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Meat quality of fresh Bonylip Barb and all-female hybrid Bonylip Barb (*Osteochilus hasselti* Valenciennes, 1842) fish based on organoleptic, physical and chemical characteristics

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Abstract
This research aimed to discover the quality comparison of fresh Bonylip Barb and all-female hybrid Bonylip Barb fish meat based on organoleptic, physical and chemical characteristics. The result showed that all-female hybrid Bonylip Barb fish was preferred by panelists, with median appearance, aroma and texture values is 7 or liked. Meat texture of Bonylip Barb fish and all-female hybrid Bonylip Barb fish are not significantly different, both of them have elastic and compact textures like fresh fish in general. Meat color of all-female hybrid Bonylip Barb fish was more yellowish white compared with Bonylip Barb fish. Nutrient content of Bonylip Barb fish includes 81.77% of water content, 1.40% of ash content, 15.99% of protein content, 0.58% of lipid content and 0.26% of carbohydrate content, while all-female hybrid Bonylip Barb fish has 80.55% of water content, 1.50% of ash content, 15.43% of protein content, 0.79% of lipid content and 1.74% of carbohydrate content.

Keywords: Fish meat, hybrid Bonylip Barb Fish, Bonylip barb fish, nutrient content, organoleptic

1. Introduction
Bonylip Barb (*O. hasselti*) have a high fecundity value, thus it can be processed into caviar to replace eggs from Sturgeon fish. The demand for female Bonylip Barb has increased since it was known, through hybridization technique all-female hybrid Bonylip Barb produced to supply market demand. Bonylip Barb with a higher percentage of female sex (all-female hybrid Bonylip Barb) produced by crossbreeding the functional male Bonylip Barb with female hybrid (from crossbreeding between female Bonylip Barb with male common carp) (Firdaus 2017) [11].

Different inherited character of each parent makes the genetic of Bonylip Barb and all-female hybrid Bonylip Barb is different. The structure of genetic will affect the growth of fish, one of which is the quality of meat. Quality of fish meat is generally assessed using the sensory method of organoleptic characteristics. The assessment results will affect the consumer's decision making which relates to the preferred level. The assessment results using sensory method can be reinforced with measurement towards texture and color of the fish meat using tools. Firmness is one of the terms in texture which is used to measure the strength of viscoelastic foodstuffs in withstanding loads until they are crushed or shredded (Viet 1991 *in* Fabera 2016) [9]. The color measurement system has various systems, one of the recommended systems to measure the color of foodstuffs is the color space from the *Commision Internationale de L'Clairage (CIE) L* a* b**, because the color perception is closest to human eye's color perception (Markovic *et al.* 2014) [18]. The other parameters is nutrient content, because it is one of the important factors that determine the level of health between physical and mental growth. Auliana (2001) [3], the nutrients needed by the living bodies consist of water, ash, protein, lipid, and carbohydrate. The nutritional value of fish is good because it has higher digestibility and biological value compared to other meat (Ciptanto 2010) [6].

The fish meat quality of all-female hybrid Bonylip Barb meat has not been known, because so far the research is concentrated on its eggs only. This research aimed to compare the quality of Bonylip Barb and all-female hybrid Bonylip Barb meat based on organoleptic, physical and chemical characteristic.

2. Materials and Methods

This research was conducted at Technology of Fishery Products Laboratory of Faculty of Fisheries and Marine Science Padjadajaran University for hedonic test, Test Laboratory of Faculty of Agricultural Industrial Technology Padjadjaran University for physical test and Central Laboratory of Padjadjaran University for proximate analysis. The tools used in this research are Cool Box, Knives, Cutting Board, Feeding Tube, Paper Labels, Styrofoam Plate, Score Sheet, Stationery, Ziplock Plastic, Laptop with *Exponent Lite Express* software, *Texture Analyzer TA.XT Express*, *Chroma Meter Minolta CR – 400* and a set of laboratory tools for proximate analysis. The materials used in this research are Bonylip Barb and all-female hybrid Bonylip Barb fish (weight ±100 – 150 gram), ice cubes, and chemical materials needed for proximate analysis (HCl, hexane solvent, H_2SO_4, $CuSO_4$, K_2SO_4, aquades, NaOH 30%, H_3BO_3 and tashiro indicators).

The method used in this research is non-experimental method, it is a research whose observations are made on a number of unmanipulated variables (Raacke 2014) [26]. This research uses two samples, namely the female Bonylip Barb fish (sample code 310) and all-female hybrid Bonylip Barb fish (sample code 597). The observations made are the organoleptic, physical, and chemical test.

The organoleptic characteristics are tested using the hedonic test to measure the preference level towards several organoleptic characteristics, such as appearance, aroma and texture of the Bonylip Barb and all-female hybrid Bonylip Barb fish. The panellists used in the hedonic test are semi-trained panellists consist of the students of Fisheries, Faculty of Fisheries and Marine Science, Padjadjaran University who have experience in hedonic test and have been given advanced explanations about fresh fish products. The number of semi-trained panellists used is 20 people as a test.

Physical test of Bonylip Barb and all-female hybrid Bonylip Barb fish is done to strengthen the results of hedonic test because it uses tools. Physical test consists of texture in the form of firmness value and fish meat color in the form of L*, a* dan b* values. The fish meat texture is tested using the *Texture Analyzer TA.XT Express* tool, while the color is tested using *Chroma Meter Minolta* CR – 400. The texture and color test are done to three spots, namely the upper part of the fish meat near the head, the center and near the base of the tail. The total replications for texture and color test are six replications each.

Chemical test is in the form of proximate analysis, with the aim for knowing the value of nutrient content of Bonylip Barb and all-female hybrid Bonylip Barb fish meat. The nutrient content consists of water content, ash content, protein content, lipid content and carbohydrates content.

The data result of hedonic test is analyzed using non-parametric statistics namely the "Wilcoxon Signed Small Sample Ranking Test". Besides that, the result is also analyzed using *Bayes* method to know the most important organoleptic characteristics considered by the panellist in the assessment of fresh Bonylip Barb fish meat quality, also to determine the more preferred sample by the panellists. The statistical data analysis used in the physical test for firmness and color is the t-Test (*Student's T-Test*). The proximate data analysis result for water content, ash content, protein content, lipid content and carbohydrates content uses comparative descriptive analysis. Explanation of nutrient content of each sample is described after the laboratory result is obtained, and then it is compared to know the difference of nutrient content from those two samples.

3. Results and Discussions

3.1 Hedonic Test

3.1.1 Appearance

Appearance is the first characteristic observed by the panellist in consuming a product (Soekarto 1995). The observed appearance is the outer appearance of the fish. Appearance of Bonylip Barb and all-female hybrid Bonylip Barb can be seen in Figure 1.

(a) (b)

Fig 1: (a) Bonylip Barb Fish, (b) All-female Hybrid Bonylip Barb Fish

Bonylip Barb fish has a darker body color and a rounded body shape. All-female hybrid Bonylip Barb fish has a brighter body color with a more regular scales pattern, and an elongated body shape. The fins of all-female hybrid Bonylip Barb look more symmetrical compared to the common Bonylip Barb fish. Firdaus (2017) [11] stated that the morphometric value of all-female hybrid Bonylip Barb fish is superior compared to the common Bonylip Barb fish, it is because there is an effort of genetic improvement through hybridization technique. The average of observation results for the appearance of Bonylip Barb and all-female hybrid Bonylip Barb fish can be seen in Table 1.

Table 1: Average Appearance Value of Fresh Bonylip Barb and All-female Hybrid Bonylip Barb Fish

Sample	Appearance
Bonylip Barb Fish	6.5^a
All-female Hybrid Bonylip Barb Fish	7.8^b

Description: The number followed by different letters shows real difference based on Wilcoxon Signed Small Sample Ranking Test with the level of 5%.

The assessment result from the panellists gives the average score of 6.5 for Bonylip Barb fish and 7.8 for the all-female hybrid Bonylip Barb fish. These numbers represent that the panellists like the appearance of both fishes. Based on the statistical analysis result using "Wilcoxon Signed Small Sample Ranking Test" at the level of 5% shows that there is a real difference between the appearance of Bonylip Barb fish and all-female hybrid Bonylip Barb fish. Panellists prefer the all-female hybrid Bonylip Barb compared to the common Bonylip Barb fish.

3.1.2 Aroma

Aroma is the attraction to make the consumers feel interested in a certain material or a food product. Fish has the aroma originated from volatile compounds. The average aroma value of Bonylip Barb and all-female hybrid Bonylip Barb fish can be seen in Table 2.

Table 2: Average Aroma Value of Fresh Bonylip Barb and All-female Hybrid Bonylip Barb Fish

Sample	Aroma
Bonylip Barb Fish	6.1[a]
All-female Hybrid Bonylip Barb Fish	7.1[b]

Description: The number followed by different letters shows real difference based on Wilcoxon Signed Small Sample Ranking Test with the level of 5%.

Aroma of the fish is typical and it develops according to the content of volatile compounds a certain species of fish has. Freshwater fish has a higher *Lipoxygenase* enzyme activity compared to the sea-water fish, resulting in the aroma similar with the plants like cucumber and melon that are produced from unsaturated C9 compounds in which 2,6-nonadienal is one of them. The aroma is the acceptable aroma in fish (Ólafsdóttir 2005) [23].

The average evaluation of panellists towards the aroma of Bonylip Barb fish is 6,1, while their evaluation towards the aroma of all-female hybrid Bonylip Barb fish is higher, 7,1. Based on hedonic scale, both of them are still acceptable and favoured by the panellist within that range. According to the statistical analysis using "Wilcoxon Signed Small Sample Ranking Test" at the level of 5%, it is shown that the result has a real difference. Panellists prefer the aroma of all-female hybrid Bonylip Barb fish. Bonylip Barb and all-female hybrid Bonylip Barb has a fresh aroma, but all-female hybrid Bonylip Barb has more neutral aroma. It is suspected that the aroma similar to the plant which originates from C9 compounds is more dominant in all-female hybrid Bonylip Barb, because the all-female hybrid Bonylip Barb used in this research is in the mature state of gonad *in* Ólafsdóttir (2005) [23] states that the increase of *Lipoxygenase* enzyme activity can produce the derived C9 compounds in the freshwater fish whose gonad is in the mature state.

3.1.3 Texture

Fish meat has shorter protein fibers and higher water content, causing fish meat to be well known as an easily damaged food (Effendie 2002) [7]. The average texture value of Bonylip Barb and all-female hybrid Bonylip Barb fish can be seen in Table 3.

Tabel 3: Average Texture Value of Fresh Bonylip Barb and All-female Hybrid Bonylip Barb Fish

Sample	Texture
Bonylip Barb Fish	7.3[a]
All-female Hybrid Bonylip Barb Fish	7.3[a]

Description: The number followed by different letters shows real difference based on Wilcoxon Signed Small Sample Ranking Test with the level of 5%.

Bonylip Barb and all-female hybrid Bonylip Barb fish meat has the average texture value of 7.3 which means there is no difference between those two, even after it has been analyzed using the "Wilcoxon Signed Small Sample Ranking Test" at the level of 5% it shows that there is no real difference. The result of organoleptic test is directly proportional to the physical test result using *Texture Analyzer TA.XT Express* tool towards the firmness value of Bonylip Barb fish meat and all-female hybrid Bonylip Barb fish meat where there is no significant difference. Both of them have elastic and compact texture of fish meat like other fish meat in general. The low water content can produce a hard and rigid texture of fish meat, while the high water content can produce a soft and elastic texture (Suryaningrum 2010) [32]. This research result shows that the water content of Bonylip Barb fish is 81.77% and the water content of all-female hybrid Bonylip Barb fish is 80.55%. Both fish have a high water content and the level is not too different, so it makes the texture of both fish meat become elastic and compact. The texture of fish meat is also affected by the protein content, because protein is the main tissue builder of the fish meat (Love 1992) [17]. The protein content of Bonylip Barb and all-female hybrid Bonylip Barb fish is not that different with its water content, that is 15.99% for Bonylip Barb fish and 15.43% for all-female hybrid Bonylip Barb fish, thus there is no real difference between both texture of fish meat. The body size of fish also affects the texture of fish meat, because as the body size increases, the fiber size in the fish meat is also increased, the distribution of fiber size in fish varies according to the increase in cell size due to the volume increase (*hypertrophic*) and increased muscle volume due to the increased cell number (*hyperplasia*). The size of fish used in this research is relatively the same, it has weight around 100 – 150 gram, thus there is no significant difference between both textures of fish meat.

3.2 Decision Making with *Bayes* Method

Determination of the most important criteria in the hedonic test can be done using Bayes method. The result of criteria calculations can be seen in Table 4.

Table 4: Criteria Value of Fresh Bonylip Barb and All-female Hybrid Bonylip Barb Fish

Criteria	Appearance	Aroma	Texture	Total Value	Priority
Appearance	1	1.4	0.9	3.35	0.36
Aroma	0.7	1	1.6	3.34	0.36
Texture	1.1	0.6	1	2.68	0.29
Total				9.36	1.00

According to the calculation result of appearance characteristic, aroma, and texture, the highest criteria value is the appearance and aroma criteria. Appearance and aroma have the same criteria value, 0.36. Connel (1975) *in* stated that aroma is a strong parameter in assessing the quality of fresh fish, because it is possible to determine the level of fish freshness accurately. According to that, aroma is the most important criteria to determine the Bonylip Barb fish product and fresh all-female hybrid Bonylip Barb fish product. After it has been known that appearance and aroma are the two most important characteristics, the calculation of appearance and aroma is done for each sample. Determination of a product by *Bayes* method using *mean* value can be seen in Table 5

Table 5: Determination of a Product by *Bayes* Method Using *Mean* Value

Sample	Criteria			Alternative Value	Priority Value
	Appearance	Aroma	Texture		
Bonylip Barb Fish	6.50	6.10	7.30	6.59	0.47
All-female Hybrid Bonylip Barb Fish	7.80	7.10	7.30	7.41	0.53
Criteria Value	0.36	0.36	0.29	13.99	1.00

According to Table 5, it can be known that the all-female hybrid Bonylip Barb is more preferred by the panellists compared to the
Bonylip Barb fish. All-female hybrid Bonylip Barb has alternative value of 7.41 and priority value of 0.53, meanwhile the Bonylip Barb has alternative value of 6.59 and priority value of 0.47. All-female hybrid Bonylip Barb fish is more preferred by the panellists because it has a more interesting appearance, which is a brighter body color with a more regular scales pattern, a more elongated body shape, and a fin that looks more symmetrical compared to the common Bonylip Barb fish. The aroma of all-female hybrid Bonylip Barb is also more preferred by the panellists because it has a fresh and has more neutral aroma compared to the common Bonylip Barb fish. Both fish have the relatively same textures.

3.3 Physical Test

3.3.1 Texture

The measured texture of fish meat is the *firmness*. *Texture Analyzer* is a tool used to measure the *firmness* value of fish meat with compression method. *Firmness* value is the total force needed to deform the product, this value shows the strength of a product to withhold certain load until it is shredded or crushed. The average texture value of Bonylip Barb and all-female hybrid Bonylip Barb fish meat can be seen in Table 6.

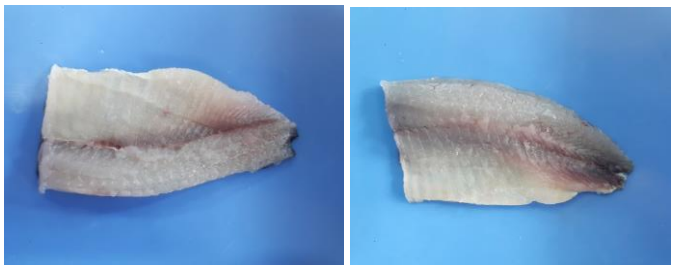
Table 6: Average Texture Value (*Firmness*) of Bonylip Barb Fish Meat and Fresh All-female Hybrid Bonylip Barb Fish Meat

Sample	*Firmness* (gForce)
Bonylip Barb Fish	1396.9[a]
All-female Hybrid Bonylip BarbFish	1392.5[a]

Description: Numbers followed by the same letters show that there is not significant difference based on t-Test at the level of 5%.
Firmness value of Bonylip Barb fish is 1396.9 *gForce* dan and the *firmness* value of all-female hybrid Bonylip Barb fish is 1392.5 *gForce*. Bonylip Barb fish has a slightly higher *firmness value* compared to the all-female hybrid Bonylip Barb. The greater the *firmness* value of a fish meat, the more compact and solid the fish meat will be, because the force given is greater to deform the product, and vice versa. According to the statistical analysis result using the t-Test at the level of 5%, the *firmness* value of Bonylip Barb fish meat and all-female hybrid Bonylip Barb fish meat is not significantly different, this is directly proportional with the panellists assessment in the hedonic test towards the texture of fish meat. Water and protein content of the Bonylip Barb and all-female hybrid Bonylip Barb fish are not that different, thus the textures of both fish meat are not significantly different. Both components can affect the texture of fish meat because low water content can produce a hard and rigid fish meat, meanwhile the high water content can produce a soft and elastic fish meat (Suryaningrum 2010) [32]. The research result shows that Bonylip Barb fish and all-female hybrid Bonylip Barb have high water content, 81, 77% for the Bonylip Barb and 80,55% for the all-female hybrid Bonylip Barb. Protein content can also affect the texture because it is the main tissue builder of the fish meat (Love 1992) [17]. The size of fish used in this research is relatively the same, with the weight about 100 – 150 gram, thus there is no difference between both textures of fish meat. The size of the fish can also affect the texture, as the size of the fish increases, the fiber size in the fish meat is also increased.

3.3.2 Color

Bonylip Barb fish meat is classified as the "light or white meat", where it has a high protein content and a relatively low lipid content. The measurement of color of the fish meat uses the tool named *Chroma Meter Minolta CR – 400*, and the value appeared will be in the form of L*, a* and b* value.



(a) (b)

Fig 2: (a) Bonylip Barb Fish Meat, (b) *All-female* Hybrid Bonylip B arb Fish Meat

Coordinate L* (lightness) shows the lightness level which has range from 0 – 100. The 0 value indicates black color and the 100 value indicates white color. Coordinate a* and b* do not have certain numerical limit and show chromatic color. Positive value of a* (+a*) indicates red color, negative value of a* (-a*) indicates green and 0 is the neutral one. Positive value of b* (+b*) indicates yellow color, negative value of b* (-b) indicates blue color and 0 is the neutral one (Pratama 2007) [24]. The average value of L*, a* dan b* of the Bonylip Barb and all-female hybrid Bonylip Barb fish meat can be seen in Table 7.

Table 7: Average Value of L*, a* and b* of the Bonylip Barb and Fresh All-female Hybrid Bonylip Barb Fish Meat

Sample	Color		
	L*	a*	b*
Bonylip Barb Fish	44.46[a]	1.88[a]	0.28[a]
All-female Hybrid Bonylip Barb Fish	46.49[a]	1.52[a]	1.93[b]

Description : Numbers followed by the same letters show that there is no significant difference based on T test at the level of 5%.
The measurement result using *Chroma Meter Minolta CR – 400* shows that the L* value for Bonylip Barb fish is 44.46 and the L* value for the *all-female* Bonylip Barb fish is 46.49. Low level of lightness in fish meat, affected by high water content, and preferably. This is directly proportional to the results of the research, in which Bonylip Barb has higher

water content compared with all-female hybrid Bonylip Barb, but intermediate amount is not significant, so there is no significant difference in statistical analysis result using t-Test towards the L* value between both of the fish meat, meaning that Bonylip Barb and *all-female* Bonylip Barb fish meat have the relatively same lightness level in color. The a* value of the Bonylip Barb (1.88) is higher compared to the *all-female* Bonylip Barb fish (1.52). The positive value of a* indicates the red color which originates from the myoglobin content in the fish meat. Myoglobin is a protein molecule called globin and the non-protein part called the heme group which transports and stores oxygen to the muscle tissues, myoglobin gives the reddish pigment which affects the color of the meat (Etza 2014) [8]. Statistical analysis result using the t-Test shows that there is no significant difference between the a* value of Bonylip Barb fish meat and the *all-female* hybrid Bonylip Barb fish. Bonylip Barb fish has the b* value of 0.28, it is quite lower compared to the *all-female* hybrid Bonylip Barb fish which has the b* value of 1.93. It is also proven in the statistical analysis using the t-Test showing that the b* value between the Bonylip Barb and the *all-female* hybrid Bonylip Barb fish has significant difference. The positive value of b* indicates yellowish color, but in the Figure 2 the significant yellowish color difference is not seen by the naked eyes of human. The higher yellowish color in the *all-female* hybrid Bonylup barb fish is thought to be originated from then *zeaxanthin* carotene pigment released by the phytoplankton which becomes the natural food of fish when it is being kept inside the maintenance pond (Watson 2011) [34]. *Chlorella* sp. is a kind of phytoplankton which produces several kinds of carotenoids, such as *beta-carotene*, *alpha-carotene*, *zeaxanthin*, *astaxanthin* and *neoxanthin*.

3.4 Proximate Analysis

Proximate analysis is conducted to know the nutrient content in the form of chemical composition in the Bonylip Barb and fresh *all-female* hybrid Bonylip Barb fish meat. The chemical compositions which are analyzed by the proximate analysis include the water content, ash content, protein content, lipid content and carbohydrates content. The result of proximate analysis can be seen in Table 8.

Table 8: Proximate Analysis Result on Bonylip Barb and *All-female* Hybrid Bonylip Barb Fish Meat

Sample	Water Content	Ash Content	Protein Content	Lipid Content	Carbohydrates Content
	(%, b/b)				
Bonylip Barb Fish	81.77	1.40	15.99	0.58	0.26
All-female Hybrid Bonylip Barb Fish	80.55	1.50	15.43	0.79	1.74

Nutrition value of fish is very good because fish is more digestible and has a higher biological value compared to other animals' meat (Ciptanto 2010) [6]. The proximate analysis result on the nutrient content of Bonylip Barb and *all-female* hybrid Bonylip Barb fish can be seen in Table 8.

3.4.1 Water Content

Water content has the highest percentage compared to other chemical compositions because basically fish is composed of water as its main content at the range of 66 – 84% (Nurrachman 2006) [22]. This causes the fish to be well known as an easily damaged food product (Effendie 2002) [7]. Water inside the fish meat has two forms, the free water and the bound water which is kind of difficult to be removed from the fish meat even by drying it (Nurrachman 2006) [22].

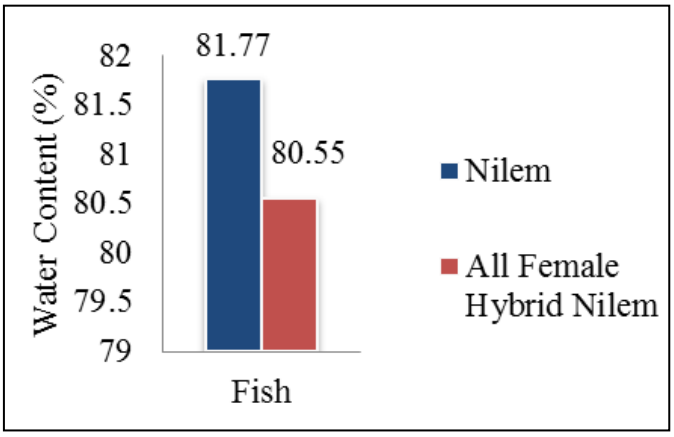


Fig 3: Graph of Water Content Percentage in Bonylip Barb and All-female Hybrid Bonylip Barb Fish

According to the result of proximate analysis, it can be seen in Figure 3 that the Bonylip Barb fish has 81.88% of water content, while the *all-female* hybrid Bonylip Barb fish has a lower percentage of water content which is 80.55%. The percentage obtained is not that different with the research done by Pratama and Rostini (2017) who mentioned that the water content of fresh Bonylip Barb is 78.45%. The water content of Bonylip Barb and *all-female* hybrid Bonylip Barb fish meat are relatively the same, thus there is no difference in panellists assessment and measurement using the *Texture Analyzer TA.XT Express* to observe the textures of both fish meat. The water content of Bonylip Barb and *all-female* hybrid Bonylip Barb show a quite high percentage. The high water content in fish meat produces a soft and elastic texture of fish meat (Suryaningrum 2010) [32].

3.4.2 Ash Content

Ash content shows the unburned inorganic substances of a material during the combustion process (Winarno 2008) [35]. The percentage of ash content in Bonylip Barb and *all-female* hybrid Bonylip bard fish can be seen in Figure 4.

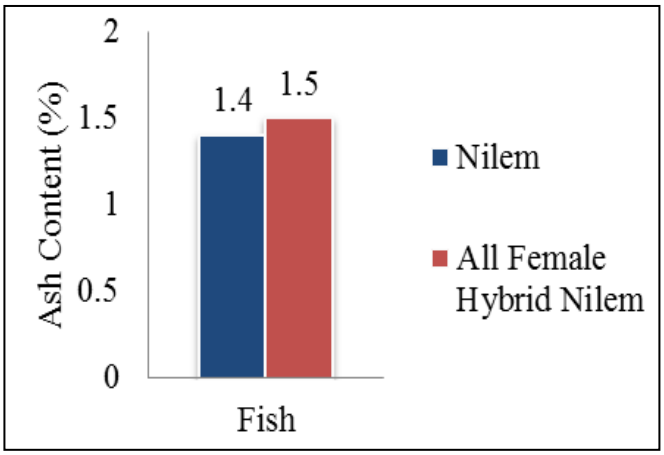


Fig 4: Graph of Ash Content Percentage in Bonylip Barb and All-female Hybrid Bonylip Barb Fish

Ash content percentage in Bonylip Barb and all-female hybrid Bonylip Barb fish can be seen in Figure 4. Bonylip Barb has 1.4% of ash content, meanwhile the all-female hybrid Bonylip Barb fish has a slightly higher ash content which is 1.5%. The percentage obtained is very close to the research result of Pratama dan Rostini (2017) [25] who mentioned that the ash content of fresh Bonylip Barb fish is 1,48%. The percentage is still in accordance with the standard of fresh fish quality based on SNI 01-2354.1-2006 (Indonesian National Standard) which states that the fresh fish quality has the ash content less than 2%. The ash content in a material estimates the minerals content of that material, in the fish meat there are several minerals like phosphorus, calcium, iron, magnesium, sulfur, sodium and potassium (Rosa *et al*. 2007) [28]. Ash content in fish meat is the good source of minerals for human body (Hall 2010) [12].

3.4.3 Protein Content

Fish is an excellent protein source because it is known to have a high protein level and has essential amino acids almost entirely needed by human body (Aberoumand 2014) [1]. Protein content in fish is the second highest content after water (Sulastri 2014) [31]. Consuming protein from fish is very beneficial for body as the cells and tissues builder, regulator of the metabolism system and as the fuel inside the body (Munthe *et al*. 2016) [20].

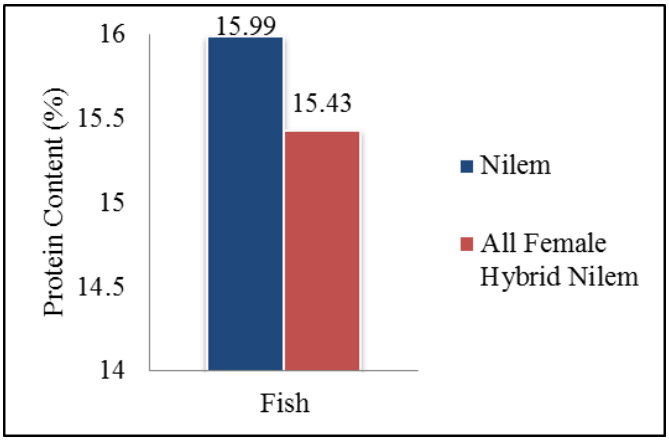


Fig 5: Graph of Protein Content Percentage in Bonylip Barb and *All-female* Hybrid Bonylip Barb Fish

Proximate analysis result can be seen in Figure 5, it is shown that the protein content percentage of Bonylip Barb is 15.99%, meanwhile the protein content percentage of *all-female* hybrid Bonylip Barb fish is 15.43%. The percentage is close to the research result of Pratama dan Rostini (2017) [25] who mentioned that the protein content of fresh Bonylip Barb fish is 14.98%. Bonylip Barb and *all-female* hybrid Bonylip Barb fish are categorized as fish with high protein content, because fish with the protein content at the range of 15 – 20% is classified into the high-protein fish (Nurhayati 2007) [21]. Protein content in the fish body can also affect the texture of fish meat, because protein is the main tissue builder in the fish meat (Love 1992) [17] *in* Bosch (2012) [5] stated that protein inside the muscle tissue of fish is divided into three parts, namely the structural protein (which consists of *actin*, *myosin*, *tropomyosin* and *actomyosin*), sarcoplasmic protein (which consists of *myoalbumin*, *globulin* and enzymes) and also the connective tissues protein (*collagen*).

3.4.4 Lipid Content

Fish has the dominant lipid which consists of triglyceride compounds and lipidty acids. Lipid has functions as the efficient energy source, also as the solvent of vitamins which are insoluble in water, as well as the source of essential lipidty acids (Sumardjo 2008) [30]. Most lipidty acids in fish are considered as the unsaturated lipidty acids (Sulastri 2004) [31]. Fish has various amounts of lipid, some have a high lipid content and vice versa. The Bonylip Barb is considered as a low-lipid fish because it has lipid content of <5% (Junianto 2003) [15].

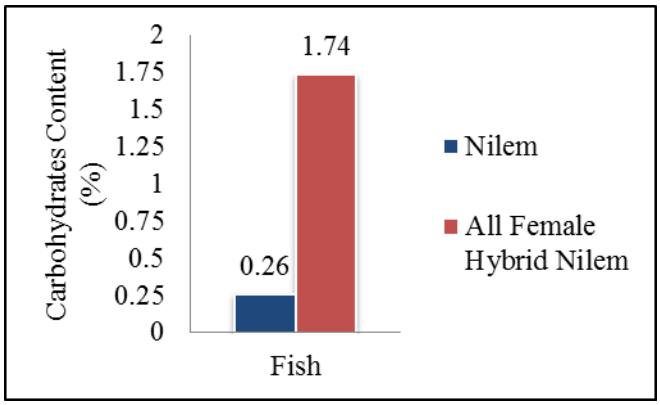


Fig 6: Graph of Lipid Content Percentage in Bonylip Barb and *All-female* Hybrid Bonylip Barb Fish

Lipid content in Bonylip Barb and all-female hybrid Bonylip Barb fish can be seen in Figure 6. Bonylip Barb fish has 0,58% of lipid content, meanwhile the *all-female* hybrid Bonylip Barb has 0,79% of lipid content. This percentage is quite different compared to the research result of Pratama dan Rostini (2017) [25] who stated that the lipid content of fresh Bonylip Barb fish is 2, 18%. It is suspected because the Bonylip Barb and *all-female* hybrid Bonylip Barb fish used in this research are the ones having gonads in the mature state, it is proven by several *all-female* hybrid Bonylip Barb fish which released eggs while the research was being conducted. In the mature phase of gonad, there is a decrease of lipid content in fish meat, because the lipid is transported to the gonad (Bosch 2012) [5]. Lipid content correlates with the water content in the fish meat, if the lipid content is high, then the lipid content is low, and vice versa (Jacquot 1961 *in* Bosch 2012) [5]. It is in accordance with the research result where Bonylip Barb has a lower lipid content compared to the *all-female* hybrid Bonylip Barb fish, but it has a higher water content compared to *all-female* hybrid Bonylip Barb, meanwhile the *all-female* hybrid Bonylip Barb which has a higher lipid content than the Bonylip Barb, has a lower water content compared to the Bonylip Barb fish.

3.4.5 Carbohydrates Content

Carbohydrates that enter the fish body will be digested with the help of amylase enzyme and turned into simple glucose. The final result of carbohydrates digestion is glucose which will be absorbed by the intestinal wall and circulated through the circulation system to the whole body parts, and then the glucose will be stored in the form of glucose or glycogen (Afrianto and Liviawaty 2005) [2].

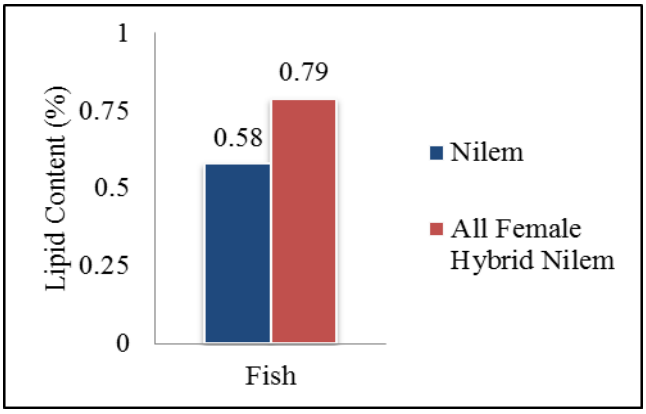


Fig 7: Graph of Carbohydrates Content Percentage in Bonylip Barb and *All-female* Hybrid Bonylip Barb Fish

Carbohydrates content calculation resulted from the *by difference* method can be seen in Figure 9, which is 0,26% for Bonylip Barb fish and 1,74% for the *all-female* hybrid Bonylip Barb fish. They have a relatively distant difference. Carbohydrates content is greatly influenced by other nutrients content because carbohydrates content is calculated by the *by difference* method, which is by reducing 100% with water content, ash content, protein and lipid content gained from the result of proximate analysis (Winarno 2008) [35]. Calculation using *by difference* method does not show the actual result, only close to the actual result, because there are still other nutrients content (in low amounts) that have not been analyzed yet.

3.5 Recapitulation of Research Results on Meat Quality of Fresh Bonylip Barb and All-female Hybrid Bonylip Barb Fish (*O. hasselti*)

Parameters used to assess the fish meat quality of Bonylip Barb and fresh all-female hybrid Bonylip Barb fish include the organoleptic, physical, and chemical characteristics. Recapitulation of research results can be seen in Table 9.

Table 9: Recapitulation of Research Results on Fish Meat Quality of Bonylip Barb Fish and Fresh All-female Hybrid Bonylip Barb Fish

Parameter	Sample	
	Bonylip Barb Fish	***All-female* Hybrid Bonylip Barb Fish**
Hedonic Test		
Appearance	6.5[a]	7.8[b]
Aroma	6.1[a]	7.1[b]
Texture	7.3[a]	7.3[a]
Bayes Method		
Alternative Value	6.59	7.41
Physical Test		
Texture (*gForce*)	1396.9[a]	1392.5[a]
Color		
L*	44.46[a]	46.49[a]
a*	1.88[a]	1.52[a]
b*	0.28[a]	1.93[b]
Proximate Analysis		
Water Content (%, b/b)	81.77	80.55
Ash Content (%, b/b)	1.40	1.50
Protein Content (%, b/b)	15.99	15.43
Lipid Content (%, b/b)	0.58	0.79
Carbohydrates Content (%, b/b)	0.26	1.74

Organoleptic characteristics are assessed by hedonic test to know the panellists' preference level towards the organoleptic characteristics consisting of appearance, aroma and texture. Physical characteristics which are tested are the texture of fish meat by observing the *firmness value* and the color of fish meat by observing the L*, a* and b* value according to the system at the *Commision Internationale de L'Clairage* (*CIE*). Chemical characteristics are tested by using proximate analysis to know the nutrient content of the fish meat including the water, ash, protein, fat, and carbohydrates content.

According to the result of hedonic test towards the organoleptic characteristics of the Bonylip Barb and all-female hybrid Bonylip Barb fish meat, both fish are classified into categories which are still preferred by the panellists. The results are then tested further using the *Bayes* method where it is shown that the all-female hybrid Bonylip Barb fish has a high alternative value, 7.41, so it is concluded that the all-female hybrid Bonylip Barb fish is more preferred by the panellists compared to the Bonylip Barb fish.

Physical test towards the *firmness* value of the Bonylip Barb and the all-female hybrid Bonylip Barb fish meat shows that there is no significant difference between them. Both fish have elastic and compact textures of fish meat just like other fresh fish meat in general. According to the measurement result using *Chroma Meter Minolta CR – 400*, the Bonylip Barb fish meat has a lightness level and reddish color which originate from the relatively same mioglobin as the all-female hybrid Bonylip Barb fish, but the all-female hybrid Bonylip Barb fish has a more yellowish color compared to the common Bonylip Barb, although the difference in the yellow color intensity is not that visible when it is seen by naked eyes. The higher yellowish color in the all-female hybrid Bonylip Barb fish is thought to be derived from *zeaxanthin* carotene pigment released by the phytoplankton which becomes the natural food of fish when it is kept inside the maintenance pond. (Watson 2011) [34].

Proximate analysis towards the Bonylip Barb and all-female hybrid Bonylip Barb fish meat shows that the Bonylip Barb fish has a slightly higher water content and protein content compared to the all-female hybrid Bonylip Barb fish, meanwhile the all-female hybrid Bonylip Barb fish has a slightly higher ash content, fat, and carbohydrates content compared to the Bonylip Barb, but the difference is not that significant. Various factors can affect the chemical composition or nutrient content in the fish meat asides from

genetic factor. Age, season, environment, and food as the nutritional intake for the fish can also affect the chemical composition or nutrient content in the fish meat.

4. Conclusion

The research results on the fish meat quality of Bonylip Barb fish and fresh all-female hybrid Bonylip Barb fish based on organoleptic, physical and chemical characteristics can be summarized as follows:

1. According to the decision making by using the *Bayes* method, all-female hybrid Bonylip Barb fish is more preferred by the panellists because it has a higher priority value, which is 0.53, meanwhile the priority value of the common Bonylip Barb fish is only 0.47, but both fish have the same median value from the hedonic scale, 7, which means they are both preferred.
2. The textures of Bonylip Barb and all-female hybrid Bonylip Barb fish meat are not significantly different, both of them have elastic and compact textures just like other fresh fish meat in general. The color of the all-female hybrid Bonylip Barb fish is more yellowish white compared to the common Bonylip Barb fish.
3. The nutrient content of the all-female hybrid Bonylip Barb fish is as follows: it has 80.55% of water content, 1.50% of ash content, 15.43% of protein content, 0.79% of fat content 1.74% of carbohydrates content. Bonylip Barb fish has the following nutrient content: 81.77% of water content, 1.40% of ash content, 15.99% of protein content, 0.58% of fat content and 0.26% of carbohydrates content.

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