Assiut J. Agric. Sci., 52 (1) 2021 (31-41) *ISSN: 1110-0486*
Website:www.aun.edu.eg/faculty_agriculture/journals_issues_form.php *E-mail: ajas@aun.edu.eg*

Effect of Moringa Leaves Powder on the Chemical, Microbial and Sensory Evaluation of Catfish Burger

Abdel-latif, Rania H.;*M.A. Kenawi and H.A. Abdelaal

Dept. Food sci., Minia Univ., Egypt.
*E-mail: mohamedkenawi@ymail.com

Received on: 4/3/2021 **Accepted for publication on:** 14/3/2021

Abstract:

Fish is considered as one of the cheapest sources of animal protein all over the globe. It provides protein, vitamins, minerals and omega-3 fatty acids for human diets. It represents one of the national income sources in Egypt. The Egyptian Fisheries Authority declared in 2020 that, the production of fish reached 1 million 920 thousand tons. Since African catfish is one of the fish species consumed in Egypt. This study was done to use the fresh (Nile Karmout) catfish (Claries gariepinus) to produce catfish burger, and study the effect of adding 1% of Moringa leaves powder to the formula on the chemical composition, microbiological stability, and sensory evaluation of the product. The data showed that the addition of 1% moringa leaves powder to the catfish burger caused reduction in the water holding capacity, and increased the cooking loss while reduced the number of the examined bacterial count and improved the sensory evaluation compared to the control samples.

Keywords: *Catfish burger, moringa leaves powder, Nile Karmout.*

Introduction:

Fish is one of the most important and cheapest sources of animal protein, minerals, and other required nutrients for human diet all over the world. It is considered as an important source of protein, vitamins, minerals and omega-3 fatty acids for the people of poor countries. Fish is characterized by being an easy-to-digest food that can be presented as a meal in many ways.

In Egypt, fish is one of the most important sources of national income. In addition, it is also considered as a source of safe protein that provides food needs and develops other industries. The Egyptian fisheries occupy more than 13 million acres, equivalent to about 150% of the agricultural land, which include seas, many lakes, the river Nile, and fish farms located in different parts of Egypt.

In a report issued by the Egyptian Fisheries Authority in 2020 confirmed that, Egypt's fish production currently has reached 1 million 920 thousand tons, of which 80% is from fish farming and 20% is from capture fisheries.

African catfish is one of the fish species most suitable for fish farming in the African continent, which have a high growth speed, resist environmental stress and resist handling stress during farming operations (Suleiman *et al*, 2009).

Its meat taste good and thus interest has developed in the cultivation of African catfish on a large scale on the African continent. In the Arab Republic of Egypt there are two species of catfish, they are:

1- African catfish Clarias gariepinus
2- Egyptian catfish Clarias anguillarus

The African catfish, Clarias gariepinus, is the most common species in the Arab Republic of Egypt.

Catfish (Clarias gariepinus) is one of the freshwater fish species that are well adapted to enclosed waters and resistance to handling and diseases. It is produced in large quantity especially in the Nasser's Lake, the first pond in Wadi El-Rayan Lake and along with the fish farming and other freshwater Lakes. Catfish is an extraordinary nutritious fish that contains large amounts of unsaturated fatty acids, vitamins, proteins, and minerals (Nelson *et al*., 2016). In addition, it has little or no saturated fat; and is low in carbohydrates.

Aref *et al*., (2018) determined the proximate composition of minced catfish fillet (Clarias gariepinus), and found that, the moisture content was 76.48%, ash content 1.22%, crude protein 19.88%, and Crude either extract 1.63%. Whereas (Zhu *et al.*, 2015), found that the chemical composition of untreated raw channel catfish fillets was 68.77±2.21%, 16.01±0.35%, 13.47±0.81%, and 1.10±0.05% for moisture, crude protein, crude either extract and total ash contents respectively.

Ozogul *et al*., (2011), reported that the maximum TBA value, in good quality fish, is 5 mg malonaldehyde (MA/ kg), while fish with TBA value up to 8 mg (MA/ kg) can be consumed. Lipid oxidation in fish and seafood products can lead to development of off-flavors and odors, which indicates of quality loss.

According to the (EU, 1995), total volatile basic nitrogen (TVB-N) levels were found to be as effective and useful indicators to measure seafood spoilage. According to the European Commission who stated that, the (TVB-N) amounts can be used as indicator when sensory methods increment doubts about the freshness of seafood products.

Water-holding capacity, is intimately associated to the juiciness, texture, and other condition properties of fish and meat (Jiang *et al.,* 2018). Water-holding capacity of fish meat muscles can be significantly affected by some processing methods such as freezing method (Jiang *et al*., 2018).

Moringa oleifera (Moringa oleifera Lam.) is considered as one of the important source of natural antioxidant, and antimicrobial agent (Dillard and German., 2000; and Hazra *et al.,* 2012).

Its leaves have been described to be an excellent source of natural antioxidants and, thus, increase the shelf life of foods containing fat for the presence of many different types of antioxidant components such as flavonoids, ascorbic acid, carotenoids and phenolics (Al-Juhaimi *et al*., 2015).

Fish and other sea foods are extremely sensitive food products and are vulnerable to chemical and microbiological spoilage during processing or storage. Therefore, one or more adequate preservation methods are required to maintain the safety and quality and to extend the shelf life of such products (Hassoun and Çoban, 2017). Microorganisms are the major cause of deterioration of most seafood products. Bacterial growth is considered to be the main cause of fish and fish product spoilage. Thus, it is recommended to ap-

ply bacterial count to monitor the quality of food products (Aref *et al*., 2018).

Sensory evaluation is test or assessment that show the reaction of the consumers towards the food products using their senses. It is a means of determining whether the product is accepted or rejected by the consumers. Boran and Köse., (2007), found an interrelationship between lipid oxidation and sensory deteriorations in ready to eat fish products during frozen storage. Therefore, lipid oxidation should be retarded to prevent or minimize the quality changes and to keep sensory and nutritional values during processing and storage of fish products.

The objectives of this investigation were to:

1-Use the fresh (Nile Karmout) catfish (Claries gariepinus) to produce minced catfish flesh.

2-Adding 1% of Moringa oleifera leaves powder to the minced flesh and produce ready to eat catfish burger product and study its effect on moisture, crude protein, Ash, pH, total acidity, color, water holding capacity (WHC), TBA values, TVB-N values, microbiological quality, and sensory evaluation of catfish burger product.

Materials and Methods:

Materials:

Moringa leaves powder: Moringa plant was gained from the university farm, El-Minia, Egypt. The leaves were completely cleansed, air dried in at ambient temperature for 24 hrs., and mechanically ground to obtain particles of 60 mesh.

Spices blend: Spices (black pepper, cumin powder, thyme powder, onion powder, and garlic powder), salt, and wheat flour were purchased from the local market of Minia city, Egypt.

Methods:

Preparation of cat fish product: Sixty kg of live karmout catfish (Claries gariepinus), average of 57±2 cm in length and 1450±10 g in weight, used in this study is obtained from a local market of El-Minia, Egypt. Fish were iced and transported directly to the Dept. Food Science Laboratory Faculty of Agriculture Minia University. The fish were thoroughly washed, gutted, manually made into fillet and mechanically minced by a meat grinder using 4 mm (coarse). Minced fish was stored refrigerated at 4□ until use.

Catfish burger product was prepared according to the recipe described by Magdy (2010) and shown in (Table 1).

Table 1. Formulation of catfish burger product.

Ingredient	%
Ground catfish Fillet	89.8
Wheat flour	3.5
Salt	2.5
Black pepper powder	1
Onion powder	1
Garlic powder	1
Cumin powder	1
Thyme powder	0.2

All the ingredients were mixed well, then divided into two equal portions. The first portion was left with no additives as control, while dried Moringa leaves powder was added to the other portion in the ratio of (1%).

Each portion was divided into small balls 50 g each, then formed into a burger-like shape 10cm diameter and 0.5 cm thickness, and placed in polystyrene (foam) tray with LDPE

cheats in between to prevent sticking as shown in (Figure 1).

Analytical methods:

Chemical composition: Moisture, crude protein, crude fat, and ash, contents were determined according to the methods of the (A.O.A.C, 1995).

Chemical quality indices:

Determination of pH: pH was measured using digital pH meter according to (Ramadhan *et al.,* 2011). About 10 g of sample was mixed with 90 ml of distilled water using homogenizer and the pH was noted.

Determination of total acidity: The total acidity for fish burger was determined by titration at zero time according to the method described by (Keeton and Melton, 1978). The acidity was expressed as lactic acid.

Determination of Total volatile basic nitrogen (TVB-N): The total volatile bases were estimated as described by A.O.A.C (1995). 10g of sample was added to the heating flask containing 300 ml distill water plus 2 g magnesium oxide. In the receiving flask 25 ml of boric acid (2%) and few drops of methyl red indicator were added. After 25 minutes of distillation, the content of the receiving flask was transferred to another flask and titrated with 0.05N (H2SO4).

The total volatile basic nitrogen (TVB-N) was determined as follows:

$$(\text{TVB-N}) = \frac{(V \times N \times 100 \times 14)}{W}$$

Where:

V=volume (ml) H2SO4 used for sample.

N=normality of H2SO4.

W=weight of sample in grams.

Determination of Thiobarbituric acid (TBA): The thiobarbituric acid (TBA) was performed as described by Tarladgis *et al.* (1969).

Physical analysis:

Determination of water holding capacity (W.H.C): Water holding capacity (W.H.C) was measured according to Alvarez & Tejada. (1992).

While, expressible water is calculated as follow:

$$\text{Expressible water (\%)} = \frac{\text{PPW - APW} \quad \text{X 100}}{\text{PPW}}$$

Where:

PPW= pre-pressed weight and APW = after-pressed weight

Water holding capacity is calculated as follows:

Water holding capacity (%) = %Moisture - % Expressible water

Determination of color (L, a, and b) and whiteness: Color values (L*, a*, and b*) were measured for fish fillet mince, by a colorimeter (Color Tec PCM Color Meter Tec. NJ. USA). The value L* is a measure of lightness, a*represents the chromatic scale from +a redness to –a greeness and b* represents the chromatic scale from +b yellowness to –b blueness. Three random measurement spots on each sample were made and the average data were recorded (Foh *et al*., 2011).

Cooking loss measurement: Cooking loss was measured according to the method of Niamnuy *et al.,* (2008) and was calculated from the differences in the mass of minced before and after cooking as follow:

$$\text{\% Cooking loss} = \frac{(\text{Mass before cooking} - \text{Mass after cooking}) \text{ X 100}}{\text{Mass before cooking}}$$

Microbiological analysis:

Total plate count (TPC): Total plate count (TPC) was determined as (CFU/g) according to the method of Harrigan and McCance, (1976).

Psychrophilic bacteria: Psychrophilic bacteria was made as (CFU/g) according to the methods described by Collins *et al*. (1989).

Coliform bacterial count: Coilform bacterial count was determined by the method of (Difco Laboratories Manual, 1998).

Sensory evaluation: Sensory evaluation for color, taste, odor, texture, and overall acceptability for the cooked untreated and treated catfish burger were carried out in order to determine the consumer acceptability for the product according to the methods described by Eyo, (1983). Ten judges were participated in this test. A numerical hedonic scale ranged between 1 and 10 (1 for very bad, and 10 for excellent) was used for sensory evaluation.

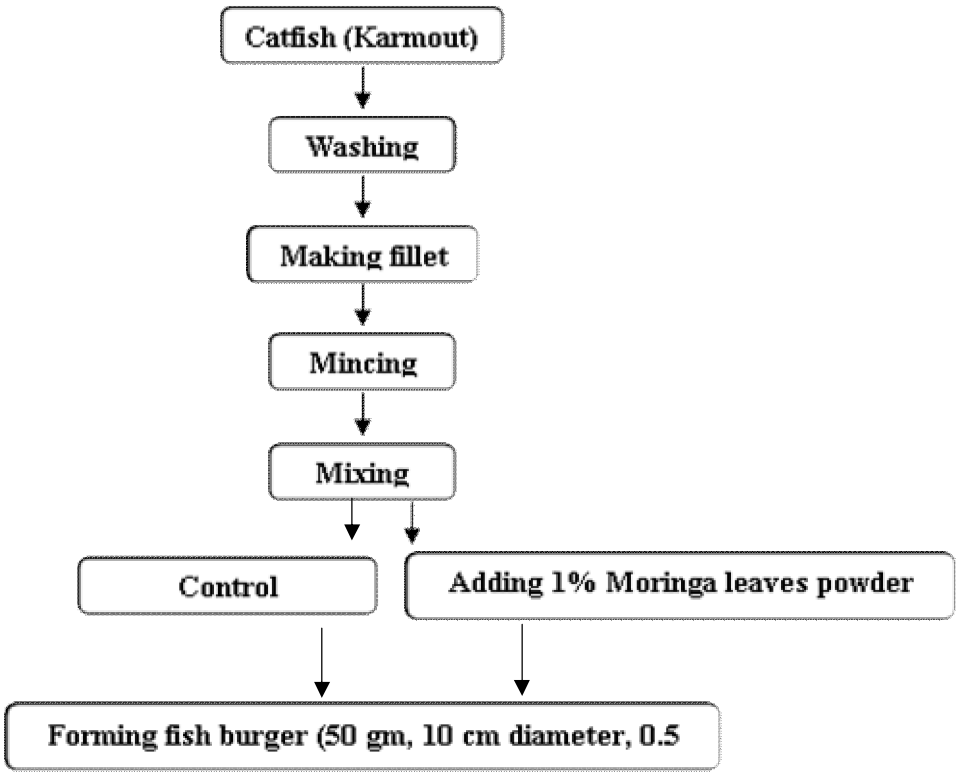

Figure 1. Flow diagram of production of catfish burger.

Results and Discussion:

The effect of adding 1% moringa leaves powder on the chemical composition, ph value and total acidity (lactic acid) of catfish burger is illustrated in Table (2). The data showed that the moisture content decreased as a result of moringa powder due to the low moisture content of dried moringa leaves compared to the catfish flesh, but that addition did not much affected the crude protein, crude either extract, and ash content. The total acidity value (expressed as lactic acid) of the sample contain 1% moringa leaves powder was higher than the control one which reflected on lowering the pH value for the moringa powder containing sample. The results come in agreement which found by (Mahmoudzadah *et al.,* 2010), and Zhu *et al.,* 2015).

Table 2. Effect of adding 1% moringa leaves powder on the chemical composition of catfish burger % (wet weight basis).

Parameters	Control	1 % moringa powder
Moisture content	69.01±0.15	67.67±0.57
Crude protein (N x 6.26)	17.85±0.23	17.22±0.59
Crude either extract	4.64±0.11	4.42±0.19
Ash content	4.03±0.10	4.01±0.07
pH	6.31±0.01	6.26±0.01
Total acidity (lactic acid)	0.66±0.01	0.72±0.05

Means of 3 replicates ±SD

Dimethylamine (DMA), trimethylamine (TMA), and ammonia (NH3) are three compounds that known as the total volatile basic nitrogen compounds (TVB-N) or as volatile amines. After the death of fish the activity of spoilage bacteria increased, resulting in reduction of trimethylamine oxide to trimethylamine (TMA), dimethylamine (DMA) and other compounds as subsequent of that action. The effect of adding 1% moringa leaves powder on the total volatile basic nitrogen (TVB-N), thiobarbituric acid (TBA), and color values (L*, a*, b*) of catfish burger are illustrate in Table (3). The data showed a reduction in both (TVB-N), and (TBA) values for the sample contained 1% moringa leaves powder. That means the addition of moringa powder little reduced the (TVB-N) and (TBA) values and suppressed the formation of the total volatile basic nitrogen (TVB-N) because moringa leaves have been described to be an excellent source of natural antioxidants as mentioned by (Al-Juhaimi *et al.,* 2015). The data also revealed reduction in the L* and b* values and an increase in a* value due to the addition of 1% moringa leaves powder (Avile´s, *et al*., 2014).

Table 3. Effect of adding 1% moringa leaves powder on the (TVB-N), (TBA), and color values (L*, a*,b*) of catfish burger % (wet weight basis).

Parameters	Control	1 % moringa powder
TVB-N (mg/100g)	9.14±0.56	8.91±0.39
TBA(mg malonaldihyde/kg)	1.17±0.01	1.03±0.01
L*	41.83±0.46	37.27±0.66
a*	13.19±0.14	17.30±0.29
b*	22.50±0.13	18.55±0.37

Means of 3 replicates ±SD

Figure (2) illustrated the effect of adding 1% moringa leaves powder on water holding capacity (WHC), expressible water (EW), and cooking loss of catfish burger. The data showed a reduction in the water holding capacity value and an increase in both expressible water and the cooking loss due to the addition of 1 % moringa leaves powder. The low cooking loss for the control sample reflected the high WHC value which means the high power to capture the water in the protein matrix.

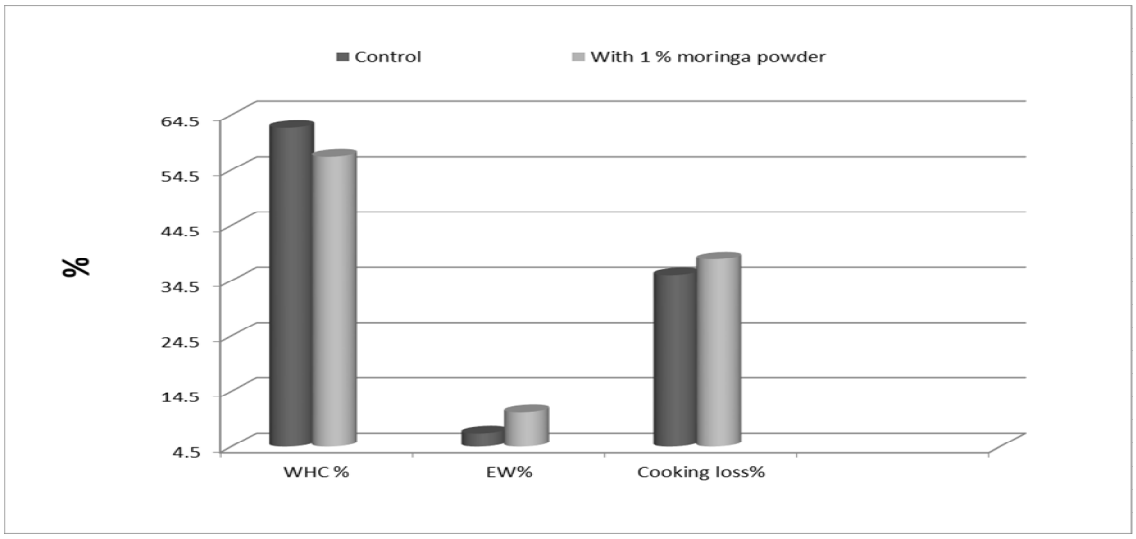

Figure 2. Effect of adding 1% moringa leaves powder on water holding capacity (WHC), expressible water (EW), and cooking loss of catfish burger.

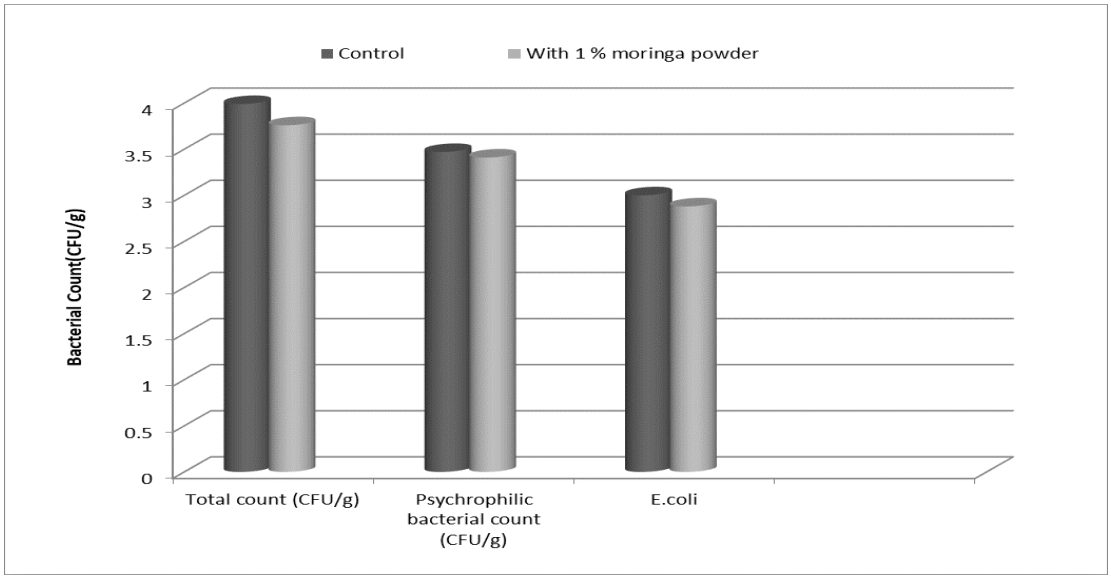

Figure 3. Effect of adding 1% moringa leaves powder on the total count, the psychrophilic bacterial count, and E.coli of catfish burger (log CFU/g).

The microbiological safety and quality of fish and fish products are very important to processors, retailers, and of course consumers. Due to its nature, fish is generally susceptible to contaminate with pathogens and other microorganisms. The effect of adding 1% moringa leaves powder on the total count, the psychrophilic bacterial count, and E.coli of catfish burger (log CFU/g) is shown in Figure (3). The data showed that the addition of 1% moringa leaves powder to the catfish burger reduced all the examined bacterial counts (total, psychrophilic, and E.coli) due to the antimicrobial effect of moringa leaves powder. That means the addition of moringa powder to the formula negatively affected the surviving of the microorganisms that contaminating the catfish burger. The results come in agreement with (Zhu *et al*., 2015).

Quality of fish products are generally examined by sensory evaluation. The effect of adding 1%

moringa leaves powder on the sensory evaluation (color, taste, odor, texture, and general acceptability) of catfish burger is illustrated in figure (4). The data showed that the addition of 1% moringa leaves powder to the catfish formula had increased the values for color, taste, odor, texture, and general acceptability compared to the control one.

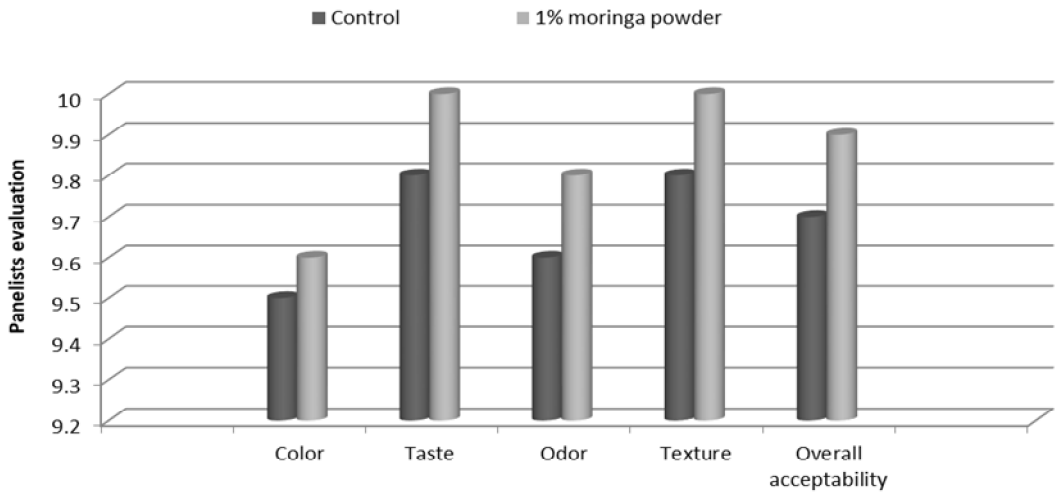

Figure 4. Effect of adding 1% moringa leaves powder on the sensory evaluation of catfish burger.

References:

Al-Juhaimi, F., K.Ghafoor, M.D. Hawashin, O.N. Alsawmahi and E.E. Babiker., (2015). Effects of different levels of Moringa (Moringa oleifera) seed flour on quality attributes of beef burgers. CYTA-Journal of Food, 14 Issue 1: 1-9.

Alvarez, C., & Tejada, M. (1997). Influence of texture of suwari gels on kamaboko gels made from sardine (Sardina pilchardus) surimi. Journal of the Science of Food and Agriculture, 75(4), 472-480.

A.O.A.C., (1995). Official methods of analysis, 16th Ed .Association of official analytical chemists international, Arlington, Virginia, USA.

Aref, S., Morsy, N., Habiba, R. A., and Zayat, F., (2018). Effect of transglutaminase enzyme, chitosan and rosemary extract on some quality characteristics of ready to eat fish fingers made from catfish (Clarias gariepinus) during frozen storage. 8, 716–731.

Avile´s, C., Juarez M., Larsen I. L., Rodas-Gonzalez A., and Aalhus, J. L., (2014). Effect of multiple vacuum packs on colour development and stability in beef steaks. Can. J. Anim. Sci. 94: 63-69.

Boran, M., and Köse, S., (2007). Storage properties of three types of fried whiting balls at refrigerated temperatures. Turkish journal of fisheries and aquatic sciences, 7(1), 65-70.

Collins, C.H., Lyne, P.M., and Grange, J.M., (1989). Counting microorganism. Microbiological methods, 127, 140.

Difco Laboratories (1998). Manual of Microbiological Culture Media. Second Edition, Division of Becton Dickinson and Co. Sparks, MD. USA.

Dillard C.J. & J.B. German., (2000). Phytochemicals: nutraceuticals and human health: a review. J.Sci. Food Agric., 80 Issue 12: 1744-1756.

Eyo Ate, B., (1983). The Presence of France in West-Central Africa as a Fundamental Problem to Nigeria. Millennium, 12(2), 110-126.

Eu, J.H., (1995). U.S. Patent No. 5,404,388. Washington, DC: U.S. Patent and Trademark Office.

Foh, M. B. K., Kamara, M. T., Amadou, I., Foh, B. M., and Xia, W., (2011). Chemical and physico-chemical properties of tilapia (Oreochromis niloticus) fish protein hydrolysate and concentrate. International journal of Biological chemistry, 5(1), 21-36.

Harrigan, W. F., and Mc Cance, M. E., (1976). Laboratory methods in food and dairy microbiology. Academic Press Inc. (London) Ltd.

Hassoun, A., and Çoban, Ö. E., (2017). Essential oils for antimicrobial and antioxidant applications in fish and other seafood products. Trends in Food Science and Technology, 68, 26-36.

Hazra, S., Biswas, S., Bhattacharyya, D., Das, S. K., and Khan, A., (2012). Quality of cooked ground buffalo meat treated with the crude extracts of Moringa oleifera (Lam.) leaves. Journal of food science and technology, 49(2), 240-245.

Jiang, Q., Okazaki, E., Zheng, J., Que, T., Chen, S., and Hu, Y.,(2018). Structure of northern snakehead (Channa argus) meat: Effects of freezing method and frozen storage. International journal of food properties, 21(1), 1166-1179.

Keeton, J.T., and Melton, C.C. (1978). Factors associated with microbial growth in ground beef extended with varying levels of textured soy protein. Journal of Food Science, 43(4), 1125-1129.

Magdy, R.M., (2010).Chemical and Technlogical Studies on Protein and Fish Oil. Master of Science Thesis. Minia University.

Mahmoudzadeh, M., Motallebi, A., Hosseini, H., (2010). Quality changes of fish burgers prepared from deep flounder (Pseudorhombus elevatus Ogilby, 1912) with and without coating during frozen storage (-18 ?C). International Journal of Food Science and Technology, 45, 374–379.

Nelson JS, Grande T.C & Wilson, M.V.H., (2016). Fishes of the world. Animal Science and Zoology. John Wiley and Sons Inc. 5th Edition.

Niamnuy, C., Devahastin, S., and Soponronnarit, S., (2008). Changes in protein compositions and their effects on physical changes of shrimp during boiling in salt solution. Food Chemistry, 108(1), 165-175.

Ozogul, Y., Durmuş, M., Balıkcı, E., Ozogul, F., Ayas, D., and Yazgan, H., (2011). The effects of the combination of freezing and the use of natural antioxidant technology on the quality of frozen sardine fillets (Sardinella aurita). International journal of food science & technology, 46(2), 236-242.

Ramadhan, K., Huda, N., and Ahmad, R., (2011). Physicochemical characteristics and sensory properties of selected Malaysian commercial chicken burgers. International Food Research Journal, 18(4).

Suleiman, J. S., Hu, B., Peng, H., and Huang, C. (2009). Separation/ preconcentration of trace amounts of Cr, Cu and Pb in environmental samples by magnetic solid-phase extraction with Bismuthiol-II-immobilized magnetic nanoparticles and their determination by ICP-OES. Talanta, 77(5), 1579-1583

Tarladgis, B.G., Watts, B.M., Younathan, M.T., and Dugan Jr, L., (1969). A distillation method for

the quantitative determination of malonaldehyde in rancid foods. Journal of the American Oil Chemists' Society, 37(1), 44-48.

Zhu, Y., Zhang, K., Ma, L., Huo, N., Yang, H., & Hao, J., (2015). Sensory, physicochemical, and microbiological changes in vacuum packed channel catfish (Clarias lazera) patties during controlled freezing-point storage. Food science and biotechnology, 24(4), 1249-1256.

Assiut J. Agric. Sci., 52 (1) 2021 (31-41) *ISSN: 1110-0486*
Website:www.aun.edu.eg/faculty_agriculture/journals_issues_form.php *E-mail: ajas@aun.edu.eg*

تأثير اضافة مطحون أوراق المورينجا على التقييم الكيميائي والميكروبي والحسي لبرجر سمك السلور (القرموط النيلي)

رانيا حسن عبد اللطيف، محمد أحمد قناوى وحسين عبد الجليل عبد العال

قسم علوم الأغذية – كلية الزراعه – جامعة المنيا

الملخص

تعتبر الأسماك من أرخص مصادر البروتين الحيواني في جميع أنحاء العالم. حيث توفر البروتين والفيتامينات والمعادن وأحماض أوميجا ٣ فى الوجبات الغذائية للأنسان خاصة فى الدول الفقيرة. كما يمثل الأنتاج السمكى أحد مصادر الدخل القومي المصرى. و قد أعلنت هيئة الثروة السمكية المصرية في عام ٢٠٢٠ أن الإنتاج السمكى قد بلغ مليون و ٩٢٠ ألف طن. و يعتبر القرموط الأفريقي هو أحد أنواع الأسماك المستهلكة في مصر ، لذلك فقد أجريت هذه الدراسة لاستخدام سمك السلور الطازج (القرموط النيلي) (Claries gariepinus) لإنتاج برجرالسمك ،تم دراسة تأثير إضافة ١٪ من مسحوق أوراق المورينجا إلى خلطة البرجر و دراسة تأثير تلك الاضافة على كل من التركيب الكيميائي ، واالنشاط الميكروبيولوجي ، والتقييم الحسي للمنتج. و قد أظهرت البيانات أن إضافة ١٪ من مسحوق أوراق المورينجا إلى برجر سمك السلور قد تسبب في تقليل قدرة الاحتفاظ بالماء ، وزيادة الفاقد في الطهي بينما قلل من العد البكتيري وأدى الى تحسين التقييم الحسي مقارنة بعينات الكونترول.