Chemical Characteristics of Tilapia (Oreochromis niloticus) Sausage using Yellow Pumpkin (Cucurbita moschata Durch) as Substitute Flour

by Agustiana Agustiana

Submission date: 15-May-2023 10:16PM (UTC-0400)
Submission ID: 2094250715
File name: 1._A._chemical_characteristics.pdf (396.91K)
Word count: 3614
Character count: 18803

International Journal of ChemTech Research
CODEN (USA): IJCRGG, ISSN: 0974-4290, ISSN(Online):2455-9555
Vol.10 No.6, pp 116-124, 2017

Chemical Characteristics of Tilapia (*Oreochromis niloticus*) Sausage using Yellow Pumpkin (*Cucurbita moschata* Durch) as Substitute Flour

Agustiana[1]* and Hafni Rahmawati[1]

Fish Technology Progam Study, Fish Processing Department, Fisheries and Marine Faculty, LambungMangkurat University, Jl. Jenderal Achmad Yani KM.36, Banjarbaru, 70714, Indonesia

Abstract : Pumpkin is a plant that is efficacious as good anti-oxidants due to its chemical contents, such as beta carotene, vitamin A, vitamin C, zinc, and selenium. It can be processed into flour, which is then substitutedin fish sausage processing to improve the nutritional value. This study was aimed to get the right percentage substitution of pumpkin flour, to know the effect of pumpkin flour substitution on the content of proximate and beta carotene of tilapia sausage product. The pumpkin was dried on sunlight for 2-3 days, and then continued with flour production. The flour was used as substitute material in tilapia sausage production at the concentration of 0%, 10%, 15% and 20% of the total fish sausage batter. The study employed a completely randomized design (CRD) with 4 treatments and 3 replications. Results showed that tilapia fish sausage using pumpkin flour as substitute loweredthe water content andcarbohydrates but increased ash content, protein, fat, and beta carotene. Tilapia fish sausage with 20% of substitute pumpkin flour was the best treatment of chemical tests, yieldingwater content of 59.75%, ash of3.64%, protein of8.02%, fat of3.02%, carbohydrate of 25.57%, and beta carotene of 3.075μg/g. The percentsubstitute pumpkin flour could increase beta carotene content in tilapia fish sausage ranged between 1,965 μg/g up to 3,075 μg/g and reduce the water content and carbohydrate.
Keywords : Tilapia Fish Sausage, Pumpkin Flour, Chemical Characteristics.

Introduction

Fish is one of the highly potential aquatic commodities to be utilized. Tilapia (*Oreochromis niloticus*), is one of the sufficiently favored fish species as human consumption. *O. niloticus* production from culture activities in South Kalimantan has increased from year to year, from 19,637 tonsin 2009 to 24,834 tons in 2010. The fish production of 2011 reached 32,428 tons, andin 2012 it reached 32,715 tons[1]. *O. niloticus* is freshwater consumption fish possessing bright prospect and high economic value, even though the unproductive fish spawners have low economic value and less preferred by consumers, so thatthey need to be utilized as a diversification effort of processed fisheries products, one of which is sausage, in order to raise its economic value.

Sausage istype of food made of meat, such as cow, chicken, fish, pork, chopped, mashed, seasoned, and put into digestive tube-like long wrapping from animals part or plastics, cooked or not cooked, and smoked or not[2]. The sausage sold in the market is, in general, one that contains micronutritional substances, such as fat,

carbohydrate, and protein, so that the production innovation of the sausage needs to be done, particularly vitamin A.

Several studies on *O. niloticus* fish sausage were performed, such as surimi sausage of red *O. niloticus* with protein isolate [3] augmentation, and *O. niloticus* sausage with carrageenan addition [4].

Yellow pumpkin (*Cucurbitamoschata*Durch) is one of the vegetables that are rich in beta carotene precursor of vitamin A [5] andhave high enough carbohydrate[6]. Beta carotene functions as vitamin A precursor or serves to help the vision of those who experience night blindness.Beta carotene contained in yellow pumpkin is 1.18mg/100g [7]. Previous studies have processed yellow pumpkin to make flour, and then used it as substitute material in the processed products to increase the nutritional value. The use of yellow pumpkin flour as substitute material in *O. niloticus* sausage production is expected to be able to raise the vitamin A content and the panelist acceptability.

Studies on yellow pumpkin fortification of beef sausage conducted [8]yield sausage of better protein, fiber, andβ-carotenecontent. Therefore, the chemical characteristics of *O. niloticus* sausage with substitute flour of yellow pumpkin.

The objectives of the study are to know the characteristics of proximate and beta caroteneof *O. niloticus* sausagemixed with the yellow pumpkin flour, to obtain the right concentration of the substitute flour in the sausage processing, and to assess the effect of the substitute yellow pumpkin flour utilization on the proximate and beta carotene content of *O. niloticus* sausage product.

Method

Time and Place of Study

This study was carried out for 4 months, from March to June, 2016. Sample production and analysis were done in the Raw Material Laboratory and Chemistry and Biochemistry Laboratory, Fish Processing Department, Fisheries and Marine Faculty, Nutrition and Animal's Feed Laboratory, AgricultureFaculty, Lambung Mangkurat University, and BalaiBesarIndustri Agro (BBIA) Bogor, WestJava Province.

Equipment and Materials

Equipment. Tools used in yellow pumpkin flour and fish sausage production were knife, cutting board, tray, grater, blender, and 60-mesh sieve. Tools needed in sausage production were knife, cutting board, bowl, digital balance, measuring cup, meat grinder, food processor, casing, thread, steaming pan, and stove.

Materials. In this study, fish sausage production used *O. niloticus* flesh, yellow pumpkin flour, tapioca flour, salt, garlic, pepper, agar, cooking oil, and cold water.

Research Procedure

Flour Production. Yellow pumpkin was longitudinally cut into several parts, washed in running water to take out the dirts from the skin. The seeds and fibers were removed, the skin was all peeled, and grated. The grates of the yellow pumpkin was then dried on sunlight for 2-3 days (depending on the weather). It was blended using a blender to have pumpkin powder. The flour was then sieved through 60-mesh sieve to obtain fine flour.

***O. niloticus* Sausage Processing.** Sausage production used unproductive large size *O. niloticus*. The sausage processing started from fish cleaning, washing, and meat separation into fillet. The meat was then ground using a meat grinder to obtain fish meat. The fish meat was mixed with salt, spices, agar, and cooking oil.After well mixed, it was added with tapioca flour while stirred and pulverised in order to gain a homogenous batter.The composition percent of the fish sausage using the substitute flour of yellow pumpkin with treatment was presented in Table 1. The sausage batter of *O. niloticus* was putting into 6 casing whose both edges were fastened with thread. Steaming the sausage batter was done at 100ºC for ± 30 minutes to cook.

Table 1.Chemical Analysis of yellow pumpkin flour

No.	Composition	Concentration/Satuan
1.	Water	13.37 %
2.	Ash	7.26 %
3.	Protein	8.29 %
4.	Fat	2.94 %
5.	Carbohydrate	68.14 %
6.	Beta carotene	11.55 μg/g

Experimental Design

This study applied a Complete Randomized Design [9] with 4 treatments and 3 replications, so that there were 12 sample units. The treatments were:

P(O) = sausage batter with 0% yellow pumpkin flour (Control).
P(A) = sausage batter with 10% substitute flour of yellow pumpkin.
P(B) = sausage batter with 15% substitute flour of yellow pumpkin.
P(C) = sausage batter with 20% substitute flour of yellow pumpkin.

ParameterMeasurements

Chemical characteristics of yellow pumpkin flour and substitute yellow pumpkin flour-based *O. niloticus* sausage, such as water content, ash, protein, fat, carbohydrate, and beta carotenefollowed AOAC [10].

Data Analysis

Weter content, ash, protein, fat, andcarbohydrate data were analyzed with Analysis of Variance (ANOVA) using 16.0 version SPSS [9], while beta carotene data were analyzed descriptively.

Results and Discussion

Characteristics of Yellow PumpkinFlour

Chemical composition of the yellow pumpkin flour, such as water content, ash, protein, fat, carbohydrate, and beta carotene, is demonstrated in Tabel1[11].

Table 1 shows that yellow pumpkin flour has high beta-carotene content, 11.55 μg/g obtaqined from total weight of 180 μg/g pumpkin.

Characteristics of *O. niloticus* Sausage Using Substitute Flour of Yellow Pumpkin.

Chemical Tests

Chemical examination was a test on the material properties measured using certain method and chemicals. The test could be done to determine the product quality[12]

Table 2 demonstrates the formulation data of *O. niloticus* sausage using the substitute flour of yellow pumpkin. The percent part of the the sausage materials used in each treatment was the same, i.e. fish meat of 60%, pumpkin flour of 20%, spice of 20%, and added with cool water as much as 40% of the total batter.

Water Content. *O. niloticus* sausage with the substitute flour of yellow pumpkin had water content as shown in Fig. 1.

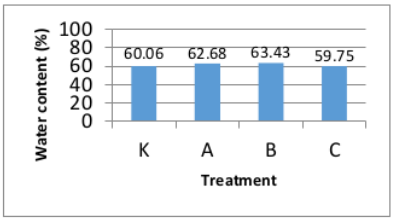

Figure 1. Water Content of *O. niloticus* Sausage.

Table 2.Material composition of *O. niloticus* sausage using the yellow pumpkin flour (%).

Materials	Treatments			
	O	A	B	C
Fish meat (%)	60.00	60.00	60.00	60.00
Mixed batter - Tapioca flour (%) - Yellow pumpkin flour (%)	 20.00 0.00	 10.00 10.00	 5.00 15.00	 0.00 20.00
Additives - salt (%) - garlic (%) - pepper (%) - cooking oil (%) - Agar (%)	 3.00 5.75 0.25 6.00 5.00	 3.00 5.75 0.25 6.00 5.00	 3.00 5.75 0.25 6.00 5.00	 3.00 5.75 0.25 6.00 5.00
Total (%)	100.00	100.00	100.00	100.00
Note: each treatment was added with 40% cold water.				

Table 3.ANOVA of water content of *O. niloticus* sausage.

Variance	df	SS	MS	$F_{calc.}$	$F_{tab.}$	
					5%	1%
Treatments	3	30.623	10.207	5.356*	4.07	7.59
Error	8	15,247	1.906			
Total	11	45.867				

Note : * significantly different.

Fig. 1 demonstrates that the water content of the sausage using the substitute flour of yellow pumpkin ranges from 59.75% to 63.43%. Based onANOVA,$F_{tab.}$was bigger than F_{cal}.at the significance level of 5%, but smaller than $F_{tab.}$ at the significance level of 1%meaning that there is siginificant difference between treatments (Table 3). In other words, different percentages of yellow pumpkin flour affect the water content of the fish sausage.

HSD test indicated that significant difference was recorded between treatment B and C, while no significant difference was found between treatment B-A, B-O, A-O, A-C, and O-C.

Water content of the food product could be influenced by the water content of the added materials as product processing material. The sausage production in this study utilized the added materials of tapioca flour and yellow pumpkin flour that had different water content.

The yellow pumpkin flour used in this study had water content of 13.37%, lower than tapioca flour. This fact is in agreement with[13] that yellow pumpkin flour has lower water content than tapioca flour that contained water of 15%.

Ash. The analytical outcomes of ash content found in *O. niloticus* sausage is presented in Fig.2.

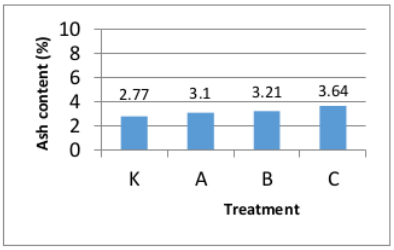

Figure 2. Ash Content of O. niloticus Sausage.

Fig. 2 shows that the ash content of *O. niloticus* sausage using the substitute flour of yellow pumpkin ranges from 2.77% to 3.64%. ANOVA indicated that F_{calc}.was bigger than F_{tab}.at the significance level of 5% and1% meaning that there were highly significant different among treatments (Table 4). In other words, the substitute flour of yellow pumpkin at different concentrations gives effect on the ash content of the sausage.

Table 4.ANOVA of Ash Content of *O. niloticus* Sausage.

Variance	df	SS	MS	$F_{calc.}$	$F_{tab.}$	
					5%	1%
Treatment	3	1.169	0.391	23.947**	4.07	7.59
Error	8	0.130	1.017			
Total	11					

Note: **highly significantly different.

Based on HSD test, this study found that there were highly significant difference between treatment C–O and C–A, significant difference between treatment C–B, B–O, and A–O, and no significant difference between treatment B–A.

Similar to water content, the higher concentration of the substitute flour of yellow pumpkin used in the sausage production will increase the ash content of the product. It was resulted from higher ash content contained in the yellow pumpkin flour than that in tapioca flour. In this study, the ash content of the yellow pumpkin flour was 7.26%, the ash content found in tapioca flour was 0.5% [14].

Table 5.ANOVA of Protein Content of *O. niloticus* Sausage.

Variance	df	SS	MS	$F_{calc.}$	$F_{tab.}$	
					5%	1%
Treatment	3	5.490	1.830	204.646**	4.07	7.59
Error	8	0.072	0.009			
Total	11	5.561				

Note: ** highly significantly different.

Protein. Protein content of *O. niloticus* sausage using the substitute flour of yellow pumpkin is given in Fig. 3. It ranges from 6.43% to 8.02%. Fig. 3 demonstrates that protein content of *O. niloticus* sausage produced using the substitute flour of yellow pumpkin ranges from 6.43% to 8.02%. Based on ANOVA, it was found that F_{calc}.was bigger thanF_{tab}.at the significance level of 5% and1% meaning that there was highly significant difference between treatments (Table 5).

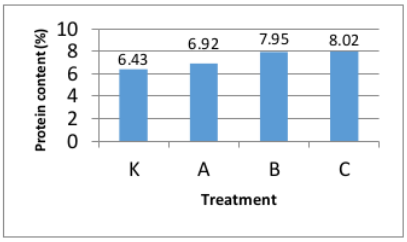

Figure 3. Protein Content of *O. niloticus* Sausage.

In other words, the use of the substitute flour of yellow pumpkin at different concentrations affects the protein content of the sausage.

HSD test revealed that there was highly significant difference between treatment A–O, B–O, C–O, B–A, and C–A, while there was siginificant difference between treatment C–B.

The higher the percent amount of the yellow pumpkin flour used is the higher the protein content of the sausage produced will be.It was resulted from higher protein content of the yellow pumpkin than tapioca flour. The yellow pumpkin flour used in this study had protein content of 8.29%. Other tapioca flour holdsprotein content of 0.5% to 0.7% [14].

Fat. The outcome of fat content analysis on *O. niloticus* sausage is demonstrated in Fig. 4.

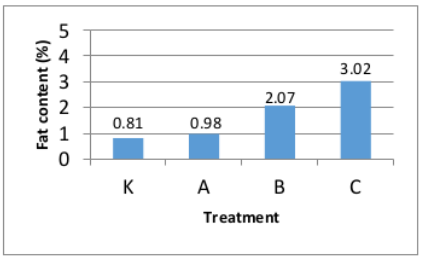

Figure 4.Fat Content of *O. niloticus*Sausage.

Fig. 4 demonstrates that fat content of *O. niloticus* sausage using the substitute flour of yellow pumpkin ranges from 0.81% to 3.02%. ANOVA indicated that F_{calc}.was bigger thanF_{tab}.at the significance level of 5% and1%meaning that there was highly significant difference between treatments. In other words, the use of the substitute flour of yellow pumpkin at different concentration influences the fat content of the fish sausage.

Based on HSD test, there was highly siginificant difference between treatment B–O, C–O, B–A, C–A, and C–B, while there was no significant difference between treatment A–O.

The higher percent of the substitute yellow pumpkin flour used in sausage processing caused the higher fat content of fish sausage. It was resulted from higher fat content of the yellow pumpkin flour than tapioca flour. The yellow pumpkin flour used in this study had fat content of 2.94%, while it wasfound that the fat content of tapioca flour was 0.2%[14].

Carbohydrates. *O. niloticus* sausage carbohydrate content is presented in Fig.5. Carbohydrate content of *O. niloticus* sausage using yellow pumpkin flour ranges from 23.33% to 29.9%. ANOVA indicated that $F_{calc.}$was bigger than $F_{tab.}$ at the significance level of 5% and1%meaning that there was siginificant difference between treatments (Table 7). In other words, the use of substitute flour of yellow pumpkin at different concentrations affects the carbohydrate content of the fish sausage produced. HSD test indicated that there was highly significant difference between treatment O–B, significant difference between treatment O–A and O–C, and no significant difference between treatment A–B, A–C, and C–B.

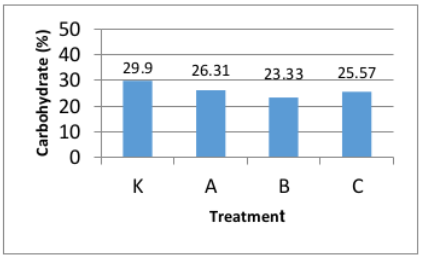

Figure 5. Carbohydrate Content of *O. niloticus* Sausage.

Table 6.ANOVA of Fat Content of *O. niloticus* Sausage.

Variance	df	SS	MS	$F_{calc.}$	$F_{tab.}$	
					5%	1%
Treatment	3	11.794	3.931	65.496**	4.07	7.59
Error	8	0.480	0.060			
Total	11	12.274				

Note: ** highly significantly different.

Table 7.ANOVA ofCarbohydrate Content of *O. niloticus* Sausage.

Variance	df	SS	MS	$F_{calc.}$	$F_{tab.}$	
					5%	1%
Treatment	3	67.022	22.341	13.531**	4.07	7.59
Error	8	13.209	1.651			
Total	11	80.230				

Note: ** highly significantly different.

The higher amount of yellow pumpkin flour used in the sausage production will reduce the carbohydrate content of the fish sausage. It was resulted from lower carbohydrate content of the yellow pumpkin flour than tapioca flour. In this study, the substitute flour of yellow pumpkin flour contained 68.14% carbohydrate, while tapioca flour had 88.2% carbohydrate [15].

Beta carotene.Beta carotene content of *O. niloticus* sausage using the substitute flour of yellow pumpkin is given Fig. 6.

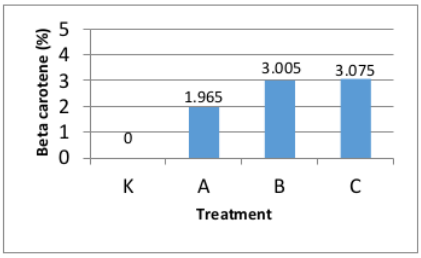

Figure6. Beta carotenecontent of *O. niloticus* sausage.

Fig.6shows that beta carotene content of*O. niloticus* sausage using the substitute flour of yellow pumpkin ranges from< 0.02 μg/g to 3.075 μg/g. The higher concentration of yellow pumpkin flour caused the higher content of beta carotene *O. niloticus* sausage.

Increased beta carotene content of the fish sausage on study could occur because yellow pumpkin flour holds beta carotene compound, and this compound its not found in tapioca flour. The yellow pumpkin flour on study had beta carotene 11.55μg/g.

Conclusion And Recommendations

Conclusion

This study came to the following conclusion that *O. niloticus* sausage made with the substitute flour of yellow pumpkin influenced the chemical characteristics of the sausage, i.e, reducing the water content and carbohydrate, but increasing the ash content, protein, fat, and beta carotene.Thebest concentration was found at the treatment C (20%pumpkin flour) with water content of 59.75%, ash 3.64%, protein 8.02%, fat 3.02%, carbohydrate 25.57%,andbeta carotene 3.075 μg/g, respectively.

The percentage of the substitute yellow pumpkin flour utilization could increase beta carotene content of *O. niloticus* sausage from 1.965 μg/g to3.075 μg/g.

Recommendations

Improvement in yellow pumpkin flor processing needs to be done in order to maintain the high beta carotene content and have finer and homogenous texture.

Further studies are also needed for other fish products, such as fish ball or nugget,by adding the yellow pumpkin flour to increase protein content and beta carotene. Other studies are expected as well to find the right cooking process (temperature and time), the use of natural preservatives, the use of right casing material, and good storing condition in order to extend the properness of *O. niloticus* sausage product using the yellow pumpkin flour.

References

1. DJPB. 2016. Statistical data of Indonesian fish culture production series. http://www.djpb.kkp.go.id/public/upload/statistik_series/Statistik%202009%20%202013%20Kerapu,%20Nila,%20RL.pdf. [accessed inJanuary 27, 2016].
2. Hadiwiyoto, S. 1983. Processed product of milk, fish, meat and egg.Edition II.First printed. Liberty. Yogyakarta.
3. Sukmana, I. Y. 2012. Utilization of red tilapia (*Oreochromis* sp) surimi in sausage processing addition of soy protein isolate. Skripsi. Aquatic product technology, faculty of fisheries and marine science, IPB. Bogor.
4. 4 Nico, M.; Putut H. R.; and Ima W. 2014. Effect of addition of carrageenan on thr quality of fish sausage treadfin bream (Nemipterus sp.) and sausage tilapia (Oreochromis sp.). Journal fisheries processing and biotechnology. 2 (3) : 99-105.
5. Astawan, M. 2004. Yellow pumpkin as an antidote and tapeworms rich antioxidant. http://www.gizi.net/cgi-bin/berita/fullnews.cgi?newsid 10817 42482,716 95. [accessedonJanuary 28, 2016].
6. Gardjito, M. 2005. Various benefits and nutritional value of yellow pumpkin. http://srahma.blogspot.com/2008/04/aneka-manfaat-dan-kandungan-labu-kuning.html. [accessedinJanuary 28, 2016].
7. Kandlakunta, B.; Rajendran, A.; and Thingnganing, L. 2008. Carotene content of some common (cereals, pulses, vegetables, spices and condiments) and unconventional sources of plant origin. Food Chemistry.106 : 85-89.
8. Prayitno, A. H.; Firdha M.; Afina V. R.; Tombak M. B.; Bekti P. G.; and Soeparno. 2009. Sausage characteristics as affected by β-caroten fortification of pumpkin (*Cucurbita moschata*). Veteriner buletin. 33(2) : 111-118.
9. Srigandono, B. 1981. Experimental design. Diponegoro university. Semarang.
10. [AOAC] Association of Official Analytical Chemist. 1995. Official methods of analysis. 16th editions.Assotiation of official analytical chemis.Inc. Arlington. Virginia.
11. Asngari, F. H. 2016. Substitute flour of yellow pumpkin (*Cucurbita moschata* Durch) on vitamin A content and panelist acceptability to *Oreochromis niloticus* sausage. Skripsi. Fish technology program

study, fish processing departement, fisheries and marine faculty, lambungmangkurat university. Banjarbaru.
12. Soekarto, S. T. 1990. Principles to food quality control and standardization. Departement of Nutrition and Food Technology. Departement of education and cultured. Direktorat jenderal of high education. PAU nutrition and food IPB. Bogor.
13. Hendrasty, H.K. 2003.Yellow pumpkin flour: processing and utilization.Kanisius.Yogyakarta.
14. Grace, M. R. 1977. Cassava processing food and agriculture organization of united nations. Roma.
15. Soemarno. 2007. Technological design for tapioca processing and its products. Magister chem technology. Brawijayauniversity. Malang.

*****

Chemical Characteristics of Tilapia (Oreochromis niloticus) Sausage using Yellow Pumpkin (Cucurbita moschata Durch) as Substitute Flour

ORIGINALITY REPORT

12%	8%	4%	4%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	paper.researchbib.com Internet Source	3%
2	Submitted to Rocky Mountain High School Student Paper	2%
3	eprints.ulm.ac.id Internet Source	1%
4	www.tandfonline.com Internet Source	1%
5	ikprress.org Internet Source	1%
6	W. Cao, R. Liu, C. Sun, X. Mei. "Co-fermentation of Stalk Juice and Clarified Grain Mash of Sweet Sorghum for Ethanol Production", Energy Sources, Part A: Recovery, Utilization, and Environmental Effects, 2014 Publication	1%
	businessdocbox.com	

7	Internet Source	1 %
8	Brandts, J.. "Competitive rivalry, social disposition, and subjective well-being: An experiment", Journal of Public Economics, 200912 Publication	<1 %
9	repository.unika.ac.id Internet Source	<1 %
10	Fatwa Ramdani, Sabaruddin Rahman, Chandra Giri. "Principal polar spectral indices for mapping mangroves forest in South East Asia: study case Indonesia", International Journal of Digital Earth, 2018 Publication	<1 %
11	journal.umy.ac.id Internet Source	<1 %
12	humaniora.journal.ugm.ac.id Internet Source	<1 %
13	journal.ugm.ac.id Internet Source	<1 %
14	doaj.org Internet Source	<1 %
15	Submitted to University of Wollongong Student Paper	<1 %

16	media.neliti.com Internet Source	<1 %
17	Amal Said Mohamed, Hala Elshahat Ghannam, Hanan Abdelhameid Soliman. " The protective role of vitamins (E + C) on Nile tilapia ( ) exposed to ZnO NPs and Zn ions: Bioaccumulation and proximate chemical composition ", Annals of Animal Science, 2021 Publication	<1 %

Exclude quotes	Off	Exclude matches	Off
Exclude bibliography	Off		

Chemical Characteristics of Tilapia (Oreochromis niloticus) Sausage using Yellow Pumpkin (Cucurbita moschata Durch) as Substitute Flour

GRADEMARK REPORT

FINAL GRADE

/0

GENERAL COMMENTS

Instructor

PAGE 1

PAGE 2

PAGE 3

PAGE 4

PAGE 5

PAGE 6

PAGE 7

PAGE 8

PAGE 9