Nutrient utilization, growth responses of *Oreochromis niloticus* juveniles fed varying dietary levels of water melon rind waste

ABSTRACT

This study was carried out to evaluate the nutrient utilization and growth response of *O. niloticus* juveniles fed a diet containing watermelon peel (WMP). Four iso-nitrogenous diets containing 0%, 25%, 50% and 75% were formulated. A total of 120 juveniles were fed at 5% body weight per day for 84 days. At the end of the experiment, WMP was most suitable as an energy supplement when it was incorporated at 50% replacement. The carcass analysis of the fish after the experiment revealed that the FCR values ranged between Treatment 1 (5.93 ± 0.73) and Treatment 3 (4.61 ± 0.17). The specific growth rate (SGR) ranged between 0.76 ± 0.04 in Treatment 3 and 0.059 ± 0.06 in Treatment 1. The highest survival value was recorded in Treatment 2 (70 ± 0.00), and the lowest survival value was recorded in Treatment 4 (53.33 ±16.67). The highest value was recorded in Treatment 3 (47.69± 0.97), and the lowest was recorded in Treatment 1 (44.07 ±0.94) for feed intake, while the protein efficiency ratio was the highest in Treatment 1 (0.22 ± 0.03). The highest mean weight gain was recorded in Treatment 3 (10.39 ± 0.54), and the lowest was recorded in Treatment 1 (7.67 ± 0.96).

Keywords: Water melon, rind waste, growth response, nutrient utilization, *Oreochromis niloticus*

INTRODUCTION

An increase in the global population over time has led to a constant need for continuous research on ways to increase food availability for the human race. (Govindan, 2018). The most important feature of this approach is the quality of the protein supply, for which fish protein has proven to be the safest and least expensive animal protein available (Ezike et al., 2013). in relation to low cholesterol and availability of essential amino acids and omega 3 acids. (Sampels, 2014). The rapid growth of the Nigerian population has led to an insufficient supply of animal protein sources. (Tunde, Kuton, Oladipo & Olasunkanmi, 2015). Consequently, this has also led to tremendous effort, resulting in increased animal production. According to Omojowo, et al. (2012), fish are a major source of animal protein and an essential food item in the diet of many people in Nigeria. Balami, Sharma & Karn (2019) stated that fish are also good sources of thiamine, riboflavin, vitamins A and D, phosphorous, calcium and iron. It is also very high in polyunsaturated fatty-acids, which are important for lowering blood cholesterol levels (Ait-Yahia, Madani, Savelli, Prost, Bouchenak, & Belleville, 2003). Therefore, it is suitable for complementing high-carbohydrate diets typical of the low-income group in Nigeria. In addition to being food, fish are also an important source of income for many people in developing countries, including Nigeria (FAO, 2008). The high cost and shortage of commercial feeds for agricultural ventures in Nigeria place great constraints on the successful operation of intensive aquaculture businesses (Akegbejo-Samsons & Ojinni, 2004). The utilization of compounded commercial feeds is an acceptable practice, but there is a need for feed formulation strategies aimed at using more available feed. Watermelon serves as a highly concentrated reservoir of the carotenoid lycopene, a fact highlighted by Quek et al. (2007). Lycopene, widely recognized for its abundance in tomatoes and enhanced absorption when accompanied by a small amount of fat, as found in olive oil, is also present in substantial quantities in watermelon and mangoes, as noted by Perkins-Veazie (2007). The present study focuses on assessing the nutrient utilization and growth response of O. niloticus juveniles when provided with different dietary levels of watermelon (WM) rind waste (peel).

METHODOLOGY

The study was carried out at the Indoor Hatchery of the Department of Aquaculture and Fisheries Management, Federal University of Agriculture, Abeokuta, Ogun State, Nigeria. A total of 120 *O. niloticus* juveniles were selected and acclimated to 10 experimental plastic bowls (44 litres in capacity) at 10 fish per tank for 7 days. The bowls were filled to $^{2}/_{3}$ of their volume with water supplied from a borehole at the experimental site. At the start of the feeding trial, the acclimated fishes were deprived of food for 24 hours and then were sorted, and 12 groups were randomly sorted into 12 experimental plastic tanks. Four (4) isonitrogenous diets (35% crude protein) were formulated to contain watermelon peel (WMP) at 0% (WMP_1) as a control and 25% (WMP_2), 50% (WMP_3), and 75% (WMP_4) as replacements for the maize fraction in the diet of the experimental fish.

The watermelon peel was collected from the market, sun-dried for 12 days and ground into fine particles to aid incorporation of the remaining ingredient. The watermelon peel was directly mixed with other finely ground feedstuffs, palletized, sundried and packed into bags and subsequently stored in a cool and dry place. The nutrient utilization and growth response were evaluated using AOAC (1990) methods. All growth data (feed conversion, feed intake, survival) were analysed using the Statistical Package for Social Sciences (SPSS 17 for Windows). The analysis was performed at a probability level of 5%, and the data were subjected to one-way analysis of variance (ANOVA). When the differences were significant, they were determined by the Duncan multiple range test. The specific growth rate (SGR) was also analysed using the formula described by de *Silva et al.* (1989).

RESULTS AND DISCUSSION

Table 1 shows the percentage composition of the experimental diet. The formulation of the feed was based on the proximate composition of the feed ingredient derived using the Pearson Square Method.

Table 1: Percentage composition of the experimental feed

Ingredient	0%	25%	50%	75%
Fish meal	23.06	22.80	22.54	22.26
Soya bean meal	11.53	11.40	11.27	11.13

Groundnut cake	23.06	22.80	22.54	22.26
Maize	34.10	26.06	17.70	9.02
Water melon	0.00	8.85	17.70	27.07
Vit premix	1.0	1.0	1.0	1.0
Salt	0.25	0.25	0.25	0.25
Vegetable	5.0	5.0	5.0	5.0
Lysinc	0.5	0.5	0.5	0.5
Methionine	0.5	0.5	0.5	0.5
D.C.P	0.5	0.5	0.5	0.5
Total	100	100	100	100

The feed utilization of Tilapia (*O. niloticus*) juveniles fed the experimental diets in terms of weight gain (MWG), feed conversion ratio (FCR) and feed intake (FI) are presented in Table 2. The average final weight ranged between 19.51±1.15 and 22.03 ± 0.37 g, with the highest weight obtained from TD3. The average size of the fish stocked was 12.10 ± 0.017 g. The mean weight gain was significantly greater in the TD_3 treatment (10.39 ± 0.54 g), and the lowest weight gain was recorded in the TD_1 treatment (7.67± 0.96 g). The FCR was greatest in TD3 (4.61±0.17 g).

Table 2: Feed utilization of Tilapia fed the different diets

Parameters	**T1**	**T2**	**T3**	**T4**
Initial weight (g)	11.83±0.20	12.10±0.17	11.63±0.22	11.60±0.25
Final weight (g)	19.51±1.15	20.80±1.31	22.03±0.37	20.54±1.01
MWG (g)	7.67±0.96	8.70±1.26	10.39±0.54	8.94±0.78
SGR (%/day)	0.59±0.06	0.64±0.07	0.76±0.04	0.68±0.03
F I (g/day)	44.07±0.94	45.30±1.38	47.69±0.97	47.22±3.38
FCR	5.93±0.73	5.37±0.57	4.61±0.17	5.30±0.19
PER	0.22±0.03	0.25±0.04	0.30±0.01	0.26±0.02
Survival (%)	60.00±10.00	70.00±0.00	56.67±6.67	53.33±16.67

Means with different superscripts along the row are significantly different (P<0.05).

The gain, specific growth rate (SGR), feed conversion ratio (FCR), and protein efficiency ratio (PER) did not significantly differ among O. niloticus fed the experimental diet ($p > 0.05$) for any of the initial weights of the *O. niloticus* juveniles. The initial weight of the fish was 11.83 ± 0.20 kg/m2, and the final weight of the fish did not significantly differ ($p > 0.05$) among the fish fed the various diets. The final body weight ranged between 22.03 ± 0.37 in TD_3 and 19.51 ± 1.15 in TD_1. The FCR decreased and increased with increasing treatment. The FCR ranged between 5.93 and 0.73 in TD_1 and 4.61 and 0.17 in TD_3.

The PER, was not significantly different ($p > 0.05$). The PER ranged between 0.30 and 0.01 in TD_3 and 0.22 and 0.03 in TD_1. The SGR ranged between 0.76 and 0.04 in TD_3 and 0.59 and 0.06 in TD_1.

FI did not significantly differ ($p > 0.051$) for any of the parameters measured for the growth feed intake of *O. niloticus* juveniles fed watermelon peel at different levels. Research has shown that 50% watermelon peel can be used as an energy source for tilapia (*O. niloticus).* Analysis of variance ($p > 0.05$) revealed that there was no significant difference in the peel length of the watermelon plants fed watermelon peel. These findings support the work of Tiamiyu *et al.* (2007)

in replacing maize with cassava flour in the diet of *C. gariepinus* 50 and above as an inclusion level of cassava flour in the diet.

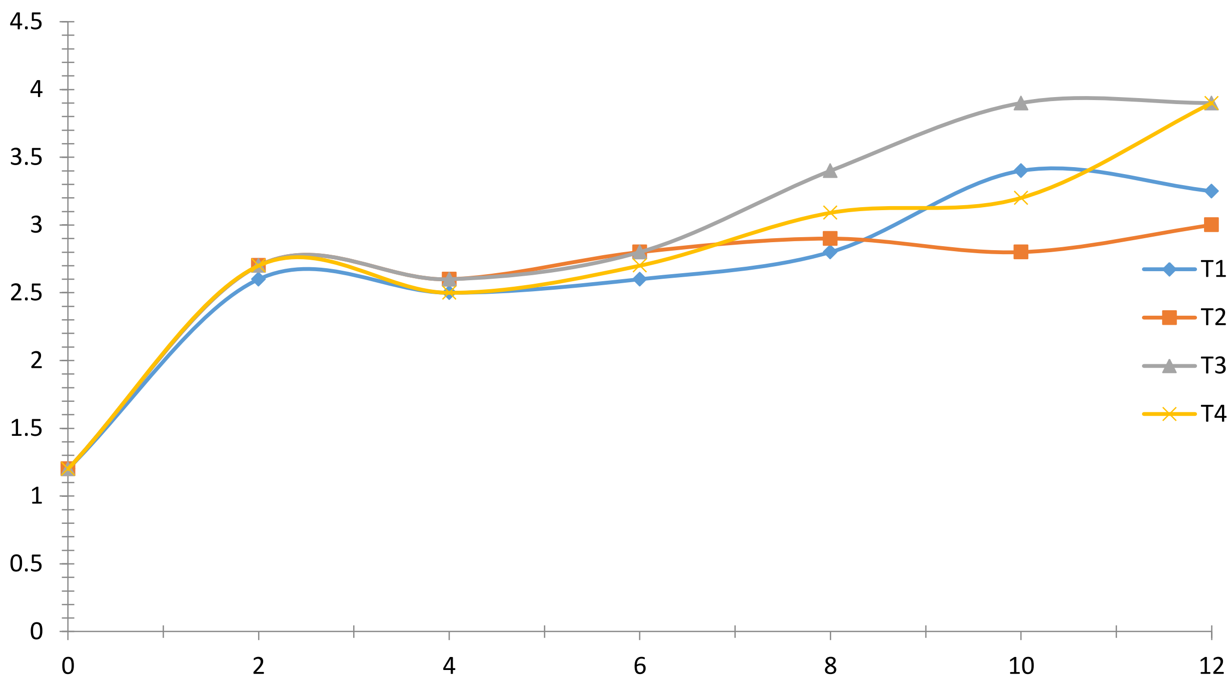

Figure 1: Growth response of *O. niloticus* juveniles fed watermelon peel at different concentrations for 12 weeks.

The initial weight of the fish (11.83 ± 0.20) and the final weight of the fish were not significantly different ($p > 0.05$) between the fish fed the various diets. The final body weight ranged between 22.03 ± 0.37 in TD_3 and 19.51± 1.15 in TD_1. The FCR decreased or increased with different treatment levels. The FCR ranged between 5.93 and 0.73 in TD_1 and 4.61 and 0.17 in TD_3. PER, but not significantly different ($p > 0.05$). The PER ranged between 0.30 and 0.01 in TD_3 and 0.22 and 0.03 in $TD_{1.}$ The SGR ranged between 0.76 and 0.04 in TD_3 and 0.59 and 0.06 in TD_1. No significant differences in FI ($p > 0.051$) were detected for any of the parameters measured for growth or feed intake of *O. niloticus* juveniles fed watermelon peels at different levels.
The proximate compositions of the carcasses of the experimental fish before and after the study are presented in Table 3. The final moisture contents were greater for all the fish fed the tested diets than the initial value. The fish had lower fibre contents for all the diets compared to the initial fibre content. The protein concentrations in the final fish samples were greater than the initial values.

Table 3: Proximate Composition of Tilapia Carcass

Parameters	Initial	T1	T2	T3	T4
Moisture	75.83±0.01	77.13±0.16^{c}	76.28±0.25^{c}	79.04±0.30^{b}	82.47±0.32^{a}
DM	24.36±0.15	22.87±0.38^{a}	23.72±0.31^{a}	20.96±0.41^{b}	17.53±0.25^{c}
Fat	2.87±0.03^{a}	2.47±0.33^{b}	3.65±0.27^{a}	1.98±0.39^{b}	0.86±0.21^{c}
Ash	5.21±0.00^{a}	6.55±0.29	6.35±0.29	6.13±0.21	6.69±0.43
Fibre	3.65±0.01^{a}	2.86±0.39^{a}	2.51±0.23^{ab}	2.22±0.18^{ab}	1.77±0.31^{b}
Protein	36.74±0.01^{b}	39.79±0.31^{bc}	39.04±0.32^{c}	42.51±0.29^{a}	40.79±0.38^{b}
NFE	1.65±0.01^{a}	1.89±0.39	1.95±0.31	1.72±0.18	1.06±0.10

Means with different superscripts along the row are significantly different (P<0.05).

The water quality parameters were tropical and did not negatively affect the growth or well-being of the experimental fish. Table 4 shows the data for the water parameters.

Table 4: Water parameters

Weeks	pH	DO	Temp
0	7.24±0.08	7.20±0.06	29.10±0.58
2	7.20±0.12	7.50±0.29	28.50±0.29
4	7.19±0.12	7.00±0.06	28.91±0.63
6	7.23±0.58	7.40±0.17	29.00±0.58
8	7.18±0.10	7.20±0.46	28.70±0.23
10	7.21±0.13	6.80±0.12	28.30±0.40
12	7.20±0.12	6.70±0.17	28.60±0.23

Conclusion

The results showed that the watermelon peel base diet for *O. niloticus* is a good substitute or replacement for the energy source for maize in compounded feed for tilapia. The results showed no negative effects on the growth or feed utilization of *O. niloticus*; moreover, the feed intake, protein efficiency ratio and survival rate were high. For suitable aquaculture fish production. majorly in developing countries where maize competes with livestock, watermelon peel can be used as a substitute for *O. niloticus* feed. Therefore, a 50% inclusion level can be recommended for aquaculture practices.

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