International Scholars Journals

Advanced Journal of Environmental Science and Technology ISSN 2756-3251, Vol. 15 (6), pp. 001-004, June, 2024. Available online at www.internationalscholarsjournals.org © International Scholars Journals

Full Length Research Paper

Comparative Analysis of Amino Acid Profiles in Commercial Nile Fishes from Sudan

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Accepted 08 January, 2024

This study was intended to identify contents of amino acids (AAs) of four commercial Nile fishes in Sudan and to use them in fishmeal manufacture. The study fishes were Dabis (*Labeo niloticus*, Forskål, 1775), Himeila (*Brycinus nurse*, Rüppell, 1832), Garmout (*Clarias gariepinus*, Burchell, 1822) and Gargur (*Synodontis schall,* Bloch and Schneider, 1801). After producing dried meat of the study fishes, AAs were determined by SYKAM (57130 AMINOACID ANALYZER) device. Eighteen amino acids were identified and computed their percentages for each fish. AAs contents in Dabis were 0.02 to 19.36%, followed by those in Garmout (0.34 to 12.63%); those in Gargur (1.03 to 10.05%) and those in Himeila (0.01 to 9.99%). Eight essential amino acids (EAA) were identified among the total content of amino acids of all the study fishes. Dabis contained the highest percentage 71.7%, followed by Gargur 38.19%; Garmout 32.96%; whereas, Himeila revealed having the least content of EAA 28.21%. Methionine had nearly the same percentages among the study fishes as 0.34% in Garmout; 0.74% in Himeila; 1.03% in Gargur and 1.54% in Dabis; whereas, tryptophan was absent in all the study fish samples. Results of EAA showed that Dabis is the best Nile fishes for stock of EAA for fishmeal manufacture; whereas, the rest of study fishes are suitable to use for human food.

Key words: Freshwater fishes, Nile fishes, amino acid, essential amino acids, white Nile.

INTRODUCTION

The freshwater fish species provide food and nutrition, subsistence and supplemental income to the wide range of people of Sudan, especially those living along River Nile (Mohammed and Alim, 2008). Fish is considered one of the most import sources of protein for both human and animal, because they contain essential amino acids such as Arginine, Histidine, Isoleucine, Leucine, Lysine, Methionine, Phenylalanine, Threonine, tryptophan, and Valine that are not synthesized by animal (Bruke et al., 1997; Buttery and D'Mello, 1994; Dahhar and Elshazly, 1993). Moreover, little is known about the nutritional value of the Nile fishes that are normally utilized either fresh or preserved dried, salted or smoked. Better knowledge of their nutritional value, which is expected to be closely associated with fish species, could contribute to the understanding of variability in meat quality of different species of the Nile fish (Elagba et al., 2010).

In general, nutritional component of the freshwater fish was found to differ between species, sexes, sizes, seasons, and geographical localities (Zenebe et al., 1998b). Therefore, fishmeal is recognized by nutritionists as a high-quality, very digestible feed ingredient that is favored for addition to the diet of most farm animals. Fishmeal also carries large quantities of energy per unit weight and is an excellent source of protein, lipids (oils), minerals, vitamins and a little carbohydrate (Miles and Jacob, 2003). Moreover, it contains all the essential amino acids, especially lysine and methionine, in adequate quantities required for poultry, swine and other animal industries (Shepherd, 1998).

The EAA requirements for several species of fish have been quantified over the past 40 years (Wilson, 2002). Lysine is the first limiting EAA in many protein sources used in fish feeds (corn gluten meal, feather meal, etc.)

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and Lysine-rich ingredients (fish meal, blood meal) are often expensive, but important for fish farm diet (Bureau and Encarnacao, 2006). Results of some selected Nile fishes showed that the Nile fishes are of high nutritional value and good source of proteins, minerals as well as essential amino acids; where, Nile Perch (*Lates niloticus,* L.) has high EAA 46%; while, Gargur (*S. shall*) has 38% (Elagba et al., 2010). Moreover, marine fishes such as Mola *(Amblypharyngodon mola),* Chela *(Osteobrama cotio cotio),* Chapila *(Gudusia chapra),* Punti *(Puntius stigma),* Tengra *(Mystus tengra)* and Kankila *(Xenentodon cancila)*, their glutamic acid contents were estimated between 5.76 to 6.96%. On the other hand, Cysteine content was quite low ranging from 0.20 to 0.31% with the highest in Chela and the lowest in Mola (Nurullah et al., 2003).

Lysine, Tryptophan and Methionine are the excellent essential amino acids for poultry diets (Dahhar and Elshazly, 1993). However, determination process of tryptophan from dry matter somewhat do not show its rates among other amino acids, because the standard procedure of protein hydrolysis in strong acid results in the destruction of tryptophan (Hill, 1965; Sakurai and Nagahama, 1985).

A majority of consumers do eat fish, because of its availability, flavor and palatability; while, few do so, because of its nutritional value. Therefore, it can be suggested that taste, size, freshness and other related external appearances should not be the only factors to be considered in making choice for marketing and consumption of the Nile fishes (Elagba et al., 2010).

Therefore, the aim of this study was done to identify contents of AAs of four commercial Nile fishes and to use them in manufacturing fishmeal.

MATERIALS AND METHODS

Samples collection

Four commercial Nile fish species of this study including Dabis (*L. niloticus*), Himeila (*B. nurse*)*,* Garmout (*C. gariepinus*) and Gargur (*S. schall*); were identified according to Bailey (1994) and purchased from the fish market in the Central Market in Khartoum State. Their standard length rage ranged between 14 to 18 cm.

Amino acid composition

Fishes of this study were processed immediately after purchase for preparing them ready for amino acids analysis at the Environment and Natural Research Institute, the National Centre for Research, Khartoum. Fishes were removed from their viscera firstly by dissecting their abdomens and then boiled in water for discarding fats (oils). Then, the cooked-fish were pressed by cylinder drum and pistol to reduce the water quantity. All pressed meats were exposed to sunlight for three days until their weights were stable. This step was followed the description of Wilson (2002).

The compressed meat were then packed in plastic sacs tightly and transferred to the Central Laboratory in Soba, Khartoum south.

Amino acids contents were determined with SYKAM (57130 AMINOACID ANALYZER) device. The total amino acids were screened in form of ug/8 mg and then converted into mg/100 g by using a following formula:-

Conc. In µg/umg ×12.5 = conc. in mg/100 g.

RESULTS

Total amino acids

Eighteen amino acids were identified and computed their percentages for each fish (Table 1). Dabis contained the highest percentages of amino acids, which ranged between 0.02 and 19.36%, followed by those in Garmout, which ranged between 0.86 and 12.63%; those in Gargur, which ranged between 1.03 and 10.05% and those in Himeila, which ranged between 0.01 and 9.99%.

The highest AA in Dabis was glutamic (19.36%); in Garmout was glycine (12.63%); in Gargur was glutamic (10.05%) and that in Himeila was cysteine (9.99%); while, the lowest AA in Dabis was cysteine (0.02%); in Garmout was methionine (0.34%); in Gargur was methionine (1.03%) and in Himeila was lysine (0.01%).

Methionine had nearly the same percentages among the study fishes as 0.34% in Garmout; 0.74% in Himeila; 1.03% in Gargur and 1.54% in Dabis; whereas, tryptophan was absent in all the study fish samples.

Essential amino acids

Eight essential amino acids (EAA) were identified among the total content of amino acids of all the study fishes (Figure 1). Their ratios were different in body structures of these fishes. Dabis contained the highest percentage 71.7%, followed by Gargur 38.19%, Garmout 32.96%; whereas, Himeila revealed having the least content of EAA 28.21%. Leucine had the highest percentage 16.26% followed by lysine 14.35% and threonine 9.37% in Dabis alone; whereas, lysine had the lowest percent-tage 0.01% in Himeila. Moreover, all the study fishes had not any tryptophan ratio in their EAA content as shaded in Table 1.

Results of EAA showed that Dabis is the best Nile fishes for stock of EAA for both fishmeal manufacture; whereas, the rest of study fishes are suitable to use for human food.

DISCUSSION

The commercial fishes investigated in this present study were Dabis (*L. niloticus*), Himeila (*B. nurse*)*,* Garmout (*C. gariepinus*) and Gargur (*S. schall*). They are the popular market fishes in both rural and urban areas of the Sudan.

Table 1. Amino acids content of four commercial Nile fishes in Sudan.

Fishes amino acid	Gargur mg/100 g (%)		Dabis mg /100 g (%)		Garmut mg /100 g (%)		Himeila mg/100 g (%)	
Alanine	3859.88	8.23	3213.75	15.70	2920.63	8.68	2962.63	7.11
Ammonia	3182.38	6.79	2899.88	14.17	2942.00	8.75	2937.88	7.05
Argnine	3196.38	6.82	2583.13	12.62	2303.38	6.85	2488.75	5.97
Aspartic	3990.13	8.51	3360.25	16.41	2817.25	8.38	33.94.25	8.14
Cystine	508.88	1.09	451.13	0.02	288.13	0.86	4164.88	9.99
Glutamic	4711.13	10.05	3963.88	19.36	3229.75	9.60	3971.63	9.53
Glycine	3574.75	7.63	3159.13	15.43	4247.75	12.63	2937.25	7.05
Histidine	2002.50	4.27	1651.88	8.07	1380.50	4.11	1785.00	4.28
Isoleucine	2770.75	5.91	2070.13	10.11	1472.00	4.38	2041.13	4.90
Leucine	4139.75	8.83	3328.63	16.26	2426.75	7.22	3298.13	7.91
Lysine	3111.75	6.64	2737.13	14.35	2160.00	6.42	2659.00	0.01
Methionine	482.00	1.03	316.25	1.54	113.38	0.34	310.25	0.74
Phenylalanine	2476.88	5.28	1983.38	9.69	1433.63	4.26	1926.00	4.62
Serine	1668.88	3.56	1251.75	6.11	1163.63	3.46	1271.13	3.05
Threonine	2544.50	5.43	1918.25	9.37	1536.38	4.57	1946.13	4.67
Tryptophan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tyrosine	1799.38	3.84	1425.13	6.96	1203.13	3.58	1174.50	2.82
Valine	2851.88	6.08	2457.00	12.00	1990.88	5.92	2375.63	5.70
Total of AA	46871.8	100	20470.91	100	33629.17	100	41684.17	100

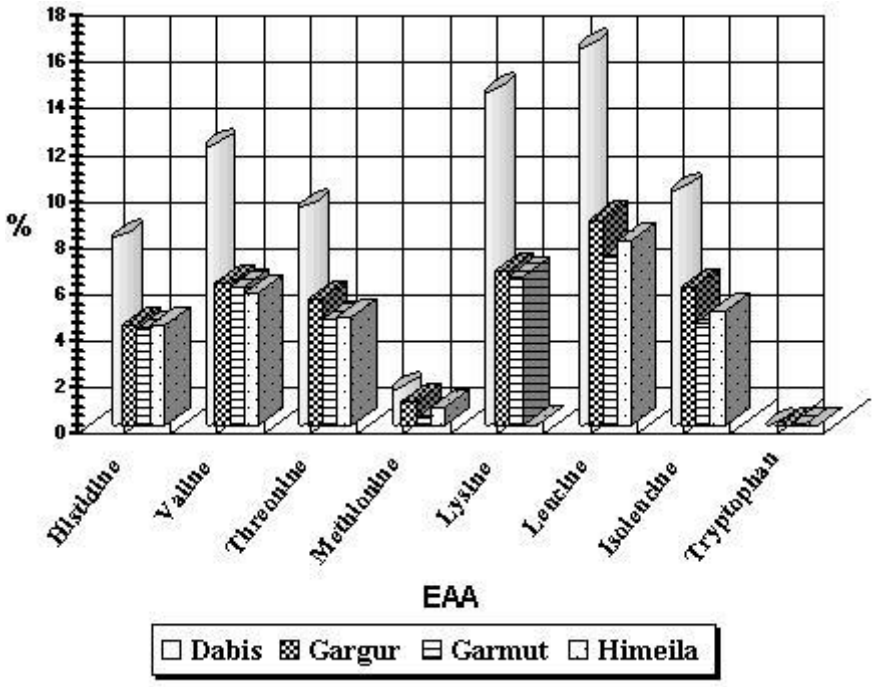

Figure 1. Essential amino acids contents of four commercial Nile fishes in Sudan.

They belong economically to the various local grades, depending upon consumers' preference in this country Sudan. Amino acids (AAs) were the major elements that had been used in assessing the nutritional value of the study fishes. AAs results varied between the study fishes though they were caught from the same source: The White Nile River. This variety in the AAs contents may indicate to the different environments from which, they

were caught and to body structure of fish families from which, they belong to. This is in-line with findings of Zenebe et al. (1998b).

Dabis contained higher percentages of AAs which,counted eighteen, than the other investigated fishes. Habit of feeding classifies Dabis as herbivore fish that may be the main reason provides them nutritive materials used to build these AAs in high percentages; whereas, the other investigated fishes are carnivores. This explanation is supported by results of Zenebe et al. (1998b).

Total number of AAs detected in dried meat of the study fishes was eighteen; whereas, EAA was at around eight. This result explains that the study fishes are good for human consumption, because EAA ranged between 28.21 and 71.7% comparing to the well-known standard ratio of protein in fish which, ranges between 16 and 20%. Although, Dabis was the best food for human though its small sizes are excellent for fishmeal production due to numerous numbers of fine spines constructed its body which, may be harmful for digestive canal of human when eaten at this sizes. In addition, both Garmout and Himeila showed having very high percentages of AAs besides EAA (Table 1).The ratio of the AAs content recorded from Garmout ranged from 3.46 to 12.63%; while, that ratio for Himeila was in range of 2.82 to 9.99%. Although, they are good for human consumption, but they are not suitable for use as nutritive principles for manufacturing fishmeal, because they may not induce either growth of cultured fishes or poultry due to their low ratios of AAs. This results, therefore, is useful in developing nutrient-balanced, cost-effective diets and practical feeds for cultured fish.

Tryptophan was absent in all contents of AAs of the investigated fishes. The absence of tryptophan may be due to influence of hydrolysis of dried meat that done with SYKAM device, which depends on Hcl in titration to analyze the content of AAs in dried meat. The use of Hcl in titration process leads tryptophan to be destroyed rapidly during the hydrolysis of protein in acid. Therefore, it should boil the dried meat in acid solution, because tryptophan is much more stable by this process. This is in agreement with results of Hill (1965).

Most people eat fish for their preferences in consumption mode; while, few of them tend to have fishes depending on their nutritional values. Therefore, knowing of AAs contents of commercial fishes should be one of the main elements used by consumer for choice type of fish to be eaten. This suggestion harmonizes with that of Elagba et al. (2010).

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