Global Scientific JOURNALS

GSJ: Volume 7, Issue 7, July 2019, Online: ISSN 2320-9186
www.globalscientificjournal.com

CHEMICAL COMPOSITION OF TORTILLA CHIPS WITH THE ADDITION OF SQUID INK (*LOLIGO VULGARIS* LAMARCK, 1798) IN PANGANDARAN WATER, WEST JAVA, INDONESIA

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KeyWords
Tortilla Chips, Squid Ink, Chemical Composition.

ABSTRACT

This research aims to obtain the chemical composition of tortilla chips with the addition of squid ink (*Loligo vulgaris* Lamarck). This research was conducted out at the Fisheries Product Processing Laboratory of the Faculty of Fisheries and Marine Sciences, Padjadjaran University, which began in May 2019 until 10 May 2019. The research method was carried out experimentally consisting of 2 additional squid ink treatments namely 0% (control) and 1%. The parameters observed were chemical tests (moisture content, ash content, fat content, protein content and carbohydrate content) on tortilla chips carried out by 20 semi-trained panelists. The research concludes that the chemical composition of tortilla chips with the addition of 1% squid ink has a moisture content of 3.43%, ash content of 3.57%, fat content of 27.56%, protein content of 7.49% and carbohydrate content of 56.95 %.

CONCLUSION

Tortilla chips are a typical snack from Mexico in the form of brownish yellow chips and made from corn. Tortillas come from the word "torta" which means cakes. The Mexicans call tortillas on every cake made from corn and flour (flour, wheat or sorghum) in flat form (Wahyuni 2008). Currently snack Tortilla chips can be found easily in Indonesian supermarkets. Tortilla chips have a variety of shapes, such as triangles and rectangles with different thickness sizes (Febrianto *et al.* 2014).

The snack food sector are food that is generally eaten in between meals But although the snack food eaten by any group of people and most loved by children. Corn is not a balanced food due to lack of essential amino acid (Chhabra *et al.* 2017).

Tortilla chips made from corn contain quite high energy, but the protein content is low, especially the essential amino acid content. (Santoso *et al.* 2006) states that the carbohydrate content of tortilla chips is 80 / 100g, while the protein content is 11 / 100g.

The main nutrient content in corn seeds is carbohydrate, protein and fat. Corn carbohydrate content is 72% of the weight of the seeds which are mostly starch and most are in the endosperm (Indrawuri 2010). A tortilla chips rich in vitamin b and protein.The calcium from this product also high because of alkaline treatment (Kaur and Aggarwal 2017).

Tortilla chips are expected to increase the acceptance of food types in the community by modifying the addition of squid ink as a source of protein. Black squid ink bags are used to increase flavor and taste, besides the colors produced from pigments can also increase the benefits of food ingredients. Squid ink shows certain phytochemical compounds that have properties to prevent various diseases (Astawan 2008).

Squid (*Loligo vulgaris*) Is a demersal or semi-pelagic occupant in the coastal area and continental exposure to a depth of 400m. Squid make diurnal movements, ie during the day they will cluster near the water market and will spread to the water column at night. Squid are attracted to light (positive phototaxis), therefore are often captured using the help of light (Roper *et al.* 1984).

The area of the spread of squid is in the Western Pacific waters, Northern Australia, the Philippine Island, the northern part of the South China Sea to Japan according to (Roper *et al.* 1984). Classification of squid namely Saanin (1984) :

Kingdom	: Animalia
Phylum	: Mollusca
Class	: Cephalopods
Subclass	: Coleoidea
Order	: Teuthoidea
Family	: Loliginidae
Genus	: Loligo
Species	: *Loligo vulgaris* Lamarck

Picture 1. Squid *(Loligo vulgaris)*
Source : Personal documentation

The cuttlefish released the secretion of colored ink for defense predators (Wood *et al.* 2010). The characteristics possessed by squid are the presence of ink bags located above the large intestine. When the bag is opened it will emit black ink caused by the melanin pigment. Melanin or a black pigment is melanoprotein containing 10-15 % proteins, consisting of essential amino acid and non essential and polysaccharides sulphate (Luo and Liu 2013) And an anticoagulant (Pushpamali *et al.* 2008). A polysaccharide of ink squid has also studied or possessing superior antioxidant, tumors and anti anti chemotherapy (Kumar *et al.* 2018). Ink cephalopods is antiseptic to the processed meat cephalopods ika-shiokara (Nirmale *et al.* 2002). The squid will remove the ink through the siphon to avoid predators (Buchsbaum *et al.* 1987). Based on observation Fitrial and Khotimah (2017) , ink *loligo vulgaris*. having a smooth , while ink sepia sp. having a rough . In general the presentation of body parts that edible around 80 % , while the rest to be disposed of and used for other purposes. The edible part of consisting of 50 % shaped coat and the rest 30 % is made up of the other part (Sudjoko 1988).

The ink sac is a gland that produces ink rich in melanin which is above the large intestine which empties near the anus which forms as a diverticulum from the back of the intestine (Derby 2014). Squid ink contains melanin, protein, lipids, glycosaminoglycans, mucosaccharides (Kim 2014). Melanin of ink squids have anti-tumor activity by inhibiting activity thromboxane plasmin to increase and improve the immune system to kill cancer cells (Zhong *et al.* 2009). Based on the research Nair *et al.* (2011) stated that cuttlefish and having ink or cuttlefish antibacterial activity. Sac ink squid known rich in taurine and hydroxyproline (Shirai *et al.* 1997). Of the nature of antiretroviral as squid ink , antitumor , anti oxidant , and the ability to protect a cell from damage caused by chemotherapy and potential of the antibacterial of ink squid pathogenic against bacteria (Smiline *et al.* 2012).

Squid ink has been used in some dishes and food namely rice black, in a sauce baby squid ink , ink soup with pork and squid in addition ink processed food as a dye (Derby *et al.* 2013). The characteristics of a good squid ink are a bag that does not break, squid ink still looks fresh, the color of ink is pitch black and is not separated by the body of the squid, the distinctive aroma of squid ink. The squid ink is not good, the squid ink looks dry, the smell of foul smell, the black color is dull and the bag smaller and smaller.

Based on research Nitsae *et al.* (2017) the utilization of waste have not yet been widely squid ink , but in east nusa tenggara especially in kabupaten alor , waste squid ink has been used as an additional material for the diversified products in the process. Ink cuttlefish disposed when waste processing ink because sac are black yielded product that does not attract, trouble the who smells and besides sac ink have efficacy to health (Sasaki *et al.* 1997). Adding squid ink to tortilla chips will make this snack has a high protein content and has a savory and salty flavor. This research aims to obtain the chemical composition of tortilla chips with the addition of squid ink.

MATERIAL AND METHODS

Material and Tools

Tools used: digital scales, containers, knives, tortilla chips, spoons, spatulas, measuring teapots, rolling pins, baking pans, drying ovens, pressure cookers, steamed pan, stove deep frying, meat grinder and plastic. The ingredients of tortilla chips are used: pipil corn, squid ink, cornstarch, granulated sugar, water, salt and garlic.

Research Methods

The method used in this research is the experimental method. The treatment used is by adding squid ink to tortilla chips based on corn weights, as follows:

1. Treatment A (control): without the addition of 0% squid ink.
2. Treatment B: add 1% of squid ink.

The formulations used in this research are as follows:

Table 1. Formulation of Making Tortilla Chips

Bahan	Perlakuan (%)	
	A	C
Pipile Corn(g)	100	100
Squid ink (ml)	0	1
Water (ml)	5	5
Salt (%)	3,2	3,2
Sugar (%)	6	6
Garlic (%)	2	2
Cornstarch (%)	5	5

Source : (Muthiah 2017) modified

The procedure for making tortilla chips refers to the modified research (Muthiah 2017).

Stage of squid ink preparation as follows:

a. Prepare whole fresh squid.
b. The ink bag from the bottom of the whole body of the squid is taken, then separated in a clean container.
c. Ink in the squid bag is taken by slowly applying pressure, then the ink coming out is accommodated in a clean container.
d. Ask the squid to be stored in separate containers according to the treatment to be added to the Tortilla chips mixture.

Phases of making tortilla chips as follows:

a. Ask the squid treated (control and 1%) mixed with corn flour and additional spices according to the treatment.
b. Stir the mixture until smooth.
c. Make thin sheets using a rolling pin with a thickness of ± 1-2 mm.
d. Printed round and in rectangular shape with a length of ± 35mm and width ± 25mm.
e. Put it in the oven (45^{o}C for 120 minutes).
f. Fry it (deep frying, ± 5-10 seconds).

Parameters Observed

The parameters observed were the proximate test (water content, ash content, fat content, protein content and carbohydrate content) in tortilla chips without the addition of squid ink and tortilla chips with the addition of squid ink by 1%.

Moisture Content

Water content is the amount of water in a material determined from the weight reduction of a material heated at the test temperature. The principle of testing moisture content is to remove water molecules through heating with a vacuum oven at a temperature of 95°C - 100°C with an air pressure of no more than 100 mmHg for 5 hours or the oven does not vacuum at 105°C for 16 hours - 24 hours. Determination of the weight of water content is based on differences in sample weight before and after drying in order to determine the amount of water in a material determined from the weight reduction of a material heated at the test temperature. Steps for testing moisture content are as follows:

a. Empty cup is dried in the oven for 30 minutes then weighed.
b. Then as many as 5 g of the sample is put into a cup and dried in an oven with a temperature of 100°C - 105°C for 6 hours.
c. Cup cooled in desiccator for 30 minutes.
d. Then weigh again.

Water content calculation uses the following formula:

$$\% \text{ Moisture content} = \frac{(B1-B2)}{B} x\ 100\ \%$$

Information:

B = Sample weight (g)
B1 = Weight of sample + cup before drying (g)
B2 = Weight of sample + cup after drying (g)

Ash Content

Measurement of ash content based on AOAC (1995), using Muffle Furnace by working as follows:

a. The sample is mashed by using mortal until homogeneous then weighed ± 2 grams.
b. The sample is inserted into a porcelain cup that has been known for its weight, then burned until it does not cause smoke and is then ignored in the Muffle Furnace until the sample is white at a temperature of 550°C for 10 hours.
c. After the sample is white, the porcelain cup is closed and taken with a clamp and put in the oven for 15 minutes.
d. The sample obtained is cooled in a desiccator for approximately 30 minutes then weigh it.
e. The ash content in the sample is determined by the weight of the organic compound that evaporates.
f. Calculation of % ash content is calculated using the formula below:

$$\text{Ash content (\%)} = \frac{C-A\ X100\%}{B-A}$$

Information:

A = Empty cup (g)
B = Cup with sample (g)
C = Cup and sample after ignited (g)

Fat Levels

Calculation of fat content (AOAC 2005). The way it works is as follows:

a. Balanced samples on empty round bottom flasks (A g) and 2 g sample homogenates (B g), are included in the fat sleeve.
b. Insert 150 ml of chloroform into a round bottom flask, fat sleeve into the soxhlet extractor, and install the soxhlet circuit correctly.
c. Extracted at 60°C for 6 hours, and evaporated to dryness.
d. Insert a round bottom flask containing fat in an oven at 105°C for ± 2 hours to remove residual chloroform and water vapor, cool it in a desiccator for 30 minutes, and weigh the weight of a round bottom flask containing fat (C g) until constant .
e. Fat calculation in the sample uses the formula below:

$$Fat\ levels\ (\%) = \frac{C-A}{B} x\ 100\ \%$$

Information:

A = Empty pumpkin weight (g)
B = Weight of sample (g)
C = Extraction of round bottom and fat flask (g)

Protein Levels

The principle of analysis of protein content is the process of releasing nitrogen from proteins in materials using sulfuric acid by heating. Determination of total nitrogen with protein content using the Macro-Kjedhal method in accordance with (AOAC 1995). that is :

a. The mashed sample is weighed as much as 0.5 g and then put into a 30 ml kjeldahl flask.
b. Ask the squid to add 10 ml of concentrated sulfuric acid (H_2SO_4) and 2 g of selenium then the sample is boiled (deconstruction) for 1 to 1.5 hours until the liquid turns green to clear.
c. The solution is cooled and transferred into a 100 ml volumetric flask and then slowly added distilled water to the boundary mark.
d. Contents of silent volumetric flask.
e. Ask the squid to add 20 ml of 30% Sodium Hydroxide (NaOH) and then distilled.
f. Celestial is stored in 125 ml erlenmeyer containing 25 ml of 3% H_3BO_3 and 5 drops of indicator solution (mixture of methyl red and methyl blue)
g. Destylate is diluted to about 50 ml and titrated with 0.1 N hydrochloric acid (HCl) until the color changes to pink.

Protein levels are calculated based on N levels in materials multiplied by conversion factors. The formula used in testing protein content is:

$$\text{Protein Level (\%)} = \frac{(\text{ml HCL})\ x\ (N\ HCL) x\ 14{,}008}{W} x\ 100\ \%$$

Information :

14,008 = Weight equivalent to nitrogen
W = Sample weight (g)
N = Normality of acid titrant

Carbohydrate levels

Carbohydrate levels are calculated using luff school (Baedhowie and Pranggonowati 2005). The way it works is as follows:

a. 5 g sample added 200 ml 3% HCl.
b. Direfluk with cooling back for 2.5 hours in under brooth.
c. The sample is cooled, neutralized to pH 7 with 40% NaOH.
d. Analysis by the luff schoorl method, 25 ml sample was taken and added with 25 ml luff schoorl, heated for 10 minutes.
e. Cooled, then added 15% KI as much as 15 ml.
f. Added 25% H_2SO_4 as much as 25 ml.
g. Tititated with 0.1 N thiosulfate solution with 1% starch indicator.
h. Until the solution is colored milk solution titration, note the use of 0.1 N thiosulfate solution.
i. Done steps with blank solutions.
j. As for the calculation of carbohydrate levels as follows:

Ml $Na_2S_2O_3$ = ml $Na_2S_2O_3$ (Blankets) x N. $Na_2S_2O_3$ x 10
Mg Glucose = conversion number + (ml $Na_2S_2O_3$ x Conversion Factor)

$$\text{Kadar karbohidrat } = \frac{berat\ glukosa\ (mg) x\ p}{berat\ sampel\ (g)} x\ 100\ \%$$

Information:

P = Sample dilution: volume taken for analysis

Data Analysis

Proximate data were analyzed in a comparative descriptive manner by comparing the chemical composition of tortilla chips without the addition of squid ink with tortilla chips added with squid ink.

RESULTS

Proximate Test

Proximate test results include moisture, ash, fat, protein and carbohydrates. Proximate test results on tortilla chips without the addition of squid ink (0%) with the addition of squid ink tortilla chips (1%), can be seen in Table **2**.

Table 2. Proximate Test Result

Chemical Composition	Treatment	
	0%	**1%**
Water	4,09	3,43
Ash	3,61	3,57
Fat	30,6	27,56
Protein	6,25	7,49
Carbohidrat	57,45	56,95

Source: Research Laboratory and Biodiversity and Biotechnology Research Institute at the Society (LPPM) Bogor Agricultural Institute.

Water Content

Water is an important component in food ingredients because water affects the appearance, texture and taste of food. Determination of tortillas at moisture content is important because it is directly related to crispness (Kingcam *et al.* 2008). One of the main characters of the snack is crispy because crispness is the texture limit of snacks that can be accepted and these properties are directly related to water content. The water content values obtained from the proximate test of tortilla chips without the most preferred addition and treatment can be seen in Table **2**.

Decreasing water content in tortilla chips can be caused by the cooking process. Cooking is a processing that can reduce the water content of food (Sundari *et al.* 2015). Based on the results of the study that the treatment of 1% water content decreased with the addition of squid ink. According to Vioni *et al.* (2018) the mineral content in squid ink will increase the cup cake mineral content resulting in decreased water content in the cup cake raw material. The water content of the tortilla chips is affected by the water content of the ingredients. Based on research Hulalata *et al.* (2013) stated that long drying and the number of the water level can affect the level of fondness of consumers on squid salted and dried or preferred by the consumer. From both tortilla chips samples, the treatment sample was 1% which had the lowest water content and had a crunchy texture.

Ash Content

Ash is an inorganic substance left over from the combustion of an organic material. Determination of total ash is used for various purposes, namely in addition to the parameters of nutritional value in food ingredients also to determine whether or not a processing process. The ash content values obtained from the proximate test of tortilla chips without the most preferred addition and treatment can be seen in Table **2**.

Based on the SNI of ash content in tortilla chips which refers to the study (Febrianto *et al.* 2014) is 1.375%. Level the tortilla chips without additions or with the addition of squid ink, which is 3.61% and 3.57% has a higher value. Based on the results of the measurement of ash content on tortilla chips, it shows that with the addition of squid ink, the ash content decreases. According to Setyawati *et al.* (2013) the decrease in ash content is highly expected because it will affect the increasing content of organic matter. Organic materials contain important food substances, namely protein, fat, vitamins and carbohydrates. This is in accordance with the research (Sudarmadji *et al.* 1989) that the decrease in ash content can be influenced by the ingredients and the method of mixing the ingredients. The ash content with 1% squid ink treatment is less than the 0% control treatment so that the addition of squid ink treatment will reduce the proportion of the ash content contained in tortilla chips.

Fat Levels

Fat is a component of food that provides the highest energy. If carbohydrates and proteins supply 4 kcal / gram, fat can supply energy of 9 kcal / gram. In addition to functioning in terms of nutrition, fat plays a role in the formation of texture and product taste (Winarno 2004). The value of fat content from the proximate test results of tortilla chips without the most preferred addition and treatment can be seen in Table **2**.

Based on SNI the maximum total fat content with the treatment of frying on tortilla chips which refers to the quality requirements of snacks is 38%. The fat content of tortilla chips without addition or by adding squid ink is 30.6% and 27.56% decreases. Squid ink has a

low fat content. According to (Gonzalez *et al.* 2003) squid fat content is 0.2% while according to (Prabawati 2005) squid body fat levels are 0.2% - 1.4% derived from saturated fatty acids, monounsaturated fatty acids and unsaturated fatty acids double.

Protein Levels

Protein is a food substance that is important for the human body, because it functions as a fuel in the body and also as a building material and regulator (Winarno 2004). Protein is one component that is assessed in the chemical test of tortilla chips. The protein content values obtained from the proximate test of tortilla chips without the most preferred addition and treatment can be seen in Table **2**.

The standard quality of tortilla chips for protein content refers to the quality standard of commercial tortilla chips "Happytos" which is 6%. The protein content of tortilla chips without addition or by the addition of squid ink is 6.25% and 7.49% has a higher value than the standard quality of commercial tortilla chips. Protein content in tortilla chips is done by testing a sample of 20 g. Based on the packaging of Happytos tortilla chips (160 g) the protein content obtained from the research results with the addition of squid ink is 25% - 29.96%. Tortilla chips with the addition of squid ink are expected to be one of the diversified processed squid ink waste that can increase the level of squid protein consumption in the community.

Levels of Carbohydrates

Carbohydrates are a component of food that acts as an energy supplier. In addition to producing energy, carbohydrates in food also play a role in determining texture characteristics (Febrianto *et al.* 2014). The carbohydrate content values obtained from the proximate test of tortilla chips without the most preferred addition and treatment can be seen in Table **2**.

Based on the results of the decline caused by the calculation of carbohydrate levels carried out by difference. The biggest contribution of carbohydrates to tortilla chips is obtained from pipile corn. According to (Winarno 1991) that in plant foods, carbohydrates are a relatively high component. These tortilla chips products show that the product can be used as an energy source. This is in line with the opinion (Wahyuni 2008) based on a 2000 kcal diet, the carbohydrate content of tortilla chips is sufficient to meet the minimum (USDA) standard of carbohydrate tortilla chips by 57%.

CONCLUSION

Based on the results of research that has obtained chemical composition of tortilla chips with the addition of 1% squid ink has a moisture content of 3.43%, ash content of 3.57%, fat content of 27.56%, protein content of 7.49% and carbohydrate content 56 , 95%. This proves that tortilla chips are processed by waste which can increase the level of squid consumption in the community.

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