E-ISSN: 2347-5129
P-ISSN: 2394-0506
(ICV-Poland) Impact Value: 76.37
(GIF) Impact Factor: 0.549
IJFAS 2025; 13(5): 24-29

www.fisheriesjournal.com
Received: 06-07-2025
Accepted: 08-08-2025

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Effect of monoculture and polyculture systems stocking density on chemical compositions and metabolizable energy of Nile tilapia *Oreochromis niloticus* and African catfish *Clarias gariepinus* fingerlings reared in concreted ponds

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DOI: https://www.doi.org/10.22271/fish.2025.v13.i5a.3142

Abstract
The proximate physio-chemical analysis of Nile tilapia *Oreochromis niloticus* and African catfish *Clarias gariepinus* fingerlings were carried out to elucidate the effect of mono and polyculture systems of different stocking density on chemical compositions quality and metabolizable energy. Fresh samples; (*O. niloticus* and *C. gariepinus*) were analysed, the results of the proximate body fish showed insignificance in protein (22.70 and 21.05%) and in lipid 1.16 and 2.63% respectively; among *O. niloticus* and *C. gariepinus* and; the dried samples analysis of (tilapia *O. niloticus* and catfish *C. gariepinus)*; of each treatments (1 Tilapa *O. niloticus*: 0 Catfish *C. gariepinus*, 0 Tilapa *O. niloticus*: 1Catfish *C. gariepinus*, 1 Tilapa: 1 Catfish, 2 Tilapia: 1 Catfish, 3 Tilapia: 1 Catfish, 1 Tilapa: 2 Catfish and 1 Tilapa: 3 Catfish) at different stocking density 12, 24, 36 and 48 SDfish/m-3 were carried; To detect its effect on (moisture content, crude protein (CP) content, Crude Fat (CF) Analysis, ash content, crude fibre (CF) content, Nitrogen free extracts (NFE) and metabolizable energy (ME). Data analysis using SPSS, One way ANOVA for the results of the proximate analysis of the body fish of monoculture and polyculture; showed that the *O. niloticus* had the highest level of crude protein (57.75%) in 2T:1C and least (51.46) in 1T:3C compared with; *C. gariepinus* having the least (50.22) in 1T:1C and highest (54.71%)in 0T:1C. also the results showed the highest crude fat content for *C. gariepinus* (16.65%) in 2T:1C whilst *O. niloticus* had the least (9.06%) in 3T:1C. In terms of moisture content (as-dried meat) also, *O. niloticus* has the highest (8.85%) while *C. gariepinus* had the least (7.08%). While *C. gariepinus* had the highest level of metabolizable energy (3001.55 k/Jg-1) and *O. niloticus* having the least (2743.38 k/Jg-1). In addition, the results showed higher significant different (p<0.01) in crude fibre and; (p<0.05) in crude protein, Nitrogen free extracts, Ash, protein protective value and metabolizable energy of mono and polyculture systems. Results showed that the fish species in monoculture and polyculture systems with different stocking density have an impact on the proximate analysis and quality of fish meat.

Keywords: *O. niloticus*, *C. gariepinus*, culture systems, stocking density and proximate analysis

1. Introduction

Due to the increase in the human population and the decline of wild fisheries, aquaculture becomes one of the fastest-growing food-producing sectors in the aquatic field. It plays a crucial role in meeting the rising demand for seafood products [1]. Recently, aquaculture represents 47% of the total global fish production, contributing to the most massive fish supply for human consumption [2]. The increase of fish production from aquaculture led to a rise in per capita consumption of fish to 20.3 kg in 2016 compared to 9 kg in 1961 [2]. Fish is one of the most perishable food items and several preservation methods are implemented worldwide for preserving fish [3-5]. Fish and fishery products have been recognized as very important sources for human nutrition. Fishes are characterized by their HIG contents of high quality, easily digestible protein and essential amino acids.

Moreover, they are low in the saturated fatty acids and contain considerable amounts of the unsaturated fatty acids, especially omega-3 fatty acids, which are regarded as oxidation preventive compounds. The oil-soluble vitamins are known to be rich in fish. In addition, they are good source of several minerals particularly fluorine and iodine, which are needed for the development of strong teeth and the prevention of goitre in man [6, 7]. Chemical composition and quality criteria of raw fish are among the major factors that affect the overall acceptability of processed fish products. Several factors included; species, age, physical state, fed type and time of catching and region of catch have been reported to affect chemical composition of fish [8]. Fish and fishery products have long been recognized as healthy foods with excellent nutritional value, providing high-quality protein, minerals, vitamins, essential fatty acids and trace elements. Fish is widely consumed in many parts of the world by humans due to its high content of good protein that characterizes by an excellent amino acid composition and easily digestibility [9]. The African catfish (*Clarias gariepinus*) is one of the major fish species cultured in Africa. It has also been introduced into aquaculture in different parts of the world, including the Netherlands, Hungary, much of South-East Asia, and East Asia [10]. The species is also one of the most important individual commercial freshwater fish in many parts of Africa [11, 12]. This species can be cultivated in areas with a tropical climate, areas with access to geothermal waters, or with the use of heated recirculating water systems. It is considered a very hardy fish in aquaculture terms and can be densely stocked in low-oxygen waters, making it ideal for culture in areas with a limited water supply.

Since dietary composition is a major determinant of the nutritional quality of fish flesh [13, 14], numerous reports are available on Nile tilapia and African catfish slaughter traits and fillet quality [15, 16]. However, there are limited reports related to the effect of Polycultures system on the quality of fish flesh. This study aimed to evaluate the effect of mono and Polycultures at different stocking density on the meat quality of Nile tilapia *Oreochromis niloticus* and African catfish *Clarias gariepinus* fingerlings cultured in concreted ponds.

2. Materials and Methods

2.1 Study Area

The experimental work was conducted in College of Animal Production Science and Technology (CAPST), and Hatchery of Freshwater Aquaculture Research Centre (FARC), Kuku Camp.

2.2 Samples preparation and preservation

In the first day of the start of the experiment was randomly taken 200 g samples to the proximate analysis (*O. niloticus* 100g, and *C. gariepinus* 100 g). The samples were stored in ice containers and preserved immediately in minced ice layers (first minced ice layer then samples layer and ice layer), and transferred to the Nutritional Laboratory (NL) of Industrial Consultation Centre (ICC), for the chemical composition proximate analysis of fingerlings.

At the end of the experiment also a 2200 g samples were randomly taken (1100 g tilapia O. *niloticus* and 1100g catfish C. gariepinus) of 365 g from each treatments (1Tilapa *O. niloticus*: 0 Catfish *C. gariepinus*, 0 Tilapa *O. niloticus*: 1Catfish *C. gariepinus*, 1 Tilapa: 1 Catfish, 2 Tilapia: 1 Catfish, 3 Tilapia: 1 Catfish, 1 Tilapa: 2 Catfish and 1 Tilapa: 3 Catfish) respectively. Each one from the collected samples was gutted and washed with clean and dried at room temperature. Then 100 grams were taken from this derides of each treatment and putted into sterilized container (200 ml size). Then all samples put in container (2000 ml size) and transferred to the Advanced Animal Nutritional Laboratory of Faculty of Agriculture, Alexandria University, Egypt, for the chemical composition proximate analysis.

2.3 Samples Analysis

Whole body proximate composition was determined for the initial *C. gariepinus* and *O. niloticus* fingerlings prior to stocking. At the end of the experiment also, fish harvested from treatments (T_1 to T_7) a body chemical composition analysis of (Nile tilapia *O. niloticus* and African catfish *C. gariepinus*) such as moisture content, crude protein (CP) content, crude tat (CF).

Analysis, ash content, crude fibre (CF) content, Nitrogen free extracts (NFE), to be evaluated using the following methods of proximate analysis: Samples were thawed and dried in a forced-air oven at 70 °C for 48 h and ground to pass a 1-mm screen. The [17], analytical procedures were used on dry matter, which was obtained by oven drying at 105 °C for 24 h; OM was obtained as the difference between dry matter and ash obtained after ashing at 550 °C for 4 hours. Crude protein (CP as 6.25×N) by Kjeldahl technique and ether extract by using the extraction system, Nitrogen free extracts NFE was computed using the formula [100-(% moisture +% ash +% crude protein +% crude fat +% crude fibre)] [18].

2.4 Statistical analysis

Data were analysed using SPSS (version 26) and Microsoft Excel (2013). Results were compared with Analysis of variance and considered significant at $p<0.05$. LSD test was used to identify statistically significant differences among treatment means.

3. Results

The proximate composition (% as meat) of fish species (Nile tilapia *O. niloticus* and African catfish *C. gariepinus*) cultured in concrete ponds are presented in Table 1. The results showed a significance difference ($p<0.05$) in crude protein, crude fat, Fat: Protein, dry matter, moisture content and metabolizable energy. While the result showed no differences in crude fibre (0.46% and 0.46%), Ash (19.39% and 19.64%) and Nitrogen free Extract's (4.82 and 5.67) of O. *niloticus* and *C. gariepinus* respectively ($p>0.05$).

The proximate analysis (%) and the metabolizable energy (kJg^{-1}) of fish meat (*O. niloticus*) fingerlings cultured at different stocking density in concrete ponds are shown in Table 2 there was significance differences ($p<0.05$) in crude protein, crude fibre and Nitrogen free Extract's. The proximate analysis (%) and the metabolizable energy (kJg^{-1}) of fish meat (*C. gariepinus*) fingerlings cultured at different stocking density in concrete ponds are shown in Table 3.2; there was significance differences ($p<0.05$) in crude protein, crude fibre, ash and Nitrogen free Extract's. The proximate analysis (%) and the metabolizable energy (kJg^{-1}) of fish meat (*O. niloticus*) fingerlings polyculture system in concrete ponds are shown in Table 3 there was significance differences ($p<0.05$) in crude protein, crude fibre, Nitrogen free Extract's and protein value.

Crude protein values ranged from 51.46 to 57.75% and 2, Tilapia *O. niloticus*: 1, Catfish *C. gariepinus* had the highest crude protein protective content (57.75%) whilst the least was in 1, Tilapia *O. niloticus*: 3 Catfish *C. gariepinus* (51.46%). The proximate analysis (%) and the metabolizable energy (kJg^{-1}) of fish meat (*C. gariepinus*) fingerlings polyculture in concrete ponds are shown in Table 3.4; there was significance differences ($p<0.05$) in crude protein, crude fibre, Ash, Nitrogen free Extract's, fat: protein, protein protective value, and metabolizable energy.

Table 1: Comparative of proximate analysis of fish species (Nile tilapia O. *niloticus* and African catfish *C. gariepinus*) cultured in concrete ponds (means ± SD)

Parameters	*O. niloticus*	*C. gariepinus*	Sg.
CP%	55.29±3.1^{a}	52.18±1.1^{b}	*
CF%	0.46±0.3^{a}	0.45±0.2^{a}	NS
EE%	11.11±1.8^{b}	14.98±2.1^{a}	*
Moisture%	8.85±1.0^{a}	7.08±0.8^{b}	*
DM%	91.16±0.0^{b}	92.86±1.2^{a}	*
Ash%	19.39±1.6^{a}	19.64±2.1^{a}	NS
NFE	4.82±2.5^{a}	5.67±0.9^{a}	NS
F:P	0.20±0.0^{b}	0.29±0.0^{a}	*
Metabolizable energy (k/Jg-1)	2774.83±89.6^{b}	2987.79±159.3^{a}	*

DM, Dry Matter., CP, Crude Protein., CF, crude fibre., EE, Ether Extract., NFE, Nitrogen free Extract's., F: P, Fat: Protein. Means with similar superscripts in same row are statistically insignificantly different ($p>0.05$). NS, No significant ($p>0.05$). *, Significant different at ($p<0.05$). **, Significant different at ($p<0.01$).

Table 2: Effect of stocking density (SD) on proximate analysis of Nile tilapia O. *niloticus* reared in concrete ponds (means ± SD)

Parameters	12	24	36	48	Sg.
CP%	57.47±1.7^{a}	56.95±2.9^{a}	54.96±3.6^{a}	53.70±2.8^{b}	*
CF%	0.18±0.0^{d}	0.14±0.0^{d}	0.48±0.1c	0.74±0.1^{a}	*
EE%	11.03±2.0^{a}	11.69±2.8^{a}	11.02±2.0^{a}	11.04±1.4^{a}	NS
Moisture%	8.84±0.1^{b}	8.35±0.9^{b}	8.77±1.0^{b}	9.18±1.4^{b}	NS
DM%	91.19±1.0^{a}	91.65±1.0^{a}	91.23±1.1^{a}	90.82±0.7^{a}	NS
Ash%	20.29±2.8^{a}	19.18±1.6^{a}	19.76±1.3^{a}	18.68±1.4^{a}	NS
NFE	2.07±0.1^{b}	3.37±0.7^{ab}	5.01±2.9^{a}	6.73±1.6^{a}	*
F:P	0.19±0.0^{a}	0.21±0.1^{a}	0.20±0.0^{a}	0.21±0.0^{a}	NS
Metabolizable energy (k/Jg-1)	2750.02±93.5^{a}	2825.01±186.6^{a}	2764.10±109.3^{a}	2772.87±82.4^{a}	NS
Effect of stocking density (SD) on proximate analysis of African catfish *C. gariepinus;* reared in concrete ponds (means ± SD)					
CP	54.71±3.2^{a}	50.22±0.2^{b}	52.11±1.3^{b}	51.95±0.9^{b}	**
CF	0.31±0.0^{b}	0.49±0.0^{b}	0.60±0.2^{a}	0.36±0.1^{b}	*
EE	15.44±1.0^{a}	15.93±2.1^{a}	14.17±3.0^{a}	15.10±1.7^{a}	NS
Moisture	6.74±0.1^{a}	7.69±1.0^{a}	6.89±0.6^{a}	7.15±1.0^{a}	NS
DM	93.26±2.1^{a}	92.34±0.9^{a}	92.95±1.2^{a}	92.83±0.9^{a}	NS
Ash	16.83±0.9^{b}	20.75±2.2^{a}	19.94±2.0^{a}	20.20±1.4^{a}	*
NFE	5.99±0.8^{ab}	4.99±0.1^{b}	6.30±1.1^{a}	5.23±0.6^{b}	*
F:P	0.28±0.0^{a}	0.32±0.0^{a}	0.27±0.1^{a}	0.29±0.0^{a}	NS
Metabolizable energy (k/Jg-1)	3001.55±154.0^{a}	2971.23±156.7^{a}	2945.62±206.3^{a}	2974.36±110.3^{a}	

DM, Dry Matter., CP, Crude Protein., EE, Ether Extract., NFE, nitrogen free Extract's., F: P, Fat: Protein. Means with similar superscripts in same row are statistically insignificantly different ($p>0.05$). NS, No significant ($p>0.05$). *, Significant different at ($p<0.05$). **, Significant different at ($p<0.01$).

Table 3: Effect of polyculture system on proximate analysis of Nile tilapia *O. niloticus;* reared in concrete ponds (means ± SD)

Parameters Treatments	CP%	CF%	EE%	Moisture%	DM%	Ash%	NFE	F:P	PPV%	Metabolizable energy (k/Jg-1)
1T:0C	57.47±1.7^{a}	0.18±0.0^{e}	11.03±2.0^{a}	8.84±0.1^{b}	91.19±1.0^{a}	20.29±2.8^{a}	2.07±0.1^{c}	0.19±0.1^{a}	0.35±0.0^{a}	2750.02±93.5^{a}
1T:1C	56.95±3.0^{a}	0.14±0.0^{e}	11.69±2.8^{a}	8.35±0.9^{b}	91.65±0.9^{a}	19.18±1.6^{a}	3.37±0.7^{c}	0.21±0.1^{a}	0.36±0.0^{a}	2825.01±186.6^{a}
2T:1C	57.75±0.9^{a}	0.43±0.1^{d}	11.95±1.9^{a}	8.32±1.1^{b}	91.68±1.2^{a}	19.16±0.1^{a}	2.41±0.0^{c}	0.21±0.1^{a}	0.37±0.0^{a}	2838.91±113.8^{a}
3T:1C	55.93±2.1^{a}	0.77±0.1^{a}	9.06±1.1^{a}	9.97±1.0^{b}	91.03±1.0^{a}	18.66±0.4^{a}	5.58±0.9^{b}	0.18±0.0^{a}	0.34±0.0^{a}	2743.38±22.1^{a}
1T:2C	52.17±2.9^{b}	0.53±0.1^{c}	10.09±2.0^{a}	9.21±0.9^{b}	90.78±1.0^{a}	20.36±1.8^{a}	7.62±1.2^{a}	0.19±0.1^{a}	0.31±0.0^{d}	2689.28±11.6^{a}
1T:3C	51.46±0.1^{b}	0.71±0.0^{a}	11.82±1.2^{a}	9.39±1.9^{b}	90.61±0.1^{a}	18.71±2.2^{a}	7.88±1.1^{a}	0.23±0.0^{a}	0.33±0.1^{c}	2802.36±117.8^{a}
Before Exp.	22.70±0.8^{c}	0.59±0.1^{b}	1.16±0.1^{b}	73.47±0.9^{a}	26.53±0.9^{b}	2.32±0.0^{b}	0.75±0.3^{d}	0.11±0.1^{a}	0.00±0.0^{e}	2743.38±22.1^{a}
Sg.	**	**	**	**	**	**	*	*	**	NS

DM, Dry Matter., CP, Crude Protein., CF, crude fibre EE, Ether Extract., NFE, Nitrogen free Extract's., F: P, Fat: Protein and PPV, protein protective value. Means with similar superscripts in same Colum are statistically insignificantly different ($p>0.05$). NS, No significant ($p>0.05$). *, Significant different at ($p<0.05$). **, Significant different at ($p<0.01$). 1Tilapa *O. niloticus*: 0 Catfish *C. gariepinus*, 1 Tilapia: 1 Catfish, 2 Tilapia: 1 Catfish, 3 Tilapia: 1 Catfish, 1 Tilapa: 2 Catfish and 1 Tilapia: 3 Catfish.

Table 4: Effect of polyculture system on proximate analysis of African Catfish *C. gariepinus* reared in concrete ponds (means ± SD)

Parameters Treatments	CP%	CF%	EE%	Moisture%	DM%	Ash%	NFE	F:P	PPV%	metabolizable energy
0T:1C	54.71±3.2^{a}	0.31±0.3^{bc}	15.44±1.0^{a}	6.74±0.1^{a}	93.26±2.1^{a}	16.83±0.9^{d}	5.99±0.8^{ab}	0.28±0.0^{a}	0.26±0.0^{b}	2999.55±154.0^{a}
1T:1C	50.22±0.2^{b}	0.49±0.0^{a}	15.93±2.1^{a}	7.69±1.0^{a}	92.34±0.9^{a}	20.75±2.2^{ab}	4.99±0.1^{b}	0.32±0.1^{a}	0.23±0.0^{c}	2971.23±156.7^{ab}
2T:1C	51.93±0.9^{b}	0.80±0.0^{a}	16.65±0.1^{a}	6.82±0.1^{a}	93.18±1.0^{a}	18.25±0.9^{d}	5.56±0.6^{b}	0.32±0.0^{a}	0.24±0.0^{c}	2999.49±59.5^{a}
3T:1C	51.89±0.9^{b}	0.30±0.3^{c}	15.97±1.0^{a}	7.47±1.0^{a}	92.53±1.1^{a}	19.21±1.1^{bc}	5.17±1.0^{b}	0.31±0.0^{a}	0.25±0.0^{c}	2994.90±74.1^{a}
1T:2C	52.29±1.8^{ab}	0.39±0.4^{b}	11.68±2.1^{b}	6.95±1.0^{a}	92.72±1.6^{a}	21.63±0.9^{a}	7.04±1.0^{a}	0.22±0.0^{b}	0.24±0.0^{c}	2991.76±178.3^{b}
1T:3C	52.01±1.0^{ab}	0.41±0.4^{b}	14.23±2.0^{a}	6.83±1.2^{a}	93.13±0.9^{a}	21.19±0.9^{a}	5.29±0.2^{b}	0.27±0.1^{a}	0.33±0.0^{a}	2973.81±118.0^{b}
Before Exp.	21.05±0.6^{c}	0.40±0.4^{ab}	2.63±0.1^{c}	72.97±0.6^{b}	27.03±0.6^{b}	2.57±0.1^{e}	0.37±0.1^{c}	0.12±0.0^{c}	0.00±0.0^{d}	2815.55±154.0^{a}
Sg.	**	**	**	**	**	**	**	*	**	*

DM, Dry Matter., CP, Crude Protein., EE, Ether Extract., NFE, Nitrogen free Extract's., F: P, Fat: Protein and protein protective value. Means with similar superscripts in same Colum are statistically insignificantly different (p>0.05). NS, No significant (p>0.05) *, Significant different at (p<0.05) **, Significant different at (p<0.01. 0Tilapa *O. niloticus*: 1Catfish *C. gariepinus*, 1 Tilapia: 1 Catfish, 2 Tilapia: 1 Catfish, 3 Tilapia: 1 Catfish, 1 Tilapia: 2 Catfish and 1 Tilapia: 3 Catfish.

4. Discussion

Results of the proximate analysis for monoculture and polyculture at different stocking density treatments in tables (1, 2, 3 and 4) revealed that table 1 (with same stocking ratios) gave a significant difference, whereas table 2, 3 and 4 (polyculture at different stocking ratios) also gave Significant different (p<0.05) among fish species and treatments in parameters studied.

The protein results of present study of fresh fish (catfish and tilapia) ranged from 21.05±0.6 to 22.70±0.8; this result agrees with that of [19], who also reported Tilapia is higher in protein than catfish. Per 100 g serving, tilapia provides 26.2g of protein, while catfish contains 18.4g, also Tilapia contains more essential amino acids, such as lysine, histidine, and phenylalanine. The present results of protein content% of wet whole fish optioned by monoculture and polyculture at different stocking density of *O. niloticus* and *Clarias gariepinus* (22.70±0.8 and 21.05±0.6) respectively. Gave insignificant different (p>0.05) among fish species and treatments this current results agree with [20,21,22]; they reported that the protein contents of most raw fin fish flesh are in the range of 17-22%, with an average of 19/100 g,

Fresh water fish have generally slightly higher moisture and lower protein contents than marine fish. In addition, the present results of protein content ranged from 50.22 to 57.75% (% dried fish) of this study within ambit of [23]. Who found that protein content ranged from 54.19-65.41% of red tilapia and striped mullet body composition in monoculture and polyculture system condition. The results of lipid content ranged from 9.06 to 16.65% of treatment at different stocking density this results within of the scope observations made by [9]. The amount of lipids in fish may vary widely from 0.2 to 24%, depending upon anatomical position, sex, and location in body, age, season, and diet. In many pelagic fish, lipid contents ranging from 12 to 20% are found during winter as compared with 3-5% levels during summer.

The present obtained results; that the different stocking density has effect on protein content while insignificantly affected lipid content with agreement with [24]. Who found that the different stocking density markedly affected the chemical composition of *Mugil cephalus L.* Lipid content was higher in the highest density, while protein content was lowest. In the same respect, [25] showed no significant effect of stocking density on the carcass composition.

However, [26] found that moisture content in body fish was significantly affected by protein level in dietary only, without stocking density effect, but the other components (crude protein, total lipid and ash) were significantly affected by stocking density. The higher body protein contents at the 2T:1C density group might be associated with the highest growth rate due to increased protein synthesis in this treatment, these results agree with that of [27], who reported that stocking density significantly influenced body composition of *A. marmorata*, with higher body moisture and protein levels and lower lipid and ash contents at high density. The fat content in fish meat is an important economic characteristic. The fat content% as dried meat of Nile tilapia *O. niloticus* and African catfish *C. gariepinus* there was significance differences among fish species.

The results showed that catfish have the highest fat content (16.65%) with compared by *O. niloticus* (9.06%). The fish are commonly categorized as fatty (having fat more than 10% weight), medium-fat fish (fat 5-10%) or lower-fat fish 2% [28, 29]. Therefore, tilapia is a lower-fat fish and catfish is fatty fish based on these criteria (among freshwater fishes). The significant variation in total fat contents of fish muscles among species is due to the importance of fish muscle as a storage site and its ability to deposit fat, but also to the feed of these species in their natural environment, season, age, or even the maturity of species [30, 31]. In addition, the currant results of lipid of Nile tilapia *O. niloticus* (9.06%) and African catfish *C. gariepinus* (16.65%) of this study does not agree with [23]. Who found that lipid content ranged from 24.77-34.05% of red tilapia and striped mullet body composition monoculture and polyculture system condition.

Based on the body fishes results, there was a general trend towards increasing the percentage of moisture in tilapia as compared to catfish *C. gariepinus*, i.e. moisture content (73.47±0.9%) in tilapia *O. niloticus* were higher compared with catfish *C. gariepinus* (72.97±0.6%). The current findings are consistent with the ranges reported by other researchers [32, 33]. Generally, the results of the proximate analysis of the body fish in monoculture and polyculture; showed that the *O. niloticus* had the highest level of crude protein (57.75%) in 2 *O. niloticus*: 1 *C. gariepinus* and least (51.46) in 1 *O. niloticus*: 3 *C. gariepinus* compared with; *C. gariepinus* having the least (50.22) in 1 *O. niloticus*:1 *C. gariepinus* and highest (54.71%) in 0 *O. niloticus*: 1 *C. gariepinus*. also the results show the highest crude fat content had *C. gariepinus* (16.65%) in 2 *O. niloticus*:1 *O. niloticus* whilst *O. niloticus* had the least (9.06%) in 3 *O. niloticus*: 1 *C. gariepinus*. In terms of moisture content (as-dried meat) also, *O. niloticus* has the highest (8.85%) while *C. gariepinus* had the least (7.08%). *C. gariepinus* had the highest level of metabolizable energy (2987.79 k/Jg-1) with *O. niloticus* having the least (2774.83 k/Jg-1). On the other hand results of parameters (Ash content, Nitrogen free Extract's, Fat: Protein and protein protective value) shows significantly affected by polyculture system and stocking density. This result is consistent with [30, 31].

5. Conclusion

The study concluded that: the monoculture and polyculture systems with higher stocking density have an impact on the chemical components of fishes, the higher the stocking density the lower quality of the fish chemical components (content slightly decreased with increasing stocking density) therefore, results of current study shows the treatment (1T:3C at 48 SD) with having 1 tilapia *O. niloticus*: 3 catfish *C. gariepinus* polyculture least crude protein content.

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