Journal of the College of Specific Education for Educational and Specific Studies **Issue (20) May 2022**

Quality assessment of dried-salted grass carp (Cteanopharynogodon idellus) fish fillets

تقدير جودة شرائح سمك مبروك الحشائش المملحة المجففة

By

Omar A. Emam* Sayed M. Ibrahim**

Ghada M. El-Basiouny* Mai Ahmed Abdel Meguid[1]

Abstract

This study aims to maximize the utilization of low-priced grass carp (*Cteanopharynogodon idellus*) to obtain dried salted fish products. Carp fish fillets were salted using different levels of salt; 10% and 15% in the presence of 1% black cumin, garlic, rosemary and mixtures thereof, salted, dried and packaged in polyethylene bags. The results showed that the yield of the edible part (flesh) recorded 40.5%, and at pH 6.35, 14.20 mg /100 g TVBN, 1.12 mg/100 g TMAN, 0.42 mg MDA/kg sample as TBA value. These values changed greatly in dried salted fish products as affected by salting and drying processes. Also, the 15% salt products were more stable and better quality than the 10% salted products. Although, the plant extracts used had a low effect on the values of dried

salted products; however, it improved the odor characteristic of these products. This study recommends the possibility of maximizing the carp species to produce some dried salted fish products, as both salting and drying are cheap techniques and do not require more experience.

[1] Researcher at Benha university.

* Faculty of specific Education, Benha Univ

** National Institute of Oceanography and Fisheries

Keywords: Fish curing, chemical composition, essential oils, water activity

Introduction

Fish has been widely accepted as a good source of high quality protein and contains many vitamins and minerals for the maintenance of healthy body. It is a good source for the health and consumption of fish minimizes the risk of stroke, due to omega-3 fatty acids and peptides as bioactive substances. However, it is an extremely perishable commodity and quality loss can occur very rapidly after catch **(Musa *et al*., 2010; Dewi *et al.*, 2011 and Ravichandran *et al.*, 2012**). Fish preservation techniques, curing and drying are the traditional preservation techniques and they are cost-effective too. Improper handling and processing leads to spoilage and insect infestation and hence results in a product of poor quality. The quality of the final product depends significantly on the quality of raw materials, the processing variables and drying method. Globally about 1.4 million metric tons of fish, accounting for about 8.0 per cent of the total world catch, are cured and utilized **(Patterson *et al*., 2018).** The problems of dried fish products are associated with fly infestation and contamination during storage. The sun-dried fish products are contaminated by dust, dirt or sand and pathogens and they are considered unhygienic by contributing the partial destruction of protein contents of the fish through oxidation and bacterial or enzymatic degradation. Moreover, the physical and organoleptic qualities of most of the traditional sun-dried products available in the market are not satisfactory for human consumption (**Reza, 2002; Saha, 1999 and Hasan, 2006**). On

the other side, natural antioxidant and antimicrobial activity of plant extracts have been recognized for many years and applied in several food systems as antioxidant or antibacterial agents (**Fernandez-Lopez et al., 2005; Ahn et al., 2007; Kanatt et al., 2007**). With regard to carp fish species in Egypt, four carp fish species; common, silver, grass and bighead carp are extensively cultured. They are considered the most widely cultured species in Egypt, due to their fast growth rate, easy cultivation and high feed efficiency ratio. Total annual fish production in Egypt during 2019 recorded 2,038,991 metric tons (carp species production recorded 232,920 metric tons, 11.42%) and the annual share per capita was 20.26 kg as available domestic production as set by General Authority for Fish Resources Development (**GAFRD, 2019**). Therefore, this study aims to maximize the utilization of low-priced grass carp (*Cteanopharynogodon idellus*) to obtain some dried salted fish products.

Materials and Methods

Materials

Fish samples: About 20 kg of Grass carp fish (*Ctenopharyngodon idellus*) samples (Fig. 1) were purchased from fish market, Alobour city, Cairo during June, 2019. The average weight and length of raw fish samples were 2.5Kg and 42cm, respectively. They were transferred using icebox to Fish processing Lab., Alqanatir Alkhairia-Fish Research Station, National Institute of Oceanography and Fisheries. Carp samples were carefully washed with tap water, head, scales, skin, viscera and bones were removed. Fish fillets obtained were carefully rewashed to remove any traces of blood, drained and packed in polyethylene bags.

Fig. (1). Grass carp fish (*Ctenopharyngodon idellus*) and dried-salted fillets.

Plant extracts; garlic (*Allium sativum*), black cumin (*Nigella sativa)* and rosemary (*Rosmarius officinalis*) were purchased in brown glass bottles (10ml capacity) from local market, Alqanatir Alkhairia city, Qalyoubya. Sodium chloride (Bono salt composed 98.5% min. sodium chloride, 30-70ppm potassium iodate and 0.3% max humidity) produced by the Egyptian salts & minerals Company (EMISAL). Plastic containers; clear hard plastic containers with lids (1Kg capacity) were purchased from local market, Alqanatir Alkhairia city, Qalyoubya.

Salting and drying techniques; prepared grass carp fillets could be divided into two groups (10% and 15% salt) as follows: Control sample (salted fillets without plant extracts), salted samples incorporated with 1% of (black cumin, garlic, rosemary, and mixtures thereof extracts), salting process was done for only one day at ambient temperature, washed with distilled water to remove completely the excess salt, drained and dried by drying oven at 60°C for 3 days to obtain moisture content ranged from 7.75 to 12.33%. After that, dried salted

treatments were left inside the oven till cooled, and packed in polyethylene bags (Fig.1).

Analytical Methods

Chemical composition; moisture, crude protein (Nitrogen × 6.25), lipid and ash content (**AOAC, 2000**) were determined. Physico-chemical quality indices; pH value was measured (**Egbert *et al*., 1992**), using a digital pH meter (Hydrolab model Crison-Spain MM40^{+}) and Water activity (a_w) (**Demeyer, 1979**) and water phase salt (**Codex, 2013**) were calculated. Thiobarbituric acid (TBA) value (**Tarladgis *et al*., 1960**), total volatile basic nitrogen (TVB-N) content (**Pearson, 1976**), Trimethyleamine nitrogen (TMA-N) (**AOAC, 2000**) were determined. The obtained results (n = 3) were statistically analyzed and the least significant difference (LSD) was done between the treatments studied using SPSS (Ver. 16).

4- Results and Discussion

Quality of raw grass carp fish

Table (1) shows the biochemical analysis and quality criteria of raw grass carp flesh (on wet weight basis). Results showed that the yield of edible part (flesh) of grass carp was 40.5%; the remaining part as by-products (waste) was 59.50%.

Table (1): Biochemical analysis and quality criteria of raw grass carp flesh (on wet weight basis).

Item	%	Quality Indices	Value
Yield	40.50%	**pH value**	6.35±0.01
Moisture	77.06±0.86	**TVB-N** content (mg/100g)	14.20±0.24
Crude protein	16.44±1.22	**TMA-N** content (mg/100g)	1.12±0.02

Lipid	4.27±0.34	**TBA value** (mg MDA/kg)	0.42±0.01
Ash	1.48±0.03		

TVB-N: total volatile basic nitrogen; TMA-N: trimethylamine nitrogen; TBA: thiobarbituric acid.

Carp flesh contained 77.06% moisture, 16.44% crude protein, 6.26% fat, 1.48% ash (on wet weight basis). Also, carp flesh have 6.35 pH value, 14.20 mg /100 g total volatile nitrogenous bases, 1.12 mg / 100 g TMA, 0.42 mg MDA/kg TBA value. With regard to some previous studies, it was found that edible parts of carp species were 44.09% of common carp (**Elsayed, 2016**); 40.55% of common carp (**Saber, 2017**). This variation in edible parts of carp fish is due to species, size, location of catch, season, spawning period, sex, feeding, post-harvest behavior, and filleting skills too. The results of proximate analysis are lower than those reported by **Haq *et al.*, (2013)**; they showed that the grass carp mince contained 79.15% moisture, 18.01% protein, 4.89% lipid, and 2.01% ash content. Also, it was found that chemical composition constituents were 73.24% moisture, 17.68% protein, 6.14% fat, and 1.60% ash content of common carp (**Talab, 2016**); the corresponding values were 73.40%, 15.26%, 7.98%, and 071% of common carp (**Elsayed, 2016**); 70.47%, 15.605%, 12.24%,0.68% of common carp (**Mahmoud, 2016**); 72.99%, 19.14%, 4.76%, 2.11% of grass carp (**Mahmoud, 2017**); 80.395%, 16.06%, 2.68%, 0.60% of common carp (**Saber, 2017**). Several researches have been reported that the proximal analysis of fish varies according to several factors such as fish spp., individuals, inside the one species, season, sexual status, size, diet, location, ecology conditions etc. Proximate composition of fish is varying with species, body size, season, environmental factors and nutritional status, whereas the

sensory parameters are less affected by these variables. Different rearing systems generate products having variable quality level (**Sankar and Ramachandra, 2001** and **Hoseini *et al.*, 2013**).

From the same Table (1), the results of quality criteria of raw grass carp flesh were pH value 6.35, TVN 14.20 mg/100gm, TMA 1.12 mg/100gm and TBA value 0.42 mg MDA/kg sample. These results are similar with those reported by **Talab , 2014; Elsayed, 2016; Mahmoud, 2016; Mahmoud , 2017, Saber, 2017 and Abd-Allah, 2019**), the range of values were 5.98-6.78 pH, 11.77-23.80.mg/100gm TVN, 1.17-4.36 mg/100gm TMA and 0.04-1.49 mg MDA/ kg samples of carp fish species while **Haq *et al.*, (2013)** found pH value of grass carp fish was 6.80. Based on the results of this study, the values of quality criteria indicated that grass carp fish samples were good and accepted. A value of 35 mg/100 g of TVB-N has been suggested as border line (**Ghaly, 2010**).

Quality of salted grass carp fillets

The physical properties of salted grass carp flesh at levels of 10% and 15% are shown in Table (2). The moisture ranged 78.35-82.05% and 76.04-81.32% for salted fish fillets with 10% and 15% concentrations, respectively.

Table (2): The physical properties of salted grass carp fillets at levels of 10% and 15%.

Item	Salted grass carp fillets with plant extracts										LSD (P<0.05)
	Control		Black cumin		Garlic		Rosemary		Mixed		
	10 %	15 %	10 %	15 %	10 %	15 %	10 %	15 %	10 %	15 %	
Moistur	78.79	78.35	78.35	76.04	82.05	81.32	80.40	79.42	81.96	78.61	2.72

e											
Salt	2.30	2.90	2.93	2.30	1.80	2.50	2.25	2.70	2.50	2.80	0.50
WPS	2.83	3.57	3.60	2.94	2.15	2.98	2.72	3.29	2.96	3.43	0.63
a_w	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.00

WPS: % water phase salt. $a_{w:}$ water activity; LSD: least Significant difference ($P<0.05$)

Increase in moisture content was higher in 10% salted fillets compared with 15% salt fillets. The salt content was ranged from 1.80 - 2.93% of the salted fillets with 10%, while it was ranged from 2.30 - 2.90% of 15% salted fillets treatments. The values of the water phase salt of the salt ranged from 2.15 - 3.60% and 2.94 - 3.57% for the salted samples at 10% and 15%, respectively. Water activity values were 0.98 for all salted fish fillets (10% and 15%). The highest value of moisture content was found in the garlic treatment while the lowest content was in case of black cumin treatments either salting 10% or 15% levels. A significant change ($P<0.05$) was found in the moisture and salt content as a resultant of fish fillets salting process while it was no significant in water activity. Based on the results in this study, the rates of water diffusion are positively correlated with increasing of salt concentration. Also, loss of water from fish muscles is due to heavy uptake of salt as reported by **Martínez-Alvarez and Gomez-Guillén, (2006); Bellagha *et al.*, (2007); Boudhrioua *et al.*, (2009)** and **Dewi *et al.*, (2011**).

Table (3) demonstrates the quality indices of salted grass carp flesh at levels of 10% and 15%. The pH values ranged from 6.29-6.74 for 10% salted fillets, while it slightly

decreased to 5.95-6.41 for 15% salted fillets. The values of TVBN content ranged from 14.00 - 22.40 mg/100 g of 10% salted treatments, while in the case of 15% all treatments contained 14.00 mg/100 g sample.

Table (3): Quality indices of salted grass carp flesh at levels of 10% and 15%.

Index	Salted grass carp fillets with plant extracts;										LSD (P<0.05)
	Control		Black cumin		Garlic		Rosemary		Mixed		
	10 %	15 %	10 %	15 %	10 %	15 %	10 %	15 %	10 %	15 %	
pH	6.43	6.31	6.37	5.95	6.29	6.00	6.42	6.41	6.74	6.32	0.32
TVB	22.40	14.00	22.40	14.00	22.40	14.00	14.00	14.00	14.00	14.00	6.21
TMA	0.89	0.62	0.82	0.48	0.74	0.48	0.67	0.44	0.65	0.45	0.13
TBA	0.62	0.51	0.59	0.60	0.61	0.59	0.67	0.69	0.45	0.67	0.11

TVB-N: total volatile basic nitrogen (mg/100g). TMA-N: trimethylamine nitrogen (mg/100g), TBA: thiobarbituric acid (mg MDA/kg); LSD: least Significant difference ($P<0.05$).

The values of TMAN ranged from 0.65 - 0.89 mg/ 100gm TMA in salted treatments with 10%, while it decreased slightly to reach 0.44 - 0.62 mg/100 g in the treatments at 15%. The values of TBA ranged from 0.45-0.67 MDA/kg of 10% for salted treatments, while it slightly increased to reach 0.51-0.67 MDA/kg for 15% salted treatments. Based on these results, it could be observed that there are a clear variation in moisture content, salt and WPS in different treatments; due to salting method, salt concentrations and analyzed part and also type of plant extracts used. Also, there was a significant different (*P<0.05*) in pH, TMA and TBA studied between 10% and 15%

treatments, lowered between 15% treatments followed by 10% treatments. However, no significant differences in TVB content only between control and 10% samples treated with black cumin and garlic.

Dried –salted grass carp fillets

The physical properties of dried-salted grass carp fillets at 10% and 15% salt levels are presented in Table (4). The drying process led to a significant decrease in moisture content to reach a range of 8.18-12.33% in 10% dried salted treatments, while it reached from 7.75-11.12% in 15% dried salted treatments. The salt content ranged between 3.90 - 5.80% of 10% dried salted treatments, while it recorded 5.60 - 5.80% of 15% treatments. The values of the water phase salt of the salt ranged from 24.03 - 41.49% and 34.42 - 41.51% in the 10% and 15% dried salted treatments, respectively. The values of water activity ranged 0.24-0.54 and 0.40-0.54 in the dried salted treatments with 10% and 15%, respectively and they were highly lower than MPLs as reported (0.75 and 0.70) by **Codex (2003)** and **Philippines Std., (2015)**, respectively. There was a significant different (*P<0.05*) in moisture content between control samples and others especially garlic treatments.

Table (4): The physical properties of dried-salted grass carp fillets at levels of 10% and 15%.

Item	Salted grass carp fillets with plant extracts;										LSD (P< 0.05)	MPLs
	Control		Black cumin		Garlic		Rosemary		Mixed			
	10%	15%	10%	15%	10%	15%	10%	15%	10%	15%		
Moisture	12.33	11.1	9.59	9.37	8.18	7.75	8.84	8.00	9.54	8.30	2.09	-

		5										
Salt	3.90	5.80	5.70	5.00	5.80	5.50	5.40	5.10	4.30	5.20	1.11	-
WPS	24.03	34.42	37.28	34.79	41.49	41.51	37.29	38.93	31.07	38.52	7.54	-
a_w	0.24	0.40	0.45	0.41	0.54	0.54	0.47	0.49	0.34	0.48	0.14	0.70-0.75

WPS: % water phase salt; a_w: water activity; LSD: least Significant difference ($P<0.05$), MPLs: maximum permissible limits for dried salted fish (**CODEX, 2003**) and **Philippines Std., (2015).**

Our results obtained are in agreement with **Bala and Mondol (2001) and Sidhi *et al.*, (2018)**; they reported by drying led to reduce the water activity, inhibit or destroy the growth of the microorganism, inactive autolytic enzymes and to prolong the shell life as well as desirable sensorial changes of finished salted products. This can be done by salting, and / or drying. Also, **AL-Temimi (2018)** studied that the chemical composition of dried carp and he found that moisture, protein, fat, and ash was 12.59, 18.24, 55.73 and 13.41%, respectively. **Patterson *et al.*, (2018)** found that the chemical composition of commercially dried fish were 53.17% moisture, 14.72% protein, 1.04 % lipid, 0.72% ash and 0.08% carbohydrate content.

Quality indices of dried- salted grass carp fillets

Table (5) demonstrates some quality indices of dried-salted grass carp flesh at levels of 10% and 15%. Results of pH values ranged from 6.29 - 6.74 in 10% treatments, while it decreased slightly to be 5.95 - 6.41 in 15% treatments. Also, there was stability in the values of the TVBN to record 14.00 -

22.40 mg/ 100 g for 10% treatments, while in the case of 15% treatments; it was 14.00 mg /100 g in all treatments. TMA values decreased to 0.50 - 0.65 mg/ 100g in 10% treatments, while it slightly decreased to 0.43 - 0.50 mg /100g in 15% treatments. There was stability in the values of TBA, which was 0.45-0.67 MDA/kg in 10% treatments, while it increased slightly to range of 0.51-0.67 MDA/kg in 15% treatments. Also, it was found a significant different ($P<0.05$) in pH value between 15% black cumin treatment and other ones and the same observation was found in TBA value too.

Table (5): Some quality indices of dried-salted grass carp flesh at levels of 10% and 15%.

Index	Salted grass carp fillets with plant extracts;										LSD (P<0.05)
	Control		Black cumin		Garlic		Rosemary		Mixed		
	10%	15%	10%	15%	10%	15%	10%	15%	10%	15%	
pH	6.43	6.31	6.37	5.95	6.29	6.00	6.42	6.41	6.74	6.32	0.32
TVB	22.40	14.00	22.40	14.00	22.40	14.00	14.00	14.00	14.00	14.00	5.81
TMA	0.57	0.50	0.50	0.48	0.63	0.48	0.63	0.43	0.65	0.45	0.12
TBA	0.62	0.51	0.59	0.60	0.61	0.59	0.67	0.69	0.45	0.67	0.11

TVB-N: total volatile basic nitrogen. TMA-N: trimethylamine nitrogen. TBA: thiobarbituric acid reactive. LSD: least Significant difference ($P<0.05$).

These results are in accordance with those reported by **Patterson *et al.*, (2018) and Abou- Zied *et al.*, (2019)**; they mentioned that **t**his variation in the quality of dried-salted products is due to the processing techniques vary with the type,

nature, size, and condition of the fish. The quality of the final product depends significantly on the quality of raw materials, the processing variables and both salting and drying methods.

Conclusion

Carp species are a major source of dried salted fish products. Salted carp samples with 15% have more stable and better quality than the products salted with 10%. Plant extracts used had a little effect on dried-salted products however; they improved the odor property of them. This work recommends that carp fish species can be maximized for production of some dried salted fish products which they have a long shelf life, easy storing and handling. Both salting and drying are cheap techniques and don't require more experience. The wastes of this industry are also a major source for production of fishmeal and oils.

References

Abd-Allah, Shimaa, S. (2019). Studies on production and quality evaluation of some nutritious crackers supplemented with inexpensive fish proteins. Ph. D. Thesis, Faculty of Agriculture, ALAzher Univ.

Abou-Zied, A. S.;Talab, A.S.; Ibrahim, M.A. and Ibrahim,S.M. (2020). Quality attributes of artificial dried and dried salted Sand smelt fish (Atherina boyeri). Egyptian Journal of Aquatic Biology & Fisheries, Vol. 24(7): 307 – 317.

Ahn, J.; Grun, I. U. and Mustapha, V. (2007). Effect of plant extracts on microbial growth, color change, and lipid oxidation in cooked beef. Food Microbiol., 24: 7-14.

Al-Temimi, W.K.A. (2018). Studying of physical and chemical properties and microbial content for dried fish by microwave. Diyala Journal of Agricultural Sciences 10:12-28.

AOAC (2000). Official Methods of Analysis of the Association of Analytical Chemists. 18th Ed., Washington, D.C.

Bala, B. K. and Mondol, M. R. A. (2001). Experimental investigation on solar drying of fish using solar tunnel dryer. Drying Technology, 19(2):427–436.

Bellagha, S.; Sahli, A.; Farhat, A.; Kechaou, N. and Glenza, A. (2007). Studies on salting and drying of sardine (Sardinella aurita): Experimental kinetics and modeling. Journal of Food Engineering, 78(3):947–952.

Boudhrioua, N.; Djendoubi, N.; Bellagha, S. and Kechaou N. (2009). Study of moisture and salt transfers during salting of sardine fillets. J. of Food Eng., 94:83-89.

Codex Alimentarius (2003). Code of practice for fish and fishery products. CAC/RCP 52. Rome: FAO/WHO. 134 p.

CODEX STAN 236 (2003).Codex Standard for Boiled Dried Salted Anchovies. Codex Alimentarius Commission. Food and Agriculture Organization/World Health Organization (FAO/WHO) Joint Programme. Rome, Italy.

Demeyer, D. (1979). Comparison between calculated halotolerant and halophili histamine-forming bacteria and measured values of water activity (aw) in dry in red meat fish products. Bulletin of the Japanese sausage. Fleischwirt, 59 (7): 973-975.

Dewi, R.S.; Nurul Huda, G. and Ahmad, R. (2011). Changes in the physicochemical properties, microstructure and

sensory characteristics of shark dendeng using different drying methods. American Journal of food Technology 6: 149-157.

Egbert, W. R.; Huffman, D. L.; Chen, C. M. and Jones, W. R. (1992). Microbial and oxidative changes in low-fat ground beef during simulated retail distribution. J. Food Sci., 57: 1269-1269.

Elsayed, H. M. (2016). Effect of edible coating on the quality characteristics of fishery products. M.Sc., Fac. Agric., Zagazig Univ. Egypt

Fernandez-Lopez, J.; Zhi, N.; Aleson-Carbonell, L.; Perez-Alvarez, J. A. and Kuri, V. (2005). Antioxidant and antibacterial activities of natural extracts: application in meat balls. Meat Sci. 69: 371-380.

GAFRD (2019). General Authority for Fish Resources Development. Fish Statistics Year Book. 29th Ed. Ministry of Agricultural and Land Reclamation, Egypt.

Ghaly, A.E.; Dave, D.; Budge, S. and Brooks, M.S. (2010). Fish spoilage mechanism and preservation techniques review. Am. J. Appl. Sci. 7(7):859-877.

Haq, M.; Dutta, P.L.; Sultana, N. and Rahman, M.A. (2013). Production and quality assessment of fish burger from grass carp, Ctenopharyngodon idella (Cuvier and Valenciennes, 1844). J. of Fisheries 1(1): 42-47.

Hasan, M.M. (2006). Improvement of food quality of traditional dried small indigenous fish products using rotary dryer and solar tunnel dryer. M.Sc. Thesis, Dept. of Fisheries Technology, Bangladesh Agriculture University, Mymensingh, Bangladesh.

Hoseini, M.; Baboli, M. J. and Sary, A. A. (2013). Chemical composition and fatty acids profile of farmed Big head

carp (Hypophthalmichthys nobilis) and Grass carp (Ctenopharyngodon idella) filet. AACL Bioflux 6(3):202-210.

Kanatt, S. R.; Chander, R. and Sharma, A. (2007). Antioxidant potential of mint (Mentha spicata L.) in radiation processed lamb meat. Food Chem., 100: 451-458.

Mahmoud, Fify, R.A. (2017). Untraditional preservation methods of some fish meat products. Ph. D. Thesis. Faculty of Agriculture, Mansoura Univ., Egypt.

Mahmoud, M. M. (2016). Processing of non-traditional fishery products. M.Sc. Thesis, Fac. Agric., Ain Shams Univ. Egypt.

Musa, U.; Hati, S.S.; Adamu,Y.I. and Mustapha, A. (2010). Pesticides residues in smoked fish samples from North-Eastern Nigeria. J. of Applied Sciences 10: 975 - 980.

Patterson, J.; Kailasam, S.; Giftson, H. and Immaculate, J. K. (2018). Effect of drying technologies on the biochemical properties of Stolephorus commersonnii. Food Quality and Safety, 2018, 3, 153–158.

Pearson, D. (1976). The Chemical Analysis of Food .Chem. Pub. Comp. Inc., New York.

PHILIPPINE NATIONAL STANDARD (2015). Final draft, Dried Anchovies. BUREAU of Agriculture and fisheries Standards.

Ravichandran, S.; Joseph, F.R.S.; Kanagalakshmi, R. and Ramya, M.S. (2012). Variation in nutritive composition of two commercially important marine fin fishes. British Journal of Biomedical Science 8: 43 - 51.

Reza, M.S. (2002).Improvement of food quality of traditional marine dried fishery products using solar tunnel drier.

M.Sc. Thesis, Bangladesh Agricultural University, Mymensingh, Bangladesh.

Saber, Berlanty, M. (2017). Effect of processing methods on chemical composition and pollutants in some fish products. M.Sc. Thesis, Faculty of Specific Education, Benha University.

Saha, S.C. (1999). Studies on production, marketing and nutritional aspects of traditional dried products of Bangladesh. M.Sc. Thesis, Department of Fisheries Technology, Bangladesh Agricultural University, Mymensingh, Bangladesh.

Sankar, T.V. and Ramachandran, A. (2001). Changes in biochemical composition in Indian Major carps in relation to size. Fish. Technol. 38:22-27

Sidhi, S.D.P.; Pujianto, A.; Prasetyo, D. and Muhfizar, N.A. (2018). Experimental study of salted fish drying under greenhouse dryer. RJOAS, 5(77): 281-28.

Talab, A. S. (2014). Effect of cooking methods and freezing storage on the quality characteristics of fish cutlets. Adv. Journal of Food Sci. Technol., 6: 468-479.

Tarladgis, B. G.; Watts, B. M.; Younathan, M. T. and Dugan, Jr. L. (1960). A distillation method for the quantitative determination of Malonaldehyde in rancid foods. J. of Am. Oil Chem. Soc., 37: 44-48.

الملخص العربى

تهدف هذه الدراسة إلى تعظيم الاستفادة من مبروك الحشائش (***Cteanopharynogodon idellus***)منخفضة السعر، للحصول على منتجات سمكية مملحة مجففة. تم الحصول على عينات من مبروك الحشائش من سوق السمك بمدينة العبور بالقاهرة خلال شهر يونيو ٢٠١٩، تم تمليح شرائح الأسماك باستخدام مستويات مختلفة من الملح ١٠٪ و ١٥٪ فى وجود ١٪ كمون أسود ، ثوم ، إكليل الجبل ومخلوط منها، وتجفيفها صناعيا وتعبئتها في أكياس بولي إيثيلين. وقد

أظهرت النتائج أن نسبة الجزء الصالح للأكل (اللحم) سجل ٤٠,٥٪ ، ٦,٣٥ رقم الأس الهيدروجينى ، **14.20** مجم/ ١٠٠ جم القواعد الكلية النيتروجينية المتطايرة ، ١,١٢ مجم/ ١٠٠ جرام أمين ثلاثى الميثيل، **0.42** مجم مالونالدهيد/كجم. تغيرت هذه القيم في منتجات الأسماك المملحة المجففة حيث تأثرت بعمليتي التمليح والتجفيف. أيضا فان المنتجات المملحة بتركيز ١٥٪ كانت أكثر استقراراً وأفضل جودة من المنتجات المملحة بنسبة ١٠٪. وبالرغم من أن المستخلصات النباتية المستخدمة كان لها تأثير منخفض على المنتجات المملحة المجففة ؛ الا أنها حسنت خاصية رائحة المنتجات. وتوصي هذه الدراسة بإمكانية تعظيم الاستفادة من أنواع أسماك المبروك لإنتاج بعض منتجات الأسماك المملحة المجففة؛ والتى تتمتع بامتداد فترة صلاحيتها وسهولة تخزينها وتداولها حيث ان كلا من التمليح والتجفيف ذات تقنيات رخيصة ولا تتطلب المزيد من الخبرة.

الكلمات الافتتاحية: حفظ الاسماك، التركيب الكيميائى ، الزيوت النباتية، درجة النشاط المائى.