

Proximate analysis and Fatty Acids profile of edible Sea Urchin (*Stomopneustes variolaris*) in Sri Lanka

H.K.S. de Zoysa^{1*}, B.K.K.K. Jinadasa², G.D.T.M. Jayasinghe² and E.M.R.K.B. Edirisinghe¹

¹Faculty of Applied Sciences, Rajarata University of Sri Lanka

²National Aquatic Resources Research and Development Agency (NARA), Crow Island, Colombo-15, Sri Lanka.

Abstract

Sea urchins (*S. variolaris*) gonads (roe) are the most prominent structures in the internal cavity and are a highly prized delicacy in parts of Asia (East Asia), Mediterranean and the Caribbean countries. This study was conducted from May to October 2014, Beruwala (n=96), Tangalle (n=54) and Mount Lavinia (Mt. Lavinia) (n=43) reefs were selected as sampling locations and analysis of proximate composition of gonads of *S. variolaris* was the main objective. Gonads consisted, moisture (%) (range) 67.90(±0.10) to 71.50(±0.07), ash (%) 1.91(±0.08) to 3.15(±0.07), crude lipid (%) 7.40(±0.19) to 09.34(±0.63), crude protein (%) 11.21(±0.22) to 18.81(±2.13), carbohydrate (%) 02.90(±2.16) to 07.55(±0.36) and energy (KJ/g) 23.38(±1.40) to 26.49(±0.65). With respect to the fatty acids profile of *S. variolaris* is the highest saturated fatty acids (SFA) level (53.96%) was observed in the samples collected from Mt. Lavinia. The fatty acids, C14:0, C16:0 and C18:1 (n-9) were predominant and C12:0, C22:5(n-6) and C22:6(n-3) were lower in the gonads and n3/n6 (ω 3/ ω 6) ratio was higher in the Tangalle sample (01.27). The ω 3/ ω 6 ratio is an indicator of the nutritional importance of gonads, as high levels of ω 6 fatty acids are related to an increased incidence of breast, prostate and colon cancer, whereas diets high in ω 3 fatty acids have beneficial effects against several types of malignant tumor like diseases. All the analysis was conducted by using AOAC official method. Statistical analysis was conducted using the Minitab 16.0 statistical software. This study reveals that the sea urchins are nutritionally rich seafood and can be used as a substitute for fish.

Keywords: Echinoidea, Sea urchin, Edible species, Nutrition, Sri Lanka

*Corresponding author: dezoysahks@yahoo.com

Introduction

Sea urchins belong to the phylum Echinodermata and class Echinoidea. They are important marine creatures and widely distributed in all seas from the equator to southern and northern poles (from Arctic to Antarctic regions) and from the intertidal zone to deep sea trench, depth of more than 5000m (Jayakody, 2012). *S. variolaris* is a warm water sea urchin widely distributed in South-East Arabia, East coast of Africa to South Pacific Islands, Western India, Pakistan, Maldives area, Ceylon (Sri Lanka), Bay

of Bengal, East Indies, North Australia, China, South Japan, South Pacific Islands, Australia, Lakshadweep (India) and Visakhapatnam Coast (India)(Smith and Kroh, 2011) and one of the edible species. With respect to the Gonads, which are five skeins of roe, comprise the most prominent structures in the internal cavity of sea urchins, which are harvested for their gonads, and have a highly prized delicacy in parts of Asia (East Asia), Mediterranean and the Caribbean countries. Gonads have high nutritional value than other seafoods which consist of mainly water, protein, lipid, carbohydrate, fatty acids, vitamins and minerals. However, in Sri Lanka, no studies have been conducted until April 2014 about the nutritional value of *S. variolaris* gonads. Therefore, this study was conducted to analyse the nutritional composition of *S. variolaris* in selected areas of Sri Lanka, namely in Mount Lavinia, Beruwala and Tangalle reefs.

Materials and methods

Sea urchins (*S. variolaris*) were hand collected with aid of Scuba- diving apparatus from May to October in 2014 at selected locations in Sri Lanka and transported with seawater to analytical chemistry lab at Institute of Post-Harvest Technology (IPHT), NARA within 24 hours. All gonads were separated into male and female and composite (homogenized) in the absence of a solvent and using a mixer grinder (Sonica domestic). Moisture content, ash, crude protein, crude lipids, energy and fatty acids profile of *S. variolaris* samples in all selected area were analysed according to the AOAC, (1998) official methods of analysis 923.03. All the composite samples were analyzed in duplicates. The presence carbohydrates of sea urchins' samples were determined by subtraction of the moisture, ash, crude lipid and crude protein of each sample. Statistical analysis was conducted by using Minitab 16.0 statistical software.(AOAC, 1998)

Results

Table 1 show the proximate analysis of *S. variolaris* with selected sites. The mean values of proximate composition between male and female in Beruwala sample revealed there was no any significant difference ($p= 0.973$). However, in male sample resulted higher amount of crude lipid (%) and energy (KJ/g) as average value $9.34(\pm 0.63)$ and $26.49(\pm 0.65)$ respectively than the female sample as $7.40(\pm 0.19)$ and $23.38(\pm 1.40)$ respectively. In addition, the proximate composition among Beruwala, Tangalle and Mt. Lavinia sites showed there was no any significant difference ($p < 0.05$) of their mean values.

Table 2: Proximate analysis for Beruwala, Tangalle and Mt. Lavinia samples

Constituents	Locations			
	Beruwala		Tangalle	Mt. Lavinia
	Female (n=80)	Male (n=16)	Female + Male (n=54)	Female + Male (n=43)
Moisture (%)	71.50(±0.07)	71.11(±0.01)	67.90(±0.10)	68.64(±0.11)
Ash (%)	03.15(±0.07)	02.74(±0.02)	01.91(±0.08)	01.99(±0.07)
Crude Lipid (%)	07.40(±0.19)	09.34(±0.63)	07.94(±0.05)	07.65(±0.08)
Crude Protein (%)	11.72(±0.07)	11.21(±0.22)	14.70(±0.50)	18.81(±2.13)
Carbohydrate (%)	06.23(±0.04)	05.60(±0.45)	07.55(±0.36)	02.90(±2.16)
Energy (KJ/g)	23.38(±1.40)	26.49(±0.65)	26.40(±0.32)	25.65(±0.07)

The fatty acids C14:0, C16:0 and C18:1 (n-9) predominated and C12:0, C22:5(n-6) and C22:6(n-3) were lowest in the gonads of *S. variolaris*. Fatty acid composition of *S. variolaris* had (from identified fatty acids (80%)) the highest total saturated fatty acids (SFA) 53.96% at Beruwala male sample, 55.72% at Beruwala female sample, 51.65% at Tangalle sample and 61.46% at the Mt. Lavinia samples. Total monounsaturated fatty acids (MUFA) were 15.45% in the Beruwala male sample, and 14.52% in Beruwala female sample, 14.45% in Tangalle samples and 11.58% in Mt. Lavinia sample and lowest values of total polyunsaturated fatty acids (PUFA) were as 09.68% at Beruwala male sample, 10.25% at Beruwala female sample, 14.91% at Tangalle sample and 11.16% at Mt. Lavinia sample. The ω 3/ ω 6 ratio of *S. variolaris* was at 0.59 at Beruwala male sample, 0.54 at Beruwala female sample, 1.27 at Tangalle sample and 0.61 at Mt. Lavinia sample.

Discussion

Proximate composition values of *S. variolaris*, which was resulted higher percentage of protein (12.03%), crude fat (3.05%), carbohydrate (2.80%) and energy (Table 1.) than the *P. lividus*, (Mol *et al.*, 2008) but lower the ash (2.25%) and moisture (79.87%). also energy value was 107.81 Kcal/100 g. Red sea urchins (*S. franciscanus*) and Purple sea urchins (*S. purpuratus*) protein (%) varies from 7.7 to 9.6 and 9.5 to 12.3 respectively (Kato and Schroeter, 1985), but in *S. variolaris* which was collected from all the selected location resulted mean value of protein (%) vary from 11.21(±0.22) to

18.81(±2.13) (Table 11.). These protein values were higher than *S. franciscanus* and *S. purpuratus*, but values were revealed no any significant different among selected locations as $p=0.420$. These values were similar to value of *P. lividus* (12.03%) (Mol *et al.*, 2008). The lipid presence of gonads of *S. franciscanus* and *S. purpuratus* indicated as 7.6% to 8.3% and 5.4% to 5.2% respectively (Kato and Schroeter, 1985). However, *S. variolaris* resulted as mean values range from 07.40(±0.19) to 09.34(±0.63) (Beruwala) these values are mostly similar to as Kato and Schroeter, (1985) reported of *S. franciscanus* and *S. purpuratus* and higher than the *P. lividus* (3.05%) (Mol *et al.*, 2008). Fatty acids composition among the selected location revealed that total amount of SFA was significantly higher ($p<0.005$) than the total amount of MUFA and PUFA but in *P. lividus* consist fatty acids composition showed total amounts of MUFA and PUFA were significantly higher ($p < 0.05$) than SFA. The $\omega 3/\omega 6$ ratio of *S. variolaris* was at 0.59 at Beruwala male sample, 0.54 at Beruwala female sample, 1.27 at Tangalle sample and 0.61 at Mt. Lavinia sample. However, the ($\omega 3/\omega 6$) ratio of *P. lividus* about 1.55 (Mol *et al.*, 2008) this value similar to Tangalle sample, and higher than the Beruwala male and female and Mt. Lavinia samples.

Conclusion

The *S. variolaris* have a higher protein, lipid, carbohydrates and energy than the other edible sea urchin species (*S. franciscanus*, *S. purpuratus* and *P. lividus*) and higher amount of saturated fatty acids including most essential fatty acids required by to humans.

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