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STUDY OF THE CHEMICAL COMPOSITION OF COMMON CARP FISH REARED IN DIFFERENT CULTURE SYSTEMS

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Abstract

This study was carried out to evaluate the meat of common carp *Cyprinus carpio*, reared in different Culture systems, natural water, earthen ponds and floating cages in Baghdad city. Fish were obtained from the earthen ponds in Hawr Rajab area, floating cages in Tarmiyah area and natural waters in the Tigris River in Al shawaka area. Some chemical analysis were carried out for samples of caught fish to estimate the percentage of moisture, protein, fat and ash. The percentage of moisture in natural water fish, earthen ponds and floating cages was 68.64, 68.33 and 68.44% respectively, While The percentage of protein was 22.36, 19.46 and 20.5% in the meat of common carp fish reared in floating cages, natural waters and earthen ponds respectively. As for fat percentage, the values were 4.83, 4.04 and 3.7% in floating cages, earthen ponds and natural waters, respectively while the ash percentage in the studied fish meat samples was 1.23, 1.19 and 1.23% for natural waters, earthen ponds and floating cages, respectively. The obtained results showed that the culture systems detected significant differences among them, but proved that they were within the acceptable limits and indicated their validity for human consumption compared with the values of internationally approved criteria.

Keywords: Chemical analysis, Moisture, Fat, Protein, Common carp

Introduction

The health awareness among people to eat food with good quality has been increased. The inclusion of fish meat in the diet was very important not due to the consumer desire in taste but it has a high nutritional value and is easy to digest. Fish occupies an advanced position in the diet of human beings as they are of great importance in the growth and building of the body, as well as being used as a medicine for many diseases due to the content of many important minerals, vitamins and essential amino acids. Most recent findings in this regard is that regular fish eating by a pregnant women contributes to the mental development of the fetus and makes it less susceptible to disease (Janabi, 2005). The sensitivity and speed of spoilage and corruption in fish meat is negative because it has an ideal nutrition medium for the growth of microorganisms due to the high humidity, meat content of fat, the quality of this fat and neutral pH or near parity which encourages the process of corruption and rancidity. Therefore, the means of conservation should be used and attention to the handing and transport of fish from the fishing area until it reaches the consumer (Huss, 1995).

The common methods of culture systems in Iraq are earthen ponds and floating cages as well as natural water. Because of the circulation of some views on the sensory and qualitative characteristics of common carp meat reared in different culture systems and because of the lack of studies in Iraq on the evaluation of meat, so this study aimed to:

Evaluation of common carp meat reared in different culture systems and environments, which brought natural water, ponds and floating cages in Baghdad governorate, and studied the chemical properties of their meat.

Materials and Methods

Common carp fish were collected at a relative weight of 800-1000 g, with 10 fish from three culture systems: natural water in the Shawakah area-the Kareemat area in the area between the Shuhada Bridge and the Al-Ahrar Bridge (legally permitted) through catchment fishing and earthen ponds system in the area of Hawr Rajab, the source of supplied water was the Tigris River and floating cages system in the area of Tarmiyah and the province / Albu Faraj 2. Fish were carefully selected to the quality standards defined by Pedrosa Menabrito and Regenstein (1990). Fish with good quality are characterized by natural aroma, no scratches or cuts on the fish's body, high-frizzy with red glamor, shiny eyes, a normal eye opening, Knots and fins are complete and unbroken as well as characterized by their white meat, flexible and cohesive strength.

Chemical analysis

The muscle segments of all fish were used to determine chemical composition as follows: moisture, ash, fat and protein. The chemical tests were performed at the rate of three replicates per sample and the measurements were calculated based on wet weight.

Moisture percentage: Moisture were analyzed according to the method of A.O.A.C (2004)

Ash percentage: Ash were analyzed according to A.O.A.C (2004) .

Protein percentage: protein were analyzed according The method of semi-microkjeldahl (Pearson, 1976).

Fat percentage: fat were analyzed according to the method described in AOAC (2004).

Statistical Analysis System (SAS, 2012) was used for data analysis to study the effect of polyculture systems on the studied characteristics according to the Complete Random Design (CRD), and the comparison between the averages was done by the Duncan (1995) multidimensional test.

Results and Discussion

The obtained results showed that there was no significant difference between the three treatments (natural water, ponds and floating cages) of moisture in the muscular tissue among the studied fish (Table 1). The percentages of moisture were 68.64, 68.33 and 68.44% in fish of natural water, ponds and floating cages respectively. Luo *et al.* (2013) reported that the natural water fish are higher

moisture percentage, while fish of ponds and floating cages tend to produce higher fat content which is in place of moisture, as the accumulation of fat in the body is offset by a drop in humidity. The present result is in agreement with the results of Yu and Siah (1997) who demonstrated that there was no significant differences in the moisture ratios in fresh fish meat within one species. Results were also agreed with the finding of Ljupojevic *et al*. (2013), Abdul Nabi (2003) who found that the moisture ratios of fish reared in natural water were lower than those reported by Al-hason (2000) and higher than those found by Salloum (2011) who studied the fresh common carp reared in ponds. However, Results were not agreed with Zmijewski *et al.* (2006), who explained that the ratios of moisture and fat are inversely related, and their total is about 80% and 20% for the remaining ingredients which is common for many species.

Results indicated that there were significant differences ($p < 0.01$) between the treatments in the protein content (Table 1), where the highest recorded percentage in the common carp reared in the cages was 22.36% and the lowest value recorded in carp of natural water with mean of 19.46%, while it was 20.5% in the carp of ponds. The difference in protein ratios may be due to the effect of several factors, including the self-degradation of protein by the self-enzymes found in the meat of different kinds or to volatilize the amounts of nitrogen during transport, storage and examination as the total protein levels depend mainly on the size of the fish regardless of dietary habits, and perhaps fish that reared in natural water are more energy-efficient in the search for food, motional activity, reproduction, fluctuation of natural food available by season, and environmental factors. Additionally, the provided feed to fish in the ponds and cages systems is rich in protein rates and this is reflected in protein rates in their meat. This is in agreement with finding of Michalczyk and Surowka (2007) while the study of Mehdi *et al.* (2006) was consistent with findings of Ljupojevic *et al.* (2013) in regard with protein ratios in carp of natural water and earthen ponds. Results were agree with Salloum (2011) and Abdul Nabi (2003) studies on common carp reared in natural waters.

Same table detected that the percentage of fat in common carp reared in different culture systems was fluctuating and significant differences ($p < 0.01$) were recorded. The highest fat percentage was recorded in carp of cages and earthen ponds with means of 4.83% and 4.04% respectively, while it was 3.7% in carp of the natural water. Moreover, fat contents vary by solvent to another in the separation processes (Ackman,1989), as well as fat ratios of the same fish species vary according to their heterogeneous distribution in the muscle tissue (Steffens, 2006). The percentage of fat in common carp fish reared in floating cages depends on the components of the fish rations and the fat ratio while it depends on the quality of the natural food and its sources and the proportion of fat in the supplementary feed in the carp fish reared in the earthen ponds. Whereas reared fish in natural water cannot control the proportion of fat due to fully depend on the quantity and quality of natural feed available in their environment. This explains why the percentages of fat in culture systems (cages and earthen ponds) are higher compared to fish reared in natural waters (Mraz, 2011). In addition to high levels of energy expended in natural waters by the presence of predators, natural enemies and the large area of the river as well as the continued search for food and its significant impact on the proportion of fat found in fish meat (FAO, 2012). This also explains the high proportion of fat in carp floating cages compared to the carp docks, that can be attributed to the small space available for movement and the availability of concentrated feed which allow the energy storage. Regarding the fat percentage, the results of this study are consistent with the Ljupojevic *et al.* (2013) who studied common carp fish reared in ponds, Ullah *et al.* (2014) who investigated the common silver carp (*Hypophthalmichthys Molitrix*), Hantoush *et al.* (2014) And Al-Hamdani (2014) who studied the chemical composition of a group of river fish, including common carp, and Saleh *et al.* (2013) who studied on the *Barbus xanthopterus*.

Results of table (1) showed insignificant differences in the ash content of the common carp populations in different culture systems. The ash percentages were 1.23, 1.19 and 1.23% in common carp fish of natural water, earthen ponds and floating cages respectively. The proportion of ash in the body of the fish is related to factors such as the nature of nutrition, food components and metabolic processes (Tokur *et al.*, 2006), and is also influenced by internal factors such as size, age, gender and external factors such as time, area of fishing, seasonal variations and surrounding environment (Hindi, 1986).

Results of the studied carp groups were consistent with the study of Mehdi *et al.* (2006) on the common carp caught from natural water, with ash percentage of 1.3%. Also agreed with finding of Salih and Al-Habib, (2013) who studied several fish species included Barbus belayewi, *Barbus xanthopterus* where the recorded ash percentages reached 1.104, 1.19, 1.074 and 1.059%, respectively. They also agreed with a study conducted by Ljupojevic *et al.* (2013) on common carp fish at 0.8%, and rates were lower than those found by Al-Hason (2000), Badran, (2008) and Hantoush *et al.* (2014) in their studies on common carp caught from fresh water with means of 4.41, 3.77 and 3.14%, respectively.

Table 1 : Percentage of body components of common carp fish reared in different culture systems

Treatments	**Natural water**	**Earthen ponds**	**Floating cages**
Chemical composition (% of wet weight)			
Humidity	68.64± 0.12 a	68.33 ± 0.09 a	68.44 ±0.12 a
Protein	19.47 ± 0.01 c	20.05 ± 0.05 b	22.36± 0.04 a
Fat	3.7 ± 0.04 c	4.04 ± 0.01 b	4.83 ± 0.02 a
Ash	1.23± 0.02 a	1.19 ± 0.02 a	1.23 ± 0.02 a

The different characters within one row indicate significant differences in probability of error ($P < 0.01$) between the coefficients.

Conclusion

Common carp reared in cages culture system was superior in the fat and protein ratios. Results showed that the fishing area and the culture system have a significant and direct effect on the chemical characteristics and by knowing the chemical composition of the fish, it is possible to estimate their nutritional value and planning for their industrial and economic benefits.

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