Proximate and Amino Acid Composition of DengkeNaniura Prepared from Carp (Cyprinuscarpio) of Lake Toba Indonesia

Maria Manik1,2*, Jamaran Kaban3, Jansen Silalahi4 and Mimpin Ginting3

1Doctoral Student at Graduate School of Chemistry, Faculty of Mathematics and Natural Sciences, University of Sumatera Utara, Medan, 20155, Indonesia
2Lecturer at University of HKBP Nommensen, Medan, 20234, Indonesia
3Department of Chemistry, Faculty of Mathematics and Natural Sciences, University of Sumatera Utara, Medan, 20155, Indonesia
4Faculty of Pharmacy, University of Sumatera Utara, Medan, 20155, Indonesia

*maria_l_manik@yahoo.com

Abstract. Dengkenaniurais a traditional Batak Toba dish processed from carp (Cyprinus carpio) marinated with lime juice and spices and consumed without cooking. Dengkenaniur in this research was prepared with carp taken from Haranggaol village, Lake Toba area, marinated with jungga lime (Citrus jambhiri Lush) juice and various spices for 7 hours. This research was conducted to analyze the proximate nutritional values and amino acid composition of fresh carp meat and after the carp meat was processed as dengkenaniur. The research was done experimentally in a laboratory by acquiring data descriptively. The results of proximate analysis of dengkenaniurashow the moisture content decreased from 74.6% to 69.26%; the fat content decreased from 5.74% to 4.35% and the protein content decreased from 18.3% to 17.09%, while the ash content increased from 1.13% to 2.69% and the carbohydrate content proximately increased from 0.23% to 6.61%. The results of amino acid analysis with HPLC show the largest amino acids in fresh meat and dengkenaniurare lysine (4.5% and 4.55%), leucine (4.04% and 4.48%) and arginine (3.09% and 3.46%), glutamic acid (7.94% and 8.69%) and aspartic acid (5.07% and 5.54%).

1. Introduction
Fish as a food source has an important role in fulfilling the nutritional needs of individuals. As a source of nutrition, fish generally contains: 66-84% water; 0.1 - 22% fat; 15-24% protein; 0.8 - 2% ash [1] [2]. Fish protein contains essential amino acids and non-essential amino acids [3]. In general, the highest essential amino acids in fish are lysine and arginine, whereas for non-essential amino acids these are aspartic acid and glutamate [4].

Carp (Cyprinuscarpio) is a freshwater fish that is widely consumed. In North Sumatra, carp are thriving in Lake Toba and for a long time have been an important protein source as well as a necessity in cultural customs of Batak society.

Fish is a product that spoils easily. Various attempts are made to extend the shelf life of fish, both for short and long periods. Acidification in the process of preserving fish is often carried out on whole
fish and weeded fish. In food processing technology, this acidification process is called marinating. The term marinades is used for fresh or frozen fish products which are soaked in organic acids that can be consumed like vinegar, usually added with salt and without seasoning and then put in sauce or cooking oils [5].

*Dengkenaniura* or marinated fish is a type of traditional Batak Toba’s food in North Sumatra which is consumed without cooking as a source of protein. *Dengkenaniurais* traditionally made from *Cyprinus carpio* fresh from Lake Toba. This food is made by marinating the fish in jungga lime juice and spices until the fish becomes soft and ready to be consumed without cooking. The method of processing *dengkenaniura* varies in time spent marinating and the amount of seasoning used subject to individual taste. It is found that marinating time in acidic solutions and spices varies between 3-9 hours [6] [7] [8] [9] [10].

In this research, *dengkenaniura* was made with carp (*Cyprinus carpio*) from Lake Toba with the formulations used in the processing of *dengkenaniura* according to Manik [9] with various marination time. The analysis was performed on fresh carp meat and after the carp meat was processed as *dengkenaniura* to determine the effect of processing on proximate nutritional chemical composition and amino acid composition.

Proximate analysis on the nutrient content of fresh carp from West Java was conducted by [11] and cultivated carp in Pematang Siantar by [12]. [13] examined the amino acid content in freshwater rainbow trout fish in [14] analyzing amino acids in carp in Iran.

Publication on *dengkenaniura* is still limited. [6] analyzed changes in protein content and organoleptic tests with *naniura* stored in low temperatures and still highly acceptable within 6 days of storage. [9] analyzed the changes in protein nutrition components on the effect of sodium benzoate on *dengkenaniura* quality using Kjeldhal method and discovered that the sample is still in good quality after 10 days of storage at room temperature. [12] analyzed the proximate chemical composition of *dengkenaniura* nutrition processed from carp cultivated in ponds from Pematang Siantar.

2. Methodology

Carp (*Cyprinus carpio*) used in this research was taken from the waters of Lake Toba in the Haranggaol area. Live carp weighting approximately 1 kg each was taken to the laboratory using a closed plastic container that contains water and oxygen.

Fresh jungga lime (*Citrus jamhiri Lush*) juice used to marinate the carp. *Dengkenaniura* seasonings such as andaliman (*Zanthoxylum acanthopodium*), chili pepper, shallots, garlic, ginger, turmeric, galangal, torch lily, candlenut and salt are obtained from Pringgan, a traditional market in Medan. Seasonings were chosen by visual freshness.

Carp was cleaned, deboned and deskinned. The carp meat was washed with cool boiled water and drained. The carp meat that has been drained was placed in a glass container and then marinated with junggalime juice with a ratio of 1g of jungga lime juice to 1.8 g of carp meat and added 3% of salt. Marination in junggalime juice was carried out in a room at 18° C within a period of 7 hours. The mixture of spices was then put in a carp marinating1 (one) hour before the marination time is finished. The fish marination container was sealed tightly during the process.

Chemical analysis was carried out on the fresh carp meat before and after marination. The analysis was carried out on the chemical composition of nutrition in fresh carp meat and *dengkenaniura* with proximate analysis to determine moisture, fat, protein and ash contents using methods AOAC. The total carbohydrate was calculated by difference as 100% - (% moisture + % ash + % lipid + % protein). Amino acid composition was analyzed by High Performance Liquid Chromatography (HPLC) (AOAC 2005) [15].

This research is a laboratory experiment with descriptive research design. Reported research results are the average of three analyses. Results are presented as mean ± SD (Standard Deviation).

3. Results and Discussion
3.1. Proximate Composition

The results of proximate analysis of the nutritional content of fresh carp meat and *dengkenaniura* are shown in Table 1.

| Composition       | Fresh Carp Meat (%) | Dengke Naniura (%) |
|-------------------|---------------------|--------------------|
| Moisture Content  | 74.6 ± 0.63         | 69.26 ± 0.98       |
| Fat Content       | 5.74 ± 0.03         | 4.35 ± 0.07        |
| Protein Content   | 18.3 ± 0.06         | 17.09 ± 0.02       |
| Ash Content       | 1.13 ± 0.04         | 2.69 ± 0.02        |
| Carbohydrate      | 0.23                | 6.61               |

From the results of the analysis, there was a change in the proximate chemical composition of the carp meat after being processed into *dengkenaniura*. The moisture content decreased from 74.6% to 69.26%; the fat content decreased from 5.74% to 4.35% and the protein content decreased from 18.3% to 17.09%, while the ash content increased from 1.13% to 2.69% and the carbohydrate content proximately increased from 0.23% to 6.61%.

The results of proximate analysis of fresh carp in this study are found in the range of several research results, namely moisture content (75.48-80.94%), fat content (1.76-5.61%), protein content (12.97-18.17%) and ash content (0.96-3.14%) [11] [12] [16] [17] [18] [19]. The chemical composition of fresh carp meat can vary according to the sex, age, size, season and geographical differences in areas where the fish live [18].

The results of proximate analysis of *dengkenaniura* in this research are in accordance with the results of proximate analysis of *dengkenaniura* with carp material cultivated in ponds from PematangSiantar that have been carried out previously by marination in jungga lime juice and spices for 9 hours [12].

Decrease in moisture content occurred due to the decreased binding capacity of water in fish meat tissue so that the water was pushed out of the tissue, caused by a decrease in pH [20]. Acid could cause protein hydrolysis. The hydrolysis reaction requires water so that the water in the fish tissue decreased [4].

Fat content decreased because in the marination process (immersion in organic acid solution), fat loss due to extraction of fat from fish meat into acidic solutions and spices [21].

Protein content in *dengkenaniura* could decrease due to soaking of carp meat in acidic solution. The chemical component that is heavily affected by the addition of acid is protein. In this marination process there could be swelling in the fish muscle (bloating) because the acid causes changes in the properties of collagen protein and will make fish meat soft without heat treatment [4]. Softening on the meat also caused by the hydrolysis of proteins by acid [20] [22]. According to [23] on acidified fish products, hydrolysis also occurred by the action of proteolytic enzymes. In acidic mediaproteolytic enzymes and trypsin remain active to break down part of the protein and release some free amino acids. Trypsin and chymotrypsin could attack the myofibrillar protein and cause tissue softening. Decrease in protein content can also occur due to breakdown caused by microbes. [24] states that heterofermentative Lactic Acid Bacteria could grow and cause decomposition on amino acids.

Increased levels of ash content in *dengkenaniura* caused by the spices attached to the meat. *Dengkenaniura* seasonings such as jungga acid, andaliman, candlenut, chilli pepper, onion, garlic, ginger, turmeric, galangal, torch lily and salt added ash to the *dengkenaniura*.

Generally fish contain carbohydrates in a very small amount (<0.5%) [25]. Carbohydrates in *dengkenaniura* come from spices.
3.2. The composition of amino acids of fresh carp and dengkenaniura

Analysis of amino acid composition of fresh carp meat and *dengkenaniura* with HPLC showed results as shown in Table 2. Both in fresh carp meat and *dengkenaniura* can be found 9 types of essential amino acids and 6 types of non-essential amino acids. In the case of *dengkenaniura* the number of amino acids increased slightly with the exception of amino acid histidine and methionine which decreased slightly. The number of essential amino acids in fresh carp meat was 24.12% and in *dengkenaniura* it increased to 25.67%. Amino acids lysine (4.5% in fresh meat and 4.55% in *dengkenaniura*), leucine (4.04% in fresh meat and 4.48% in *dengkenaniura*) and arginine (3.09% in fresh meat and 3.46% in *dengkenaniura*) are essential amino acids with the biggest amount. Methionine (1.37% in fresh meat and 1.36% in *dengkenaniura*) and histidine (1.54% in fresh carp and 1.42% in *dengkenaniura*) are the smallest amount of amino acids.

Likewise for non-essential amino acids in fresh meat were 21.93% increased to 23.65% in *dengkenaniura*. Glutamic acid (7.94% in fresh meat and 8.69% in *dengkenaniura*) and aspartic acid (5.07% in fresh meat and 5.54% in *dengkenaniura*) are the largest amount of non-essential amino acids. Tyrosine amino acids (1.6% in fresh meat and 1.78% in *dengkenaniura*) and serine (1.97% in fresh meat and 2.07% in *dengkenaniura*) are the smallest of non-essential amino acids.

| Amino Acids essential (AA ess) | Fresh Carp Meat (%) | Dengke Naniura (%) |
|-------------------------------|---------------------|---------------------|
| Lysine                        | 4.5 ± 0.27          | 4.55 ± 0.08         |
| Valine                        | 2.64 ± 0.35         | 2.92 ± 0.02         |
| Phenylalanine                 | 2.29 ± 0.40         | 2.46 ± 0.13         |
| I-leucine                     | 2.47 ± 0.23         | 2.75 ± 0.06         |
| Leucine                       | 4.04 ± 0.27         | 4.48 ± 0.09         |
| Methionine                    | 1.37 ± 0.09         | 1.36 ± 0.01         |
| Threonine                     | 2.18 ± 0.31         | 2.27 ± 0.03         |
| Histidine                     | 1.54 ± 0.47         | 1.42 ± 0.05         |
| Arginine                      | 3.09 ± 0.42         | 3.46 ± 0.05         |
| Total AA essential            | 24,12               | 25,67               |

| Amino Acids non-essential (AA non ess) | Fresh Carp Meat (%) | Dengke Naniura (%) |
|----------------------------------------|---------------------|---------------------|
| Aspartic Acid                          | 5.07 ± 0.10         | 5.54 ± 0.72         |
| Glutamic Acid                          | 7.94 ± 0.35         | 8.69 ± 0.13         |
| Serine                                 | 1.97 ± 0.30         | 2.07 ± 0.03         |
| Glycine                                | 2.26 ± 0.31         | 2.36 ± 0.02         |
Alanine  
3,09 ± 0,04  
3,21 ± 0,06  

Tyrosine  
1,6 ± 0,29  
1,78 ± 0,06  

Total AA non essential  
21,93  
23,65  

[14] analyzed amino acids in carp found in Iran’s freshwater and found the presence of 8 types of essential amino acids that also be found in the results of this research except for amino acid arginine. The percentage of amino acid in carp in Iran is two or three times greater than the carp of this research. The amino acid methionine is also the smallest amount of amino acid. [13] research on freshwater rainbow trout in Turkey also found that lysine as an essential amino acid and aspartic acid and glutamic acid as the largest amount of non-essential amino acids.

4. Conclusion
From the results of this research, it is concluded that the processing of fresh meat carp into dengke naniura results in changes of the proximate nutrient chemical composition and amino acid composition. Protein as the main nutritional component decreases by 2.1% and the fat decreases to 24.21%. Dengke naniura contains amino acids which are of the same type as fresh carp with a small increase observed in the amount of most types. The largest essential amino acids in fresh carp and dengke naniura are lysine, leucine and arginine, while the smallest amount found are methionine and histidine.

References

[1] A. Khomsan, *Pangan dan Gizi untuk Kesehatan*. Jakarta: PT. Raja Grafindo Persada, 2010.
[2] H. Warsito, Rindiani, and F. Nurdyansyah, *Ilmu Bahan Makanan Dasar*. Yogyakarta: Nuha Medika, 2015.
[3] A. Irawan, *Pengawetan Ikandan Hasil Perikanan*. Solo: Aneka, 1995.
[4] H. Belitz and G. W, *Food Chemistry*. Berlin, Germany: Springer-Verlag, 1997.
[5] H. A. Duyar and E. Eke, “Production and Quality Determination of Marinade from Different Fish Species,” *J. Anim. Vet. Adv.*, vol. 8, no. 2, pp. 270–275, 2009.
[6] A. Nainggolan and M. Manik, “Pengaruh penyimpanan dingin (chilling storage) dan lama penyimpanan terhadap mutu ikan mas (Cyprinus carpio) naniura,” Universitas HKBP Nommensen, 1997.
[7] M. B. Manalu, “MEMPERKENALKAN NANIURA MAKANAN KHAS BATAK SEBAGAI HIDANGAN APPETIZER,” *Mag. Ilm. Panor. Nusantr.*, vol. 7, pp. 52–61, 2009.
[8] M. Manik and B. Naibaho, “Pengaruh Natrium Benzoat dan Lama Penyimpanan terhadap Mutu ‘Dengke Mas Naniura’ (Ikan Mas Naniura),” Medan, 2005.
[9] M. Manik, “Pengaruh Natrium Benzoat dan Lama Penyimpanan pada Suhu Kamar terhadap Mutu ‘Dengke Mas Naniura’ (Ikan Mas Naniura),” in *Prosiding Seminar Nasional SNYuBe11*, 2013.
[10] Paiton, “Dekkenaiura (dengan resep),” 2013. [Online]. Available: dapursolia.blogspot.com/2013/01/dekke-nani-ura-dengan-resep.html. [Accessed: 10-Mar-2015].
[11] R. I. Pratama, I. Rostini, and M. Y. Awaluddin, “KOMPOSISI KANDUNGAN SENYAWA FLAVOR IKAN MAS (Cyprinus carpio) SEGAR DAN HASIL PENGUKUSANNYA,” *J. Akuatika*, vol. IV, no. 1, pp. 55–67, 2013.
[12] M. Manik, J. Kaban, J. Silalahi, and M. Ginting, “Komposisi Proksimat Dengke Naniura yang Diolah Dari Ikan Mas (Cyprinus carpio) Hasil Budidaya,” in *Seminar Nasional Kimia*, 2015.
[13] Ö. Özden, “Changes in amino acid and fatty acid composition during shelf-life of marinated...
fish,” *J. Sci. Food Agric.*, vol. 85, no. 12, pp. 2015–2020, Sep. 2005.

[14] Z. K. Khidhir, “Comparative Quality Assessments of Five Local Fresh Fish in Sulaimani City Markets,” College of Veterinary Medicine University of Sulaimani, 2003.

[15] AOAC, “Official Method of Analysis of The Association of Official Analytical of Chemist,” Arlington, 2005.

[16] M. Afkhami, A. Mokhlesi, K. D. Bastami, R. Khoshnoo, N. Eshaghi, and M. Ehsanpour, “Survey of some Chemical Compositions and Fatty Acids in Cultured Common Carp (Cyprinus carpio) and Grass Carp (Ctenopharyngodon idella), Noshahr, Iran,” *World J. Fish Mar. Sci.*, vol. 3, no. 3, pp. 533–538, 2011.

[17] K. S. J. Al-Hussainy, “Extraction of Oil from Fish and Their By-Products and Studying Their Chemical, Physical Properties and Their Uses in Food, Drug and Industrial Systems,” University of Basrah, 2007.

[18] A. Sary, M. Velayatzadeh, and K. Sary, “PROXIMATE Proximate composition of farmed fish,” *Adv. Environ. Biol.*, vol. 6, no. 11, pp. 2841–2845, 2012.

[19] A. A. Hantoush, Q. H. Al-Hamadany, A. S. Al-Hassoon, and H. J. Al-Ibadi, “Nutritional value of important commercial fish from Iraqi waters,” *Int. J. Mar. Sci.*, vol. 29, no. 1, pp. 13–22, 2015.

[20] J. Davidek, J. Velíšek, and J. Pokornéy, “Chemical Changes During Food Processing,” *Dev. Food Sci.*, vol. 21, 1990.

[21] M. Voldrich, J. Dobias, P. Kalac jr., and D. Curda, “Changes of fatty acid composition during the processing of fish,” *Food / Nahrung*, vol. 35, no. 6, pp. 663–664, Jan. 1991.

[22] F. G. Winarno, S. Fardiaz, and D. Fardiaz, *Pengantar Teknologi Pangan*. Jakarta: PT Gramedia Pustaka Utama, 1982.

[23] P. S. Jayasinghe, “Studies On the Chemical-Microbiological Aspects of Fish Curing,” University of Sri Jayawardanapura, 2000.

[24] J. Björkroth, “Microbiological ecology of marinated meat products,” *Meat Sci.*, vol. 70, no. 3, pp. 477–480, 2005.

[25] K. I. Sallam, A. M. Ahmed, M. M. Elgazzar, and E. A. Eldaly, “Chemical quality and sensory attributes of marinated Pacific saury (Cololabis saira) during vacuum-packaged storage at 4°C,” *Food Chem.*, vol. 102, no. 4, pp. 1061–1070, 2007.