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PROXIMATE AND AMINO ACID COMPOSITIONS OF THE POND-CULTURED SPOTTED BARB, *PUNTIUS BINOTATUS*

Leong-Seng Lim[1*], Wei-Kang Chor[1], Rian Freddie bin Firdaus[1], Linus Malitam[2], Julian Ransangan[1] and Rossita Shapawi[1]

[1] Borneo Marine Research Institute, Universiti Malaysia Sabah, Jalan UMS, 88400 Kota Kinabalu, Sabah
[2]Innovasi Sedia Private Ltd. Lot 37, Block E, Ground Floor, New World Commercial Center, 89500 Penampang, Sabah
*Corresponding author: leongsen@ums.edu.my

ABSTRACT The pond culture of spotted barb (Puntius binotatus) has been started in Sabah. However, the nutritional values of these cultured P. binotatus as a protein source for human consumption have never been assessed. Therefore, the proximate and amino acid compositions of these cultured P. binotatus (n = 6, 3 females and 3 males) were evaluated to provide baseline information on its nutritional quality. The fish whole body contained about 18% and 9% of crude protein and lipid, respectively (in wet weight basis), 11% ash and 67% moisture. These proximate values were comparable to the wild-caught P. binotatus as reported in previous study. In addition, the cultured P. binotatus contained high levels of glutamic acid, aspartic acid, and glycine, (approximately 37.4, 24.5, and 23.0 mg/ g of sample, respectively). It also contained high level of lysine (23.5 mg/ g of sample) which is an essential amino acid in human diet. In conclusion, the nutritional quality of the cultured P. binotatus is good hence it is a suitable protein source for human consumption.

(Keywords: Proximate, Amino acids composition, spotted barb, Puntius binotatus)

INTRODUCTION

Freshwater or riverine fishes are usually an important protein source to the indigenous people of the area [1]. In Malaysia, public is encouraged by the government to consume freshwater fishes [2, 3]. Therefore, studies on the proximate and amino acid compositions of freshwater fishes are important to provide baseline information on their nutritional value as a protein source for human consumption.

The spotted barb (*Puntius binotatus*), also scientifically synonymous to *Barbodes binotatus*, *Capoeta binotata*, and *Systomus binotatus,* is an indigenous cyprinid in Asia [4, 5] that occurs in the mountain streams, rivers and lakes of many Asian countries, including Brunei Darussalam, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Thailand and Vietnam. However, it is an introduced species in Singapore and in other non-Asian country, such as Palau [6]. In the Mindanao of Philippines, *P. binotatus* is an economically important fish species [7, 8]. The planning of cultivating this fish has also initiated recently in Indonesia [9]. In Sabah, *P. binotatus* is locally known as "Turongou" (common name in Malay is *tebal sisik*) and popular to the indigenous people as a deep-fried delicacy. For the mass production and to promote the delicacy of *P. binotatus* at commercial level, the pond culture of this fish has been started by a local company, Innovasi Sedia Private Limited [10, 11, 12; culture condition see 10]. The length and weight relationships of these pond-cultured *P. binotatus* have been assessed by Lim *et al*. [10]. However, their nutritional quality for the purpose of human consumption has never been evaluated. Therefore, the present study was conducted to determine the proximate and amino acid compositions of the cultured *P. binotatus* to provide baseline information on their nutritional value.

MATERIALS AND METHODS

Fish specimens

A total of 6 fresh specimens of pond-cultured *P. binotatus* were obtained from Innovasi Sedia Private Limited. Among these specimens, 3 females and another 3 males were selected based on the examination of the reproductive organs through dissection [11]. Table 1 shows the body measurements of the specimens. These specimens were in the size range of 7.9 – 9.1 cm in total length (TL), and 6.8 – 9.9 g in body weight (BW). The condition factor ($100 \times BW/ TL^3$) was in the range of 1.23 to 1.40. Specimens with short range of condition factor were chosen to avoid the possibility of large variations in the fish proximate composition due to other possible factors. The whole body of each specimen was minced using kitchen knife, kept in the sealed plastic bag, and stored in a refrigerator at -4°C until the bio-chemical analyses were conducted.

Table 1. Body measurements of the specimens

No.	Specimens	Total length (TL, cm)	Body weight (BW, g)	Condition factor ($100 \times BW / TL^3$)
1.	Female (F) – 1	7.90	6.78	1.38
2.	F – 2	9.00	9.67	1.33
3.	F – 3	9.10	9.92	1.32
4.	Male (M) – 1	8.35	7.16	1.23
5.	M – 2	8.35	7.63	1.31
6.	M – 2	8.00	7.17	1.40

Proximate composition analysis

The crude protein, lipid, moisture and ash contents of the specimens were analyzed according to the standard methods described by Association of Analytical Chemists [13]. The crude protein and lipid levels were determined following the Kjeldahl method using an automatic system (Kjeltec 2300) and the ether-extraction method in a soxhlet extraction unit (Soxtec 2043), respectively. To determine the moisture, the samples were dried overnight in an oven at 105°C. For ash content, the samples were incinerated at 550°C in a muffle furnace for 6 hours and weighted the remaining residue.

High performance liquid chromatography (HPLC) for amino acids

The amino acids content of the specimens were determined through high performance liquid chromatography (HPLC). Prior to the analysis, the minced specimens were freeze-dried and hydrolyzed by 6 N hydrochloric acid (HCl) for 24 hours at 110°C. The acid-hydrolyzed specimens were then analyzed for its amino acids composition using an HPLC device (LC-10AVP, Shimadzu Brand, Japan) with a post-column derivation instrument (PCX5200, Picking Laboratories Brand, Mountain View, CA). From the chart recorder, the height of each peak that represented each individual amino acid was integrated, measured, and recorded. The data then was calculated and presented in the value of milligram per gram (mg/ g) of sample.

RESULTS AND DISCUSSION

The proximate and amino acids compositions of the cultured *P. binotatus* are shown in Table 2. In general, crude protein and lipid levels (in wet weight basis) of the cultured *P. binotatus* were approximately 18% and 9%, respectively. These results were similar with those reported by Tee *et al*. [2] on the wild-caught *P. binotatus* (protein and lipid approximately 18% and 10%, respectively), suggesting that the macro-nutrients of the cultured *P. binotatus* is as good as the wild-caught fish for human consumption. The lipid content of *P. binotatus* was generally higher (around 9 – 10%) than the other Malaysian freshwater food fishes [2]. In fact, cyprinids are known to contain high levels of essential fatty acids that have anti-atherosclerotic efficacy which is good for human health, especially for those with cardiovascular diseases [14]. Although the fatty acids content in many cyprinids has been evaluated, none has been conducted on the *P. binotatus*. Further study should be conducted to determine the fatty acids content of the wild-caught and the cultured *P. binotatus*.

Relatively higher level of ash content was found the cultured *P. binotatus* contained (about 11%) than the wild-caught *P. binotatus* (0.9%) as reported by Tee *et al*. [2]. The high ash content in the cultured *P. binotatus* could be due to the accumulation of minerals from the artificial diets [15].

The present study was the first report on the amino acids composition of *P. binotatus*. In general, the cultured *P. binotatus* contained high levels of glutamic acid, aspartic acid, glycine, and moderately high in alanine. These amino acids were reported to be related to the characteristic flavour of the fish [16]. According to Fuentes *et al.* [17], the cultured sea bass (*Dicentrarchus labrax*) contained more abundant of these amino acids than the wild seabass. Apparently, high contents of these amino acids in the cultured *P. binotatus* can be due to their consumption on the artificial diets. Interestingly, the cultured *P. binotatus* also contained high level of lysine, which is an essential amino acid in the human diet. This result further supported the cultured *P. binotatus* as a good protein source for human consumption,

Table 2. Proximate and amino acid compositions of the cultured (present study) and wild-caught (literature) P. binotatus

Parameters	**Mean ± SD**	
	Present study (Cultured fish)	Tee et al. (1989) (Wild-caught fish)
Proximate (g/ 100 g sample)		
Protein	17.9 ± 1.1	18.0
Lipid	8.6 ± 2.4	9.9
Moisture	67.0 ± 2.1	71.6
Ash	11.2 ± 1.7	0.9
Amino acids (mg/ g sample)		
Aspartic acid	24.5 ± 1.3	-
Threonine	10.9 ± 0.4	-
Serine	11.8 ± 0.5	-
Glutamic acid	37.4 ± 1.8	-
Glycine	23.0 ± 3.2	-
Alanine	18.3 ± 1.2	-
Cysteine	12.2 ± 0.5	-
Methionine	7.5 ± 0.4	-
Isoleucine	12.3 ± 0.8	-
Leucine	19.7 ± 0.8	-
Tyrosine	7.4 ± 0.7	-
Phenylalanine	11.1 ± 0.5	-
Lysine	23.5 ± 1.3	-
Ammonia	0.7 ± 0.1	-
Arginine	17.3 ± 1.2	-

and also in agreement with the recommendation by Tee *et al*. [2] on *P. binotatus* as human food in the campaign to encourage the consumption of freshwater fishes in Malaysia.

CONCLUSION

The pond-cultured *P. binotatus* contained about 18% crude protein, 9% crude lipid, 11% ash and 67% moisture. The crude protein and lipid levels were comparable to the wild-caught *P. binotatus* as reported in previous study. Besides that, the cultured *P. binotatus* contained high levels of glutamic acid, aspartic acid, and glycine, (approximately 37.4, 24.5, and 23.0 mg/ g of sample, respectively). It also riches in lysine (23.5 mg/ g of sample), which is an essential amino acid in human diet. In conclusion, the nutritional quality of the cultured *P. binotatus* is good. Therefore, it is recommended for human consumption.

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