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Salinity variation as a limiting environmental factor and its effect on biochemistry and protein quality of *Tilapia zillii*

Amr M. Nasef
Marine Biology Section, Zoology Department, Faculty of Science, Al-Azhar University, Nasr City, Cairo, Egypt.
marine@azhar.edu.eg

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ABSTRACT

Fish differ in their ability to adapt to the environment and vary in their nutritional and economic values. Therefore, this study was conducted to clarify the dynamics of the biochemical composition of the *Tilapia zillii*, and detect the impact of salinity, as a limiting environmental factor, on the organism's potential to adapt to the environment. In addition, the assessment of the feasibility of transport and farming operations with their financial returns was also considered. Hence, the green tilapia, *Tilapia zillii* that lives in different aquatic environments (fresh: <0.05 ‰ Ismailia Canal - brackish 20:28 ‰ Altemsah Lake - salty 30 - ‰ eastern Altemsah Lake) was subjected to a quantitative/ qualitative study. The approximate composition and biochemical components were seasonally analyzed in the muscle tissue of this species representing different environments. The amount of crude protein, fat, carbohydrates, calorific value, moisture and ash were also measured.

The quantitative biochemical analyses showed statistically significant differences (P<0.05) among the samples extracted from the environmental areas of different salinity levels. Similar results were detected in the values of protein, fat, carbohydrates, calories, water, and ash content. On applying the protein electrophoresis technique, the qualitative analysis showed no large qualitative variation among the studied samples.

INTRODUCTION

On a global scale, fish is the most important source of nutrient-dense food **(FAO, 2003)**. However, these values may vary considerably within and among species and with feeding, season and physical conditions' activity (**Agusa, 2007)**. In addition, the variation in the chemical composition of fish bodies is attributed to the changes in the environment, which may be related to the level of water quality factors and the variable eating conditions **(Takamaet *et al*., 1999; Davenpart *et al*., 2009)**.

The salinity of marine ecosystems may fluctuate both seasonally or a seasonally due to rainfall and oceanic upwelling or downwelling. Salinity affects water density causing circulation and stratification, especially in estuaries. Numerous chemical reactions follow the changes in salinity, hence most equilibrium and rate constants are salinity dependent. For instance, higher salinity increases pH and reduces organic matter solubility **(Cai *et al*., 1998)**.

Filipucci (2011) claimed that numerous markers of aquatic environment physico-chemical or biological quality have been created. For example, salinity stress, through natural freshwater inputs, reduces energetic budgets. Therefore, scope-for-growth (SFG) would detect a reduction in physiological fitness (and biochemical composition) due to salinity. According to **Velasco *et al*. (2019)**, the ion concentration of aquatic ecosystems worldwide fluctuates as a result of climate change and human impact such as agricultural drainage.

Academics have recently paid close attention to the studies on the chemical composition of fish due to their importance, and researchers have claimed that the chemical composition may compromise the economic value of fish **(Zenebe, 1998)**.

Biswas *et al*. (2018) emphasized that the tilapia is a popular fish for its rapid growth and hardiness, as well as its resistance to the environmental changes and disease. **Laghari *et al*. (2019)** investigated the biochemical composition and nutrient content of the *Tilapia zillii*. They discovered that the range of moisture, protein, fat, and ash content percentages varied monthly.

Salinity is one of the ecological characteristics that are unique to the aquatic environment. The effect of external salinity on fish growth capacity has been proven by a number of writers. This holds true for a wide range of fish species, including both marine and freshwater (FW) fish.

In reality, animals that are not affected by fluctuations in salinity during their development and growth are uncommon. This study was presentedis to determine the impact of salinity variations in aquatic settings on the biochemistry of the *Tilapia zillii* collected from various aquatic environments (salty 30 ‰ - brackish 20: 28 ‰ - fresh: <0.05 ‰), through biochemical analysis and comparative electrophoresis separation (SDS – PAGE). The current investigation also attempted to investigate the effect of change in aquatic habitat on protein patterns.

MATERIALS AND METHODS

Fishes

One species of fishes was used in the current study, *Tilapia zillii* which taken from from different aquatic environments (Salty 30: ‰ (eastern) Altemsah Lake - brackish 20: 28 ‰ Altemsah Lake - fresh: <0.05‰ Ismailia Canal)

. The identification and the systematic position of the selected fishes were confirmed according to the available literature including **Nelson (1976)**, **Wheeler (1987)** and **FAO (1973)** as follows:

Order: Perciformes
Family: Cichlidae
Genus: Tilapia
Species: *Tilapia zillii*

Sampling

A number of 120 fish samples were seasonally collected in the period between January 2017 and January 2018 from different aquatic habitats (Fresh = < 0.05 ‰ Ismailia Canal - Brackish = 20:28 ‰ - Al-temsah Lake - Salty = 30 ‰ (eastern) Altemsah Lake). Specimens were labelled as XL size and transferred to the laboratory for analysis.

Salinity determination

The salinity of the water was calculated using the drying method of **APHA (1985)**.

Determination of total protein

Total protein was determined using the Folin phenol reagent, which was described in the study of **Lowry *et al*. (1951)**, with a modification provided by **Ansell and Lander (1967)**.

Total lipid determination

The method of **Knight *et al*. (1972)** was used to determine total lipids**.**

Determination of total carbohydrate

Glycogen was determined using the technique of **Carrol *et al*. (1956)**.

Calculation of calorific value

For the biochemical composition, the calorific content of each sample (stage) was estimated by multiplying each component by the relevant calorific equivalents (4.2 kcal for carbohydrates; 9.45 kcal for lipids and 5.7 kcal for protein). The values were calculated in terms of kcal per gram **(Phillips, 1969)**.

Water Content

It is determined by weight loss at 105°C until a steady weight is reached following the steps of **Ruiz-Roso *et al*. (1998)**.

Ash Content

It is calculated by incineration at 450–500 degrees to a consistent weight in a muffle furnace according to the **AOAC (1990)**.

Electrophoresis studies

Sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS – PAGE): SDS – PAGE (10%) technology was used according to the approach of **Abd- Elaziz (2004)**.

Statistical analyses

Statistical tests were conducted using the statistical software, SPSS (2008), to identify the mean, standard deviation: x and F-test, to measure and analyze the extent of variance in the effect rates, where

The differences are significant at ($P<0.05$).

The differences are not significant at ($P>0.05$).

Note:

All the analyses were done in duplicate.

The data was presented as mean values with their standard deviations.

RESULTS

The data in Tables (1-3) demonstrate the presence of seasonal variation of biochemical composition in the *Tilapia zillii*, combined with different degrees of salinity in different aquatic environments (Fresh = <0.05 ‰S, Brackish = 28 ‰S and Salty = 30 ‰S), where the values of protein, lipid, carbohydrate, calorific, water content and ash differed seasonally.

Table (4) shows the relationship between (salinity degree variation) as aquatic environmental factor and the biochemical composition of the *Tilapia zilli* , where the maximum average of protein was recorded with marine environment. On the other hand, the minimum average of protein was registered with brackish environment. The highest average of lipid was recorded with fresh environment, while its minimum was detected with brackish and marine environment. While, the brackish environment was associated with the minimum average of protein.

On the other hand, the maximum average of carbohydrate was observed with fresh and brackish environment, while its minimum average was recorded with marine environment. At the same time, the maximum average of calorific was regarded with marine environment, while the maximum average of water content was recorded with fresh environment. Concurrently, the highest average of ash was recorded with brackish environment.

On the other hand, the minimum average of calorific was detected with brackish environment, while the lowest average of water content was recorded with salty environment, unlike the ash, which recorded its lowest average with the freshwater environment.

Table 1. Seasonal variation of Biochemical composition of of *Tilapia zillii* from fresh (F) aquatic environments (< 0.05 ‰ - Ismailia Canal)

Fish	**(F) *Tilapia zillii***				**Annual Mean ± SD**
Seasons / Parameters	**Winter**	**Spring**	**Summer**	**Autumn**	
Protein (g/100g)	15	19	18	16	17.0±1.5
Lipid (g/100g)	1.5	2.3	2	1.5	1.8±0.34
Carbohydrate (g/100g)	1.2	1.9	1.7	1.1	1.5±0.33
Cal. Value (K.cal / 100g)	104.72	138.01	128.64	109.99	120.34±13.5
W. content (g/100g)	77.2	78.4	78.3	77.5	77.9±0.51
ASH (g/100g)	1.3	1.4	1.5	1.1	1.3±0.15
S ‰	**<0.05**	**<0.05**	**<0.05**	**<0.05**	**< 0.05**

Table 2. Seasonal variation of biochemical composition of *Tilapia zillii* from brackish (B) aquatic environments (28 ‰ Al-temsah Lake)

Fish	**(B) *Tilapia zilli***				**Annual Mean ± SD**
Seasons / Parameters	**Winter**	**Spring**	**Summer**	**Autumn**	
Protein (g/100g)	15.6	18.7	17.6	15.5	16.8±1.3
Lipid (g/100g)	1.4	1.9	1.7	1.5	1.6±0.19
Carbohydrate (g/100g)	1.1	2	1.8	1.3	1.5±0.36
Cal. Value (K.cal / 100g)	110.55	132.94	123.94	108.02	118.86±10.1
W. content (g/100g)	77.1	78	77.8	77.3	77.5±0.36
ASH (g/100g)	1.3	1.7	1.4	1.1	1.5±0.23
S ‰	**25**	**28.7**	**29.8**	**28.5**	**28±1.8**

Table 3. Seasonal variation of biochemical composition of of *Tilapia zillii* from Salty (S) aquatic environments: 30 ‰ (eastern) Al-temsah Lake

Fish / **Seasons** / **Parameters**	**(S) *Tilapia zillii*** Winter	Spring	Summer	Autumn	**Annual Mean ± SD**
Protein (g/100g)	16	20	19	17	18±1.6
Lipid (g/100g)	1.5	1.9	1.7	1.4	1.6±0.19
Carbohydrate (g/100g)	1.2	1.5	1.3	1	1.2±0.18
Cal. Value (K.cal / 100g)	110.415	138.255	129.825	114.33	123.21±11.3
W. content (g/100g)	77.1	77.9	77.6	77	77.4±0.37
ASH (g/100g)	1.2	1.8	1.5	1.3	1.4±0.05
S ‰	**28.7**	**30.3**	**31**	**30**	**30±0.83**

Table 4. The relationship between variation in aquatic environmental type and biochemical composition of *Tilapia zillii* edible portion (g / 100g tissue) with statistical analyses

Fish / Parameters	*T. zillii*			
	F A. Mean ± SD	**B** A. Mean ± SD	**S** A. Mean ± SD	**P value**
Protein (g/100g)	**17±1.5**	**16.8±1.3**	**18±1.6**	**0.031**
Lipid (g/100g)	**1.8±0.34**	**1.6±0.19**	**1.6±0.19**	**0.002**
Carbohydrate (g/100g)	**1.5±0.33**	**1.5±0.36**	**1.2±0.18**	**0.006**
Cal. Value (K.cal / 100g)	**120.34±13.5**	**118.86±10.1**	**123.21±11.3**	**0.002**
W. content (g/100g)	**77.9±0.51**	**77.5±0.36**	**77.4±0.37**	**0.014**
ASH (g/100g)	**1.3±0.15**	**1.5±0.23**	**1.4±0.05**	**0.023**
S ‰	**< 0.05**	**28**	**30**	**-**

Abbreviations: (**F** = Fresh; **B** = Brackish; **S** = Salty)

Statistical analyses

The results of (F- test) statistical analyses showed that statistically significant differences were noted between the environmentally different samples, in the values of protein, fat, carbohydrates, calories, water and ash content, where *P* values <0.05.

SDS – PAGE results of muscles proteins of *Tilapia zillii* from different aquatic environments

The number of bands was equal between male and female in almost all patterns. It was also similar in position with high and low molecular weights, but the variation was determined in densities and volumes. The electrophoretic patterns (T30 M-F) showed that the number of bands was equal between male and female, except for band 66 kDa – albumin: (major), it was increasing in female only.

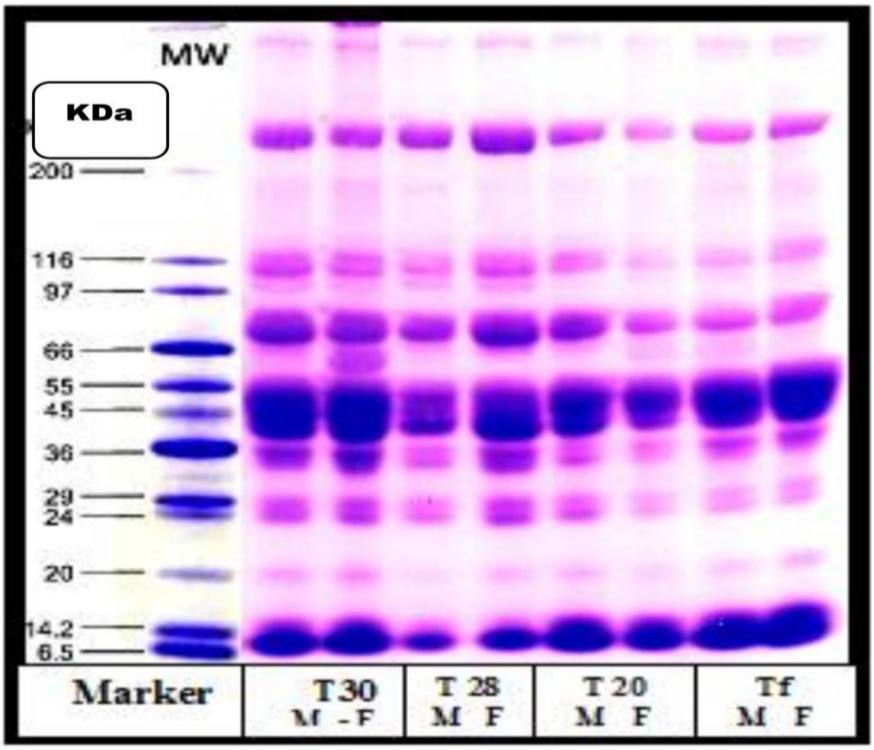

Fig. 1. Sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS – PAGE)

Abbreviations

(T30 M-F) = *Tilpia zillii* protein (from salty water environment 30 ‰): Male & Female.

(T28 M-F) = *T. zillii* protein (from brackish water environment 28 ‰): Male & Female.

(T20 M-F) = *T. zillii* protein (from brackish water environment 20 ‰): Male & Female.

(TF M-F) = *T. zillii* protein (from fresh water lower than 0.5 ‰): Male & Female.

(MW) = Molecular weight.

(KDa) = Kilo Dalton.

Fig. (1) shows the results of comparative electrophoresis analysis of lateral muscles protein of *Tilpia zillii* taken from different aquatic environments. Generally, 10 protein bands were defined in samples representing all environments. They shared in molecular weights, while they differed slightly in volumes and densities as follows: 200 kDa - myosin, 116 kDa - β-galactosidase, 55 kDa - glutamic dehydrogenase: (major), 45 kDa - ovalbumin: (major), 36 kDa - glyceraldehyde-3-phosphate dehydrogenase: (major), 29 kDa - carbonic anhydrase, 24 kDa - trypsinogen, 20 kDa -trypsin inhibitor, 14 kDa - α-lactalbumin : (major), and 6.5 kDa - aprotinin: (major).

Patterns (T30 M-F) show results of *Tilpia zillii* protein taken from salty water environment (30)‰ with male & female. A number of 10 protein bands (the previously mentioned) were detected, which differentiated slightly in size and densities and ranged between 200 kDa and 6.5 kDa. In addition, one increasing band was only found in female with value of 66 kDa - albumin: (major). Pattern (T28 M-F), (T20 M-F) and (TF M-F) show results of *Tilpia zillii* protein taken from brackish water environment with 28 ‰, 20 ‰,and freshwater environment lower than 0.5 ‰, respectively, including male & female. There were 10 protein bands (the previously mentioned), which differentiated slightly in size and densities and ranged between 200 kDa to 6.5 kDa. These results indicate that there was a slight difference of protein bands among samples of *T. zillii* taken from different aquatic environments.

DISCUSSION

The biochemical composition of fish muscle generally clarifies the quality of fish as a food essential to human health. Therefore, the current study was conducted to clarify the dynamics of the biochemical composition of the *Tilapia zillii*, and show how far this species is affected by the difference in salinity as a specific environmental factor, showing the extent of the organism's ability to adapt to the environment.

A deficiency of protein is one of the large negative influencing foods in many tropical countries, and economic fish is one of the important resources that can fill the gap. In this context, **Al-Moasher (2011)** reported that this fish species is more widespread and more supportive to the economic activity.

One of the main goals of the marine ecologists is to identify factors, which influence the aquatic organisms. This goal is difficult to achieve due to the complexity of natural environment **(Lee, 2008)**. The knowledge about the relationship between the environmental factors and fishes is very important. The condition of the sea's environment is changing, forming an impact on the biochemical makeup of marine creatures **(Farina *et al*., 2003)**. These variations are caused by changes in temperature or salinity. The variations in the investigated species, according to **Sumpton (2003)** reflect changes in the availability of food types, which are influenced by environmental conditions **(Choy, 1986)**.

The present work revealed the presence of a differentiation in the biochemical composition, where the maximum values of protein were recorded with marine environment. While, the highest values of lipid and carbohydrate were recorded with fresh environment, and the minimum value of protein was recorded with brackish environment. On the other hand, the minimum value of lipid and carbohydrate were recorded with marine environment. At the same time, the maximum values of calorific, water content and ash were detected with marine environment.

On the other hand, the minimum values of calorific and ash were recorded with brackish environment, while the lowest value of water content was observed with fresh environment. This finding agrees with those of **Amer *et al*. (1991)**, **Hashem (1992)** and **Abd-Elaziz (2009)**.

The distribution patterns of the major biochemical components in muscle obtained from one species and different environments were analyzed. They showed variation in biochemical composition and provided information about the variability in biochemical components associated with those of different aquatic environments.

Regarding the biochemical composition of the studied fishes, the data showed that the biochemical composition differ with respect to the aquatic environment. The increase in lipids and calorific value may be due to water density difference factor and the need for floatation and buoyancy (Because of the water density difference factor in fresh water), as well as the availability of light and the abundance of food and producers.

The change in various biochemical ratios across different environments could be attributed to other environmental conditions, such as light intensity, depth and salinity rate, all of which have an impact on physiological processes including metabolism and growth. This, for example, agrees with the result of **Schmitt and Santos (1993)**. It's possible that the increased glucose levels are due to the increased activity (glycogenolysis); an explanation that coincides with those of **Siu-Ming Chan *et al*. (1988)** and **Abd-Elaziz (2009)** who found that carbohydrates accumulate in nascent tissues. Additionally, the result of protein concurs with those of **Venugopal and Shahidi (1998)**, **Jassim *et al.* (2014)**, **Bœufa and Payan (2001)** and **Mian and Siddiqui (2020)**.

Jameel *et al*. (2004), **Larumbe-Morán *et al*. (2010)** and **Mian and Siddiquai (2020)** deduced that salinity had probably caused no adverse effects on the biochemical composition of the species. It was also reported that the better growth was achieved in low salinity due to an increase in the feed conversion efficiency and the low energy budget **(Likongwe *et al*., 1996; Mian & Siddiqui, 2020)**. Compared to the afore- mentioned varieties in perspectives, the present study revealed that better findings were achieved in both fresh and salty waters alike.

The current findings concur with those of the previous works assessing the consistency of hydration, which may contribute to *O. niloticus* in heterosmotic environments. It was also demonstrated that the water content of muscle tissue decreased with the increase of the environmental salinity **(Venkatachari, 1974)**. Moreover, the drinking rates in fish is affected by salinity, but a clear evidence on the existance of a relationship between drinking mechanism and growth control is not available. On the other hand, the possibility of a direct physical action of salinity on the digestive enzyme growth and proximate composition is attainable **(Bœufa & Payan, 2001; Rivera-Ingraham & Lignot, 2017)**.

The changes of lipid levels may be due to the physiological changes of the studied species affected by variations in salinity and environment. This agrees with the results of **Akpan (1997)** and **Abd-Elaziz (2009)**. In addition, the variation in biochemical composition may be due to food conversion, hormonal stimulation or enzyme activity affected by salinity **(Bœuf & Payan, 2001)**.

Some of the tilapia species are commonly high salinity tolerant because being euryhaline can tolerate a relatively wide range of salinities. Furthermore, the tilapia is extremely tolerant in a variety of water conditions **(Main & Siddiqui, 2020)**. In this context, many authors have worked on tilapia species and its salinity tolerance **(Boeuf & Payan, 2001; Jameel *et al*., 2004; Kamal & Mair, 2005; Asad *et al*., 2010; Khan**

***et al*., 2014)**. An early investigation showed fast growth rates in isotonic salinity because of the reduced cost of osmoregulation **(Febry & Lutz, 1987)**. However, few researches have shown that the tilapia remarkably grow in high salinities **(Kuweye *et al*., 1993)**.

Consequently, the euryhaline fish species need more protein due to higher energy budget, metabolism and osmoregulation **(Larumbe-Morán *et al*., 2010)**.
Evidence suggests that the tilapia species also showed remarkable growth at salinity ranging from 10-20 ppt **(Suresh & Lin, 1992; Mian & Siddiqui, 2020)**. Furthermore, **Martínez-'Alvarez *et al*. (2002)** also reported that the protein content of the body tissues fluctuated due to variation of environmental salinity.

Contrary to the present finding, other studies **(Osibona, 2011; Jassim *et al.* 2014; Job *et al*., 2015; Khan *et al*., 2017)** reported that the chemical composition of the *Tilapia zilli* comprised of fat (11.17%), moisture (66.54%) and ash (3.47%). **Osibona (2011)** found, in his study on this species in Nigeria, that the percentages of components were as follows: 19.55% protein, 0.96% fat, 76.75% moisture and 1.11% ash. Additionally, **Mian and Siddiqui (2020)** stated that, the environmental salinity had no adverse effects on growth or biochemical changes and added that there is no required high protein levels in diets at any salinity level.

In the present study, *i* a good content was found in the nutrient value of the *Tilapia zillii*, having high percentage of biochemical composition in spite of being clearly affected by the variation of salinity. This result is consistent with the findings of **King *et al*. (1990)** and **Naczk *et al*. (2004)** who mentioned that those differences are likely due to differences in species, diet nutrient composition **(Fabris *et al*., 2006)**, surrounding medium **(Kádár *et al*., 2006)** and other environmental factors (e.g., season, location, substrate, depth, water salinity, temperature, and anthropogenic influence). **Özyurt *et al*. (2005)** stated that, interpretation is tricky and dependent on a variety of factors. This is also in agreement with the finding of **Nasef (2016)** who stated that, the seasonal fluctuation is not the only element that influences marine or aquatic creatures.

The oscillations in proximate composition of marine creatures are mostly related to the food composition and availability rate, which are influenced by changes in the environmental conditions **(Choy, 1986 & El-Sayed, 2004)** as deduced in the current study.

Because the factors are numerous and overlap, this study sought to determine how far these factors impact the species under study, and which factor is more influential.

The changes in chemical composition of the body (moisture, protein, fat ash) which depend on the type of food, composition, density of fish and physiological processes **(Jassim *et al*., 2014)** are affected by the variation in the environmental factors, such as temperature and salinity, and the different habitats **(Salam, 2002)**. For example, global environmental change is having quantifiable consequences on the pelagic ecosystem, including those that support high-value commercial fisheries, either directly or through trophic interactions **(Vicenç *et al*. (2021)** developed in collaboration with marine biologists and ecologists as an integral part of marine.

In the present study, the results provided detailed information about biochemical composition of *T. zillii* , in addition the reflection of aquatic environmental variation in salinity on the biochemical composition of the *Tilapia zilli* in three different salinity environments: marine water, brackish, and fresh water. This work is an attempt to shed light on some environmental factors and define the extent of their impact on aquatic organisms.

Legal (1958) emphasized that, the electrophoretic pattern of serum protein of *Blennius pavowas* is affected by salinity changes. In contrast, the present study showed that protein bands was not significantly affected by different salinities (0.5 – 20 – 28 -30 ppt) at similar protein levels. The present findings, with respect to the protein levels of muscle, were nearly not affected by any of the studied salinities. Hence, this finding indicates that the salinity range 0-30 ppt may not have undesirable effects on physiological changes.

The results of the quantitative biochemical analysis showed a discrepancy between the samples extracted from the environmental areas of different salinities, and through the statistical analysis. It became clear that there are statistically significant differences between the environmentally different samples recorded. This confirms the presence of a quantitative difference. Simultaneously, the qualitative analysis through the application of the protein electrophoresis technique for example, showed the absence of a large qualitative difference among the samples under study; This means that the qualitative evaluation of protein is not affected by the quantitative estimates, which reflects the organism's ability to adapt to the environment.

In general, the ecological studies are based on many means and methods electrophoresis of muscle proteins, which have been widely used in the marine biology. These kinds of studies brought about a new look on the evaluation and discrimination of the effect of different salinity levels forming a main environmental factor that influences the aquatic organism’s protein electrophoretic findings **(Yilmaz *et al*., 2007)**.

Unfortunately, in literature, no ecological studies have been found using muscular protein electrophoresis with marine animals. In this study, through comparative electrophoretic studies of muscle proteins concerning the *Tilapia zillii* collected from three different salinity environments (marine water, brackish and fresh water), results showed that no difference was detected in the number or molecular weights of protein bands among the samples of this specified species, a representative for all aquatic environments.

The variation was in the shape, size and density of protein bands; this variation can be relied upon as a taxonomic characteristic, and as a revealing evidence that shows the extent of the influence and difference of the aquatic environment on aquatic organisms. The thickness of protein bands in the *Tilapia zillii* collected from three different salinity aquatic environments (Salty water, Brackish water, and fresh water) may be related to the different nutrients in the organism's environment. It can also be attributed to the reflective change that occurred to adapt to different salinities in the fish environment. This finding coincides with that of **Niolson (2004)** who stated that the differentiation in food items is the cause of this finding. **Pinoeir *et al*. (2001)**, who postulated that the number of separated protein bands is related to the species' food and eating behavior, as well as the species’ niche environment.

However, **Sharaf-Eldeen, *et al*. (2012)** published another study on the total number of protein bands with respect to *T. zillii,* using SDS–PAGE. The specimens under study were collected from three ecologically diverse places that differed in food and niche environment.

Habeeb and Mahdi (2013) investigated the comparative electrophoretic examinations of muscle proteins in two species of freshwater fish in Iraq; namely, the *Tilapia zillii* and the *Orochromis aureus*. The results revealed differences in the number of protein bands between the two species, with four protein bands for *T. zillii* and three for *O. aureus*.

SDS-PAGE is a useful taxonomic criterion for distinguishing between fish after electrophoretic examination of lateral muscle proteins. Some researchers have used electrophoreses of muscle proteins and some enzymes to aid in the identification of fish species **(Pinoeir *et al*., 2001; Yilmaz *et al*., 2007)**. Because electrophoresis is a simple, quick and highly sensitive method for the analysis of protein **(William & Michael, 2000)**, it has been used to examine biochemical variation in fish populations **(Diyaware, 2012)**.

The results obtained in this study confirm the effects related to various environmental factors and climatic conditions, addressing the extent of their impact on marine species, and spotting the importance of linking sciences and communication between scientists. The recorded data are significant for the welfare of human life and the sustainable development of the environment and its creatures.

CONCLUSION

The discrepancy in the values of quantitative biochemical analysis with statistically significant differences between environmentally different samples does not mean the total difference. This indicates that the difference may be more quantitative than qualitative, an indication which was confirmed during the qualitative analysis through the application of protein electrophoresis technology, for example, showing no significant qualitative difference between the samples under study. It was concluded that the organism under study was not significantly affected by the change in salinity as a specific environmental factor, and this was evident from the quality of the environmental impact on the biology of the organism and its nutritional value, which was reflected on the ability of the organism to continue and adapt to different aquatic environments.

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الملخص العربي

تغير الملوحة كعامل بيئى محدد وأثره على التركيب البيوكيميائي ، وجودة البروتين في *Tilapia zillii*

عمرو محمد ناصف
شعبة علوم البحار ، قسم علم الحيوان ، كلية العلوم ، جامعة الأزهر ، مدينة نصر ؛ القاهرة ـ مصر.

marine@azhar.edu.eg

تعد الأسماك عاملا أساسيا بالغ االأهمية في غذاء وصحة الأنسان، لذا تسعى الحكومات دائما لتنمية الثروة السمكية من خلال المحافظة علي البيئة والأستثمار من الأستزراع السمكي، الذي يتطلب دراسات بيئية مستفيضة وخبرات علمية لتوفير الوسط البيئي الملائم لنمو وازدهار الثروة السمكية؛ وتختلف الأسماك في قدرتها على التأقلم البيئي من نوع الي آخر ، وكذا في قيمتها الغذائية والأقتصادية، لذا، فقد أجريت هذه الدراسة لتوضيح ديناميكيات التركيب الكيميائي الحيوي في البلطي الأخضر (تلابيا زيللي) ،وبيان مدي تأثرها باختلاف الملوحة كعامل بيئي محدد ، بما يوضح مدى قدرة الكائن على التكيف البيئي، و يوضح جدوى عمليات النقل والأستزراع ومالها من مردود بيئي؛ وقد تم هذا من خلال اختيار نوع البلطي الأخضر الذي يعيش في بيئات مائية مختلفة من حيث طبيعة المياه (عذبة: <٠.٠٥ ترعة الإسماعيلية - معتدلة الملوحة ٢٨:٢٠ بحيرة التمساح - مالح ٣٠ - ‰ شرق بحيرة التمساح)؛ وتم تحليل التركيب التقريبي والمكونات البيوكيميائية موسمياً في الأنسجة العضلية لهذا النوع على اختلاف بيئاته ، تم قياس كمية البروتين الخام والدهون والكربوهيدرات والقيمة الحرارية والرطوبة والرماد.

أظهرت نتائج التحليل الكيميائي الحيوي الكمي وجود فروق معنوية ذات دلالة إحصائية (P<0.05) في القيم بين العينات المستخرجة من مناطق بيئية مختلفة الملوحة ، في قيم البروتين و الدهون والكربوهيدرات والسعر الحراري و ومحتوي الماء والرماد، في حين أوضح التحليل الكيفي من خلال تطبيق تقنية الفصل الكهربي للبروتين كمثال ، عدم وجود تباين كيفي كبير بين العينات محل الدراسة ؛ بما يعني ضعف تأثر الكائن محل الدراسة بتغير الملوحة كعامل بيئي محدد، وقدرة الكائن على التأقلم مع بيئات مائية مختلفة.