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Effects of Zingiber officinale as Feed Additive on the Common Carp Body Composition

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Abstract

The present study was conducted to evaluate the use of ginger powder in diet of common carp, Cyprinus capio (27.0±3.0 gr). Different levels of the plant powder (0, 0.25, 0.5, 1 and 2 gr / per 100gr food) were sprayed on commercial diet. The feed was offered by 8 weeks. Results Showed that fish fed experimental diets had no significant difference ($P>0.05$) in amount of NFE, but have significant difference in protein, lipid, ash, moisture percent and kcal energy from different diet ($p<0.05$) while in kruskal-wallis test illustrated significant difference in amount of carbohydrate and muscle fiber ($p<0.05$). So, the best results in amount of protein, lipid, and energy have shown in maximum dosage of ginger powder in carp commercial diet and low amount of them shown in control group. There were high amount of carbohydrate and low amount of fiber in control group. There was the lack of fiber in control group and upper level of ash in the third treatment. In this study we are arriving at a conclusion that; using ginger powder can be an efficacious medicine to improve quality and quantity of Cyprinus carpio muscle.

Keywords: Zingiber officinale, common carp, body composition, feed additive

Introduction

For thousands of years, medicinal plants have had primitive and in time helpful roles in human life. In recent years some novel applications of these initially raw materials have been developed, to name some, are: their use as antifungal agents (Boulenouar et al., 2012) or in the formulation of insecticides (Motazedian et al., 2012). In aquaculture sector, the use of medicinal plants (phytochemicals) has been increased significantly over the past decade for such different purposes as sex reversal compound (Tzchori et al., 2004), growth enhancer (Turan and Akyurt, 2005, Ahmadi et al., 2012; Asadi et al., 2012; Banaee, 2010; Banaee et al., 2011), immunostimulant, antipathogenic (Yılmaz etal., 2013a), and antistress (Chakraborty and Henze, 2011). One of the relatively new practiced ways to improve health conditions for cultivated aquatic organisms is using medicinal herb as an immunostimulator or growth enhancer (Citarasu, 2010). Several such herbal components as flowers, leaves, seeds and roots from different plant species have been shown to enhance growth, none specific immune response as well as survival rates of such cultivated species as African catfish, Clarias gariepinus (Dada and Ikuerowo, 2009 and Soosean et al., 2010), tilapia Orechromis mossambicus (Immanuel et al., 2009) and common carp, Cyprinus carpio (Alishahi et al., 2010; Pakravan et al., 2012; Fallahpour etal.,2014). Ginger is generally considered as a safe herbal medicine (Weidner and Sigwart, 2000); contains alkaloids, flavonoids, polyphenols, saponin, steroids, tannin, fiber, carbohydrate, vitamins, carotenoids and minerals

(Otunola et al., 2010; Shirin and Prakash, 2010); natural antioxidants as gingerols, shogaols and zingerone(Hori et al., 2003); essential oils which has potent anti-inflammatory effects and oleoresin (Zarate and Yeoman, 1996). Ginger is among the spices with reported antiplatelet, antibacterial, antifungal, antiviral, antiworm, anti-inflammatory, anti-oxidative activity, have effects on gastrointestinal, cardiovascular systems, antilipidemic and antihyperglycemic, anti-tumour properties and are known to be effective as an immuno-modulatory agent in human and animals, including fish(Nya and Austin, 2009; Apines-Amar et al., 2012 and Talpur et al.,2013). Supplementing ginger in fish diets may enhance the body composition. The term growth will signify change in magnitude. The variable undergoing change may be the length or other physical dimensions, including volume, weight, or mass either of an organism's whole body or its various tissues or it may relate to lipids, protein content, or other chemical constituent of the body. Growth may also relate to the change in the number of animals in population (Weatherly and Gill, 1987). Body composition is a good indicator of the physiological condition of a fish but it is relatively time consuming to measure. Proximate body composition is the analysis of water, fat, protein and ash contents of fish. Carbohydrates and non-protein compounds are present in negligible amount and are usually ignored for routine analysis (Cui and Wootton, 1988). The percentage of water is good indicator of its relative contents of energy, proteins and lipids.The lower the percentage of water, greater the lipids and protein contents and higher the energy density of the fish (Dempson, et al., 2004). However, these values vary considerably within and between species, size, sexual condition, feeding season and physical activity. Protein content, which is important component, tends to vary little in healthy fish (Weatherly and Gills, 1987). The body composition activities of ginger have not yet been full study in fish. Hence, the present study was aimed at evaluating the long-term (60 days) effects of dietary inclusion of Zingiber officinale powder on carcass quality of common carp juveniles.

Materials and methods

180 number of Juvenile common carp, C. carpio(20±3gr) was obtained from (Carp Farm, Simorgh, Mazandaran province, Iran),were transported to the private aquarium farm and kept in 15 aquarium(120×100×40cm) under the same environmental conditions (Temperature=22±4˚c, pH=7.5 ±0.5, Do=8.7±0.3ppm, NO2=0.3±0.01ppm, No3=5±0.01ppm, NH4=0.5±0.01ppm, Total hardness =150±50ppm). They were fed on a commercial carp food (Beyza Feed Mill, Shiraz, Iran)for 10 days. Some proximate composition figures of the commercial diet (dry basis %) were <10% humidity and ash, 35-37% protein, 9-11% lipid, fiber5%, TVN <45 and 3500 kcal/kg energy as diet brochure composing 1% canola oil with (0, 0.25, 0.5 ,1 and 2gr Ginger powder/ per100 gr) commercial diet by post pelleting liquid spraying method for weekly usage and fish fed by diet in 3% of their body weight twice a day till two month . At the end of feeding period, three fish from each tank were sampled for proximate composition analysis 24 h after the last feeding. Sampled fish were anaesthetized by using clove powder (100 ppm).Then chemical compositions of whole body of them (moisture, protein, lipid, Ash, fiber, Carbohydrate, NFE (Nitrogen Free Extraction) and Energy) were determined following the Association of Official Analytical Chemists (AOAC) methods (AOAC 2000). Moisture was determined by drying in oven (Binder, Tuttlingen, Germany), at 105 ˚C for 24 h (Sidhu 2003). Crude protein was determined by using a Kjeldal system (Gerhardt, type VAP.40, Konigswinter, Germany). A conversion factor of 6.25 was used to convert total nitrogen to crude protein for all varieties of fish (Ritzmann& Daniels 1975).Crude lipid was determined with ether extraction in a Soxhlet extractor (Gerhardt, type SE-416) Folch et al (1957). Ash was determined using a mu\e furnace (Nabertherm, Lilienthal, Germany), at 550 ˚C for 8h. There is no single method suitable for determining total carbohydrate in all tissues and, apart from

the indirect infrared method mentioned earlier under protein, the methods are not straightforward. For these reasons it is common to estimate carbohydrate (C) by difference. C (%) =100-P-W-F-A.In this formula: P: percentage of protein= (N×6.25), W: water percentage, F: fat percentage and A is Ash percentage (AOAC, 2000).For fiber percentage content in the first stage samples digested in sulfuric acid and sodium hydroxide solutions and the residue calcined, then the difference in weight after calcinations indicates the quantity of fiber present by (weight of crucible with dry residue (g) - weight of crucible with ash (g))/(weight of sample (g))×100 (jafari khorshidi, 2004). Assuming to this point all matters in filet are 100% NFE measured by: 100- (crude fiber%+ Ash%+ Moisture%+ Crude lipid%+ crude protein %) and total kcal energy calculated by 10× (5.5×amount of filet protein) + (9.1× amount of filet lipid) + (NFE×4.1) (jafari khorshidi, 2004). After all calculations statistical analyses have done with the SPSS Version18.Values is expressed as mean±SD. kruskal-wallis(Man-whitny-U) and Duncan tests were used to check for differences between treatments, at 95% significance level was used to evaluate the effects of ginger powder on the chemical compositions of common carp(Duncan,1995).

Results

As results have shown in table 1, there are a significant difference between control group and others by kruskal-wallis (Man Whitney-U test) in amount of carbohydrate and fiber ($p<0.05$). There is significant difference between (T1) and other group in amount of carbohydrate and (T1) by two last treatments in amount of fiber ($p<0.05$). Also, there is a significant difference between (T2) and two last one in amount of carbohydrate and fiber. Brightly shown this differ between (T3) and (T4) in carbohydrate level too ($p<0.05$). Furthermore, there is ($p>0.05$) in amount of NFE between treatments by this test.

Table 1: Amount of carbohydrate, fiber and nitrogen fecal extraction (NFE) in Cyprinus carpio body composition

Indexes	Control group	0.25g/100g diet(T1)	0.5g/100g diet(T2)	1g/100g diet(T3)	2g/100g diet(T4)
Carbohydrate %	1.61±0.01	0.87±0.02	1.1±0.02	1.21±0.01	0.97±0.0
Fiber%	0.11±0.01	0.48±0.02	0.51±0.01	0.31±0.03	0.38±0.04
NFE%	1.5±0.05	0.39±0.01	0.6±0.2	0.57±0.41	0.59±0.04

The upper levels of carbohydrate, NFE and lower level of fiber were seen in control group, while in the low amount of carbohydrate was in 2gr ginger powder / per100 gr commercial diet, high amount of fiber was seen in 0.5gr ginger powder / per100 gr diet and low amount of NFE was in 0.25 gr Zingiber officinale powder/ 100 gr per diet (figures-1&2&3)

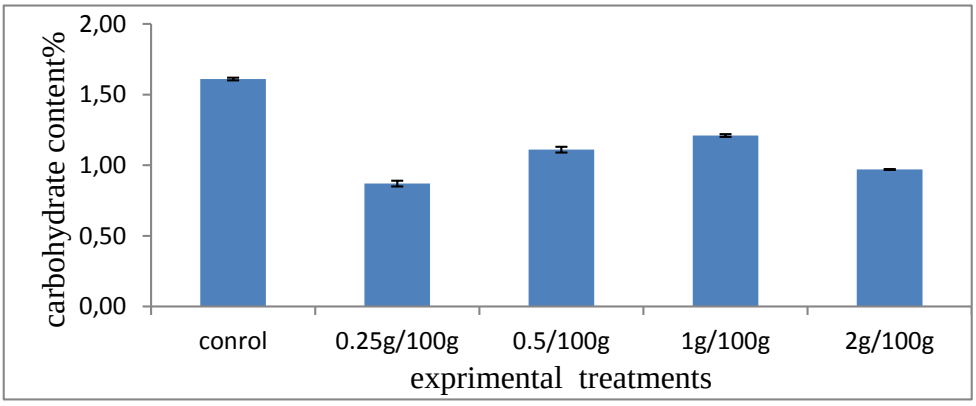

Figure 1: Carbohydrate content in common carp body composition

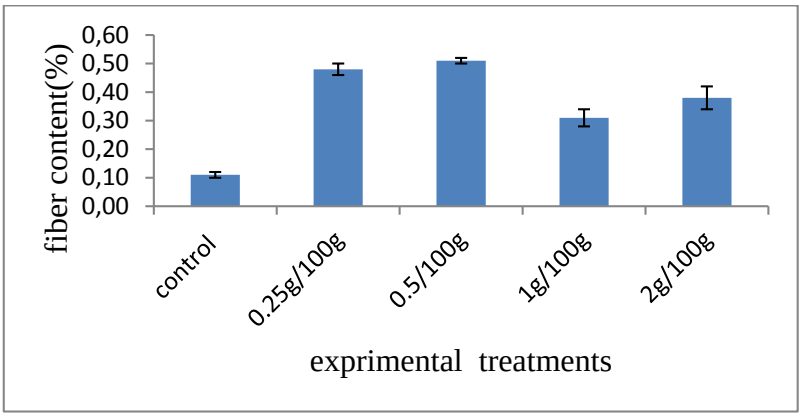

Figure 2: Fiber content in common carp body composition

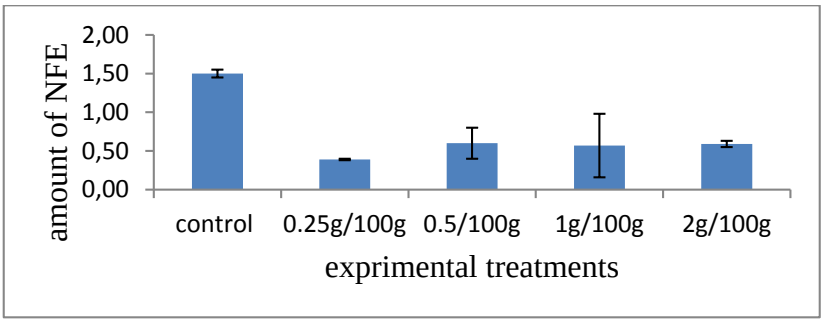

Figure 3: NFE content in common carp body composition

For amount of protein, lipid, ash, moisture and kcal energy the Duncan test demonstrated significant difference between experimental groups obviously ($p<0.05$).So on, the best levels of protein (18.92±0.02%), lipid (2.33±0.03%) shown in (T4) (figures-4&5).

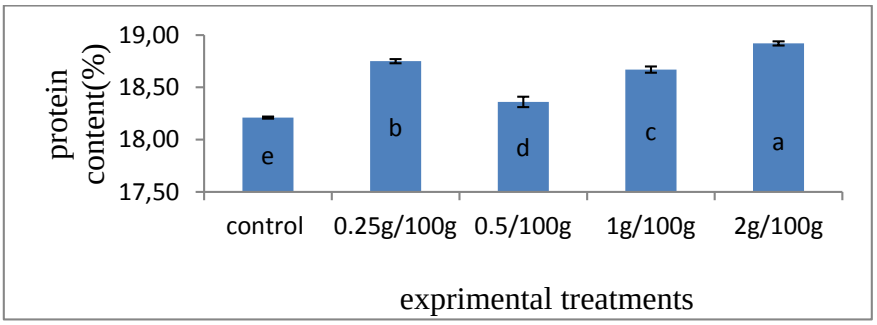

Figure 4: Protein content in common carp body composition

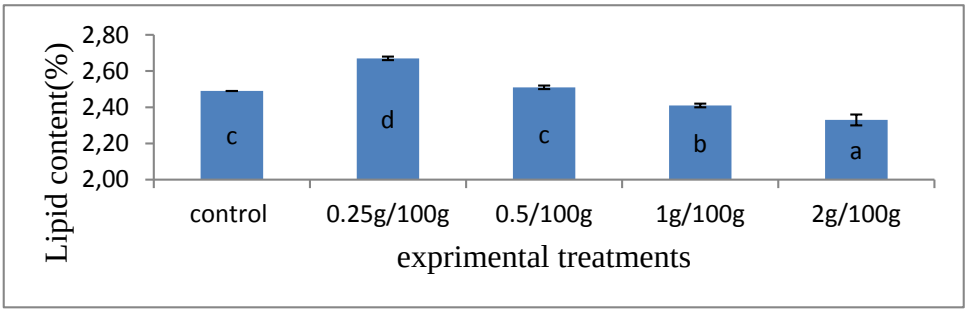

Figure 5: Lipid content in common carp body composition

As, determined in (figure 6) high amount of kilocalorie energy (1064.2±4.00) is in the last experimental group and low amount of it (1030.3±2.00) in control group, but also this one and (T2) were in the same group by Duncan statistical test like amount of lipid(figure5).

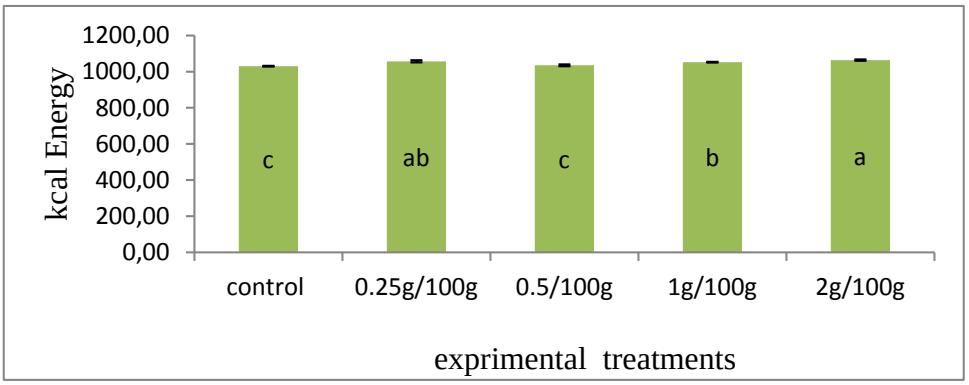

Figure 6: Kilocalorie energy in common carp body composition

After Duncan test; the result observed that the amount of moisture in (T1=75.16±0.01%) and (T4=75.13±0.03%) both are the best but, the lowest amount (75.33±0.03%) precept in control group (figure7).

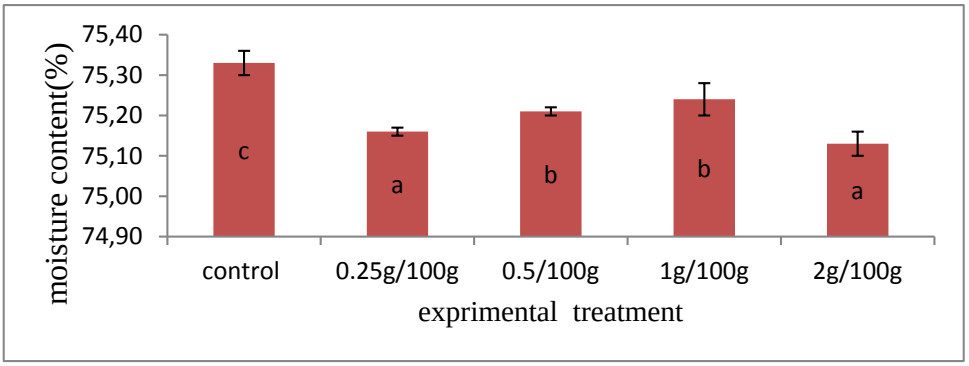

Figure 7: Moisture content in common carp body composition

There was (2.81±0.01%) ash in 0.5gr ginger powder / 100 gr per diet as an upper level and lower level (2.36±0.01%) was in control group (figure8).

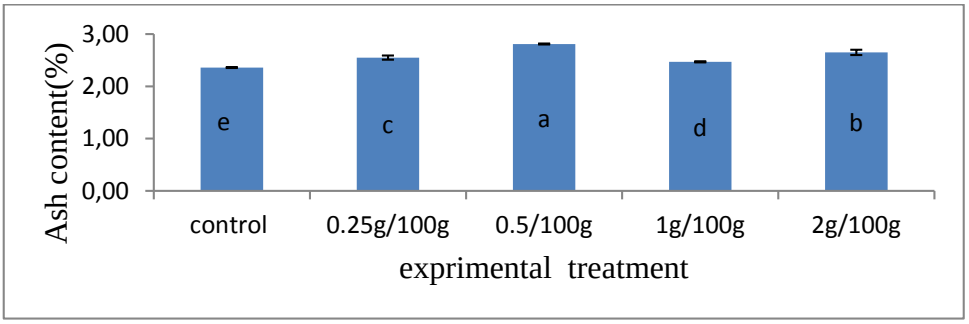

Figure 8: Ash content in common carp body composition

In the same manner results of the tests illustrated used the Zingiber officinale powder in common carp commercial diet cause to improve their body composition, increasing the protein and decreased the lipid consumption for their filet consumers.

Discussion

Limited scientific research has been carried out to evaluate the effects of medicinal plant powder on carcass quality in aquatics. Chemicals properties of fresh water fishes investigation is very important, because useful information for experts related to food resources having low fat, high protein and being easily accessible. Comparative Bahrami babaheydari et al, (2014) survey by used different levels of Wood Betony (WB), Stachys lavandulifolia extract, as complement in common carp commercial diet indicate that the levels of moisture contents were approximately similar (77.58±1.45, 77.77±1.25, 77.61±1.61 and 77.47±0.90) Crude protein levels (16.61±0.62, 16.64 ±1.47, 16.91±0.87 and 17.12±0.41). Total lipid content was lowered in fish fed with a high dose of wood betony (2.04%) as compared with other groups (2.44, 2.53 and 2.44%) fed with 0, 2, and 4% of S. lavandulifolia levels respectively but in ours moisture content were approximately (75.33 ±0.03, 75.16±0.01, 75.21±0.01, 75.24±0.04, 75.13±0.03), crude protein content in whole fish body (18.21±0.01, 18.75±0.02, 18.36±0.05, 18.67±0.03, 18.92±0.02). total lipid content was lowered in fish fed with a high dose of ginger powder (2.33±0.03) as compared by other groups (2.49, 2.67, 2.51 and 2.41) fed with 0,0.25, 0.5,1 gram ginger powder in per 100 gram commercial diet were significant difference and ours were upper and effectively than them ($p<0.05$). compared this one by Pakravan et al, (2011) by used dietary willow herb, Epilobium hirsutum extract on common carp body composition (78.91 ± 0.19, 78.66 ± 0.43, 78.5 ± 0.19, 78.36 ± 0.18 ,78.95 ± 0.2) moisture, (16.9 ± 0.44, 17.15 ± 0.09, 17.47 ± 0.27, 17.34 ± 0.48, 17.41 ± 0.36) crude protein levels as% (2.46 ± 0.46, 2.06 ± 0.25, 2.22 ± 0.12, 2.48 ± 0.09 ,1.99 ± 0.09) lipid content and 0.07 ash in 0,0.5,1 and 3 +2% multivitamin, 0.06 ash in 3% willow herb extract like Bahrami babaheydari et al, (2014) research illustrated significant difference too ($p<0.05$). Fallahpour et al, (2014) showed slight changes in body composition in fish(cyprinus carpio) fed a diet supplemented with marshmallow (Althaea officinalis L.) extract (0.25%, 0.50 and 1%, and with normal diet as controls) compared with controls like our survey and have significant($p<0.05$) Similar results were observed in fish fed with alfalfa (15 and 20%), soybean meal (30 and 60%) and cottonseed meal (30 and 60%), (Ali et al., 2003; Toko et al., 2008). In addition, composition of Cyprinus carpio compared the present study with Hosseini et al. (2013) showed high difference in amount of protein (15.69±1.54) fat (14.45%), Ash (1.2±1.3%) and (66.57 ±12.2%) moisture because of our survey approached to upper levels of moisture, ash, protein than their study but in lipid content in ours were lower that ($p \leq 0.05$). in the other hand the chemical content of this fish were (15.99±0.29%) CP,(2.71±2.01%) lipid, (0.93±0%) ash and (79.53±0.71%) moisture (Ojagh et al., 2009) comparison between two study showed the upper levels of moisture and lower levels of ash were in their survey, had significant difference but there was no significant difference in amount of lipid ($p>0.05$). Body composition in common carp fed by pellet diet had (74.01%) moisture, (15.7%) crude protein, (2.04%) lipid and (5.2%) as compared by present study demonstrated lower amount of moisture ,lipid and protein content and high amount of ash, had significant difference ($p<0.05$). Generally these differences refer to distinction environmental factors such as temperature (Cordier et al 2002; Tocher et al 2004), pH and salinity are known to influence the composition of lipids in fish (De Torrengo & Brenner 1976). Also Different climate, age, weight of samples, time and place of examined.

Glencross et al. (2004) found an increase in crude protein levels in rainbow trout fed with 12.5% yellow lupine meal. Increased body composition of tilapia was observed after feeding them diets enriched with 5 and 10% alfalfa meal (Ali et al., 2003).These differ originated to difference between complement addition, common carp initial weight in tests and difference between environmental conditions.

On the other hand, proximate body composition including the levels of moisture, crude protein, crude lipid and ash as % of wet weight were not affected by inclusion of the plant extract in the diets of Nile tilapia, Oreochromis niloticus (Abdel et al., 2009), red sea bream (Ji et al., 2007a) in disagreement with our results. Several such factors as species specific characteristics, medicinal plant composition as well as the duration of the experiments can affect the response (Citarasu, 2010).

As compared Hosseini et al., 2013 research by the new one showed (0.4%) fiber, (1.91±1.02%) carbohydrate, (1.5±0.94%) amount of NFE and 2239.8 kcal energy. Hence to in ours amount of fiber (control=0.11, T1=0.48,T2=0.51,T3=0.31 and T4= 0.38) except T1 and T2 examine group were lower, in amount Nitrogen free Extraction except control group, for amount of Carbohydrate (control= 1.61, T1=0.87,T2=1.1,T3=1.21 and T4= 0.97) and amount of energy our results were lower in all treatment, had significant difference ($p<0.05$) (Table1).

Collected common carp in two sites of the Indus River at Shehbaz khel (SK = upstream) and Chashma (CH = downstream) showed (CH= 78.30 M%,10.08 fat,45.53 CP%, 7.14% ash, 37.25 total carbohydrate,421.84 kcal energy and CK=79.08 moisture content, 13.99 Fat,53.59 CP,7.91 ash, 24.51 total carbohydrate and 438.3 kcal energy value by Jabeen and Chahudry(2011) as comparison by recent study brightly seen significant difference in all part of carcass analysis utility of Zingiber officinale powder in carp commercial diet and control(carbohydrate content= 1.61,0.87,1.1,1.21,0.97, kcal energy= 1030.3, 1057.1,1035.2,1052.4, 1064.2) had best results than them($p<0.05$). these differ raised in geographical variation ,study season, fish age, type of their diet and method of sampling probably.

Attention to importance of fish body composition values cause to negligence of carbohydrate in fish muscle and lack of study in amount of other body content except(Cp, CL, Ash ,moisture %) speech about themes were a little and need to more research four this topic.

Conclusion

Various studies of dietary herbal supplements in different fish species have demonstrated hematological, serum biochemical or immunological enhancements but there is lack data about their body composition. In the present study, results showed that the choice of herbs, their dose and time of application is very important for obtaining higher efficiency. Different levels of Zingiber officinale powder in diets of common carp may have positive efficiency. Hence, it is suggested to use 2gr dietary ginger powder in juvenile common carp diet. The present study is the first attempt to examine the effects of dietary ginger powder on carcass status of common carp.Further studies are needed to determine the optimal application frequency for favorable Zingiber officinale performance and to assess its impacts on filet essential fatty acid , essential Amino acids and their profiles , effects of them in carp IA and IT indexes , taste , commercial diet to improved the survival rates and growth performance .

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