MOISTURE, ASH AND FAT COMPOSITION OF *PANGASIANODON HYPOPHTHALMUS* (SAUVAGE, 1878) AND *PANGASIUS NASUTUS* (BLEEKER, 1863)

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ABSTRACT

Introduction: The purpose of the study is to analyse the moisture, ash and fat composition of *Pangasianodon hypophthalmus* (Sauvage, 1878) and *Pangasius nasutus* (Bleeker, 1863) by using proximate analysis. **Methods:** The specimens for *P.hypophthalmus* were collected from Institute of Oceanography and Maritime Studies (INOCEM) Hatchery, Kuantan, Pahang. A total of four fishes were taken with an average weight of 0.6kg and length of 38 cm. Specimens of *P.nasutus* which are wild fish were caught from Pahang river at Pekan, Pahang. A total of two fishes were caught with the total average weight of 1.1kg and length of 45cm. The independent-samples t-test and one-way ANOVA by SPSS version 12.0 software were used to analyze the results for objective one and two respectively. Each analysis was repeated three times. **Results:** There is no significant difference for moisture content between

both species, however, there is a significant different in ash and fat content between *P.hypophthalmus* and *P.nasutus*. **Conclusions:** This study indicates that species *P.hypopthalmus* and *P.nasutus* shares similar nutrient composition.

KEYWORDS: Proximate analysis, *P.hypophthalmus*, *P.nasutus*, Nutrient composition

INTRODUCTION

According to Fish and Agriculture Organization of the United Nations (2018), fish has always been one of the primary sources of protein predominantly in developing countries. Other than providing protein and essential fatty acids to human, it also supplies micronutrients to vulnerable populations; thus, occasionally providing a solution to health problems such as lowering down the cardiovascular disease's risks, arthritis, and certain types of cancer (Maurya et al., 2018). Local fatty fish such as *P. hypophthalmus* and *P. nasutus* provides high omega-3 and omega-6 that is proven to be beneficial for human consumption (Maurya et al., 2018). Studies on nutritional content of local freshwater fish provides insight into their benefits and importance as one of the sources for healthy diet.

P. hypophthalmus and *P. nasutus* are freshwater fish highly consumed in Malaysia, particularly in Pahang where it is popularly cooked in a special local delicacy called *Patin Tempoyak*. *P. hypophthalmus* is commonly bred as caged fish. On the other hand, since *P.nasutus* has higher sensitivity to the environment; it is mostly found living in the wild and not farmed. Despite originating from the same family, they have different physical attributes. Both species also live and grow in different environment, feed on different types of food, and grow to a slightly different adult length and weight (Helfman et al., 2009). Therefore, due to these differences, the question arise whether these factors may affect the nutritional composition of *P.nasutus* and *P.hypophthalmus*.

Interestingly, the market price for both species also differ in which the cost of *P. nasutus* is threefold and is more in favor of consumers suggesting its taste is better (Hashim et al., 2015). With regards to this difference, the aim of this study to analyse the nutritional composition of both species could further shed light into the matter related to nutrition content, taste and market price. The information garnered from this research can help consumers in making a better decision in fish selection. On the perspective of the fishmongers and local restaurant owners, information on nutrient content could provide added value, therefore, boosting the marketability of the fish. Therefore, the outcome of this research can benefit both the fishmongers and the consumers.

METHODS

Location of the study

The study was an experimental study where the food composition analysis was conducted at the Food Analysis Laboratory, Department of Nutrition Sciences, International Islamic University Malaysia, Kuantan Campus, Pahang.

Source of specimen

The specimen for *P. hypophthalmus* were collected from Institute of Oceanography and Maritime Studies (INOCEM) Hatchery, which is located at Kuantan, Pahang. A total of four fishes were taken with an average weight of 0.6kg and average length of 38 cm. Meanwhile, *P.nasutus* was caught wild from the Pahang River in Pekan, Pahang. A total of two fishes were caught with the total average weight of 1.1kg and length of 45cm.

Sampling Strategy

The samples were put in an icebox that contained ice with fish/ice ratio of 1:2 to maintain the freshness of the fish during transportation to the Food Analysis Laboratory. *P.hypophthalamus* and *P.nasutus* were measured and weighed before they were separated into three parts that is the head, flesh (middle) and tail. The flesh and the skin were kept intact and taken together for the analysis as these are the parts that are consumed by the locals.

Proximate Analysis

The general steps and principle of the methods were referred to the official methods of analysis by the Association of Official Analytical Chemists (AOAC) International (1995). Each analysis was done using triplicate samples. The oven drying method was used for moisture analysis. The samples for moisture analysis were then continued for ash analysis by using furnace method. Fat analysis was done by using Soxtec 2050 machine method.

Statistical Analysis

The independent-samples t-test and one-way ANOVA by SPSS version 12.0 software were used to analyze the results for objective one and two, respectively. Each analysis was repeated three times.

RESULTS

Determination and Comparison of Moisture Composition

Table 3.1 shows results of moisture analysis on *P.hypophthalmus* and *P.nasutus* samples. The findings indicate that *P. hypophthalmus* contained higher moisture content than *P. nasutus* with 73.58% and 63.68% respectively. Independent t-test showed that it failed to reject the null hypothesis. There is no significant difference ($p>0.05$) of the mean moisture value between *P. hypophthalmus* and *P. nasutus.*

Table 3.1. Moisture content between *P.hypophthalmus* and *P.nasutus* samples

Variable	*P. Hypophthalamus* (Mean)	*P. Nasutus* (Mean)	t-statistic (df)	p-value
Moisture %	73.58	63.68	0.214 (70)	0.645

According to the Food and Agriculture Organization of the United Nation (2018), moisture content of fatty fish is around 70%, and for specific specimens of certain species it may be identified with a water content ranging up to 90%.

Determination and Comparison of Ash Composition

Table 3.2 showed *P. hypophthalmus* contained higher ash content than *P. nasutus* with 1.59% and 1.51% respectively. Independent t-test showed that it failed to reject null hypothesis. There is no significant difference ($p>0.05$) of ash percentage (%) between *P. hypophthalmus* and *P.nasutus.* The ash content of the fatty fish flesh in this research is in the range of 0.5 to 2%. According to the Fish and Agriculture Organization of the United Nations (2018), the overall ash content is in the range of 1 to 2%.

Table 3.2. Ash content between *P.hypophthalmus* and *P.nasutus* samples

Variable	*P. Hypophthalamus* (Mean)	*P. Nasutus* (Mean)	t-statistic (df)	p-value
Ash %	1.59	1.51	0.928(70)	0.339

Determination and Comparison of Fat Composition

The fat content of the fatty fish flesh in this research is in the range of 0.5 to 6%. Table 3.3 shows the mean results of fat analysis on *P.hypophthalmus* and *P.nasutus* samples. *P.hypophthalmus* contained lower fat content compared to *P.nasutus* with 3.09% and 5.49% respectively. Independent t-test showed that there is no significant difference ($p>0.05$) of fat percentage (%) between *P.hypophthalmus* and *P.nasutus.* Studies on the nutritional composition of farmed *Pangasius* species by Karl et al. (2010) showed the amount of fat content varying from 1.4% to 3.2%. This is consistent with results from the current study.

Table 3.3. Fat content between *P.hypophthalmus* and *P.nasutus* samples

Variable	*P. Hypophthalamus* (Mean)	*P. Nasutus* (Mean)	t-statistic (df)	p-value
Fat %	3.09	5.49	1.879(70)	0.175

Determination and Comparison of Ash Composition Between Body Parts of *P.hypophthalmus* and *P.nasutus.*

Analysis of ash content in three main parts of the fish were conducted. In particular, 24 samples of *P.hypophthalmus* and *P.nasutus* were collected from the head, flesh, and tail. Table 3.4 shows results of ash analysis between the different body parts of *P.hypophthalmus* and *P.nasutus* samples.

Table 3.4. Mean ash content between body parts of *P.hypophthalmus* and *P.nasutus*

Body Parts	*n*	Mean (%)	SD	F-statistic (df)	p-value
Head	24	1.56	1.30	3.269	0.044
Flesh	24	1.06	0.46	(2,69)	
Tail	24	2.04	1.84		

It can be observed that the tail part contains the highest mean ash content. One-way ANOVA test indicates that there was at least one statistically significant difference between the three groups of body parts, as determined by the value of $F(2,69) = 3.268$, $p = 0.044$. These finding highlights that there is at least one significant difference of ash percentage (%) between head, flesh, and tail of *Pangasianodon*

hypophthalmus and *Pangasius nasutus*. A Tukey post hoc test revealed that there is a significant difference between the ash percentage of flesh and tail (p=0.034). Mineral and vitamin levels in individual fish of the same genus can differ considerably in different parts of the fish (Murray & Burt, 2001).

Determination and comparison of moisture composition Between different Body Parts of *P.hypophthalmus* and *P.nasutus*.

Table 3.5 shows results of moisture analysis between body parts of *P.hypophthalmus* and *P.nasutus* samples. The mean moisture content of the fatty fish in this research is highest in the flesh. Among the reason is because water in the fresh fish muscle is tightly bound to the system's proteins in such a way that it cannot be drained easily unless under intense pressure. One-way ANOVA test showed that there was no statistically significant difference between the body parts as determined by the value of $F(2,69) = 2.650$, $p = 0.078$. It can be concluded that there is no significant difference of moisture percentage (%) between head, flesh, and tail of *P.hypophthalmus* and *P.nasutus*.

Table 3.5. Moisture content between body parts of *P.hypophthalmus* and *P.nasutus*

Body Parts	*n*	Mean (%)	SD	F-statistic (df)	p-value
Head	24	65.86	11.21	2.650	0.175
Flesh	24	71.12	6.26	(2,69)	
Tail	24	68.63	5.00		

Determination and Comparison of Fat Composition between body parts of both *P.hypophthalmus* and *P.nasutus*.

In a fish 's body the fat is not necessarily distributed uniformly. This is one of several reasons one of which is the reliance of the fish's water quality and protein intake. Fat analysis between body parts of *P.hypophthalmus* and *P.nasutus* samples (Table 3.6) shows that the mean fat content of the fatty fish in the research is the highest in the head part (5.90%). One-way ANOVA test shows that there is at least one statistically significant difference between groups as determined by the value of $F(2,69) = 3.922$, $p = 0.024$. It can be concluded that there is at least one significant difference of fat percentage (%) between head, flesh, and tail of *P.hypophthalmus* and *P.nasutus*. A Tukey post hoc test revealed that there is a significant difference between the ash percentage of flesh and tail (p=0.034).

Table 3.6. Fat content between body parts of *P.hypophthalmus* and *P.nasutus*

Body Parts	*n*	Mean (%)	SD	F-statistic (df)	p-value
Head	24	5.90	5.66	3.922	0.024
Flesh	24	4.66	4.72	(2,69)	
Tail	24	2.31	2.54		

DISCUSSION

Adequate nutrition is a cornerstone of good wellbeing and every human being deserves good quality nutrient food. Hence, it is necessary to recognize the dietary status of a particular community before designing and initiating successful action strategies to enhance nutrition at the population level. The estimation of nutrients of food intake require reliable data on the composition of foods. Such details are also the fundamental principles of the Food-Based Dietary Recommendations, which provide the essential knowledge on food sources for various nutrients. Amongst food that is consumed daily worldwide is fish. Numerous species of fish are consumed as food in nearly all regions of the world. Fish has been an essential source of proteins and other foods for humans throughout history. According to Food and Agriculture Organisation of the United Nation (2018), 75% of the fish caught in the world is consumed. In Malaysia, the demand for fish is increasing. The consumption of fish per capita is increases up to 59 kg in 2016, which is one of the highest in the world. Fish that is not used for food is then changed into oil and fishmeal used mainly for animal feed (including farmed fish).

In the current study, the moisture content in *P.hypophthalmus* is higher than *P.nasutus* with 73.58% and 63.68% respectively. However, there is no significant difference of moisture content between these two fish. According to Food and Agriculture Organization of the United Nation (2018), the average water content of the fatty fish flesh is around 70%, and for specific specimens of certain species it may be identified with a water content ranges up to 90%. In addition to that, the moisture content for fish ranges from 66 - 71% (Maurya et al, 2018). This result also coincides with the findings of Begum et al. (2012) on the Proximate Composition of *P. hypophthalmus* that generated the result of moisture content of 78%. Karl et al. (2010) in the experiment on pangasius species yields the result ranging from 75 - 83%.

In this study, the moisture content between body parts is the highest in the flesh, followed by tail, and subsequently head with 71.12%, 68.63%, and 65.86% respectively. It can be concluded that there is no significant difference of moisture percentage (%) between head, flesh, and tail of *P. hypophthalmus* and *P. nasutus*. Fish body parts that hold the most amount of moisture content is the flesh part. This is because the water in the fresh fish muscle is closely attached to the proteins in the system in such a way that it cannot be quickly removed except under heavy strain (Murray & Burt, 2001). Moreover, the water content of the muscle is considerably higher at the tail than at the head; this small yet constant rise from head to tail is offset by a minor drop in protein content.

Ash content is indeed essential to the nutrition and longevity of a food. Ash refers to the inorganic residue remaining after either ignition or complete oxidation of organic matter in a food sample (Merriam-Webster's Collegiate Dictionary, 1993). Ash content helps to decide the level and form of minerals in food. It is important as the level of minerals will establish the physiochemical properties of food as well as slow down the development of microorganisms. Mineral content is also a critical component of food safety, consistency and, like soil, microbial viability. In this study, *P.hypophthalmus* contained higher ash content than *P.nasutus* with 1.59% and 1.51% respectively. However, there is no significant difference of ash content between *P.hypophthalmus* and *P.nasutus*.

The mineral and vitamin level of individual fish of the same species, and in separate sections of the same fish, can often vary considerably (Murray & Burt, 2001). Parallel to this study, the result from this study showed that the ash content in *P. hypophthalmus* and *P. nasutus* between body parts did significantly vary. A study conducted by Kefas et al. (2014) on freshwater fish shows that the ash content for the fish is highest in the tail, followed by the head, and then the flesh with the ash content ranging from 1.53 - 2.00%.

The fat content of fish can differ considerably more than the water, protein or mineral content across all species. Fatty fish is considered as beneficial for human health as it contains high omega-3 fatty acids. The benefits that come with omega-3 fatty acids are lowering blood pressure, heart rate, as well as reducing risk of having cardiovascular diseases. In this study, *P.hypophthalmus* contained lower fat content than *P.nasutus* with 3.09% and 5.49% respectively. Nevertheless, there is no significant difference of fat percentage (%) between *P.hypophthalmus* and *P.nasutus*.

The fat is not always spread evenly in a fish 's body. This is due to many factors one of it includes the dependency of the water and protein content of the fish. In this study, the highest fat percentage is in the head, followed by flesh, and

tail with 5.90%, 4.66%, 2.31% respectively. Results show at least one significant difference of fat percentage (%) between head, flesh, and tail of *P. hypophthalmus* and *P. nasutus*. A similar study conducted by Kefas et al. (2014) showed that the fat percentage of a freshwater fish is the highest in the flesh, followed by the head, and subsequently the tail.

In summary, the moisture content of both *P.hypophthalmus* and *P.nasutus* varied slightly however, it is insignificant. This shows that despite coming from different species they have a similar moisture percentage. This can help the consumer in retaining the quality of food that uses both *P.hypophthalmus* and *P.nasutus* in preserving the fish in a uniform way thus reducing the cost required for preservation. Similarly, the different parts of the fish carry no significant difference of moisture content between the body parts of the fish. Furthermore, the ash content for both fishes features a similar total content where the differences is insignificant. This is an indicator that the mineral content between *P.hypophthalmus* and *P.nasutus* is similar. This is also an indication for consumers that despite the differences in the price range between these two fishes, it contains a similar amount of mineral content that is beneficial for the human health. Nevertheless, further analysis is required to identify specific minerals contained in each of the species. The ash content between the body parts of the fishes showed at least one significant difference. Lastly, fat content of both *P.hypophthalmus* and *P.nasutus* has some differences however it is not significant. Fat contributes to the palatability of the food, hence the amount of fat in both species show that it gives a similar palatability level to its consumers. This goes the same for the fat content between body parts of the fish, it also shows at least one significant difference and the amount of fat content in the head is the highest for both species.

CONCLUSION

As a farmed fish, *P.hypophthalmus* is widely bred, while *P.nasutus* has a greater environmental sensitivity; hence, it is often caught in the wild and not farmed. It has distinct features, despite being from the same family. Both fish often live and develop in diverse habitats, feed on diverse diets, and develop to a slightly different adult length and weight. Nevertheless, the results show that in this research *P.hypopthalmus* and *P.nasutus* species have a common nutritional composition of moisture, ash and fat. The research was able to fill in the information gap concerning the nutrient composition in the area of *P.hypophthalmus* and *P.nasutus*. Thus, this research can benefit both the fishmongers and the consumers of the fish. Hence, boosting the marketability of the fish.

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