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Effect of some water sources on growth performance of Nile tilapia (*Oreochromis niloticus*) and Grey mullet (*Mugil cephalus*)

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ABSTRACT

The present experiment was carried out to study the impact of water sources on cultured Nile tilapia; *Oreochromis niloticus* and Grey mullet; *Mugil cephalus*. Six earthen ponds (1 feddan for each) were used in this experiment in three different farms in the same area. Three treatments were tested in two replicates (2 ponds), therefore six ponds were stocked with *O. niloticus* (9000 fish/pond) and (3000 fish/pond) of Grey mullet for each pond. *O. niloticus* and *M. cephalus* fingerlings averaged 37.18, 38.14 and 36.56g for *O. niloticus* and 23.69, 21.89 and 22.15g for *M. cephalus* in weight were assigned randomly to the three treatments. The first experimental ponds group was supplied by underground water, while the second group was supplied by agricultural drainage water and finally, the third ponds group were irrigated by a mixture between underground water and drainage waste water. The growth experiment period lasted for 26 weeks and the obtained results indicated that, the third ponds group showed the best regarding health and growth of cultured fishes.

Though water performance quality characteristics differ between underground water and agricultural drainage water, but both sources are considered suitable for aquaculture. And ground water and mixture between underground water and drainage water are gave the best of final weights and the highest total yields and quite safe for human consumption.

Keywords: Grey mullet, *Mugil cephalus*, Nile tilapia, *Oreochromis niloticus*, aquaculture, growth performance.

INTRODUCTION

Water is a critical factor in the life of all aquatic species. In aquaculture, any characteristic of water that affects the survival, reproduction, growth, or management of fish or other aquatic creatures in any way is a water quality variable (Boyd, 2003). In all culture systems, fish performs its physiological activities such as breathing, excretion of wastes, feeding, maintaining salt balance and reproduction in the water medium. Accordingly, the overall performance of any aquaculture system is partly determined by its water quality (Alam and Al-Hafedh, 2006). Poor water quality stresses and adversely affects fish growth with consequently low production, profit and product quality (Iwama *et al*., 2000). Production is reduced when the water contains contaminants that can impair development, growth, reproduction or even cause mortality to the cultured species. As a result, fish farmers are obliged to manage water quality so as to provide a relatively stress-free environment that meets the physical, chemical and biological standards for the fishes' normal health and growth performance (Isyiagi *et al*., 2009 and Manal Elkareem *et al*., 2014).

Pollution of aquatic environments with heavy metals has seriously increased worldwide attention and under certain environmental conditions fish may concentrate large amounts of some metals from the water in their tissues (Mansour and Sidky, 2002). Some metals such as zinc, iron are essential in trace amounts for normal growth and development; however, others such as cadmium, lead and mercury are potentially harmful to most organisms even in very low concentrations. Heavy metals and more specifically mercury have been reported as hazardous environmental pollutants able to accumulate along the aquatic food chain with severe risk for animal and human health. However, considerable controversy surrounds the interpretation of the relationship between pathological changes in Nile tilapia and grey mullets and prolonged exposure to water pollutants. It was reported that metals are taken up through different organs of the fish and induced morphological, histological and biochemical alterations in the tissues which may critically influence fish quality (Olojo *et al*., 2005; Fadel & Gaber, 2007 and Khattaby *et al*., (2010).

Irrigation of crops with raw, municipal wastewater has been a common practice for many decades in developing countries such as China, Mexico, Peru, Egypt, Lebanon, Morocco, India and Vietnam, mainly due to its nutrient value recognized by farmers (Jiménez *et al*. 2010). Moreover, in some poor areas of developing countries like Mexico, wastewater reuse represents a critical opportunity of improving living standards by increasing income and ensuring food supplies (Jiménez, 2006). Unfortunately, the use of untreated municipal wastewater in an agricultural setting poses risks to human health due to the potential presence of excreta-related pathogens (viruses, bacteria, protozoan and multicellular parasites), skin irritants and toxic chemicals including heavy metals; although it is uncommon to find unsafe levels of heavy metals in municipal wastewater (Bos *et al*., 2010). Consequently, it is important to both treat the wastewater and select wastewater treatment processes that reduce pathogen, while retaining nutrients if the water is to be applied for irrigation purposes (Jiménez *et al*., 2010). Reuse of treated, high-quality reclaimed wastewater for agriculture not only protects human health but is also a good conservation strategy by reducing the consumption of limited drinking water for irrigation and reducing fertilizer costs to the agricultural sector in low-income countries.

The present study was carried out to investigate the effect of using different three water sources (underground water, agricultural drainage water and a mixture of them) in fish farms under the Egyptian conditions on the health and growth performance of cultured Nile tilapia and Grey mullet.

MATERIALS AND METHODS

The practical part of the present study was carried out in three different private farms in the same area at Tollumbat No. 7 in Riyad City, Kafr El-Sheikh Governorate, Egypt, to evaluate the effect of wastewater in aquaculture. There are two main categories of water supply for aquaculture, groundwater (GW) and agricultural drainage water (ADW). Groundwater (also called well water, or spring water) often differs substantially from surface water in many characteristics such as temperature, turbidity, dissolved gases, pH and dissolved solids.

The procedures done in this study such as pond preparation, stocking rate and pond daily management are described in details. Also water quality measurements, fish sampling and data collected during harvest are recorded too. Equations and statistical methods for analyzing the specific growth rate, daily weight gain and the condition factor are given. The current experiment was conducted using randomized block design for three treatments of similar surface area (4200 m^2) for each pond.

The experimental ponds were equal in water volume (4200 m^3) with the same average water depth of 1,00m. Each pond had inlet and outlet water gates through which the water level was controlled. The source of underground came from depth of 140m. While agricultural drainage water came from El-Gharbia drainage canal.

Experimental fish:

The experimental ponds were stocked with fish species; *Oreochromis niloticus* and *Mugil cephalus*. *O. niloticus* fingerlings were stocked at an average initial length of 14.62, 14.31 and 14.20 cm and an average initial total weight of 37.18, 38.14 and 36.56g for the three treatments, respectively. The average initial length of *M. cephalus* fingerlings were 14.99, 13.90 and 14.28 cm and an average initial total weight of 23.69, 21.89 and 22.15g for the three treatments. The fingerlings of *O. niloticus* and *M. cephalus* were collected from different fish farms Riyad City, Kafer El-Shiek Governorate. Each pond was stocked with 12000 fish/feddan (9000 *O. niloticus* and 3000 *M.cephalus*). The trial lasted for about 168 days started on the 19th of June and harvested on 26th of November 2014.

Treatments:

O. niloticus and *M. cephalus* were exposed to three treatments, in the first treatment the source of irrigation was from wells, in the second treatment was agricultural drainage water and in the third treatment used was a mixture between underground water and drainage water.

Pond management

Fertilizers applications

The experimental ponds were fertilized throughout experimental period (26 weeks) according to Diana and Lin (1998). Fertilization occurred once a week by broadcasting of:

-Organic fertilizer (poultry manure 65 kg/feddan/week)

-Inorganic fertilizers (Triple super phosphate; 20% P_2O_5 and urea containing 46% nitrogen) were added as sources of phosphorus and nitrogen to ponds weekly at a rate of 8 kg/feddan of Triple super-phosphate, by dissolving it in water and splashed all over the experimental ponds water, while 2kg urea /feddan were broadcasted at pond water surface.

Supplementary feed

Commercial diet was manufactured by local animal feed factory. The fingerlings were fed on the commercial floating diet six days/week at a daily feeding rate of 3% of the estimated fish-weight twice daily at 9.00am and 3.00pm during the experimental period.

Feed quantity was adjusted according to average body weight of the biweekly sample of each pond. In order to determine the average weight of fish, biweekly samples were taken by seining where 30 fishes/species from each pond were collected and then reterned again in the pond after individual measuring the weight and length (Jauncey and Rose,1982).

Water management

Water temperature, dissolved oxygen and pH were measured weekly at 6 am. and 12pm. using thermometer, dissolved oxygen meter (YSI model 57) and pH meter (model Corning 345), respectively. Determinations of the other water quality parameters (alkalinity and ammonia) were carried out every two weeks according to the methods of Boyd (1979).

Six fish randomly were taken from treatments, and exposed to LC50 of zinc (18.62 mg/l), copper (0.56mg/l) and cadmium (11.8 mg/l) separately for the estimation of Cd, Cu and Zn in the musculature and blood. Tissues and blood were pooled separately in petri dishes and dried at 60˚C, until the weight became constant. One gram of each tissue from control and exposed groups were transferred to a 100 ml beaker and 1 ml H_2SO_4, 2 ml HNO_3 and 0.5 ml of perchloric acid was added (Topping, 1973). The beaker was gently heated on a hot plate, until the tissue dissolved. The content of the beaker was diluted to 10-15 ml with triple distilled water. The concentrations of the heavy metals were estimated by Atomic Absorption Spectrophotometer with air-acetylene mixture as fuel.

Fish samples and measurements

Random samples 30 fish from each species of each pond (two replicate for each treatment) were taken every 2 weeks during the experimental period. During this experiment, body measurements (body weight in g and body length in cm) at biweekly interval throughout the whole experiment period were recorded.

Condition factor was determined by using the following formula:

$$\mathbf{K\%} = [\text{ weight (g) / length (cm)}^3] \times 100$$

Specific growth rate was calculated according to **Jauncey and Rose (1982)** by using the following formula:

$$\mathbf{SGR}\% = \frac{LnW2 - LnW1}{t} \text{ x } 100$$

Clinical examination:

Samples of the collected fishes were examined using the methods described by **Noga (1996)** to investigate any lesions on the external body surface.

Postmortem examination:

The postmortem examination was performed to examine internal organs of fishes according to **Stoskopf (1993)**. The abdominal wall was removed and the internal organs were examined for abnormalities.

Clinical examination:

Five of the collected fishes were examined using the methods described by Conoary and Hermann (1981) to investigate any lesions on the external body surface. Fishes were examined for skin darkening, discoloration, paleness, congestion, hemorrhages, erosions or ulcers and presence of eye cloudiness, ragged, torn fins or raised scales. Internally, the abdomen was examined for enlargement; distention, parasitic larvae or sunken eyes. Mouth and gills were examined for abnormalities.

Postmortem examination:

The postmortem examination was performed to examine internal organs of fishes according to Stoskopf, (1993). The abdominal wall was removed and the internal organs were examined macro and microscopically for abnormalities, gills muscles and internal organs were examined for the presence of any visible cysts.

Harvesting

At the end of the experiment (26^{th} of November, 2014), ponds were gradually drained from the water and fish were harvested by seining and transferred to fiberglass tanks and carried to the processing centre where they washed, and the fish of the different fish species were sorted and collectively weighed.

Statistical analysis

The statistical analysis of data collected was carried out by applying the computer program (SAS, 1996). Differences among means were tested for significance according to Duncan's multiple range test (1955).

RESULTS AND DISCUSSION

Physico-chemical water quality results and heavy metals:

In fish ponds the physico-chemical characteristics of water and flora as primary production and nutritive fauna as secondary productive are well known in their relationship to fish production. These characteristics vary according to certain conditions prevailing such ponds, which depend largely on the nature of soil and water. Furthermore, these properties might vary from a pond to another within the same farm, even if they have the same surface area and the water column as well. These variations are mostly due to the management technique, feeding and fertilization regimes, aeration, fish species and number of stock (Abdel-Hakim *et al*., 2000).

Table 1: Some water quality parameters and concentrations of heavy metals indifferent farms during the experimental period.

Parameters	No.	UGW	ADW	MW
Temp.(C°)	3	24.22±0.08c	27.94±0.08a	25.98±0.08b
DO oxygen	3	3.62±0.009c	4.83±0.009a	4.12±0.009b
pH	3	7.09±0.01c	8.15±0.01a	7.44±0.01b
salinity(mg/l)	3	1.81±0.007c	2.49±0.007a	1.99±0.007b
No_3 mg/l	3	0.00±0.004c	0.72±0.004a	0.31±0.004b
NH_2 mg/l	3	0.00±0.004c	0.71±0.004a	0.30±0.004b
NH_3 mg/l	3	0.00±0.004c	0.041±0.004a	0.017±0.004
Total hardness(mg/l)	3	955.0±3.17c	1912.0±3.17a	1333.0±3.17b
Secchi disck(cm)	3	49.48±0.76a	20.05±0.76c	25.71±0.76b
Cu ppm	3	0.02±0.006c	0.05±0.006a	0.04±0.006b
Cd ppm	3	0.00±0.004c	0.01±0.004a	0.01±0.004b
Pb ppm	3	0.01±0.006c	0.09±0.006a	0.07±0.006b
Fe ppm	3	0.29±0.005c	1.15±0.005a	0.43±0.005b
Mn ppm	3	0.12±0.005c	0.80±0.005a	0.19±0.005b
ZN ppm	3	0.03±0.006c	0.08±0.006a	0.04±0.006b

a, b, c ± Means with the same letter in each column are not significantly different (P≥0.05).

Results obtained in the present study are summarized in Table (1). In general, averages of water temperature ranges were optimal for growth of Nile tilapia and grey mullet, in one way or another close to the records of Lai and Lam (1997). Dissolved oxygen readings were within the normal tolerance level of tilapia (AIT 1986). The pH values and the average values of seechi disk readings were compatable with the recomendations of Boyd (1998). The average concentration of unionized ammonia (NH_3) was wihin larable values of tilapia (Diana and Lin, 1998). While the concentration of nitrite seemed to be constant among treatments and came near the records of Diana and Lin (1998) and Ayas *et al*. (2012). The values of the total alkalinity were compatable to those mentioned by Reddy and DeLaune (2008). The above results showed that all parameters of water quality were within suitable ranges as recommonded by Boyd, (1979). In this respect Khattaby *et al*. (2010) found that, the highest measurements of dissolved Oxygen, phosphorus and total ammonia were recorded in ponds received agricultural drainage water compared to both irrigation or fertilized water.

The minimum, maximum and mean concentrations of heavy metals in water collected from the three different farms at the Riyad City are summarized in Table 1. The order of the metal concentrations found in water was Cu<Zn<Pb<cd<Fe. The minimum and maximum copper concentrations varied from 0.02 to 0.05 µg g-1 wet weight (ww) in the different water sources. The ranges of cadmium were optimal for

growth of Nile tilapia and grey mullet ww in the different water sources. The minimum and maximum lead concentrations varied from 0.01 to 0.09 µg g-1 wet weight (ww) in the different water sources. The concentrations of iron varied from 0.29 to 1.15 µg g-1 wet weight (ww) in the different water sources, the minimum and maximum nickel concentrations varied from 0.12 to 0.80 µg g-1 wet weight (ww) in the different water sources and the concentrations of zinc varied from 0.03 to 0.08 µg g-1 wet weight (ww) in the different water sources. The differences were significant ($p<0.05$) in heavy metals concentrations regarding water sources (Table 1) with the highest level at treatment 2 for all.

Heavy metals results:

Heavy metals concentrations in blood:

As shown in Table (2) the agriculture drainage water (ADW) recorded significantly increased levels of Iron, copper, manganese, cadmium, lead and zinc compared with the underground water (UGW) and mixed water (MW) in the blood of Nile tilapia and grey mullet.

Irrespective of whether the metal is essential or non essential, the accumulation levels of all the three metals in the different organs were significantly high. Metal uptake by aquatic organism is a two phased process, which involves initial rapid adsorption or binding to surface, followed by a slower transport into the cell interior. In epithelial tissues the last step is rate limiting factor in transepithelial movement of metals. Transport of metal into the intracellular compartment may be facilitated by either diffusion of the metal across the cell membrane or by active transport by a carrier protein (Brezonik *et al*., 1991). A third process involved in determining metal uptake is the speciation of the metals in the medium before contact with gill epithelia. It is generally accepted that metal accumulation in tissues of aquatic animals is dependent upon the exposure concentration and period, as well as some other factors, such as salinity, temperature, interacting agents and metabolic activities of tissue concerned (Mansour and Sidky, 2002 & Mansour and Sidky, 2002).

Table 2: Concentrations of heavy metals (Fe, Cu, Ni, Cd, Pb and Zn) in blood of *O. niloticus* and *M. cephalus* reared in ponds irrigated with different water sources.

Parameter	No.	Nile tilapia (ppm) Cr			Grey mullet (ppm) Zn		
		UGW	ADW	MW	UGW	ADW	MW
Fe	**3**	20.64±0.006c	28.79±0.006a	24.67±0.006b	19.53±0.006c	27.69±0.006a	23.49±0.006b
Cu	**3**	0.11±0.006c	0.33±0.006a	0.52±0.006b	0.11±0.006c	0.50±0.006a	0.32±0.006b
Mn	**3**	0.31±0.006c	0.88±0.006a	0.49±0.006b	0.28±0.006c	0.85±0.006a	0.46±0.006b
Cd	**3**	0.019±0.006c	0.026±0.006a	0.020±0.006b	0.018±0.006c	0.027±0.006a	0.019±0.006b
Pb	**3**	5.08±0.006c	7.52±0.006a	6.61±0.006b	4.57±0.006c	7.06±0.006a	6.12±0.006b
ZN	**3**	19.56±0.006c	31.48±0.006a	22.65±0.006b	17.42±0.006c	29.34±0.006a	20.51±0.006b

a, b, c ± Means with the same letter in each column are not significantly different ($P\geq0.05$).

Heavy metals concentrations in the Musculatures of fish:

Obtained results in the present study show that, the metal concentrations in fish musculature of *O. niloticus* and *M. Cephalus* are closely associated with metal content of water in the three treatments (Table 3) and detected in the following order: Fe >Cu >Mn >Cd > Pb > Zn. This may be attributed to the abundance of these metals in water and sediments by the same pattern. A remarkable relationship between heavy metals concentrations in musculature and source of water were observed by Ibrahim *et al.* (2000 a) and Ibrahim and El-Naggar (2006). The present results indicate that the concentrations of heavy metals in fish musculature reared in ADW are higher than those of underground water and the mixture between them (Table 3).

Table 3: Concentrations of heavy metals (Fe, Cu, Ni, Cd, Pb and Zn) in musculatures of *O. Niloticus* and *M. cephalus* reared in ponds irrigated with different water sources.

Parameter	No.	Nile tilapia			Grey mullet		
		UGW	ADW	MW	UGW	ADW	MW
Fe ppm	3	42.70±0.006a	62.38±0.006c	46.91±0.006b	39.47±0.008a	56.31±0.008c	42.32±0.008b
Cu ppm	3	0.29±0.006a	1.19±0.006c	0.67±0.006b	0.18±0.005a	0.98±0.005c	0.57±0.005b
Mn ppm	3	0.73±0.006a	1.34±0.006c	0.94±0.006b	0.52±0.006a	01.13±0.006c	0.75±0.006b
Cd ppm	3	0.024±0.006a	0.032±0.006c	0.024±0.006b	0.022±0.006a	0.031±0.006c	0.025±0.006b
Pb ppm	3	2.19±0.006a	3.28±0.006c	2.55±0.006b	1.79±0.006a	3.78±0.006c	2.22±0.006b
ZN ppm	3	19.97±0.006a	30.12±0.006c	20.20±0.006b	18.31±0.006a	31.04±0.006c	21.89±0.006b

a, b, c ± Means with the same letter in each column are not significantly different (P≥0.05).

Karakoc and Dincer (2003) reported that Zn accumulation increased with increasing temperature. Karakoc (1999) observed increase in the uptake of Cu in the liver, gill and musculature of *Tilapia nilotica* at low salinities since a decrease in salinity from 20 to 50 per cent caused an increase in the metal uptake. Dallinger and Kautzky (1985) reported the accumulation of class ‘B’ metals in metabolically active organs such as liver and kidney.

Growth parameters:

Growth and survival which together determine the ultimate yield are influenced by a number of biological parameters such as genetic materials and managerial practices, including water and food quality, energy content of the food and stocking density (El-Sayed 1999 and Ashagrie *et al*., 2008).

Table 4: The effect of water source on growth parameters of Nile Tilapia and Grey mullet.

Parameters	No.	Nile tilapia			Grey mullet		
		UGW	ADW	MW	UGW	ADW	MW
Initial weight	60	37.18±0.90b	38.14±0.90a	36.56±0.90c	23.69±0.94a	21.89±0.94b	22.15±0.94b
Final weight	60	298.65±4.98a	231.67±4.98b	287.43±4.98a	265.61±5.22a	207.22±5.22b	247.13±5.22a
Initial length	60	14.62±1.01a	14.31±1.01ab	14.20±1.01b	14.99±0.83a	13.90±0.83c	14.28±0.83b
Final length	60	27.09±1.63a	24.03±1.63b	26.68±1.63a	30.31±1.27a	26.69±1.27b	28.85±1.27a
Initial K	60	1.19±0.27b	1.32±0.27a	1.29±0.27a	0.72±0.14c	0.82±0.14a	0.77±0.14b
Final K	60	1.55±0.29a	1.72±0.29a	1.61±0.29a	1.00±0.37a	1.07±0.37a	1.05±0.37a
DWG, g/fish	60	1.56±0.35a	1.15±0.35b	1.49±0.35ab	1.73±0.29a	1.32±0.29b	1.61±0.29a
SGR, %/d	60	1.24±0.19a	1.06±0.19b	1.22±0.19a	1.72±0.26a	1.57±0.26b	1.72±0.26a

a, b, c ± Means with the same letter in each column are not significantly different (P≥0.05).

Table (4) shows the effect of water sources on growth parameters of monosex *O. niloticus* and *M. cephalus*. As described in Table (4), the initial body weight (37.18, 38.14 and 36.56g) and body length (14.62, 14.31 and 14.20 cm) for Nile tilapia and initial body weight (23.69, 21.89 and 22.15g) and body length (14.99, 13.90 and 14.28 cm) for *M. Cephalus* reared at the beganing of th experiment. The differences in initial BW and BL among the different treatments were insignificant indicating the random distribution of fish around the different experimental treatments. At the end of the experimental period the averages of BW were 298.65, 231.67 and 287.43g and BL found to be 27.09, 24.03 and 26.68 cm for Nile tilapia and 265.61, 207.22 and 249.13g and BL found to be 30.31, 26.69 and 28.85 cm for *M. cephalus* for the three water sources, UGW, ADW and MW, respectively and the differences among treatments were significant (P<0.05). The obtained results related to the abundance of natural food (phytoplankton and zooplankton) in the experimental ponds. These results are in agreement with those of Mc Donald (1985) who found that tilapia fish (*O. aureus*) fed on blue green algae (*Anabaena* spp.) gained more weight than the control. Tefei *et al*. (2000) demonstrated that *O. niloticu*s was found to be essentially phytoplanktivorous in Lake Chamo; the blue green algae contributed over 60% of the total food ingested, of these, and more than 50% was due to Anabaena. From these data, it can be concluded that fish do not need to be fed immediately after stocking but can be supported by the natural food in the pond ecosystem (Abdelghany *et al*., 2002; Kamal and Agouz 2006). Nutrient enrichment can enhance primary productivity in aquatic ecosystem (Geiger, 1983). The increase of plankton abundance can significantly increase fish production in ponds (Geiger and Parker, 1985). On the other hand, Khattaby *et al*., (2010) found that at the end of experimental period, averages of final weights were 223.06, 272.79 and 330.80g for *O. niloticus* reared in fresh water, fertilized water and agricultural drainage water, respectively.

Condition factor of fish is essentially a measure of relative muscle to bone growth and the differing growth responses of these tissues to diet treatment may be reflected by changes in condition factor (Ibrahim *et al*., 2000 b; Soltan *et al*., 2006). It is frequently assumed to reflect not only characteristics of fish such as health, reproductive state and growth but also characteristics of the environment such as habitat quality, water quality and prey availability (Liao *et al*. 1995).

As described in Table (4), the averages of initial (K) for Nile tilapia were 1.19, 1.32 and 1.29 and 0.72, 0.82 and 0.77 for *M. cephalus*. While at the end of this experiment the averages of (K) values were 1.55, 1.72and 1.61 for Nile tialpia and 1.00, 1.07 and 1.05 for *M. Cephalus* for the three treatments T1, T2 and T3, respectively. The differences among treatments were significant ($P<0.05$). Putheti *et al*., (2008) found that, K values in well waters were observed in well highly significant than in drainage water. Concentrations of metals and nonmetals in aquatic environment are known to affect the metabolism of bacteria and higher organisms in the water. The effect of pollution of water on a body can be reduced to that of predicting the dissolve oxygen content (Obire *et al*., 2008).

Manal Elkareem *et al*. (2014) found that, the mean condition factor of fish was found to be 1.23 g/cm3 and 1.22 g/cm^3 in treated wastewater and White Nile, respectively. Both values were above 1.0 indicating good conditions of the fish (Barnham and Baxter, 1998), however, they were below those obtained by (Nwabueze, 2013) for *Clarias anguillaris* which may be attributed to the difference in species. Furthermore, King (1995) attributed differences in condition factors of fish to food abundance, adaptation to the environment and gonadal development.

Table (4) shows the effect of the effect of sources of water on daily weight gain (DWG) of *O. niloticus* and grey mullet. As described in this table, the averages of (DWG) for fish reared were 1. 56, 1.15 and 1.49g/fish for Nile tilapia and 1.73, 1.32 and 1.61 for g/fish grey mullet for the three treatments T1, T2 and T3, respectively. Analysis of variance indicated that the studied water sources were significantly affected on DWG of Nile tilapia and grey mullet during the experimental period. Soliman (2006) when practically studied using resirculated ground water for maximum productivity of *O. niloticus* found that, differences were significant between total weight and daily weight gain values for fishes reared in well water over those that cultured in both mixed and recirculated waters under the three stocking density tested. In the same trend, specific growth rate (Table 4), for Nile tilapia were 1.24, 1.06 and 1.22%/d and 1.72, 1.57 and 1.72%/d for grey mullet. Analysis of variance indicated that the studied water sources were significantly affecting the SGR of Nile tilapia and grey mullet during the experimental period.

Total yield:

Averages of total yield at the end of the experiment were listed in Table (5). As described in this Table, *Oreochromis niloticus* gained the highest yield 7023.85kg - 100% compared with 1983.82kg – 28.24% gained by grey mullet.

As in this Table, Nile tilapia (T1) gained the highest yield (2607.21kg), compared with (T2) (1897.38kg) and (T3) (2519.26kg). While total yield of grey mullet, (T1) gained the highest yield (741.05kg), compared with (T2) (553.28kg) and (T3) (689.49kg). These results indicated that, the low of gain in the agriculture drainage water (ADW) compared with underground water (UGW) and mixed water (MW) reported in similar study (Soliman, 2006) when practically studied using of ground water for maximum productivity of O. niloticus found that, total yield for fishes reared in well water and mixed water were increase than those that cultured in recirculated waters under the three stocking density tested. In the same trend.

Table 5: The effect of water source on total yield of Nile Tilapia and Grey mullet.

Treatments	Nile tilapia		Grey mullet	
	Yield (kg/feddan)	%total yield	Yield (kg/feddan)	%total yield
T1 (UGW)	2607.21	37.12%	741.05	37.35%
T2 (ADW)	1897.38	27.01%	553.28	27.89%
T3 (MW)	2519.26	35.87%	689.49	34.76%
Total yield	7023.85	100%	1983.82	100
% of the biggest value	100%		28.24%	

Chemical composition:

The changes in chemical composition during development and in response to different factors are the result of differential growth of tissues. The main tissues involved in the whole-body growth are bones, muscles and adipose tissues. The relative development of these tissues is very important for the conformation of fish and thus its yield in processing (Soltan *et al*., 1999).

Proximate analysis shows significant ($P \leq 0.001$) effects in the three treatments. As described in Table (6) underground water released the highest values of protein, while agriculture drainage water released the highest values of fat and ash. This closely met the remarks of Soliman (2006) who emphasized that groundwater is commonly considered the most desirable water source for aquaculture because, at a given site, it is usually consistent in quantity and quality, and free of toxic pollutants.

Table 6: Least-square means and tested standard error of the factors affecting on chemical composition % DM basis of Nile tilapia and Grey mullet.

Species	Treatment	No.	Moisture%	Protein%	Fat*	Ash%
O. niloticus	UGW	6	62.40±0.08a	61.80±0.09a	20.10±0.06c	18.10±0.05b
	ADW	6	61.90±0.08a	58.40±0.09c	22.40±0.06a	19.20±0.05a
	MW	6	62.30±0.08a	60.20±0.09b	21.50±0.06b	18.30±0.05b
M. cephalus	UGW	6	65.90±0.07a	64.40±0.06a	18.20±0.05b	17.40±0.06b
	ADW	6	64.20±0.07b	61.70±0.06c	19.60±0.05a	18.70±0.06a
	MW	6	65.10±0.07ab	63.10±0.06b	18.70±0.05ab	18.20±0.06ab

Clinical and Post-mortem Examination of fishes:

Some tilapia fish from ponds supplied with agriculture drainage water showed skin darkening, exophthalmia, presence of eye cloudiness, abdominal distension with watery fluids exuded from the vent as shown in Photo (1). Internally, Liver was pale, enlarged in some fishes and congested with necrotic patches in other fishes. Spleens were congested and enlarged in most examined fishes. Kidneys were congested in some fishes and apparently normal in the others. Gall- bladder was enlarged and engorged with bile in some cases it contain white patches. On the other side, clinical examinations of Grey mullet revealed the presence of excessive mucus secretion covering the skin and dark grey coloration or even blackness of the skin. Hemorrhagic spots over the skin were occasionally seen and the eyes appeared cloudy. In addition to that there were easily detached scales with skin ulceration (Photo 2). Such signs were closely matching the findings of Eaton and Stinson (1983) and Fernandes and Mazon (2003).Concerning the damaged internal organs Huang *et al*. (2006) attributed that to the pollution by residues of agriculture and industrial activities in ponds supplied with agriculture waste water.

CONCLUSION

In spite of the differences in most water physicochemical characteristics between underground and fresh water, these characteristics still in adequate range which could be considered most suitable for aquaculture purposes. Concerning heavy metals residues, their levels in the edible muscles of the investigated fish species reared in either underground or fresh water are quite safe for human consumption, where these residues were below the permissible concentrations mentioned by national organizations interested in pollution and human health. According to the obtained results as we recommended to use mixed water of underground and agriculture drainage water as reliable water sources for fish rearing ponds which gave the of best final weights and the highest total yields.

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Photo 1: Tilapia showing skin darkening, exophthalmia, presence of eye cloudiness and abdominal distension:

Photo 2: Grey mullet showing darkness in the color of the skin, detachment of the scales, large irregular hemorrhages on the body surface.

ARABIC SUMMARY

تأثير بعض مصادر مياه الإستزراع السمكى على أداء النمو لأسماك البلطي النيلي والبورى

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أجريت هذه التجربة لدراسة تأثير مصادر مياه الإستزراع السمكى على صحة وأداء النمو لأسماك البلطي النيلي والبوري الرمادي. استخدمت ستة أحواض ترابية (١ فدان) في هذه التجربة في ثلاث مزارع مختلفة فى نفس المنطقة. وقد تم تصميم هذه التجربة لتشمل ثلاثة معاملات (كل معاملة تشمل مكررتين). وتم تسكين أسماك البلطى النيلي (٩٠٠٠ أصبعية/الحوض) و (٣٠٠٠ أأصبعية/الحوض) لأسماك البوري. وكان متوسط أوزان إصبعيات البلطى النيلي ٣٧.١٨، ٣٨.١٤ و٣٦.٥٦جم و٢٣.٦٩، ٢١.٨٩ و٢٢.١٥جم لأسماك البورى. وكان مصدر الرى فى المعاملة الاولى مياه الآبار الجوفية، والمعاملة الثانية كان مصدر الرى مياه الصرف الزراعي والمعاملة الثالثة كان مصدر الرى خليط بين المياه الجوفية، ومياه الصرف الصرف الزراعى. إستمرت التجربة ٢٦ أسبوع. نستنتج من هذه التجربة أنه يمكن إستخدام خليط من مياه الابار ومياه الصرف الزراعى فى الاستزراع السمكى حيث أعطى كلا من تربية الاسماك فى المياه الجوفية والمياه الخليطة بين المياه الجوفية ومياه الصرف الزراعى حيث اعطت افضل وزن نهائى وأعلى محصول كلى. وتكون الاسماك المستزرعة فى هذه المياه امنة للإستهلاك الادمى من حيث متبقيات العناصر الثقيلة.