COMPARATIVE STUDY OF TOTAL LIPIDS IN THE MUSCLES OF CYPRINUS CARPIO REARING IN PONDS AND RIVER

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ABSTRAC

The aim of the current study is to compare total lipid profile of *Cyprinus carpio* reared in earthen ponds and wild fish (river). A total of 80 fish samples were collected from these locations for the period from November-December 2020 and divided into three weight groups (W1 , less than 500 g ;W2, 500-1000g and W3 , more than 1000g). Results of present study showed that the total cholesterol content ranged between 17.69-21.63mg\100g in W3 and W1 respectively in river fish, while in pond fish ranged between 22.08-23.59mg\g in W2 and W3 respectively. High density lipoprotein in river fish ranged between 5.84-12.21mg\g in W3 and W1 respectively, in pond fish ranged between 11.18-12.92mg\g in W2 and W1. Low density lipoprotein in river fish ranged between 0.908-1.215 mg\g in W3 and W2, in pond fish ranged between 1.266-1.588 mg\g in W2 and W3 respectively and finally triglycerides in river fish ranged between 53.25-59.69 mg\g in W3 and W1.In pond fish ranged between 60.57-65.98 mg\g in W2 and W3 respectively. Results of statistical analysis of lipid profile showed a significant difference P≤0.05 of Cholesterol, HDL,LDL and Triglycerides in W3 between ponds and river fish , but no significant difference P>0.05 in W1 and W2 of Cholesterol, HDL,LDL and Triglycerides between ponds and river fish.

Keywords: fish, HDL,LDL

دراسة مقارنة للدهون الكلية في عضلات اسماك االكارب الشائع *Cyprinus carpio* المرباة في الاحواض والنهر

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المستخلص

هدفت الدراسة الحالية الى اجراء مقارنة في مستوى الدهون الكلية لأسماك الكارب الشائع *Cyprinus carpio* المرباة في الأحواض الترابية والنهر . جمع 80 عينة من الأسماك في الموقعين أعلاه للفترة من نوفمبر إلى ديسمبر 2020 وقسمت إلى ثلاث مجاميع وزنية (W1:أقل من 500 غم وW2 : بين 500–1000 غم) و W3 : أكثر من 1000) . أظهرت نتائج الدراسة الحالية أن محتوى الكوليسترول الكلي تراوح بين 17,69–21,63 ملغم\ 100 غم في W3 و W1 على التوالي في أسماك النهر ، بينما تراوح في أسماك الأحواض بين 22,08–23,59 ملغم\ غم في W2 و W3 على التوالي . تراوح البروتين الدهني عالي الكثافة بين 5,84–12,21 ملغم\ غم في النهر في W3 و W1 على التوالي ، بينما تراوح في أسماك الأحواض بين 11,18–12,92 ملغم\ غم في W2 و W1. تراوح البروتين الدهني منخفض الكثافة في اسماك النهربين 0,908–1,215 مغم\ غم في W3 و W2، بينما في أسماك الأحواض تراوح بين 1,266–1,588 مغم\ غم في W2 و W3 على التوالي وأخيراً تراوحت الدهون الثلاثية في أسماك النهر بين 53,25–59,69 مغم\ غم في W3 و W1. وفي أسماك الأحواض تراوحت بين 60,57–65,98 مغم\ غم في W2 و W3 على التوالي. أظهرت نتائج التحليل الإحصائي وجود فروق معنوية P ≤ 0,05 للكوليسترول وHDL و LDL والدهون الثلاثية في W3 بين الأحواض والأسماك النهرية ، ولكن لا يوجد فرق معنوي P >0,05 بين W1 و W2 للكوليسترول و HDL وLDL والدهون الثلاثية مقارنة بين اسماك الاحواض والنهر.

الكلمات المفتاحيه:اسماك,الكوليستيرول,البروتين الدهني، منخفض الكثافه وعالي الكثافه.

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INTRODUCTION

The fisheries sector is one of the vital sectors due to its economic and health importance(3).Common carp *Cyprinus carpio* consider the most common species of fish cultured in Iraq, this fish species have many characteristics made it suitable for breeding in aquatic environment in Iraq included rapid increase in weight as well as resistance to many pathogens in aquatic environment (4).Carp is an omnivorous species, bottom feeder eating (2).Common carp is a valuable nutritional source of proteins, lipids and other nutritive components which play many important roles in human health. Cholesterol is a waxy, fat-like substance found in the walls of cells in all parts of the body, from the nervous system to the liver to the heart. As with oil and water, cholesterol (which is fatty) and blood (which is watery) do not mix. Cholesterol is widely distributed in the animal body, being particularly abundant in the brain and nervous tissue, blood, bile, liver and the skin. The exogenous intake of cholesterol is one of the factors affecting the level of LDL cholesterol in the blood serum of the human population (21). Zivkovic et al. (22) stated differences in cholesterol content of different fish species, ranging from 15.80 - 80.65 mg /100 g meat. Cholesterol content in fish meat can vary, even in related species which are living in the same area, and have similar eating habits. High Density Lipoprotein (HDL) transports cholesterol and its esters from peripheral tissues to the liver for its catabolism (scavenging action) (16). Low Density Lipoprotein (LDL) regulates cholesterol synthesis in extra-hepatic tissue. The triglycerides are the most abundant of all lipids. They constitute about 98% of total dietary lipids, the remaining 2% consists of phospholipids and cholesterol and its ester (8). The aims of this study was to compare the total lipid TL content from fatty tissues of wild and cultured of *C. carpio*, in order to identify possible nutritional deficiencies in cultured fish and to obtain information to formulate a more suitable diet for this species broodstock.

MATERIALS AND METHODS

A total of 80 fish samples were collected from earthen ponds and Tigris river for the period from November-December 2020 and divided into three weight groups (W1 , less than 500 g ;W2, 500-1000g and W3 , more than 1000g**).** In ponds fish were fed twice daily using commercial diet(Total protein 26%) . Fish was homogenized with saline, then it is placed in the centrifuged for 5 minutes, To obtain samples in solution form, then the supernatant was taken for analysis in ELITech kit ,France origin According to the protocol.The application is available on request

Wave length 505nm

Temperature 37 °C

Read against reagent blank

	Blank	**Calibration**	**Test**
Reagent R	**300 µl**	**300 µl**	**300 µl**
Distilled water	**3 µl**	-	-
Calibrator	-	**3 µl**	-
Sample	-	-	**3 µl**

Mix and read the absorbance (A) after a 4 minutes and 30 seconds of incubation With selectra Touch prosoft ware use the application included in the barcode available at the end of this insert.

Calculation

$$\frac{A_{\text{sample}}}{A_{\text{calibrator}}} \times n$$

n=calibrator concentration

Conversion factor

mg\dlx0.0259=mmoI\L

Mg\dlx0.01=g\l

Statistical analysis

The Statistical Analysis System (18) program was used to detect the effect of difference factors in study parameters. Least significant difference –LSD test (Analysis of Variation-ANOVA) was used to significant compare between means in this study.

RESULTS AND DISCUSSION

Results of present study showed that the total cholesterol content in river fish decreased with weight gain, but in pond fish it increased with weight gain. Total cholesterol ranged between 17.69-21.63mg\100g in W3 and W1 respectively in river fish. Total cholesterol in pond fish ranged between 22.08-23.59mg\g in W2 and W3 respectively (Tab.1) with no significant differences P>0.05 between W1 compared to W2, Also between W2 compared to W3(15). Lipids are generally regarded as the most important constituent that determine the quality of fish meat .The total lipid

contents of fish are reported to vary significantly with gradual increase in the weight and length of the fish and also due to seasonal changes aside from the available nutrients in varied habitats. Similar comparisons regarding the percent fat contents of *Oreochromis niloticus* can be found in literature reports (1). The total lipid content was found to have a direct relationship with body weight of wild and farmed *Catla catla*(11) . High density lipoprotein ranged between 5.84-12.21mg\g in river in W3 and W1 respectively in river fish with a significant increased P≤0.05 of W1 and W2 compared to W3, while high density lipoprotein in pond fish ranged between 11.18-12.92mg\g in W2 and W1 respectively, no significant differences P>0.05 among weight groups . High-density lipoprotein decreases with weight gain in both pond and river fish . Low density lipoprotein in river fish ranged between 0.908-1.215 mg\g in W3 and W2 respectively with a significant increased P≤0.05 of W1 and W2 compared to W3,while in pond fish ranged between 1.266-1.588 mg\g in W2 and W3 respectively with no significant differences P>0.05 among weight groups. Low-density lipoprotein decreases with weight gain in river fish and increases with weight gain in pond fish.. Finally Triglycerides in river fish ranged between 53.25-59.69 mg\g in W3 and W1 respectively, while in pond fish ranged between 60.57-65.98 mg\g in W2 and W3 respectively(Tab.1).

Table 1. Effect of body weight group in Lipid profile in muscle

Resource	Weight group (g)	Mean ± SE Total cholesterol content mg\l00g	H.D.L. mg\L	L.D.L. mg\DL	Triglycerides mg \L
River	W1	21.63 ±1.39 a	12.21 ±0.50 a	1.155 ±0.09 ab	59.69 ±5.78
	W2	20.37 ±o.71 ab	11.73 ±0.66 a	1.215 ±0;07 a	59.14 ±3.62
	W3	17.69 ±0.90 b	5.84 ±0.61 b	0.908 ±0.07 b	53.25 ±2.60
LSD value	-	3.01 *	2.048 *	0.251 *	13.39 NS
ponds	W1	22.67 ±1.17	12.92 ±0.71	1.36 ±0.07	65.77 ±4.98
	W2	22.08 ±0.71	11.18 ±0.59	1.266 ±0.07	60.57 ±1.38
	W3	23.59 ±1.20	11.37 ±1.07	1.588 ±0.27	65.98 ±2.66
LSD value	-	2.97 NS	2.31 NS	0.402 NS	8.98 NS

Means having with the different differed significantly * (P≤0.05).

Result of statistical analysis of lipid profile showed a significant difference P≤0.05 of Cholesterol, HDL,LDL and Triglycerides of W3 pond fish compared to river fish (Tab.2), but no significant difference P>0.05 in W1 and W2 between ponds and river fish.

Table 2. Effect of resource in Lipid profile in muscle

Weight group	Resource	Mean ± SE Total cholesterol content mg\l	H.D.L. mg\L	L.D.L. mg\DL	Triglycerides mg \L
W1	River	21.63 ±1.39	12.21 ±0.50	1.155 ±0.09	59.69 ±5.78
	Ponds	22.67 ±1.17	12.92 ±0.71	1.36 ±0.07	65.77 ±4.98
LSD value	-	4.06 NS	1.95 NS	0.276 NS	17.16 NS
W2	River	20.37 ±0.71	11.73 ±0.66	1.215 ±0.07	59.14 ±3.62
	Ponds	22.08 ±0.71	11.18 ±0.59	1.266 ±0.07	60.57 ±1.38
LSD value	-	2.109 NS	1.876 NS	0.214 NS	8.14 NS
W3	River	17.69 ±0.90 b	5.84 ±0.61 b	0.908 ±0.07 b	53.25 ±2.60 b
	Ponds	23.59 ±1.20 a	11.37 ±1.07 a	1.588 ±0.27 a	65.98 ±2.66 a
LSD value	-	3.46 *	2.85 *	0.642 *	8.59 *

Means having with the different differed significantly * (P≤0.05).

Cholesterol is ubiquitous within the body of fish and other animals (6). Cholesterol is considered to be an important constituent of brain tissue containing phospholipids. An important factor affecting lipid content and composition is the genetic background. Muscle lipid contents is a highly heritable trait in common carp and that there is a relatively high

positive genetic correlation between body size (length and body weight) and lipid content. The wild fish has to make strenuous efforts in foraging food organisms, for which more fats are consumed to supply energy and consequently, the deposition of fat in the body of the wild fish species is comparatively lower (17). This is consistent with present research. Another factor with a strong effect on lipid content and composition in animals is sex or sexual maturation .Chaman and Ali (7) concluded that cholesterol which is supplied to the gonads stems mainly from the muscle stores (edible tissues) and liver. Cholesterol acts as a precursor to produce cortisol hormones, estradiol, testosterone, progesterone. Intake of cholesterol in a large amounts cause the increase LDL cholesterol in the blood serum (14). The total cholesterol content in the meat of fish depends on the species, age, sex, spawning cycle, harvesting period and geographical location of the reservoir (9,20). Bieniarz et al.(5) confirmed a statistically significant differences in the total cholesterol content in the meat of some line of carp *Cyprinus carpio* depending on the age and season. Where Tocher et al. (19) mentioned The differences probably might be due to the differences in feeding because, wild fish was fed selectively on natural nutrients (planktons, algae and water plants), while earthen ponds cultured fish is always was fed on natural feed and manufactured feed (supplementary diets) and this differ according to ingredients (inputs) used to formulate the supplementary feed. It is widely believed that the wild fish acceptability is better than that of farmed fish .In the current study, there is a significant difference between river and ponds fish. Duo et al. (10) confirmed findings that wild fish generally have lower lipid levels than cultured fish. As stated by Kestemont et al. (13).Total lipid was formed by the cholesterol so the elevation in its components leads to the increase in total lipid) . Gonzales et al. (12) mentioned the differences probably might be due to the differences in feeding because, wild fish was fed selectively on natural nutrients (planktons, algae and water plants), while earthen ponds cultured fish is always was fed on natural feed and manufactured feed (supplementary diets) and this differ according to ingredients (inputs) used to formulate the supplementary feed.

REFERENCES

1. Al-Asgha, N. A. 1992. Variation in the carcass composition of *Oreochromis niloticus* in relation to body weight and length. Pak. J. Zool. 24:47-51

2. Adamek, Z., J. Musil and I. Sukop. 2004. Diet composition and selectivity in 0+perch (*Perca fluviatilis* L.) and its competition with adult fish and carp (*Cyprinus carpio* L.) stock in pond culture. Agric.Cons.Sci. 69: 21-27

3. Al-Khafaji, T. T. and H. N. Al-Amary. 2016. Effect of adding vitamine-e and flax oil linum usitatissimum to the diets of two types of carp fish *Cyprinus carpio*, *Hypophthalmichthys molitrix* raised in floating cages of Euphrates river – City of Samawah. The Iraqi . Agric. Sci.47(1): 337-342

4. Al-Mahmood , S .,W. D. Bakir and H. S. Hussein. 2017. Gross and histopathological study on common *carp Cyprinus carpio* L. diseases in rearing culturing ponds in Kirkuk Province – Iraq. The Iraqi J.Vet. Med. 41(1):109-117

5. Bieniarz, K., M. Kołdras, J. Kaminski and T. Mejza.2001. Fatty acids, fat and cholesterol in some lines of carp (*Cyprinus carpio* L.*)* in Poland. Arch. Polish Fish.9 (1):5-24

6. Chaman, B., K. Ahsan, S. Nazish, R. Sumayya and M. Y. Ali. 2016. Size dependent variation in cholesterol and fatty acids profile of different tissues of carnivore freshwater catfish, Wallago attu. Pak. J. Zool.48(4):1017-1024

7. Chaman, B. and M. Ali.2021. Size dependent variation in cholesterol and fatty acids profile in different tissues of freshwater cyprinid *Ctenopharyngodon idella*, commonwealth J.Acad. Res. (CJAR.EU). 2 (1):1-14

8. Chauhan, B. S. 2008. Principle of Biochemistry and Biophysics.University Science Press(An Imprint of Laxmi Publications pvt.Ltd.).118-119

9. Donmez, M. 2009 .Determination of fatty acid compositions and cholesterol levels of some freshwater fish living in Porsuk Dam, Turkey. Chem. Nat. Comp.. 45 (1):14-17

10. Duo, L .,S. Sirithon, L. W. Mark, J. M. Neil and J. S. Andrew. 2005. Lean meat and

heart health. Asia Pac. J. Clin. Nutr.14 (2):113-119

11. Hassan, M., S. Ali, I. Tahira and B. Hussain. 2010. Total lipids and fatty acid profile in the liver of wild and farmed *Catla catla* fish. Grasas Y.Acites, 61 (1): 52-57. DOI: 10.3989/gya.032009

12. Gonzalez, S., G. Flick, S. Okeefe, S. Duncan, E.McLean and S. Craig. 2006. Composition of farmed and wild yellow perch (*Perca flavescens*). J. Food Compo. Anal. 19: 720-726

13. Kestemont, P., E. Vandeloise, C. Melard, P. Fontaine and P.B. Brown. 2001. Growth and nutritional status of Eurasian perch *Perca fluviatilis* fed graded levels of dietary lipids with or without added ethoxyquin. Aquaculture. 203:85–99

14. Ljubojevic, D., V. Dordevic and M.Cirkovic.2017. Evaluation of nutritive quality of common carp, *Cyprinus carpio* L. f. Series: Earth and Environ. Sci. 85, 012013

15. Love, R. T., T. Miyazaikr and S. Rabegnator. 1984. Requirements for alpha – tocopherol by channel cat fish fed diets low in polyunsaturated triglycerides. J. Nutr. 114: 894 – 901

16. Mireille, O., J. B.Tessa and A. F. Edward.2019. HDL and reverse cholesterol transport basic mechanisms and their tooles in vascular health and disease . Cir. Res. 124 (10): 1505-1518

17. Muhammad, H., S. A. S. Chatha,T.Ismat and H. Bilal. 2010. Total lipids and fatty acid profile in the liver of wild and farmed *Catla catla* fish, Grasas Yaceites. 61 (1): 52-57

18. SAS. 2012. Statistical Analysis System, User's Guide. Statistical. Version 9.1th ed. SAS. Inst. Inc. Cary. N.C. USA

19. Tocher, D. R ., M. B. Betancor, S. Matthew, R. E. Olsen and J. A. Napier. 2019. Omega-3 long-chain polyunsaturated fatty acids, EPA and DHA: Bridging the gap between supply and demand. Nutrients.11,89:1-22

20. Vorlova, L., E. Sieglova., R. Karpiskova and V. Kopriva.2001. Cholesterol content in eggs during the laying period. Acta. Vet. Brno. 70(4): 387-390

21. Yidam, O. A.,H. Elhashmi, S. Rowaida and A. Yousif. 2019. Effect of some water quality parameters on cholesterol and triglycerides of wild and cultured nile tilapia (*Oreochromis niloticus*), Sudan J. Aqua. Sci. Mar. Biol. (3)1 : 11-19

22. Zivkovic, D.,V. Peric, M. B. and P. Marija. 2002. Cholesterol content in eat of some cyprinidae. J. Agric.Sci. 47(2): 179-187.