Physicochemical Properties of Some Shrimp Pastes from Dawei District,Tanintharyi Region

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***Abstract*:** The present research concerned with the analytical studies on some shrimp pastes from Dawei district,Tanintharyi region. Physicochemical properties of four shrimp pastes were collected from Kyauk Kha Mauk, Nyaung Zin, Ti Zit and Kan Pa Ni, Dawei District of Tanintharyi region. In this work, moisture, ash, protein and fat contents were determined by using Oven Drying, Ashing, Macro Kjeldahl and Soxhlet Extraction methods respectively. These measurements are essential to control and maintain products and quality in manufacturing and trade. The salt contents in Kyauk Kha Mauk ngapi, Nyaung Zin ngapi, Ti Zit ngapi and Kan Pa Ni ngapi were 32.56%, 24.24%, 30.48% and 28.40%, respectively. The determinations of dyes were done by Wool-dyeing method. According to EDXRF analysis, Cl, Ca, K, S, Fe, Sr, Br, Cu, Zn and Mn were detected in some shrimp pastes. Quantitative determinations of some minerals such as Ca, Mg, Cu, Cd, Mn and Zn were carried out by using AAS method.

Keywords:Shrimp pastes, Dawei District , physicochemical properties, EDXRF , AAS

I. Introduction

Shrimp

Shrimp is the most typical and impressive of shell fish animals. There are no generally accepted meaning for the terms “shrimp” and “prawns”. The shrimp is a marine animal which is the most suitable for farming (Stanaby, *et al.*, 1963)**.**

Nutritional Value of Shrimp

The main source of food in shrimp is the meaty tail, but some cultures and various cuisines choose to eat other parts of the shrimp as well. Shrimp is a popular option and is also very low in calorie (approximately 1 calorie/1 gram of shrimp). As an organic life form, shrimp is packed with protein, and is composed primarily of water, but there is also a small amount of fat as well. However, the most beneficial aspect of shrimp is the treasure of vitamins and nutrients that it contains. Shrimp can be a delectable and efficient way to balance our nutrition and promote a healthy body (Newest, 2015).

Shrimp Paste

Shrimp paste is not only made from shrimp but also from small fish, small prawn and krill. Shrimp paste is made by mixing shrimp with salt. The mixture is stored overnight and drained and sun dried. The dried mixture is packed in container. The shrimp paste in an Asian market is packed in a plastic container. A good shrimp paste should be dark peep purple almost brown in color. It should be smooth and pasty on the dry side (Netsuwan, 2012).

II. Materials and Methods

Collection of Samples

In this research, shrimp paste samples were purchased from different places in Dawei district, Tanintharyi region, including Kyauk Kha Mauk, Nyaung Zin, Ti Zit and Kan Pa Ni. Four samples were used in this research work.

Figure 1.1 Shrimp samples (gwe)

Figure 1.2 Shrimp paste

Determination of pH

The pH values of shrimp paste samples were detected by pH meter.

Determination of Moisture Content

The moisture content of shrimp paste samples were determined by oven-drying method.

Determination of Ash Content

The ash content of shrimp paste samples were determined by furnace and the temperature of furnace was maintained at 105◦C for 20 minutes.

Determination of Protein Content

The protein content of shrimp paste samples were determined by Kjeldahl digestion method.

Determination of Fat Content

The fat content of shrimp paste samples were determined by Soxhlet extractor method.

Determination of Crude Fiber Content

The crude fiber content of shrimp paste samples were determined by AOAC method.

Determination of Carbohydrate Content

The total carbohydrate content of each shrimp paste samples can be obtained as the difference between 100 and the sum of the percentages of ash, fat, moisture, fiber and protein.

Determination of Salt Content

The salt content of shrimp paste samples were determined by AOAC method.

Determination of Dyes

The dyes of shrimp paste samples were determined by Wool-dyeing method (Frank, 2000).

Qualitative Elemental Analysis of the Shrimp Paste Samples by (EDXRF) Spectrometry

Qualitative elemental analysis Ca, K, S, Fe, Sr, Br, Cu, Zn and Mn of the shrimp paste samples were detected by energy dispersive X-ray Fluorescence (EDXRF) spectrometry.

Determination of Mineral Contents in Shrimp Pastes

Trace elements (Ca, Mg, Cu, Cd , Mn and Zn) in shrimp paste samples were detected by atomic absorption spectroscopy (AAS).

III. Results and Discussion

Sample Collection of Some Shrimp Paste Samples

Shrimp paste samples used in this research were purchased from Kyauk Kha Mauk, Nyaung Zin, Ti Zit and Kan Pa Ni of Dawei District ,Tanintharyi region. The samples were stored in air-tight plastic bottle.

pH Values in Shrimp Pastes

The pH values in shrimp paste samples were measured by pH meter. The pH values of shrimp pastes were found to be 8.0, 8.4, 8.1 and 8.5 in Kyauk Kha Mauk, Nyaung Zin, Ti Zit and Kan Pa Ni, respectively. During food storage and spoilage, changes may occur due to enzymic action and microbiological growth. All the pH values found were in the alkaline pH range of 8.0 to 8.5. These observed values agreed closely to that literature value of 7.0 to 8.5 (Table.1).

Moisture Content in Shrimp Pastes

The moisture contents were determined by oven drying method. The moisture contents of shrimp pastes were found to be 44.7%, 36.1%, 45.9%, and 34.1% in Kyauk Kha Mauk, Nyaung Zin, Ti Zit and Kan Pa Ni, respectively. The literature moisture content is 33.79% to 52.54% (Pongsetkul, *et al.*, 2014). (Table.2)

Table 1. pH Values of Some Shrimp Pastes

No.	Samples	pH values	*Literature Value
1.	Kyauk Kha Mauk ngapi	8.0	7.0-8.5
2.	Nyaung Zin ngapi	8.4	
3.	Ti Zit ngapi	8.1	
4.	Kan Pa Ni ngapi	8.5	

* Pongsetkul, *et al.*, 2014

Ash Content in Shrimp Pastes

In this work, the ash content of shrimp paste samples were determined by ashing method. The ash content of shrimp pastes were found to be 21.6%, 28.3%, 20.6% and 29.5%, respectively. (Table.2)

Protein Content in Shrimp Pastes

Protein contents were measured by Macro kjeldahl's method. The main work of protein is to build the body and to repair the warm out tissue, but any protein eaten in excess of the amount required by the body can be used to provide energy (Ruth, 1977). The protein contents of shrimp pastes were found to be 25.0%, 26.4%, 25.2% and 27.9%, respectively. (Table.2)

Table 2. Nutritional Values of Shrimp Pastes

No	Samples	Nutritional Values (%)					
		Moisture	Ash	Protein	Fat	Crude fiber	Carbo-Hydrate
1.	KyaukKha Mauk ngapi	44.7 ± 0.002	21.6 ± 0.004	25.0 ± 0.002	5.6 ± 0.001	1.6 ± 0.002	1.5 ± 0.002
2.	NyaungZin ngapi	36.1 ± 0.017	28.3 ± 0.003	26.4 ± 0.001	5.8 ± 0.001	1.3 ± 0.001	2.1 ± 0.003
3.	Ti Zit ngapi	45.9 ± 0.002	20.6 ± 0.002	25.2 ± 0.002	5.5 ± 0.003	1.4 ± 0.003	1.4 ± 0.001
4.	KanPa Ni ngapi	34.1 ± 0.002	29.5 ± 0.003	27.9 ± 0.002	5.7 ± 0.003	1.1 ± 0.001	1.7 ± 0.003

Fat Content in Shrimp Pastes

Fat contents were measured by Soxhelt extraction method using PE (boiling point 60 ºC-80ºC). The contents of fat were found to be 5.6%, 5.8%, 5.5% and 5.7% in shrimp paste samples respectively. (Table.2)

Crude Fiber Content in Shrimp Pastes

It was found 1.6%, 1.3%, 1.4% and 1.1%, respectively. The highest crude fiber content is Kyauk Kha Mauk ngapi than other shrimp pastes. Fiber helps in the maintenance of human health and has been known to reduce cholesterol level in the body (Eromosele, 1993) .(Table.2)

Carbohydrate Contents in Shrimp Pastes

Carbohydrate content was calculated by the word formula stated. The carbohydrate content were found to be 1.5%, 2.1%, 1.4% and 1.7%, respectively. (Table.2)

Energy Values in Shrimp Pastes

Energy values were calculated by the word formula. In these studies, the energy values of shrimp pastes were found to be 166.8 kcal/100g, 160.2 kcal/100g, 155.9 kcal/100g and 169.7 kcal/100g, respectively.

Salt Content in Shrimp Pastes

The determination of salt content by AOAC method.The contents of salt were found to be 32.56%, 24.24%, 30.48% and 28.40% in shrimp paste samples respectively. All samples contained salt, which is needed for preservation. Salt content was greatly different during the production of shrimp pastes due to different habitat and environment.

Dyes Content in Shrimp Pastes

The determination of dyes was done by Wool-dyeing method. According to Wool-dyeing method, artificial dye was not detected in all samples. Food dye was found to be presented in all shrimp pastes. (Table.3)

Relative Abundance of Some Elements Present in Shrimp Pastes

In this study, relative abundance of some elements in some shrimp pastes were determined by EDXRF spectrometer. According to qualitative EDXRF analysis, Cl was found to be present as major element in some shrimp pastes. According to EDXRF analysis, no toxic elements were found. (Table 4)

Table 3. Screening of Food Dyes and Artificial Dyes in Shrimp Pastes

No.	Samples	Food Dyes (+ / -) *	Artificial Dyes (+ / -)*
1	Kyauk Kha Mauk ngapi	+	-
2	Nyaung Zin ngapi	+	-
3	Ti Zit ngapi	+	-
4	Kan Pa Ni ngapi	+	-

* (+) = present
(-) = absent

Table 4. Relative Abundance of Some Elements Present in Shrimp Paste Samples by EDXRF Method

No.	Elements	Relative Abundance (%)			
		Kyauk KhaMauk ngapi	Nyaung Zin ngapi	Ti Zit ngapi	KanPa Ningapi
1.	Cl	4.317	10.214	4.217	10.224
2.	Ca	0.573	0.346	0.773	0.366
3.	K	0.188	0.291	0.178	0.290
4.	S	0.241	0.419	0.251	0.409
5.	Fe	0.005	0.004	0.005	0.005
6.	Sr	0.007	0.013	0.006	0.014
7.	Br	0.003	0.006	0.003	0.006
8.	Cu	0.001	0.003	0.001	0.003
9.	Zn	0.001	0.002	0.001	0.002
10.	Mn	ND	ND	ND	ND
11.	CH	94.665	88.702	94.565	88.681

ND = Not detected

Mineral Contents in Shrimp Pastes

In the present work, the mineral contents in some shrimp paste samples were determined by atomic absorption spectrophotometer. The mineral found in some shrimp paste samples are Ca, Mg, Cu, Cd , Mn and Zn. (Table.5)

The mean values of calcium contents in some shrimp pastes were found to be 47.32 ppm, 55.60 ppm, 46.29 ppm and 59.67 ppm, respectively. Among these samples, the Ca content of Ma Aing ngapi is higher than other shrimp pastes. Magnesium plays an important role in the structure of the skeleton and muscles.

The mean values of trace element concentration in some shrimp pastes were found to be Mg 9.389 ppm, 8.496 ppm, 9.296 ppm and 9.586 ppm, respectively. Copper is an essential mineral for our body. The mean value of trace elements concentration in some shrimp pastes was found to be Cu 0.346 ppm, 0.664 ppm, 0.352 ppm and 0.655ppm, respectively. Cadmium is a heavy metal posing severe risk to human health (Edward, 2013). The mean value of Cd concentration in some shrimp pastes was found to be 0.049 ppm, 0.097 ppm, 0.048 ppm and 0.098 ppm, respectively. Manganese is essential for certain enzymes.

Table 5. Mineral Contents of Shrimp Pastes

No.	Samples	Mineral Contents (ppm)					
		Ca	Mg	Cu	Cd	Mn	Zn
1.	Kyauk Kha Mauk ngapi	47.32 ± 0.100	9.389 ± 0.009	0.346 ± 0.005	0.049 ± 0.001	0.235 ± 0.001	0.872 ± 0.001
2.	Nyaung Zin ngapi	55.60 ± 0.257	8.496 ± 0.016	0.664 ± 0.004	0.097 ± 0.003	0.213 ± 0.003	1.415 ± 0.002
3.	Ti Zit ngapi	46.29 ± 0.100	9.296 ± 0.008	0.352 ± 0.003	0.048 ± 0.001	0.232 ± 0.001	0.783 ± 0.003
4.	Kan Pa Ni ngapi	59.67 ± 0.357	9.586 ± 0.017	0.655 ± 0.005	0.098 ± 0.002	0.206 ± 0.003	1.406 ± 0.002

The mean value of trace elements concentration in some shrimp pastes were found to be Mn 0.235 ppm, 0.213 ppm,0.232 ppm and 0.206 ppm, respectively. Zinc help cells in our body communicate with each other. The mean values of trace elements concentration in some shrimp pastes were found to be Zn 0.872 ppm, 1.415 ppm, 0.783 ppm and 1.406 ppm, respectively. Among these samples, the highest Zn content is Nyaung Zin ngapi than other shrimp pastes**.**

IV. Conclusion

Shrimp paste samples were collected from Kyauk Kha Mauk, Nyaung Zin, Ti Zit and Kan Pa Ni of Dawei District, Tanintharyi region. The pH value of Kyauk Kha Mauk ngapi, Nyaung Zin ngapi, Ti Zit ngapi and Kan Pa Ni ngapi were found to be 8.0, 8.4, 8.1 and 8.5, respectively. Among then, the pH value of Kan Pa Ni ngapi is higher than other shrimp paste samples. The moisture and ash contents in (Kyauk Kha Mauk ngapi, Nyaung Zin ngapi, Ti Zit ngapi and Ka Pa Ni ngapi) were found to be in the range of 34.1% to 45.9% and 20.6 % to 29.5%, respectively. The ash contents of Nyaung Zin ngapi and Kan Pa Ni ngapi are higher than other shrimp paste samples. The protein contents of Kyauk Kha Mauk ngapi is the lowest in all samples. The fat contents of Kyauk Kha Mauk ngapi, Nyaung Zin ngapi, Ti Zit ngapi and Kan Pa Ni were found to be 5.6%, 5.8%, 5.5% and 5.7%, respectively. The crude fiber contents of Kyauk Kha Mauk ngapi, Nyaung Zin ngapi, Ti Zit ngapi and Kan Pa Ni ngapi were found to be 1.6%, 1.3%, 1.4% and 1.1%, respectively. The carbohydrate contents of Kyauk Kha Mauk ngapi, Nyaung Zin ngapi, Ti Zit ngapi and Kan Pa Ni ngapi were found to be 1.5%, 2.1%, 1.4% and 1.7%, respectively. The energy values of Kyauk Kha Mauk ngapi, Nyaung Zin ngapi, Ti Zit ngapi and Kan Pa Ni ngapi were found to be 166.8 kcal/100g, 160.2 kcal/100g, 155.9 kcal/100g and 169.7 kcal/100g, respectively. The salt contents in Kyauk Kha Mauk ngapi, Nyaung Zin ngapi, Ti Zit ngapi and Kan Pa Ni ngapi were found to be in the range of 20.08% to 32.56%. In the determination of dyes, the hazard dye does not detect in all shrimp paste samples. Therefore, they are suitable for human consumption. Qualitative EDXRF element analysis revealed that four shrimp paste samples contained Cl as major elements. Other elements were also found Ca, K, S, Fe, Sr, Br, Cu, Zn and Mn as minor elements. The heavy metal of Cu and Cd content in all shrimp paste samples was very far below the allowable level of FDA limit of 4.00 ppm Cu and 3.0 ppm Cd (FDA, 1996). So that all shrimp paste samples were not harmful effect for human. According to these results, such as nutritional values, dyes, salt contents, EDXRF and AAS, all shrimp paste samples are suitable for human consumption and

health. In contract, consumers should store the shrimp paste at chilled temperature and should be eaten by roasting or boiling.

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References

[1] AOAC.2000. Official Method of Analysis. Washington, D.C. :17th Ed., Association of Official Chemists, 86-275

[2] Edward.2013. "The Health Danger of Cadmium" http://www.global healthy center .com / health

[3] Eromosele, I.O. and Eromosele. C.O.1993.Studies on the Chemical Composition and Physicochemical Properties of Seeds of Some Wild Plants.Plant Food Hum. Nutrition, 43, 251-258

[4] FDA.1996. Fish and Fisheries Products Hazards and Controls Guide.Washington D.C. : U.S. Office of Seafood, 91, 117

[5] Frank, E.2000.Anaiytical Methods and Techniques for Colours in Foods ,Canada : Food Research Division, Health Protection Branch , Ottawa,135-139

[6] Netsuwan, N.(2012). " Shrimp Paste " http://www.thaitable. com / thai / shrimp-paste

[7] Newest, (2015), "Nutritional Value of Shrimp" http://www.Orgnicfacts-net/health-benefits/animal-product/healt benefits-of- shrimp-html.

[8] Pongsetkul, J., S. Benjakul, P. Sampavapol, K. Osako and N.Faithong.2014.Chemical Composition and Physical Properties of Salted Shrimp Paste (Kapi)".International Aquat. Res.,6, 155-156

[9] Ruth, B.1977. Food and Nutrition, London : Heinemann Education Books Ltd.,23-34

[10] Stanaby, H.E. and Dassow. T. A.1963.Industrial Fishery Technology.New York:ReinholdPub.Corp., 158