ascorbic acid. While the mean concentration of ascorbic acid in fried, smoked and steamed samples are varied and relatively small the concentration of ascorbic acid in salted samples are very high. Therefore, heat oxidizes ascorbic acid in fishes to other substances which bears no ascorbic acid activity.

The use of heat in the preservation of food (fruits, vegetables, meat, fish e.tc.) items containing ascorbic acid should be limited in temperature (<50^0C) and time to avoid its oxidation. Further research on the effect of heat on iron and iodine in fish should be studied.

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