

Proximate composition and Fatty acid analysis of Puffer fish, *Lagocephalus inermis* (Temminck and Schlegel, 1850) and *Lagocephalus lunaris* (Bloch and Schneider, 1801) from Parangipettai, Southeast coast of India

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ABSTRACT

The nutritional effects of marine food have increased far and wide due to the beneficial effects of consuming marine food, fats and oils. In general, the proximate composition is well known as a proportion composition of basic elements such as protein, lipids, carbohydrate, minerals and water. The puffer fish *Lagocephalus lunaris* and *Lagocephalus inermis* were collected at Mudasal odai fish landing centre and the skin and visceral organs like gonads and intestines were removed the edible portion only took for the analysis. Species of the fish sample was oven-dried in an electric oven at between 70 – 80 °C until the samples had constant weight. The protein, carbohydrate, fat, ash and moisture content of green -rough-back puffer fish and smooth-backed blow fish were investigated. *L. lunaris* and *L. inermis* were has 9.22 %, 8.92 %, 1.96 %, 1.87 %, 11.25 %, 11.98 %, 80.32 %, 86.05 %, 0.96 %, 1.27 % respectively. Totally seven saturated fatty acids; ten Mono unsaturated fatty acids and two poly unsaturated fatty acids were found as the major components on the investigated puffer fish. Polyunsaturated fatty acid like n-3 has 31.17 %, 31.19 and n-6 7.26 %, 7.29 % of PUSFA found as the dominant composition on puffer fish. This study revealed that these species are having high saturated fatty acid and protein content and able to compete with more commercially utilize species in terms of nutritional value, and they can definitely also compete when it comes to taste. It can act as a good source of nutritional and economic value when it is carefully handled and properly cooked.

Keywords: *Lagocephalus inermis*; *Lagocephalus lunaris*; protein; saturated fatty acid; minerals

1. INTRODUCTION

Now a day in world-wide the nutritional value of food is much more important. The nutritional effects of marine food have increased far and wide due to the beneficial effects of

consuming marine food, fats and oils. Azam, and Ali (2004). Marine food is also one of the major sources of high quality-protein, highly digestible protein Nettleton (1992). Generally the marine fish has an average valuable source of elevated value of protein in the human diet. Shahidi and Botta (1994).

In general the proximate composition is well known as a proportion composition of basic elements such as protein, lipids, carbohydrate, minerals and water. The energy yielding nutrients like protein, carbohydrate and fats are as macronutrients Ramakrishnan, and Venkat (1995). Normally fish are known as to be one of the cheapest sources of animal protein and other essential nutrients necessary in human food diets Sadiku and Oladimeji (1991). In recent years, fish lipids have also assumed vast nutritional significance owing to their protective role against the development of cardiovascular disease and rheumatoid arthritis Shahidi and Botta (1994).

Polyunsaturated fatty acids (PUFA), particularly the n-3 and n-6 PUFA have been considered an essential fatty acid. This EFA has been proved the healing effects and preventive effects on cardiovascular diseases, neurodevelopment in newborn babies, cancer and fat glycerin control on human Kinsella et al. (1990). The PUFA composition level may differ among the fish species, little awareness has been compensated to the PUFA composition level of different fish species when selecting fish for human diets. All fish are considered similar nutritional value, and selection of species is chiefly based on availability, freshness, flavor and similar factors Hearn et al. (1987).

In general, the *Lagocephalus lunaris* is known as green -rough-back puffer fish. It is a slow moving solitary fish of shallow coastal waters, found in tropical and temperate waters, caught mostly by trawl nets and purse seines. This puffer fish are also called as blow fish and globe fish as they can inflate their body with water or air when threatened making it difficult for a predator to swallow it. These fish contain 'tetrodotoxin' in the skin and visceral organs like gonads and intestine. Tetrodotoxin is named after the order of fish from which it is commonly associated, the Tetrodontiformes fish contain highly toxic, this fish are eaten by some Japan people. That people doing some special process. If cleaned properly, the puffer fish flesh is fit for human consumption and considered daintiness Torado *et al.* (1973). The smooth-backed blow fish (puffer), *L. inermis* (Temminck and Schlegel, 1850) the *L. inermis* (Bloch and Schneider, 1801) fish is regarded as an edible puffer fish species in Japan because muscle, skin and testis are non-toxic albeit the liver is highly toxic Noguchi, T., Arakawa (2008); Hwang and Noguchi (2007).

In Parangipettai coastal area this puffer fish are treated as trash fish, which are dumped with other uneconomical fish at Mudasal odai fish landing centre Parangipettai. Instead of wasting them, these fish can also be used as food fish to meet the nutritional requirements of increasing population by removing the skin and visceral organs which are suspected to contain the toxin. The present study revealed the proximate composition and fatty acid level of puffer fish.



Picture 1. *Lagocephalus lunaris*.



Picture 2. *Lagocephalus inermis*.

2. MATERIALS AND METHODS

The puffer fish were purchased in Mudasal odai landing center, Parangipettai (Lat.11°29'N; Long.79°46'E) in the month of March, 2014 and transported immediately to the laboratory for the analysis. The skin and visceral organs like gonads and intestines were removed the edible portion only took for the analysis. Those species of the fish sample was oven-dried in an electric oven at between 70 – 80 °C until the samples had constant weight and used following procedure for the analysis.

2. 1. Estimation of Protein

The Folin-Ciocalteu Phenol method of Lowry et al. (1951) was used for the estimation of total protein content in the puffer fish.

2. 2. Estimation of Carbohydrate

The total carbohydrate level was estimated by phenol- sulphuric acid method of Dubois et al. (1956).

2. 3. Estimation of Lipid

The total lipid content was estimated gravimetrically by following Folch et al. (1957).

2. 4. Fatty acid analysis

For fatty acid analysis, the samples were homogenized with chloroform: methanol (2:1 v/v) mixture and they were extracted using the method of Bligh et al. (1959). After the fat extraction, they were esterified with 1 % H_2SO_4 and fatty acid methyl esters were prepared by following the procedure of AOAC (1995). The identification and quantification of fatty acids were done using Gas Chromatography (Hewlett Packard 5890 model).

3. RESULT

3. 1. Proximate composition

In this present study the protein, carbohydrate, fat, ash and moisture content of green - rough-back puffer fish and smooth-backed blow fish were investigated. *L. lunaris* and *L. inermis* were has 9.22 %, 8.92 %, 1.96 %, 1.87 %, 11.25 %, 11.98 %, 80.32 %, 86.05 %, 0.96 %, 1.27 % respectively. The protein, carbohydrates, lipids, moisture and ash contents are the predominant elements in both puffer fish. The *L. lunaris* species having highest level of protein, carbohydrate and lipid content than *L. inermis*. Figure number one shows the proximate composition of puffer fish *L. lunaris* and *L. inermis*.

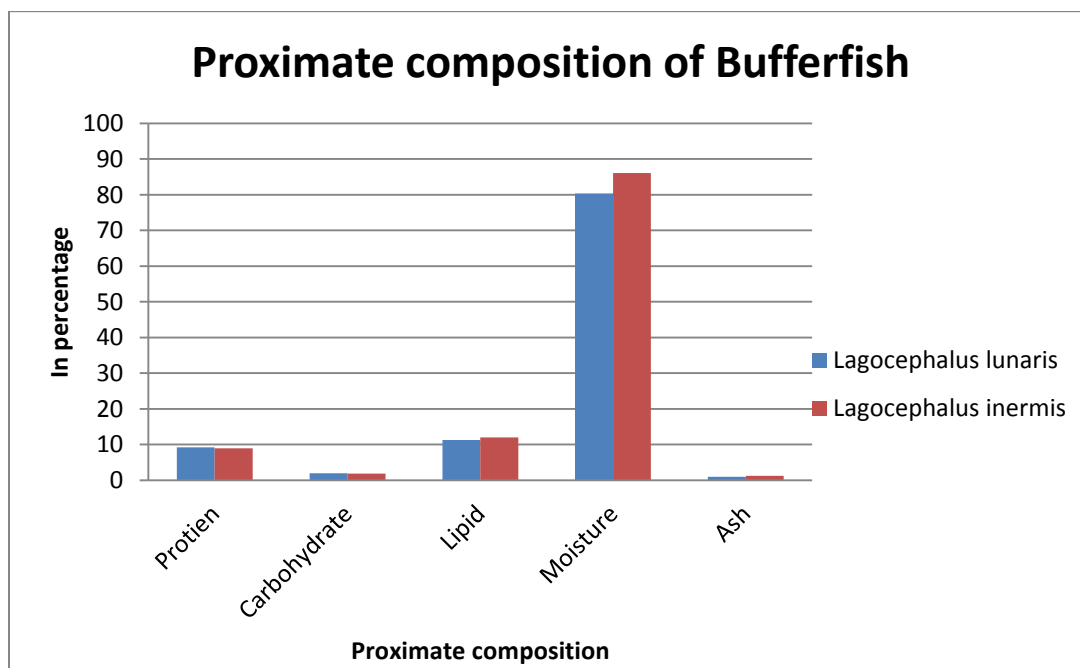


Figure 1. Proximate composition of *L. lunaris* and *L. inermis* for percentage %.

3. 2. Estimation of Fatty acid

In this current study the fatty acid level were checked in Puffer fish *L. lunaris* and *L. inermis*. Totally seven saturated fatty acids and ten Mono unsaturated fatty acids and two poly unsaturated fatty acids were found as the major components on the investigated puffer fish. Results were shows at Figure 2 and 3. Polyunsaturated fatty acid like n-3 has 31.17 %, 31.19 and n-6 7.26 %, 7.29 % of PUFA found as the dominant composition on puffer fish *L. lunaris* and *L. inermis* respectively. Results were shows at Figure 4. The fatty acid profile was measured by standard graph Figure 5.

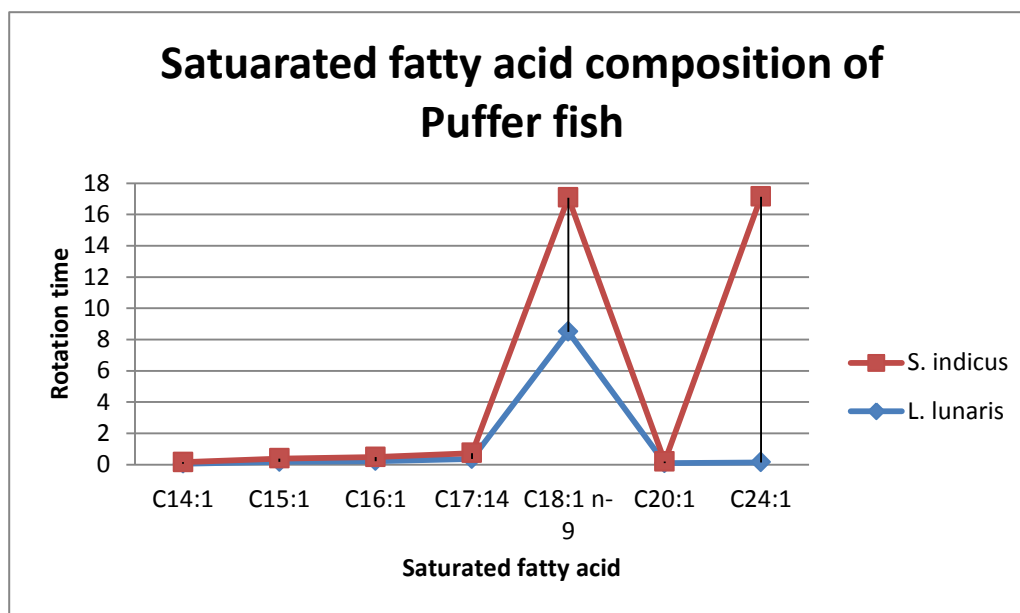


Figure 2. Proximate composition of *L. lunaris* and *L. inermis* for percentage %.

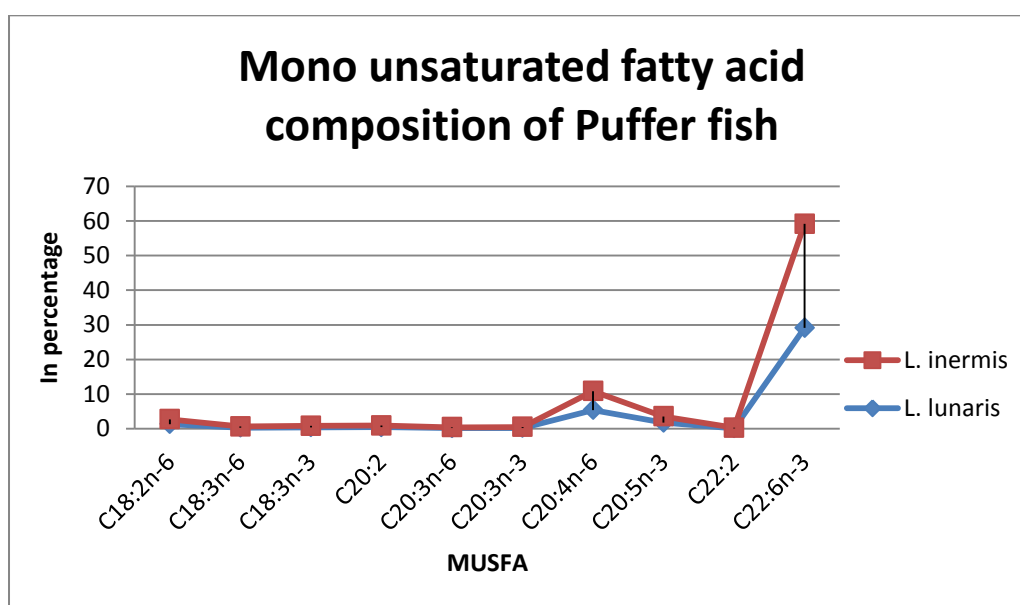


Figure 3. Mono unsaturated fatty acid composition of *L. lunaris* and *L. inermis* for percentage %.

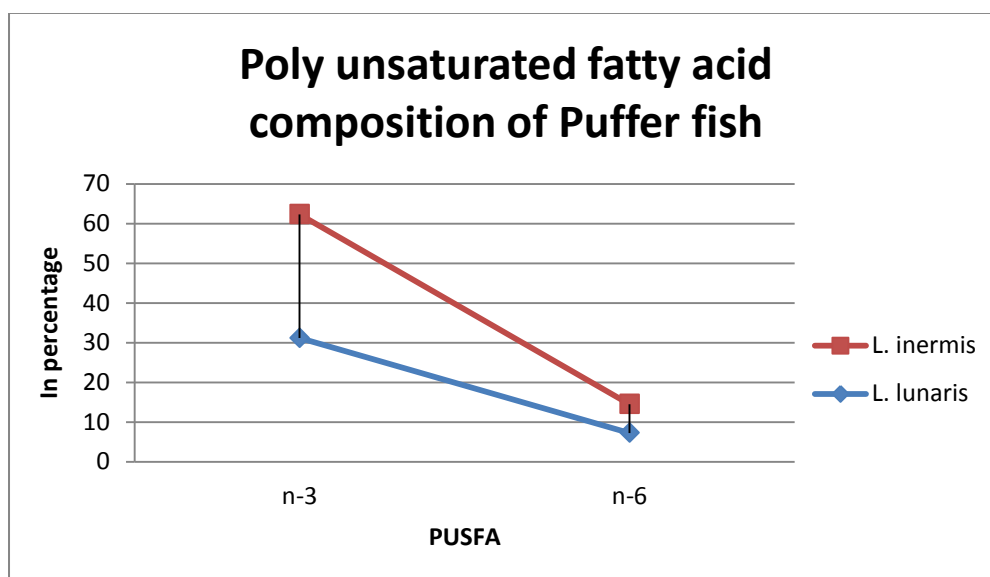


Figure 4. Poly unsaturated fatty acid composition of *L. lunaris* and *L. inermis* for percentage %.

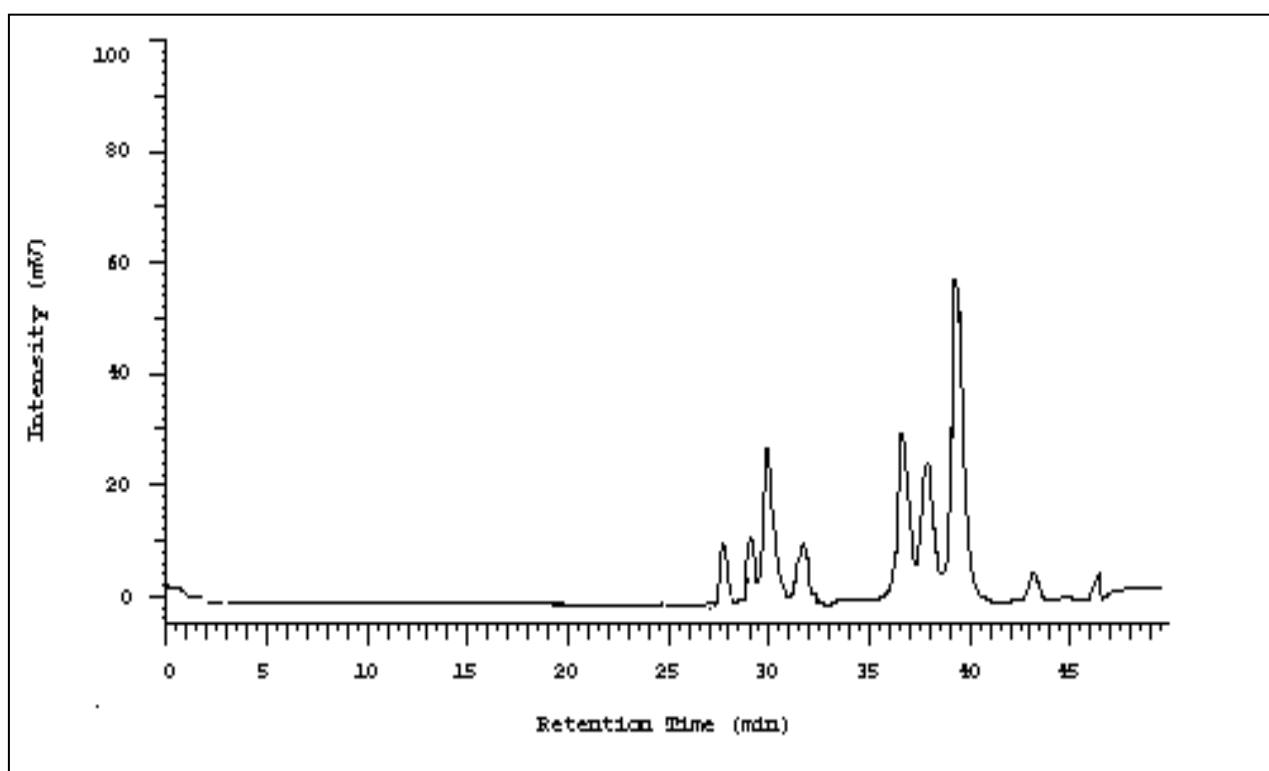


Figure 5. Fatty acid standard chart.

4. DISCUSSION

4. 1. Proximate composition

In this current investigation the protein contents varied from 8.92 to 9.22 % in the tissues of puffer fish *L. lunaris* and *L. inermis*. The proximate composition level was mentioned in Table number 1. Similar works are revealed from various fish species. Kumaran et al. were recorded the protein level 17.56 % in the Mullet fish *Mugil cephalus* (Kumaran et al.). The thornback ray *Raja clavata*, L. (1758) having 20.02 % percentage of protein content (Hulya et al.). These variations might be the food and feeding habitats of the fish. The Jitender kumar et al. were investigated the protein composition at various fish species like Catla, Rohu, Magur and Pangas fish species has found 10.11 %, 9.53 %, 14.87 % and 13.60 % respectively. This dissimilarity may be the environmental condition and consumption pattern of the fish species. In *Oreochromis mossambicus* fish parts having 33.59 % and 31.52 % of protein in head and bone part respectively [Vignesh and Srinivasan]. These much inconsistency happened due to the food and feeding behavior of fish in different regions.

The carbohydrate level of the Puffer fish were varied from 1.87 % to 1.96 % in *L. lunaris* and *L. inermis*. Similar works were done by some other fish species. Nurnadia et al. were recorded the carbohydrate concentration in marine pelagic fish *Fringescale sardinella* from west coast of Peninsular Malaysia. This Pelagic fish was had 3.07 % of carbohydrate. The Puffer fish *L. lunaris* and *L. inermis* having more carbohydrate than pelagic fish *F. sardinella* (Nurnadia et al.) The carbohydrate level in catfish *Clarios gariepinus* have been recorded in the level of 5.48 % by raw drying method, 2.78 % by Kiln-dried method and 3.84 % by electric- dry method. (Obonnya and Ibrahim). This difference may be different changes at elevated temperature. Fapohunda and Ogunkoya were observed the carbohydrate level in fresh, dried and deterioratin g fish sample of *Tilapia zillii*, *Parachanna obscura* and *Clarias gariepinus* species are having 4.72 %, 7.62 %, 11.89%, 6.93 %, 6.79 %, 10.25 % and 16.19 %, 1.92 %, 17.35 % respectively (Fapohunda and Ogunkoya). These differences may occur due to geographical location of the water, bodies and population of the fish species.

The present investigation shows very high level of lipid varied from 11.25 % to 11.98% in puffer fish. Some similar investigations were recorded on some other fish. Holma et al. were observed the fat level in fresh fish species, traditionally smoked fish species, fried fish species and salted red fish has 9.99 %, 10.00 %, 9.67 %, and 20.02 correspondingly [Holma et al.]. Kumaran et al. were recorded the lipid concentration at mullet *Mugil cephalus* having 2.42 %. Hulya et al. were recorded the lipid level on thornback ray *R. clavata*, L. [1758] fom the Sinop coast in the Black sea. This *R. clavata* fish species have 0.51 %. Manikandarajan et al. were recorded the higher concentration of lipid on *Plotosus lineatus* having 66.93 gm of lipid in body-part of cat fish *P. lineatus* fish species (Manikandarajan et al.). This much variation happens due to the food consumption pattern of fish species.

In the current study the Moisture contents various from 80.32 % to 86.05 % non puffer fish *L. lunaris* and *L. inermis*. The moisture contents on head and bone region of *Oreochromis mossambicus* having 5.89 % and 4.22 % likewise. Vignesh and Srinivasan were recorded the moisture content in the fresh fish and traditionally smoked fish had 10.0 % and 4.00 % respectively [Vignesh and Srinivasan]. Manat Chaijan et al. were observed the moisture content level at 78.88 g in dorsal, 81.67 mg/g in ventral, and 75.51 mg/kg lateral line region of *Pangasianodon gigas* [Manat Chaijan et al.]. This elevated moisture contents in fish are considered benefit because of its involvement in the stabilization of the organisms during movements.

The present study shows the optimal level of ash content in puffer fish. It were showed 0.96 % and 1.27 % of ash content in *L. lunaris* and *L. inermis* respectively. Similar studies were conducted on various fish species. The ash contents of *O. mossambicus* having 1.14 % on head and 0.89 % on bone region [Vignesh and Srinivasan]. Manat Chaijan et al., were recorded the ash contents at *P. gigas* having in dorsal region 1.47 g, in ventral region 1.13 mg/g, and lateral line 1.11 mg/kg [Manat Chaijan et al]. Holma et al., were observed the ash content in fresh fish, traditionally smoked fish, fried fish and salted red fish had 6.00 %, 06.07 %, 30.00 %, and 6.00 in that order [Holma et al.]. This dissimilarity may be most probably associated to the size of the species conducted for the separate studies or seasonal conditions at the time of study conducted.

4. 2. Fatty acid analysis

The current works revealed the optimal composition of saturated fatty acids present in the puffer fish. Similar works are done by some other authors. Manat et al were recorded the fatty acid composition at *P. gigas* species. These species has totally 17 fatty acids. In these seventeen fatty acids the SFA (45.30 %) content is the highest concentration in dorsal region of *P. gigas* [Manat et al]. Vignesh and Srinivasan, were expected the fatty acid level in *O. mossambicus* species having much more alpha linolenic acid (C18:4) (2.4390 mg /100 g) in head region and Stearic acid (C18:0) (0.7860 mg /100 g) in bone region has the major elements in *O. mossambicus* [21]. This variation might be almost certainly connected to the size of the fish investigated for the separate studies or seasonal conditions at the time of study conducted.

5. CONCLUSION

In general, the *L. lunaris* and *L. inermis* are not preferred and consumed by all the economic group of people and this was also considered as trash fish and thrown out because of the presence of tetrodotoxin in their visceral organ and skin. It has been evident that they are consumed in several parts of Cuddalore after the removal of visceral organs, intestine and skin. This study revealed that these species are having high saturated fatty acid and protein content and able to compete with more commercially utilize species in terms of nutritional importance, and they can definitely also compete when it comes to taste. It can act as a good source of nutritional and economic value when it is carefully handled and properly cooked.

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