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Towards the effective utilization of deep sea fish resources

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Introduction

Around 2400 fish species are estimated to inhabit the bathyal zone [1], which is defined as the one deeper than 200 m. They seemed to have adapted to respective habitat environments in molecular level, not only those of low molecular weight substances [2,3] but also those of proteins. There seems be a tremendous amount of underutilized fish species, which could be used as food, pharmaceuticals, animal feeds, and so on.

In order to estimate the availability of these species for human consumption, it is essential to characterize their nutritional components and functional substances for more species.

Materials and methods

More than thirty species were collected from the catch of drag net fishing in Suruga Bay, Shizuoka Pref. The common names and scientific names of the representative species examined are as follows: oilfish *Ruvettus pretiosus*, blackchin *Neoscopelus macrolepidotus*, Japanese gissu *Pterothrissus gissu*, blueberry roughy *Gephyroberyx darwinii*, Japanese bluefish *Scombrops gilberti*, rattail *Coryphaenoides marginatus*, sea toad *Chaunax abei*, lanternfish *Diaphus* sp., grenadier *C. marginatus*, eelpout *Bothrocara molle*, jellynose fish *Ateleopus japonicus*. The specimens were transported to the laboratory in ice water, and stored at -80ºC after cleaning and filleting. Edible parts (ordinary muscle in most of the species) were the major targets for this study. Inedible parts were weighed to estimate the yield.

Proximate composition was measured by the official methods. Free amino acid composition was determined by the conventional chromatography techniques. Protein components of muscle water-soluble fractions were analyzed electrophoretically. On the other hand, regarding the safety for human consumption, the cytotoxicity of the methanol extract from the viscera against NIH-3T3 cells from mouse embryos was examined [4].

Results and discussion

The yield for the edible part varied from 37 to 72%. While the water content tended to be high (>80% for a few species) for most species, it varied greatly depending on the species (Fig. 1). This was also true for the protein (>10% for some species) and lipid content (<10% for several species) (data not shown). Some oily species contain not a small amount of wax ester which would cause keriorrhea when ingested beyond the acceptable amount of flesh [5]. Actually, the presence of wax ester was recognized in a few species, although the amount was much less compared to oilfish.

Some species were rich in taurine and anserine (Figs. 2 and 3), both of which would show health promoting functions. These substances could be responsible for adaptation to deep sea environment. The other free amino acids were also found but at much lower levels compared to the substances as described above.

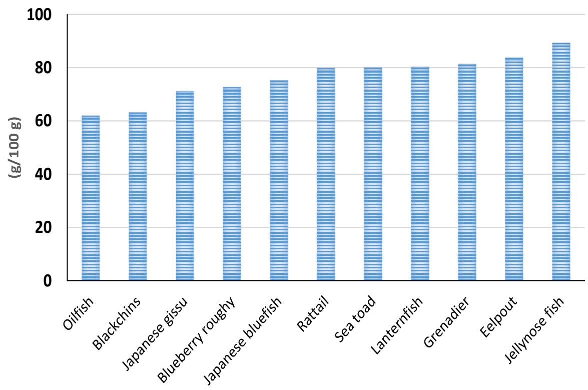

Fig. 1. Moisture contents in the edible part of deep sea fish.

Protein patterns were quite species-specific, and degradation was recognized in some species, indicative of quality deterioration during storage (data not shown). These data suggest that not a few species are available for human consumption. The safety and possibility of utilization other than food and pharmaceuticals should be kept in mind. Actually, some heavy metals have been found to contaminate deep sea species [6].

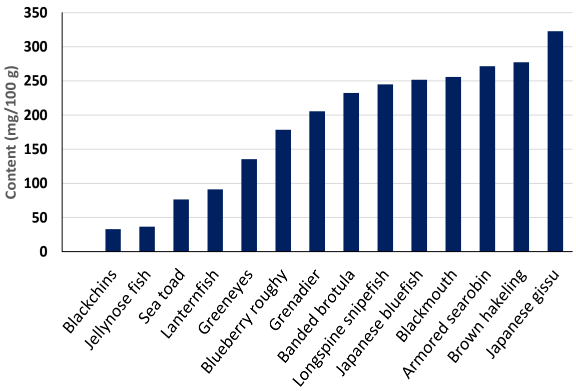

Fig. 2. Taurine contents in the edible part of deep sea fish.

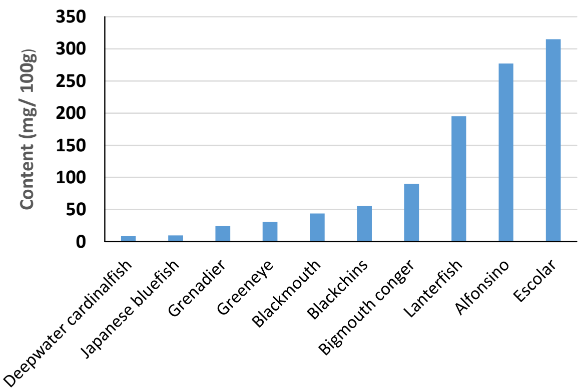

Fig. 3. Anserine contents in the edible part of deep sea fish.

The cytotoxicity tests were found to be negative for all the fish species examined. However, there may be other risk factors which have not been extracted under the present experimental conditions.

Conclusions

It is now clear that the not a few deep sea species can be not only nutritional sources but also excellent materials of bioactive substances. Further studies are needed to collect the data from the other unutilized species. The aspects of food safety and risk management should also be considered.

Acknowledgements

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