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Proximate Body Composition of Fish Species of the River Panjkora, Dir Upper Khyber Pakhtunkhwa, Pakistan

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Article Details

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ABSTRACT

Proximate composition refers to the percentages of moisture, protein, lipids, ash, and fibre in the body of a fish. To find the proximate body composition of fish species of the River Panjkora, this study was conducted. Eight freshwater fish species of Schizothorax, all uniform size, were collected from different regions of the River Panjkora and transported to the veterinary research institute's lab in Peshawar for proximate analysis. The water content was calculated by weighing the fish before and after it was burned in a furnace. Ash contents were calculated by burning the sample in the furnace at 500 °C for up to 7 hours. The Kjeldahl technique was used for estimating the protein and lipid contents. The maximum and minimum water content were observed in Racoma labiata and Crossocheilus diplocheilus, with values of 76.19% and 70.26%, respectively. The values of dry matter for the same species were 98.16% and 93.54%, respectively. Schizothorax labiatus and Crossocheilus diplocheilus exhibited ash contents of 10.99% and 7.61%, respectively. Similarly, the maximum protein values were observed in Glyptothorax stocki, with values of 76.34%. Fats were found in Schizothorax labiatus and Glyptothorax naziri, with a value of 12. 92% and 6.49% respectively. 1.69% fibres and 5.5% nitrogen-free extract were observed in Glyptosternon reticulum, and 6.76% fibres and 0.97% nitrogen-free extract were observed in Crossocheilus diplocheilus. In comparison, Racoma labiata showed 5.4% fibres, 0.39% nitrogen-free extract, and Glyptothorax stocki showed 5.42% fibres, 0.41% nitrogen-free extract. Our results confirmed that Racoma labiata and three species of Schizothorax (S. Glyptothorax, S. stocki, and S. naziri) are useful to humans due to their higher protein, lipid, and nitrogen-free extract content. Therefore, it can be suggested for human use in all respects.

INTRODUCTION

As the world population continues to grow, the demand for food is increasing daily. Fish are an excellent source of animal protein, containing essential amino acids, and are generally more available and affordable than other animal protein sources (Jia *et al.*, 2022). In developing countries, fish is considered one of the best sources of protein. They are consumed by one billion people worldwide. Fish is a staple food item due to its great importance both nutritionally and medically (Maulu *et al.*, 2021). It is also a meat of choice due to its good taste, high nutritional value, and ease of digestion (Kausar *et al.*, 2021). The meat of the fish is of high quality; it is typically low in saturated fats and cholesterol, but high in polyunsaturated fatty acids, such as eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) (Watanabe *et al.*, 2021). These unsaturated fatty acids have preventive and curative effects in various diseases, including cancers, inflammatory diseases, and arterial hypertension (Tini *et al.*, 2019). Furthermore, fish meat provides all essential amino acids, including aspartic acid, glycine, glutamic acid, methionine and lysine. Still, it is low in tryptophan compared to mammalian protein (Li *et al.*, 2021), which makes fish meat effective in combating cancer and heart ailments, as well as promoting wound healing and prolonging life expectancy (Qian *et al.*, 2020). A fish diet supplies vitamins such as A, D, and E, as well as essential minerals like sodium, iron, calcium, phosphorus, magnesium, and iodine, among other important elements (El-Sayed *et al.*, 2020).

As fish contains almost all the important and necessary components that a person needs, their nutritional worth can be determined by looking at their body composition. Proximate body composition refers to the estimation of water content, crude fat, crude protein, ash content, crude fibre, carbohydrates, and macro- and micronutrients in the body of a fish (Ahmed *et al.*, 2022). Due to the presence of negligible amounts of carbohydrates, no compound is generally ignored (Giacaman *et al.*, 2018). The proximate composition varies between species and individuals, even within the same species. This depends on the size, age, season, sex and geographic location of the fish species. The distribution of food within a species can vary depending on environmental and dietary conditions, as well as depth and water quality (Ahmed *et al.*, 2022). Body composition is also affected by biotic and biotic variables such as water levels, rainfall, food availability and also regional differences, because in eutrophic waters there is a higher lipid content than oligotrophic waters (Fernando *et al.*, 2021) Similarly it is also affected by increase in depth take place the protein increases while fats decrease. The chemical composition of the fish body may reflect the physiological state and health of the fish (Brosset *et al.*, 2023). Measuring body composition is a key factor in assessing physiological status, but it is a time-consuming process. Body moisture plays a crucial role in metabolism, as it indicates the energy content of lipids and proteins. The energy density of fish meat increases as the levels of crude fat and protein decrease, and the moisture content decreases (Wu *et al.*, 2020). Water, therefore, has a negative relationship with both, for example, less water means more lipids and more proteins and vice versa. However, these values are incorrect, as they vary significantly both between and within species (Lambers *et al.*, 2019). Additionally, their responses vary according to the fish's age, size, level of physical activity, feeding season, stage of pregnancy, fishing season, and reproductive status (Jeyasanta *et al.*, 2020). Protein is the most important ingredient in fish and lean meat, which varies in small amounts in healthy fish. Differences in lipid content correlate with differences in fish appetite, growth, reproduction, and survival (Dale *et al.*, 2019). For fish used as food by customers, knowledge of their fat, protein, and mineral content, as well as variations in size and condition parameters, is crucial. It also facilitates the selection of nutritional qualities with optimal sizes and more protein components (Jäger *et al.*, 2019). Due to its high-quality protein, a sizable portion of the global population consumes fish (Boyd *et al.*, 2022). Therefore, accurate information on these biochemical components of fish is essential for the formulation of animal supplements, such as food, fish feed, and products used in the fishing industry, as well as for human health, nutritionists, pharmacists, and chemists. It is crucial to determine the general body composition of fish before consuming it.

Today's consumers want to know and be confident about the nutritional value of the products they consume (Sáez-Royuela *et al.*, 2022). How human consumption and consumer acceptance are influenced by body composition and meat quality. To assess the nutritional value of fish, their body composition is measured using proxy analysis (Wuenschel *et al.*, 2019). Fish is typically eaten seasonally, with a preference for wild fish. There is a common misconception that wild fish have a higher protein content than farmed fish. On the other hand, the number of fish raised in farms is growing over time, while wild fishing is steadily declining.

The earlier myth requires confirmation; therefore, this research work was proposed to test and compare the composition of wild fish species in the Panjkora River, Dir, Upper Khyber Pakhtunkhwa, Pakistan. This research, with its practical implications for consumers, industry professionals, and researchers, aims to provide accurate and comprehensive information on the nutritional value and body composition of fish, empowering individuals to make informed choices about their diet and contributing to the advancement of the fishing and food industries.

MATERIALS AND METHODS

SAMPLING AREA

District Upper Dir is situated in the foothills of the Himalayas, at a latitude of 35.2042 ° N and a longitude of 71.8722 ° E, with a total area of 3,699 km². The Khyber Pakhtunkhwa province in Northwest Pakistan is home to the Panjkora River. It starts in Kohistan and flows through Dir, Timergara, and Chakdara before joining the Swat River. It is 220 kilometres long in total

SAMPLES COLLECTION

Fish samples were collected from the Panjkora River at three carefully selected sites in upper Pakistan, namely Sheringal, Chukiatan, and Darora. Eight selected fish species were harvested between June 2022 and December 2022, both independently and with the assistance of nearby fishermen. These fish included Glyptosternon reticulatum, Glyptothorax naziri, Glyptothorax stocki, Racoma labiata, Crossocheilus diplocheilus, and Schizothorax plagiostomus, labiatus, and esocinus. All fish samples were collected and then repeatedly cleaned with tap water to remove mucous, blood, and dust. After towel-drying, the fish was weighed using an electronic scale. After being sliced along the ventral side and having all its entrails removed, the fish were then identified using Jayram and Mirza's keys (Ahmad *et al.*, 2022). To analyse the fish samples' body composition, they were dried and frozen in a refrigerator.

EXPERIMENTAL PLACE AND PARAMETERS

The entire experiment was conducted at the laboratory of the Veterinary Research Institute (VRI) in Peshawar, Pakistan. Moisture content, ash content, crude protein, crude fat, crude fibre, and nitrogen-free extract were measured.

PROCEDURE FOR WATER CONTENT

Following the method of (Were *et al.*, 2021), regarding the water content, the fish species is weighed with a digital electronic scale. Then the whole fish is placed on a pre-weighed aluminium pan and dried in an electric oven at 65-80°C at constant weighing temperature until complete moisture loss, and then the sample is weighed again.

PROCEDURE FOR ASH CONTENT

Ash content is a measure of the amount of inorganic, non-combustible materials in samples. This is the residue after removing water and organics by heating the samples in an oven in the presence of oxidising agents. Ash content was determined using the process described by Lavoy *et al.* (2021).

EXTRACTION OF CRUDE PROTEINS, FATS (EITHER EXTRACT), FIBRE/ DIETARY FIBRE

Crude protein often overestimates the actual protein content of a feed, as most feeds contain nitrogen that is not protein. The Kjeldahl technique identified the proteins.

Crude fats are the amount of fats or oils in a feed. It is usually extracted using ether. The ether extracts not only contain the true fats but also fat-soluble vitamins, free fatty acids, cholesterols, etc. Crude fats were extracted using ether, following the Soxhlet method with slight modifications (Sofyan *et al.*, 2021).

Crude fibre refers to residues such as cellulose and lignin that remain after foods have been treated with acids and alkalis during digestion. The term is now considered nutritionally obsolete and is no longer used in nutritional guidelines, being replaced by fibre. The dietary fibre content in food was calculated using the method described by Li *et al.* (2022).

NITROGEN-FREE EXTRACT

Nitrogen-free extract is a computed value rather than an analysed value (Zdaniewicz *et al.*, 2020). Nitrogen-free extract was calculated as follows.

%NFE (DM Based) = %DM – (CP% + CF% + EE% + Ash %) OR %NFE (Fresh Basis) = 100 – (CP% + CF% + EE% + Ash %)

Where; DM= Dry matter, CP= Crude proteins, CF = Crude fats and EE= Ether extract

RESULTS

BODY WEIGHT

The mean body weight of all fish species was found. Schizothorax esocinus and Crossocheilus diplocheilus showed maximum and minimum weights, respectively (Table 1).

TABLE 1. SHOWS THE BODY WEIGHT OF ALL FISH SPECIES.

Species name	Local name	Family name	Mass in grams
Schizothorax plagiostomus	Kerray Machli	Cyprinidae	56.62
Schizothorax esocinus	Snow trout or Chunmachli	Cyprinidae	53.334
Schizothorax labiatus	Kunaray or Kerray Machli	Cyprinidae	605
Racoma labiate	Swati machli	Cyprinidae	42.53
Crossocheilus diplocheilus	Butten	Cyprinidae	263
Glytothorax naziri	Khantai	Sissoridae	26.64
Glyptothorax stocki	Khantai	Sissoridae	305
Glyptosternon reticulum	Khantai	Sissoridae	326

MOISTURE/WATER CONTENT, DRY MATTER OF SAMPLES AND ASH CONTENTS

The percentage of moisture contents in were determined *S. plagiostomus*, *S. abiatus* , *S. esocinus R. labiata*, *C. diplocheilus*, *G. reticulum*, *G.naziri* and *G. stocki* is and respectively. *C.diplocheilus* has the least percentage of moisture content, whereas *Racoma labiata* exhibits an excessive amount . Dry matter of ground samples for *S. plagiostomus*, *S. labiatus*, *S. esocinus*, *R. labiata*, *C. diplocheilus*, *G.reticulum*, *Glyptothorax naziri* and *G.stocki* were determined respectively. Maximum dry matter was found in *C. diplocheilus* while the least dry matter was found in *Racoma labiata* .

The ash content for *S. plagiostomus*, *S. labiatus*, *S. esocinus*, *R. labiata*, *C. diplocheilus*, *G. reticulum*, *G. naziri* and *G. stocki* was determined respectively. Maximum and minimum values were found for *S. labiatus*and *C. diplocheilus*with a value of respectively (Table 2).

TABLE 2. SHOWS THE PERCENT VALUE OF MOISTURE, ASH AND DRY MATTER IN FISH SPECIES

Fish species	Moisture content %	Ash content %	Dry matter %
Schizothorax plagiostomus	73.080	10.182	95.615

Schizothorax labiatus	74.800	10.991	95.03
Schizothorax esocinus	71.962	10.011	96.245
Racoma labiate	76.193	10.921	98.146
Crossocheilus diplocheilus	70.262	7.612	93.546
Glyptosternon reticulum	74.593	10.022	95.265
Glytothorax naziri	74.234	10.293	96.656
Glyptothorax stocki	72.355	10.224	94.898

PROTEIN CONTENT, FAT CONTENT, CRUDE FIBRES, NITROGEN FREE EXTRACT

The value of crude proteins in percent for *S. plagiostomus*, *S. labiatus*, *S. esocinus*, *R. labiata*, *C. diplocheilus*, *G. reticulum*, *G. naziri* and *G. stocki* were determined. Maximum crude protein was found in *G. stocki* and the least crude proteins was found in *S. labiatus.* Similarly, the value of Crude fats in percent for *S. plagiostomus*, *S. labiatus*, *S. esocinus*, *R. labiata*, *C. diplocheilus*, *G. reticulum*, *G. naziri* and *G. stocki* was determined. Maximum fats were recorded in *Schizothorax labiatus* and the least fats were found in *G. naziri.* The crude fibre for *S. plagiostomus*, *S. labiatus*, *S. esocinus*, *R. labiata*, *C. diplocheilus*, *G. reticulum*, *G. naziri* and *G. stockiwere* measured. Maximum and minimum values were observed in *G. reticulum* and *G. stocki* respectively.

Nitrogen free extract for *S. plagiostomus*, *S. labiatus*, *S. esocinus*, *R. labiata*, *C. diplocheilus*, *G. reticulum*, *G. naziri* and *G. stocki* were found Maximum and minimum in *C. diplocheilus* and *Racoma labiate* respectively (Table 3).

TABLE 3. SHOWS THE PROTEINS, FATS, CRUDE FIBRES AND NITROGEN FREE EXTRACT VALUES.

Fish species	**Proteins content %**	**Fats content%**	**Crude fibres %**	**NFE %**
Schizothorax plagiostomus	62.729	10.204	0.272	5.213
Schizothorax labiatus	64.343	12.924	1.223	5.564
Schizothorax esocinus	68.035	11.952	0.973	5.296
Racoma labiate	72.262	11.261	1.294	2.438

Crossocheilus diplocheilus	67.981	10.221	0.975	6.767
Glyptosternon reticulum	68.831	9.172	1.695	5.556
Glytothorax naziri	74.041	6.492	0.416	5.462
Glyptothorax stocki	76.341	7.220	0.39	5.40

DISCUSSION

Studies on the approximate body composition of edible fish species from the River Pandjkora were conducted to determine the fish's worth in terms of both its market value and quality (Rakib, *et al.*, 2021). (Všetičková, *et al.*, 2020) states that the fish species' proximal body composition varies depending on the species and is influenced by size, age, season, sex, and geographic region. Moreover, the environment, feeding habits, water depth, and water quality can all affect a person's body composition (Shamsan *et al.*, 2019). Because of this, we can state that its values will constantly vary between species and even between people. The current study's findings show that there are notable differences in the proximate body composition of different river panjkora fish species. There is a significant difference in the body weight of Schizothorax labiatus and Schizothorax esocinus, however there are no discernible differences in the mean body weight of Crosscheilus diplocheilus and Glyptothorax naziri. This is owing to the fact that the growth rate of Schizothorax was greater than the growth rate of genus Glyptothorax and Crossocheilus. Variations in moisture content between fish species are highly related to the quantity of fat in the body, which may also be related to the availability of food for the fish (Mohanty *et al.*, 2019). Crossocheilus diplocheilus and Racoma labiata have the largest and lowest dry matter, respectively. This is because the species Crosscheilus diplocheilus and Racoma labiat were widely distributed in May and June, when their metabolism was at its peak. In the same way, the dry matter changes as the moisture content does. Dry matter will decrease as the moisture content rises and vice versa (Neupane, *et al.*, 2019). Additionally, it was discovered that Schizothorax labiatus had the lowest crude protein level while Glyptothorax stocki had the highest. Since factors such as fish genetics, feeding frequency, and habitat, temperature, and water quality all affect the amount of protein needed (Pan *et al.*, 2021). As June, July, and August are the months when Glyptothorax species are most frequently collected. And at this time, only the aforementioned factors are justified. This explains why, in comparison to Schizothorax labiatus, Glyptothorax stockii exhibits the highest level of crude protein (Shabir *et al.*, 2018). Glyptothorax stocki have a higher protein content than Schizothorax labiatus because they are unable to grow as large as Schizothorax labiatus, preferring to stay small and consume mostly protenecaius food. The study indicated that Glyptothorax naziri had the lowest fat contents and Schizothorax labiatus the highest fat concentrations. This is because, in contrast to Glyptothorax naziri, which is only available during specific times of the year, Schizothorax labiatus virtually feeds year-round and is accessible during the entire twelve-month period (Sarma *et al.*, 2018). We may conclude that variations in the external elements like temperature and changes in metabolism are the cause of the changes in the composition of lipids because fish diet differs qualitatively at various times and is thus likely to result in variances in some body components such as fats etc.

CONCLUSION

In conclusion, the Schizothorax plagiostomus, Schizothorax labiatus, Schizothorax esocinus, Glyptothorax stocki naziri, and Racoma labiata are considered nutritionally beneficial fish species of the River Panjkora. The public will benefit from this information by being able to handle these production attributes sight with the essential safety measures. From a consumer viewpoint, it will also assist in differentiating nutritional values and making decisions based on this information.

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