Biological Forum – An International Journal **7**(1): 893-900(2015)

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Qualitative Assessment of Burger fish of (*Hypophthalmichthys molitrix*) by using extract and Powder of Dill Plant during Preservation in Fridge

Somayeh Hassanpour*, Abasali Zamini** and Ali Asghar Khanipour***
**M.A. Educated in the Field of Processing Fisheries Product, Islamic Azad University of Lahijan, IRAN*
***Assistant Professor of Fisheries Group, Faculty of Natural Resources, Islamic Azad University of Lahijan, IRAN*
****Ph.D., National Center of Aquatic Processing Fishes, IRAN*

(Corresponding author: Abasali Zamini)
(Received 12 February, 2015, Accepted 08 April, 2015)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: This research with the aim of qualitative evaluation and survival life of *Hypophthalmichthys molitrix* by using extract and powder of the dill plant and comparing effects of the powder and extract of this plant, in two experimental groups that one group related to extract of dill to the amount of 200mg per kg and a group related to the powder of dill to the degree of 4.5% from whole allowed additives to the *Hypophthalmichthys molitrix*. Samples were transferred to the fridge for preservation and measurement of chemical indices of corruption started from zero then during 6 months it has been done once a month. The process of chemical changes, showed increasing process in the results during different time phases in most cases as this increase in control group has had relatively rapid slope and in some cases before sixth phase it reached standard border or even higher than it whereas this increase in other treatments was observed with slower slope, also excellence of the effect of extract toward powder of this plant in different treatments was proved with more constancy in all phases ($p<0.05$). The highest consistency in sixth phase was related to the extract of dill as for indices: peroxide(PV) with mean 3.9±04.0 milli equivalent, free fatty acid(FFA) with mean of 0.25±0.028 percent Oleic acid, thiobarbituric acid (TBA) with mean of 1.33±0.021mg and total free nitrogen(TVN) with mean of 21.7±0.98 mg. This difference can be at the degree of phenolic compound of extracts and also more purity of these compounds in extract because there is a strong relationship between antioxidant power and phenolic compound. Based on considerations, frozen burger of *Hypophthalmichthys molitrix* treated with dill extract is consumptive until the end of 6 month preservation and even after this time.

Key words: *Hypophthalmichthys molitrix*-burgur fish-antioxidant-dill *Anethum graveolens*- survival life- chemical indices of corruption

INTRODUCTION

Sea food due to being enriched of protein, vitamins soluble in fat and unsaturated fatty acids of omega3, that have high importance at human food diet has got high importance to itself (Bojanical, 2009). Sea food is corrupted and usually is corrupted faster than flesh food and their flesh after death is more talented to be corrupted than other fleshes. The problem may be due to different compound of sea food because of having fatty acids with long chain with some dual bonds. Therefore we cannot preserve fish more than 12-15 hours in temperature of the environment because survival of fishes in the air depends on chemical effects of atmosphere oxygen and growth of aerobic microorganism producing corruption (Perez-Alonso *et al*, 2004).

Fish quality and des foods in fisheries industry is one important subject at aquatic processing industry especially in developing countries. Fishes and aquatics caught newly are more talented to corruption and their survival life is related to the growth of body's microorganism of body. Corruption of fish products is done regarding chemical, enzymes or microbial activities. During fish corruption, there is the possibility of element analysis and conformation of new compounds. These new compounds are responsible for change of color, flavor and texture of flesh (Ghaly *et al*, 2010) Oxidation of lipids is the main factor and reason of corruption at destructing quality of fishes muscle, color, taste and texture (Richards *et al*, 2002). Silver carp with scientific name of *Hypophthalmichthys molitrix* belongs to the bony fishes and rank of carp shapes and family of carp fishes.

Compound of flesh of silver carp includes: humidity, protein, fat and ash that the highest amount belongs to humidity, protein and fat and ash are placed at the next priorities. Of course these amounts available in filet flesh of carp have been calculated (Sifa *et al,* 2001). Flesh of these fishes had necessary amino acids of human body and about 80% of fatty acid of oil of this fish is constituted of Linoleik acid, linolenic acid and Arachidonic (Ante, 1995). In production of internal burgur fish the pure flesh of silver carp has been used that due to high efficiency of flesh, light color and having necessary jelly mode its fish burger has been welcomed by publics (Rafipour, 2010). Plant extract or compound extracted from them due to being healthy and natural are nowadays used as antioxidant and preserves accepted by consumers and various plants for this am are used in different producers (Ojagh *et al,* 2008). Nowadays regarding existence of complications of using artificial complications regarding mutagenesis, making poisoning, making cancer, using natural antioxidant like polyphenol compound available in plants such as green tea, dil and some other plants that have preserving effect against chronic disease, cancer, heart disease and mutagenesis are advised (Kaltaranta, 1992, 19970. Antioxidant activity of phenols are done through different methods such as collecting free radicals, giving hydrogen, collecting single oxygen, ion chelator and so on. Also there is direct relationship between the degree of phenol and activity of plants' antioxidant (Kaltatanta, 1997). The plant *Anethum graveolens* with Persian name of Shevid and Latin name of dill is the umbelliferus (apiaceae). Considerations showed that extract of dill save mucous layers of stomach against damages resulted from indomethacin. This action is due to antioxidant compound available in this plant that inhibit lipid peroxidation (Zaman *et al,* 2004).

Burger fish is one important food product of fish that provides the possibility of using pure flesh and protein with high food value of most fishes in producing food process prepared for industrial consumption (Khanipour, 2010). Fish burger is one valuable product accepted in the world that usually are sold in frozen form (Suvanich-Botsoglou *et al.,* 2002). Researchers are faced with problems such as taste and smell of fish and sometimes high degree of fat in fish burgurs produced from sea fishes (Suvanich *et al,* 2000). With this definition flesh of silver carp by having light color of muscle and lack of smell and especial taste is used ad proper raw matter for producing burgur and also by adding extract and powder of plant this problem is solved to some extent.

MATERIALS AND METHOD

Burgur production done in Kiarash flesh aquatic company and chemical experiment done in national center of aquatic processing research in 2013-2014. The amount of required silver carp by calculating amount of waste was 24kg. After buying silver carp(500-800gr) they became frozen with ratio of one-to-one and then were transferred to Kiarash flesh aquatic company and after distribution until start of production operation they were kept at low temperature(less than 4 centigrade degree). In this step after cutting head, fish's viscera were empty and then filet fishes were washed by pure water, blood and corps and fish remains are deleted by brushing. After full washing, filets were put into bone catcher device and separating fish flesh from bone is done. Finally preparing treatments has been done based on adding selective concentration of extract and powder of dill to the produced burgur from flesh without bone of fish and allowed additives(Iran's national standard No 58490. Required extract was supplied from company of Red flower of Mashhad. Then productive treatments were mixed separately, snapped and were packed commonly and after rapid frizzing in freezing tunnel, there were transferred to the fridge for preserving and determining survival life. Time of preserving in fridge and measurement of chemical indices was up until the end of survival life of the product. Based on predetermined timetable sampling for determining and measuring chemical factors, started from zero phase then at regular distance it was done monthly for 6 months. Number of experimental packages regarding number of treatments and date of sampling was determined 21 packages of 5 numbers and weight of each of them was 100gr. The above process is done under good hygiene condition and observing principle of HAACCP, therefore the obtained flesh has the minimum microbial load. In this research treatments include:

Treatment 1: burger fish of *Hypophthalmichthys molitrix* +dill extract 200gr per kg, Treatment 2: burger fish of *Hypophthalmichthys molitrix* + dill powder to the amount of 4.5% of allowed additive, control treatment of burger fish of *Hypophthalmichthys molitrix* without adding extract and powder of dill fish.

Filling materials and additives to the minced meat of fish *Hypophthalmichthys molitrix* for supplying burger including: toasted flour, soya, onion, garlic powder, tomato sauce, lemon juice, salt, spice, powder of albumen and vegetable. Experimenting factors that were repeated three times for all treatments are as below: measuring peroxide (PV) through Lee method and by cold extraction of chloroform (AOAC, 2005).

Measurement of free fatty acid (FFA) was done through titration and based on percent of oleic acid (Parelta *et al*, 2005). Measurement of reactive substances with tiobarbitoric acids(TBARS) was done through colorimetric method after adding reagent of TBA and reading amount of absorption in wave length of 532nanometer and calculation based on mg malon di Aldheide per kg (Natseba *et al*, 2005). Determining amount of PH was done by mixing 20gr sample per 100ml distilled water by PH meter device(Iran national standard No 1028-1386) Finally measurement of volatiles nitrogen material of TVB_N was done regarding reference (AOAC, 2002). Statistical methods: for considering normality of data in groups and treatments, Shapiro-Wilk test and designing histogram chart was used. For considering reciprocal effect of treatments and time as fixed factors and analyzing data two-way ANOVA variance analysis was used. For statistical comparison of time phases and performance of used treatments regarding the effect of considering factors of phases of one-way variance analysis and after doing test of homogeneity of variances for comparing groups together Excel 2010 software was used.

RESULT

Measured amount of volatiles nitrogen materials of TVB_N, peroxide PV, PH, free fatty acids and tiobarbitoric acid TBA during 6 month has been shown in table 1-5 and also in all experiments the result denotes that the highest increase is related to the control group and treatment having dill extract has had the best performance and deterrence effect of extract at preventing corruption of fish burger of *Hypophthalmichthys molitrix* was completely obvious and is considering as below.

Peroxide: based on the obtained result experimental groups in time of preserving (phase 1-6) has had meaningful effect on changes of the degree of peroxide. Also reciprocal effect between type of treatment and time of preserving on degree of peroxide production was observed. As regarding table 1 treatment having extract of dill have shown better performance at controlling the degree of production of peroxide at considering samples in time phases($p<0.05$). Regarding the result and increase of degree of changes of peroxide during 6 months in all treatments only in control degree of peroxide in 6th month is more than standard limitation (5 milliequivalent per 1000gr).

Table 1: Comparing the degree of changes of peroxide based on milliequivalent per kg in different treatments in 6 different time phases (monthly).

Factor	Treatment	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6
Peroxide	**Control**	0^{A}	***±0/02***$^{B\ d}$ ***0/50***	***±0/02***$^{C\ c}$ ***0/98***	***±0/02***$^{D\ d}$ ***1/66***	***±0/88***$^{E\ d}$ ***3/49***	***±0/01***$^{F\ d}$ ***5/09***
	Dill powder	0^{A}	**±0/007**^{Bc} **0/40**	**±0/02**^{Cab} **0/75**	**±0/01**$^{D\ c}$ **1/58**	**±0/88**$^{E\ c}$ **2/69**	**±0/03**$^{F\ c}$ **4/15**

Non-listed small Latin letters in column shows significant statistical difference
*non-listed big Latin letters in raw shows significant statistical difference.

Table 2: Comparing degree of changes of total free nitrogen based on mg per 100 gr in different treatments in 6 time phases (monthly).

Factor	Treatment	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6
Total free nitrogen	**control**	**±0/32**^{Ad} **14/2**	**±0/48**$^{B\ c}$ **16/8**	**±0/99**$^{C\ c}$ **18/9**	**±0/68**$^{D\ c}$ **21/1**	**±0/98**$^{E\ d}$ **23/1**	**±0/98**$^{F\ d}$ **30/1**
	Dill powder	**±0/59**$^{A\ a}$ **14/5**	**±0/98**^{Bab} **14/7**	**±0/98**$^{C\ b}$ **16/8**	**±0/47**$^{D\ b}$ **18/2**	**±0/65**$^{E\ b}$ **19/6**	**±0/69**$^{F\ b}$ **25/2**
	Dill extract	**±0/36**$^{A\ a}$ **14/2**	**±0/65** $^{A\ a}$ **14/3**	**±0/98**$^{A\ a}$ **14/7**	**±0/98**$^{B\ a}$ **16/1**	**±0/28**$^{C\ a}$ **18/2**	**±0/98**$^{D\ a}$ **21/7**

*non-listed small Latin letters in column show significant statistical difference
*non-listed big Latin letters in row show significant statistical difference.

Based on the result of total free nitrogen between experimental groups and control in time of preserving (1-6 phases) there hasn't been observed meaningful effect on changes of the degree of total free nitrogen. Also there was reciprocal relationship between type of treatment and time of preserving on degree of producing total TVN as regarding Table 2 more consistency of treatments having dill extract in controlling degree of production of total free nitrogen in considering samples in time phases are distinguished($p<0.050$ also it was distinguished that the highest increase is related to the control group that is out of standard limitation. Based on the result in this research between experimental groups and control group time of preserving (i-6 phase) has had meaningful effect on changes of the degree of TBA. Also reciprocal relationship between type of treatment and time of preserving on degree of production of TBA was obtained. As it is mentioned it table 3 treatment having extract of dill has shown better performance at controlling the degree of producing TBA at considering samples in different time phases($p<0.05$).

Table 3: Comparing degree of changes of TBA based on mg at Mallon di aldehyde in different treatments in 6 time phases (monthly).

Factor	Treatment	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6
TBA	Control	±0/007$^{A\,a}$ 0/06	±0/014$^{B\,c}$ 0/32	±0/014^{Cc} 0/48	±0/014 $^{D\,d}$ 0/85	±0/028$^{E\,c}$ 1/11	±0/028$^{F\,c}$ 1/67
	Dill powder	±0/005$^{A\,a}$ 0/06	±0/007^{Bc} 0/29	±0/003$^{C\,c}$ 0/45	±0/002$^{D\,c}$ 0/77	±0/042$^{E\,c}$ 1/04	±0/014$^{F\,c}$ 1/6
	Dill extract	±0/0007$^{A\,a}$ 0/06	±0/014 $^{B\,a}$ 0/18	±0/014$^{C\,a}$ 0/32	±0/028 $^{D\,a}$ 0/57	±0/042$^{E\,a}$ 0/7	±0/021 $^{F\,a}$ 1/33

*non-listed small Latin letters in column shows significant statistical difference
*non-listed big Latin letters in row shows significant statistical difference

In this research the degree of free fatty acids in time phases of 1-6 in all treatments has had increasing process but regarding table 4 the degree of this increase in control has been observed more than other treatments in phase 6 significantly. Also there was observed reciprocal relationship between type of treatment and time of preserving on the degree of production of FFA. As treatment having extract of dill has shown better performance at controlling the degree of production of FFA in considering samples in time phase($p<0.05$).

Table 4: Comparing the degree of changes of FFA based on percent of oleic acids in different treatments in 6 time phases.

Factor	Treatment	Phase 1	Phase 2	Phase 3	Phase4	Phase 5	Phase 6
FFA	Control	±0/007$^{A\,b}$ 0/30	±0/021$^{A\,d}$ 0/26	±0/014$^{B\,a}$ 0/45	±0/014 $^{C\,d}$ 0/76	±0/028$^{D\,d}$ 1/14	±0/028$^{E\,d}$ 1/90
	Dill powder	±0/007$^{A\,b}$ 0/31	±0/014$^{A\,c}$ 0/22	±0/014$^{B\,a}$ 0/22	±0/014$^{C\,c}$ 0/68	^{D} ±0/021^{cd} 0/89	±0/014$^{E\,c}$ 1/49
	Dill extract	^{A} ±0/0007^{a} 0/22	±0/014 $^{A\,a}$ 0/12	±0/021$^{B\,a}$ 0/26	±0/014 $^{C\,a}$ 0/48	±0/021$^{D\,a}$ 0/68	±0/028 $^{E\,a}$ 1/25

*non-listed small Latin letters in column shows significant statistical difference
*non-listed big Latin letters in row shows significant statistical difference

The results show that practically from phase 1-6 the degree of PH in all treatments and control has had decreasing process but in treatment of dill extract this decrease was observed little it seems that treatment having dill extract has better performance than changes of PH in considering samples in time phases. However all treatments and control were in standard area of (6.7) and significant difference hasn't been observed.

Table 5: Comparing degree of changes of PH in different treatments in 6 time phases.

Factor	Treatment	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6
pH	**control**	**±0/057 6/24**	**±0/014 6/18**	**±0/014 6/12**	**±0/014 6/08**	**±0/014 5/94**	**±0/021 5/82**
	Dill powder	**±0/012 6/30**	**±0/014 6/24**	**±0/014 6/20**	**±0/014 6/14**	**±0/021 6/09**	**±0/028 5/92**
	Dill extract	**±0/014 6/36**	**±0/007 6/31**	**±0/014 6/26**	**±0/014 6/22**	**±0/014 6/18**	**±0/021 6/09**

DISCUSSION AND CONCLUSION

Hydro peroxides were primary products of oxidation of PUFAs ad so the primary oxidation of oil is assessed by measuring the degree of peroxide (Lin and Lin, 2005). Generally the result of this research showed that by spending time of preservation, PV in all treatments has increased but the least degree of increase was related to treatments having extract of dill(table 10 that in comparison with the result of other researchers is adapted with some of them and isn't adapted with some others. Such researches are Rezaei and Hosseini (2008) the degree of peroxide has decreased by passing time that is attributed to analysis of hydro peroxide and is not adapted with this research. Cakli *et al* (2005) have considered chemical quality of fish fingers resulted from pink perch fish and sardine that faced with qualitative drop and corruption of the product. If in this research by using silver carp and plant extract we could minimize quality drop in burger and also the result of this research denotes the subject that regarding measurement of time of survival regarding changes in oxidation of samples, the highest consistency with mean of 9.3±04.0 in sixth phase is related to extract of dill whereas control exited the accepting limit and also this research by a study that about preventing oxidation of fat in mackerel fish by polyphenol extracted from green tea that showed compound of plant extract can be used as a strong antioxidant is adapted. In other researches and similar studies the forbidding effect of natural antioxidant has been shown well (Banejee *et al*, 2006) and adapt with research on burger produced from mixture of surimi of silver carp and red flesh that faced increase of peroxide at the time of survival (Nemati *et al* 2009) and adapt in the process of increasing peroxide by study of (Al-Bulushi *et al*, 20050. All these studies denotes that in this research extract of dill showed good forbidding effect on the process of increasing peroxide than powder of this plant and especially control group and were effective at preserving product quality. Conformation of FFA doesn't cause nutritional value alone yet its evaluation in considering fish corruption is important (lugasi et al, 20070. Amount of free fatty acids has increased in all treatments over time. The results show that in phases of 2-6 months the least degree of production of FFA in treatment having dill has been observed that significantly ($p<05.0$) is less than control and treatment having dill powder. The highest production of FFA is related to control group. A research that was done by Rezaei *et al*., 2003 faced increasing process of FFA. The result of Jorjani research on nanied Kilca (kilka nugget) in 2012 showed that FFA in different months of sampling in both treatments has had meaningful increase. The above results adapts with the result of this research. Increase of amount of TBARS during preserving in fridge may be due to partial dehydrogenization of fish texture and increase of oxidation of unsaturated fatty acids. TBARS is extensively used as indices showing the degree of secondary oxidation of fat (Lindsay, 1991). The result showed that using treatment having extracted of dill is able to reduce oxidation of oil available in burger fish significantly.

This effect has been observed both on indices of peroxide and TBARS (Table 1and 3) and also the result of measuring amount of tiobarbitoric acid shows that the least degree of production of TBA at the end of period is related to the extract of dill with mean of 0.52±0.19 and have shown better performance in controlling degree of producing TBA in considering samples in time phase. Regarding studies in this field done by Das in 2009 similar research have been done in measuring TBA in two species of mackerel and Shark at temperature of -18 centigrade degree for 6 month preserving in fridge and faced by severity increase of TBA up to 5 months. In other studies similar result has been observed that maximum degree of tiobarbitoric acid is at the end of preserving period such as a research that has been done on burger fishes produced fromtilapia (*Orechromis niloticus*) by Tokur *et al*., 2004. Huss (1995) stated that index of TVN totally includes tri methyl Amin (resulted from bacteria corruption), dimethyl Amine(resulted from self-digestion of enzymes during product preserving), Amoniak (produced by deamination pfaminoacids and neocloide) and other volatile compounds of amine in relationship with corruption of sea product. Also he added that amount of TVN doesn't show the type of corruption (Bacteria or Etholitic). Also experiment that was done on amount of total volatile nitrogen(TVB-N) showed that regarding measurement of degree of total nitrogen only dill extract has been far from standard limit up until the end of sixth phase and has shown better performance, whereas other treatments from sixth phases has been higher than standard limit(25mg per 100 gr). In research that lesanpezeshki has done in 2005 about using preservatives at production of fish burger from silver carp and concluded that degree of changes of TVN in samples having antioxidant was in allowed limit of human consumption but in control samples this amount has increased this result adapts with the result of our research. Of course as it was said effects of extract of dill causes preservation of quality of burger produced until the end of sixth month. One primary chemical change in fish meat is changes of PH. Therefore PH is not exact index for determining newness and more quality of aquatics. However it is used as a supplement index for other parameters (Varlik *et al*, 1993). Changes of PH shows that adding extract didn't have meaningful effect on changes of PH. practically from phase 1-6 the degree of PH in all treatments and control has had decreasing process but in treatment of dill extract the degree of changes has been less. It seems that treatment having dill extract has shown better performance to PH changes in considering samples in time phases. In a study that the effect of two antioxidant of citric acid and Askorbik acids on frozen mackerel, the amount of PH in different treatments was measured, there hasn't been observed significant difference between treatments resulted from existence of antioxidant by time of preservation (Aubourg, 2004). This research adapts with our research and also the result in all experimental factors denotes that adding plant extract of dill on burger fish has and positive effect and was effective at increase of time of survival of the product.

APPRECIATION

Therefore we appreciate all beloveds of national center of research and aquatic production in Bandar e Anzali and also Mr Ghadami in production line of company of Kiarash aquatic and respected staff of pharmaceutical company of Exir GolSorkh in Mashhad because of friendly and effective cooperation.

REFERENCES

Al-Bulushi, I.M., S.H., Kasapis, A. Al-Oufi, and S. Al-Mamari. (2005). Evaluating the quality.

Al-Bulushi, I.M., S.H., Kasapis, A. Al-Oufi, and S. Al-Mamari. (2005). Evaluating the quality.

Al-Bulushi, I.M., S.H., Kasapis, A. Al-Oufi, and S. Al-Mamari. (2005). Evaluating the quality and storage stability of fish burgers during frozen storage. *Fisherie Science*, **71**: 648-654p.

Ante, J. (1995). Dietetic aspect research of the production .f semi- finished food mad of fish meat. SVIBOR-Collecting Data on projects in croatin . http:// www.mzt.hr/sribor

AOAC, (2002). Official Method of Analysis. Washington, DC: Association of official Analytical Chemists.

AOAC, (2005). Official Method of Analysis (17thed). Washington, DC: Association of official Analytical Chemists.

Aubourg, S.P .,Perez-Alonso, F. & Gallardo, J.M. (2004). Studies On Rancidity inhibition in frozen horse mackerel (*Trachuus trachurus*) by citric acid and ascorbic acids. *European journal of lipid science and technology*, **106** (4): 232-240p.

Aubourg, S.P. and I. Medina. (1999). Influence of storage time and temperature on lipid seterioration during cod (Gadusmorhua) and haddock (*Melanogrammus aeglifimus*) frozen storage. *J. Sci. Food.*

Aubourg, S.P., Perez-Alonso, F .& Gallardo , J.M. (2002). Studies on rancidity inhibition in frozen horse mackerel (*Trachuus trachuus*) by citric and Ascorbic acid. *European Journal of lipid Science and Technology*, **106** (4): 232-240.

Banejee and colleagues in (2006). By the Azaksydasyvn prevent fat mackerel fish by polyphenols extracted from green tea during 90 days.

Bojancal, K., L. Kozacinskill. Filipovicl, Z. Cvtilal, N.zdolecl, B. Njaril (2009). Quality of Sea Bas meat during Storage on ice , Sijecanj-Veigacabr, **9**., 74-78.

Anerjee, S., 2006, Inhibiton of mackerel (Scomberscomberus) muscle lipoxygenase by green tea polyphenols, *Food Research International,* **39**, 486-491.

Botsoglou NA, Christaki E, Fletouris DJ, Florou - Paneri P, Spain A.B. (2002). The effect of dietary oregano essential oil lipid oxidation in raw and cooked chicken during refrigerated storage. *Meat Science* **62**: 265-259.

Celik M, Diler A, K¨uc¸ ¨ukg¨ulmez A. (2005). A comparison of the proximate compositions and fatty acid profiles of zander (*Sander lucioperca*) from two different regions and climatic conditions. *Food Chem.*, **92:** 637-41p.

Chomnawwang C. Nantachai K., Yongsawatdigul J, Thawornchinsombut S., Tungkawachara S. (2007). Chemical and biochemical changes of hybrid catfish fillet stored at 4?C and its gel properties. *Food Chem*., **103**: 420-7.

Das, K.P. (2009). Effect of ambient temperature , icing and freezing on nutrientcomposition of Rohu) Labeorohita), Grass carp and Tilapia B.Sc. Thesis, Fisherise and marine Resources Technology Discipline, Khulna University, Khulna Bangeladesh, pp. 20-30.

Ghaly, A.E., Dave, D., Budge, S and M.S. (2010). Brooks department of process Engineering and applied science, Dalhousie University Halifax Nova.

Hamilton, R.J., (2009). Rancidity in fish oil; In Fish oil, Oils and fats handbook, Vol. **4**; Rossell, B.(Ed.), chapter 10, Leatherhead pub., UK.pp.191-193.

Huss, H.H. (1995). Fresh fish: quality and quality changes, Rome: Food and agriculture Organization (FAO) of the United Nations.

Iran national standard No 1028, (2007). Meat and its products, measuring PH. Iran's institute of standard and industrial research.

Jorjani, S., (2012). Determining food value, survival life and changes of profile of fatty acids of naniedkilka during preservation in fridge, Ph.D. thesis, Tehran university of science and research.

Kaltaranta, J.K. (1997). Control of lipid oxidation fish oil with various antioxidative compounds. *JAOCS.* **69**(8): 810-813.

Khanipour, A, Matlabi, E, (2010). Considering changes of fat of mixed fish burger of kilkaandsilver carp during freezing.

Kostaki, in 2009, the same effect thyme extract and modified atmosphere packaging on the sensory properties, chemical and biological bass fish farm.

Lasanpezeshki, R, (2005). Production of fish burger from the fish *Hypophthalmichthys molitrix* and determining time of its survival by using preserving materials. M.A thesis, science and technology of sea university of fisheries group, North Tehran branch.

Lin,C.C., and Lin, C.S., (2005). Enhancement of the storage quality of frozen bonito fillrt by glazing with tea extracts. *Food Chem.* **16**(2),169-175.

Lindsay, R.C., (1991). Flavour of fish. Paper presented at 8th World Congress of Food Science and Technology, 29th September-4th October, Toronto,Canada.

Lugasia, A., Losada, V.,Hovari, J., Lebovicsa, V., Jakoczic, I., and Aubourg S., (2007). Effect of pre- soaking Whole pelagic fish in a plant extract on sensory and biochemical changes during subsequent frozen storage. LWT.**40**, 930-936.

Muret K, Sevgi K, Sengul K, Esra U, Cemalettin B, Fedra V. (2007). Biological activities and chemical composition of three honeys of different types from Anatolia. *Food Chemistry*, **100**(2): 534- 526.

Natseba, A., Lwalinda, I., Kakura, E., Muyanja, C.K., and Muyonga, J.H., (2005). Effect of pre-freezing icing duration on quality changes in frozen Nile perch (*Lates niloticus*). *Food Research International,* **38**, 469-474.

Nemati, Shabanpour, B, Shabani, Gholizadeh, M, (2009). Study of changes of fat quality and sense features of burgers produced from mixture of Cyprus carpio and red meat during preservation in fridge. Scientific research *Journal of university of agriculture and natural resources of Gorgan*. Vol. **16**, sepecial journal of A

Ojagh, S.M., Sahari, M.,Rezaei, M., and Hosseini S.V., (2008). Applicability of B_carotene and green tea polyphenols as two natural antioxidants in preservation of fresh common kilika (*Clupeonella cultriventris caspia*) with ice, *J. Appl. Ichthyol.*

Ozyurt, G., Polat, A., and Tokur, B., (2007). Chemical and sensory changes in frozen (-18°C) Wild sea bass (*Dicentrarchus labrax*) captured at different fishing seasons. *Inter. J. Food Sci. Technol.* **42**, 887-893.

Peralta, E.H.W., Watanabe, D., Kawabe, D. and Murata Hama, Y., (2005). Antioxidative activity of Philippine salt-fermented shrimp paste and variation of its contents during fermentation. *Journal of oleo science*, **54**: 553-558.

Perez-Alonso, F., Aubourg, S.P., Rodriguez, O., Barros- Velazquez, J., (2004). Shelf life extension of Atlantic pomfret (Bramabrama) fillets by packaging under a vacuum- skin system. *Journal of food Research Technological*, **218**, 313-317.

Rafipour, F., (2010). Qualitative evaluation of canned meatballs from minces meat of silver carp(having or without starch), final report of research designs, aquatic production institute of Iran's fisheries, No **88**.756, p68.

Rezaei, M., Sehri, M.E., Moeini, S, Safari, Ghaffari, F. (2003). Comparison of quality of fat of Anchoukila I two methods of transportation and temporary cold preservation. *Scientific journal of Iran fisheries*, **12**(3), 97-108.

Rezaei, M., and Hosseini, S.F., (2008). Quality Assessment of farmed Rainbow Trout (*Oncorhynchus mykiss*) during chilled storage. *J. Food Sci.*, **73**, 93-96.

Richardes, M.P. and Hultin Ho (2000). Contributions of blood components to lipid oxidation in fish muscle. *J Agric Food Chem*., **50**: 555-64.

Sifa, L., W. Lizhao, W. Jiang, C. Qiahru and C. Yongle (2001). Proximate Analysis of *Hypophthalmichthys molitrix*.htt // www.fishi base.org.

Standard 5849, (2004). Fish burger, characteristics and methods of testing. Iran's institute of standard and industrial research. First edition.

Suvanich V, Jahneke ML, Marshall D.L. (2000). Changes in selected chemical quality characteristics of channel catfish frame mince during chill and frozen storage. *J Food Sci.*, **65**(1): 24-9.

Taskaya L. Cakli S. Kisla D, Kilinic B. (Quality changes of fish burger from rainbow trout during refrigerated storage. *JFislr Aquat Sei* **20**(1-2): 147-54.

Tokur, B., S. Ozkűtűk, E. Atici, G. Ozyurt, and C.E. Ozyurt (2004). The quality changes of tilapia burger during frozen storage. European Food Research and Technolochy, 218: 420-423p.

Tokur, B., S. Ozkűtűk, E. Atici, G. Ozyurt, and C.E. Ozyurt (2006). Chemical and sensory quality changes of fish fingers, made from mirror carp (*Cyprinus carpio*), during frozen storage (-18°C). *Food Chemictry*, **99**: 335-341.

Varlik, C., Ugur, M., Gokoglu, N.,and Gun, H., (1993). Quality control methods and principals for aquaculture. *Istanbul Society of food Technology*.**17**, 98.

Zaman, R.U., Shoaib Akhtar, M. and Shafiq Khan, M., (2004). Preliminary evaluation of *Anethum graveolens* fruit in Indomethacin-ulcer-induced rats. *Biological Sciences*, **4**(2): 151-156.