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Effect of Feeding Red Sea Fish Waste Meal on Performance, Carcass Characteristics, Internal Organs Weight and Gut Microflora of Broiler Chicks

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Abstract

The study was conducted at Animal Research Centre Poultry Farm to evaluate the effects of red sea fish waste meal (RSFWM) in the diet of broilers on the performance, carcass characteristics, internal organs weight, and gut microflora. Ninety six unsexed (Hubbard classic) broiler chickens at seven days of age were randomly distributed into four treatments (24 birds per each treatment).Four experimental diets were formulated, T1 (conventional ration with no RSFWM), T2 2.5% RSFWM, T3 5% RSFWM and T4 7.5% RSFWM. The treatments were randomly assigned with three replications (8 birds each) for each of four experimental rations. The experiment was extended for six weeks. The chemical analysis showed that RSFWM contained 32.9% crude protein (CP) and 2827 kcal/kg (ME) on dry basis .DM 96.1%, Fat 5.72%, Ash 23.8%, Ca 5.3% and P 1.9%. Average body weight (BW), for T1 (2133g), T2 (2329g), T3 (2286g) and T4 (2378g) respectively) was significantly higher in T4 as compared to other treatments. Feed intake g/bird (3957.3g,4387g,4255.7g and 4394.8g) for T1, T2, T3 and T4, respectively that were significantly higher in diets fed with rations containing 2.5 and 7.5% RSFWM as compared to the control group and those fed 5% RSFWM. Body weight gain was significantly higher in birds fed 7.5% RSFWM (2215.7g) followed by those fed 2.5% (2119.8g), 5% (2162.5g) RSFWM and finally the control group (1966.1g). No significant differences were observed in feed conversion ratio among treatments. The results obtained from carcass characteristics analysis indicated that inclusion of RSFWM had no significant effects on dressing percent and wing weight of broilers. On the other hand, RSFWM inclusion improved carcass, back, breast, drum stick and thigh weight as compared to those consuming the control diet. Feeding RSFWM had no significant effect on spleen, liver, heart and gizzard weight. However, when considering body weight, body weight gain feed efficiency ratio, inclusion of RSFWM in broiler diets at up to 7.5% is recommended.

Keyword: Broiler, fish waste, performance, carcass, microflora

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Introduction

Naturally animals have a capacity to convert feeds into high quality human foods that are rich in protein. But, the production of animal products is not matched by the raised demand by human consumption as a result of the rapid growth of human population which is the major problem in the world in general, and in the developing countries in particular (Rameshwar and Kerthikeyan, 2005). Among the animal production segments, poultry farming may be considered one of the most developed activities in recent times, as a result of

advances in genetics, nutrition, sanitation and management. One of the main goals of poultry production is to efficiently and economically convert the relatively disposable, non-palatable and unattractive raw materials into nutritious foods. In ordering to meet the demand of animal protein in developing countries, improving the performance of chickens is mandatory. The total cost of feed in poultry production accounted for about 60-65% of the total cost of poultry production (Hassan, *et al.*, 2003). The bulk of the feed cost arises from protein concentrates such as groundnut cake, fish meal and soybean meal. Thus, there is the need to look for locally available and cheap sources of feed ingredients particularly those that do not attract competition between human and livestock. One positive cheap source of protein is the fish waste. The availability of major nutrients and unidentified growth factors, well balanced amino acid profile and the presence of omega3 fatty acids in FWM increases its importance in the feeding of simple stomached animals (Karimi, 2006; HLPE report 2014). Almost 40 to 50% of fish catch is thrown away as waste. This waste is highly perishable because its high moisture and protein content render it as an ideal medium for growth of microorganisms. If this waste is left unattended, it produces off odor and cause pollution problems. However, such waste could be utilized as source of protein ingredients in animal, poultry and fish feeds (Nithin *et al.* 2013).The average fish waste in Port Sudan fish market is about 634kg per day (16.15%) of the daily landing. On the other hand the daily loss due to spoilage was estimated as 50kg this was equivalent to 1.25% of the average daily landing(Hamza, *et al.*, 2017). Therefore, these massive amount of fish waste was not utilized for animal feeding, but simply released into the environment resulting in pollution not only causing problem related to odour of disposing fish waste. Efforts have not been made yet in Sudan in general and in Port Sudan in particular to utilize this waste product as alternative feed ingredient in broiler rations to minimize the disposal problems. Therefore, this study was conducted to evaluate the performance, carcass characteristics, gut micro flora and internal organs weight of broiler chickens fed diets containing graded levels of red sea fish waste meal.

Materials and Methods

Experimental birds and management:

Ninety six (96) seven day old unsexed broiler chicks of (Hubbard classic) were used. The experiment was conducted in a semi close poultry house. The house was thoroughly cleaned and disinfected prior to the arrival of the birds. The house was partitioned into 12 units measuring 1 x 1 m each. The concrete floor of all the units was covered with wood shavings up to a thickness of about 5 cm. The birds were weighed and randomly assigned to four treatment groups, with a total of 24 birds per treatment. The birds were further divided into 3 replicates of 8 birds each. The birds were subjected to standard broiler chick management procedures, which included routine vaccination against Newcastle disease and Infectious Bursal Disease (Gumboro), which were administered to all the birds within the first three weeks. Feed and water were provided for adlibitum consumption, daily light of 24 hours was maintained.

Red sea fish waste collection and processing:

Red sea fish waste (RSFWM) (head ,fins, viscera, ovaries and gills) were collected from the local market in SIGALA area Port Sudan, then boiled and oven dried at 80 ^{0}C for 24 hours to obtain a well dried RSFWM which was packaged for onward milling using Apex® Hammer Mill. The dried

product was subjected to microbiological examination to determined the presence of Salmonella and E.coli according to the methods reported by Mc Capes, *et al* (1989).The RSFWM was later subjected to proximate analysis according to the methods outlined by AOAC (1990) (Table 1).

Table 1: Proximate chemical analysis of red sea fish waste meal (RSFWM)

Nutrient	%
Moisture	3.9
Dry matter	96.1
Crude Protein	32.9
Fat	5.72
Ash	23.8
Calcium	5.3
Phosphorus	1.9
ME(Kcal/Kg)*	2827

*ME: value was calculated according to the equation of Lodhi et al.(1976)

Experimental Diets:

Four iso caloric iso nitrogenous experimental diets were formulated to meet the nutrient requirements for broiler chicks as outlined by NRC (1998). Diet 1 without RSFWM serve as control diet. The other three diets D2, D3 and D4 contained graded levels (2.5, 5.0 and 7.5 %) of RSFWM respectively. Composition and calculated analysis of the experimental are presented in Table (2)

Table 2: Composition and calculated analysis of the experimental diets

Ingredients	Red sea fish waste (RSFW) inclusion rate (%)			
	0.0	2.5	5	7.5
Sorghum	66	65.1	64.2	62.95
GNC	26	24.4	22.8	21.25
Concentrate*	5	5	5	5
DCP	1.5	1.5	1.5	1.5
Lime stone	0.5	0.5	0.5	0.5
Lysine	0.1	0.1	0.1	0.1
Methionine	0.1	0.1	0.1	0.1
Nacl	0.3	0.3	0.3	0.3
Oil	0.3	0.3	0.3	0.6
Antitoxin	0.2	0.2	0.2	0.2
Calculated analysis				
ME/Kcal/kg	3158	3151	3154	3152
C P %	22.0	22.03	22.01	22.01
C F %	4.9	4.7	4.5	4.3
Ca %	1.12	1.10	1.10	1.09
Av.p %	0.59	0.57	0.56	0.54
Methionine %	0.48	0.50	0.54	0.57
Lysine %	1.07	1.14	1.22	1.29

*concentrate (NUTRISTAR) contained:CP38 % ,CF4 %, Ca 10%,Av.P 6.5%, lysine 12%, Methionine4%,ME2090kcal/Kg ,Sodium 2.45%, Nacl 7.40%

Data collection:

The data collected were feed intake (g/bird), body weight (g/bird), body weight gain (g/bird) and feed conversion ratio (g feed/g gain) were recorded and mortality % was also recorded when occur .At the end of the sixth week two birds per replicate (one male and one female) were randomly selected and slaughtered after they were starved for eight hours. Hot carcass weight was calculated, dressing out percentage was also recorded. Eviscerated carcass was cut into prime cuts (thigh, drumsticks, wings, breast and back) and weighed. Weight of the internal organs (liver, spleen, heart and gizzard) were also recorded.

Statistical analysis:

Data generated were subjected to analysis of variance (ANOVA) using SPSS statistical package (SPSS2001). The design employed was a completely randomized and significant among treatment means were determined using least significant difference (LSD) test of the same software.

Results and Discussion

The proximate chemical composition of the RSFWM (Table 1) showed that RSFWM contained, DM 96.1%, CP 32.9%, Fat 5.72%, Ash 23.8%, Ca 5.3%, P 1.9% and 2827 Kcal/kg calculated metabolizable energy. The CP content of cooked and sun dried FWM has been reported to be 44.7 % (Asrat, *et al.*, 2008). Biazen (2010) and Hamza et al (2017) also reported values of 62,4% and 48.75 % for fish byproducts , and both are higher than the present value. A values of 41.2 % and 40.48% CP was also reported for locally processed FWM (Ojewola, *et al.*, 2005; Alemayehu, *et al.*, 2015) which is slightly higher than the present value. Windsor (2001) noted that fish meal made mainly from filleting waste and offal usually has slightly lower protein content and higher mineral content, which is the case in RSFWM used in the present experiment, reasons for the observed differences could be due to processing, type of fresh fish, duration of heating, type of dryer used, temperatures and storage period which vary in their crude protein value. Moghaddam, *et al.* (2007) recorded higher EE (22.9%) for the Kalka fish meal from which fat was not removed. Asrat et al. (2008) and Biazen (2010) reported values of 21.6% and 21.37% for locally produced FWM, respectively which are by far higher than recorded in the present study this could be explained by the method of processing used to turn the fish waste to a meal as each method leaves different quantity of residual oil in the meal. Alemayehu, et al. (2015) and Asrat et al. (2008) reported 2982.04 and 3160 Kcal/kg ME for locally produced FWM, which was slightly higher than the present findings. Similarly, Biazen (2010) reported 3987.3 Kcal/kg for locally produced fish byproduct meal, which was very much higher than the present findings. Ponce and Gernat (2002) have reported a value of 2600 Kcal/kg of feed for tilapia by product meal samples which was considerably lower than the present results these contradicted results may be due to residual oil in the meal. Biazen (2010) and Asrat et al. (2008) reported a value of 27.32% and 24.76% total ash, respectively for FWM obtained from local processors at rift valley lakes. Dale et al (2004) reported a value of 25.5% for eight tilapia byproduct meal samples. The ash content of RSFWM obtained in the present experiment was slightly lower than the values reported by these previous authors. This may be because the composition of fish waste meal can vary depending upon species of the fish and the method used to prepare the meal. The performance characteristics of broiler chickens fed red sea fish waste meal are presented in Table (3) . Results showed that the initial weight of broiler chickens were statistically similar at the commencement of the experiment. The final live weight, feed intake and total weight gain were affected by the different levels of RSFWM ($P < 0.05$).Birds fed 7.5% RSFWM have significantly ($P<0.005$) higher final live weight (2378g) and final weight gain (2215g) this result might be due to the unidentified growth factors in RSFWM. Oliveira (2003) also obtained similar result. Feed intake was affected by the levels of RSFWM ($P< 0.05$), diet contained 7.5% RSFWM had the highest value (4394.8g). In this regard RSFWM is a high value supplement and provides most of the essential amino acids required by monogastric animals, there by stimulating appetite and feed intake (Jassim, 2010).

Santana *et al*. (2008) and Jose' *et al.* (2016) reported that the inclusion of dried fish waste meal silages did not affect feed intake. However, other related studies observed higher feed intake in broilers when fish waste was added in the diets (Ochetim, 1992 and Mbamba, 2000). The contrasting results might be associated with various factors that modulate feed intake in birds such as genetic variation between strain, environmental temperature, energetic content of the diet, texture and palatability of the feed (Abdullah *et al*., 2010 and Siegel, 2014). Final body weight gain followed the same trend being relatively higher for birds fed 7.5% RSFWM which is an indication of better and optimum feed intake. Feed conversion ratio values were statistically similar with all diets; this may be due to the similarity in quality and suitability of the diets .

Table 3: Effect of feeding red sea fish waste on overall performance of 6 weeks old broiler chicks (mean)

Parameters	Red Sea Fish Waste Inclusion (%)				Sig. Level
	0.0	2.5	5	7.5	
Initial body wt(g/bird)	165.6±2.72	166.9±3.24	166.5±1.57	165.8±2.95	NS
Body weight (g/bird)	2133^{d}±126.18	2329^{b}±19.79	2286^{c}±41.88	2378^{a}±28.82	*
Feed intake (g/bird)	3957.3^{d}± 144.9	4387^{b}± 198.1	4255.7^{c}± 152.4	4394.8^{a}± 92.7	*
Weight gain (g/bird)	1966.1^{d}± 133.2	2162.5^{b}± 17.2	2119.8^{c}± 43.0	2215.7^{a}± 25.3	*
FCR (g/ feed /g/gain)	2.01 ± 0.06	2.03± 0.08	2.0± 0.09	1.98± 0.05	NS

^{a,b,c,d}Means in the same row with different subscript letter are significantly different.
*Significant (P< 0.05)
NS: Not significant

Carcass characteristics of broiler fed graded levels of red sea fish waste meal are presented in Table (4). The dressing percentage obtained in the present study (68.31% to 72.07%) was within the range that was reported by (Ochetim, 1992) but was different from the higher dressing percentage and carcass weight results reported by (Mbamba, 2000) in birds fed diets containing fish wastes. The contrasting results between the two studies might be associated with type of fish waste used and length of experimental period.The breast muscles and drumsticks are the most economically important portion of the carcass and also provide the greatest portions of edible meat in broilers (Smith and Teeter, 1987). The relative weights of these two cuts were significantly different which is in contracts with the findings of (Rosenfeld *et al.*, 1997). The sizes of the liver and gizzard, heart and spleen did not differ significantly between treatments similar results were reported by (Fanimo, *et al.*, 1996; Mohammed, *et al.*, 2009; Al-Marzooqi, et al., 2010). The results of the previous study carried out by Ologhobo *et al.* (2012) on carcass characteristics of broiler finishers fed poultry offal and cray fish waste meal as replacement for fishmeal revealed that the chickens fed cray fish waste meal had the best eviscerated weight. The result of microbial analysis for *Salmonella* and *E.coli* for samples was negative, which mean that all the treatments fed the red sea fish waste were free of salmonella and *E.coli*, this result was similar with the findings of Ghanim (2009) who reported that roasting of the locally disposed fish meal can suppressed the activity of its' fatal microorganisms.

Table 4: Effect of feeding red sea fish waste on carcass weight, dressing percent and carcass cuts weight (gm)

Parameters	Red Sea Fish Waste Inclusion (%)				Sig. Level
	0.0	2.5	5	7.5	
Carcass Weight (gm)	1563^{c}±27.42	1808^{a}±108.81	1681^{b}±31.65	1702^{b}±181.89	*
Dressing (%)	71.11±2.42	72.07±2.12	69.79±3.21	68.31±1.79	NS
Wing (gm)	91.67±7.64	102±2.5	97.50±5.00	98.33±7.64	NS
Back (gm)	340.0^{c}±29.47	409.2^{a}±41.26	402.5^{a}±33.82	378.3^{b}±31.26	*
Breast (gm)	499.2^{c}±22.68	584.2^{a}±63.70	559.2^{b}±21.26	566.7^{b}±70.06	*
Drum stick (gm)	124.2^{c}±11.81	146.7^{a}±11.55	133.3^{b}±8.4	133.3^{b}±10.10	*
Thigh (gm)	140.0^{c}±9.01	165.0^{a}±6.1	152.5^{b}±6.61	158.3^{b}±24.28	*

^{a,b,c,d} Means in the same row with different subscript letter are significantly different.
*Significant (P< 0.05)
NS:Not significant

Table 5: Effect of feeding red sea fish waste on internal organs weight (gm)

Parameters	Red Sea Fish Waste Inclusion (%)				Sig. level
	0.0	2.5	5	7.5	
Spleen	8.0.±0.0	9.0±0.0	7.0±.0.01	7.0±0.01	NS
Liver	30.5±0.015	27.9±0.162	30.5±0.015	28.7±0.112	NS
Heart	7.9±0.053	7.0±0.034	7.8±0.042	8.1±0.052	NS
Gizzard	20.7±0.084	19.4±0.061	21.7±0.10	20.5±0.112	NS

NS: Not significant

Conclusion

Considering the results of this study red sea fish waste meal can be incorporated in broiler diets up to 7.5% level for reasonable performance and carcass characteristics.

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أثر التغذية علي مخلفات أسماك البحر الاحمر علي الاداء الانتاجي ، خائص الذبيحة، وزن الاعضاء الداخلية و جراثيم الامعاء لكتاكيت اللاحم

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2. كلية الانتاج الحيواني – جامعة السودان للعلوم والتكنولوجيا

المستخلص

اجريت الدراسة بمزرعة دواجن مركز بحوث الانتاج الحيواني- كوكو لدراسة أثر التغذية علي مسحوق مخلفات اسماك البحر الاحمر علي الاداء الانتاجي ، خصائص الذبيحة، وزن الاعضاء الداخلية وبكتيريا الامعاء لكتاكيت اللاحم . تم توزيع ستة وتسعون كتكوت لاحم (Hubbard classic) عمر سبعة ايام عشوائياً الي اربعة مجموعات (24طائر لكل معاملة) والتي تم تقسيمها لاحقاً الي ثلاث تكررات لكل مجموعة ويحتوي التكرار علي ثمانية كتاكيت. تم تكوين اربعة علائق للتجربة، العليقة الاولي عليقة التحكم والتي لا تحتوي علي مسحوق مخلفات اسماك البحر الاحمرومن ثم تم اضافة مسحوق مخلفات اسماك البحر الاحمر للعلائق الثلاثة الاخري بنسب متدرجة 2.5% ، 5% ، 7.5% علي التوالي. تم توزيع المعأملات عشوائيا باستخدام التصتيم العشوائي الكامل . امتدت التجربة لفترة ستة اسابيع .أوضح التحليل الكيميائي لمسحوق مخلفات أسماك البحر الأحمر إنها تحتوي علي مادة جافة 96.1%، بروتين 32.9% ، دهون 5.72% ، رماد 23.8% ، كالسيوم ,5.3%، الفسفور ,1.9% و2827 كيلوكلوري/كيلوجرام طاقة ممثلة. متوسط .أظهرت النتائج وجود إختلاف معنوي في متوسط وزن الجسم بين المعاملات حيث كان اعلي وزن (2378g) عند التغذية علي 7.5% ، (2329g) عند 2.5% ثم (2286g) عند 5% واقل وزن (2133g) عند التغذية علي العليقة الضابطة. .تلاحظ وجود فروق معنوية (P>0.05) بين المعاملات الاربع في العلف المستهلك حيث كان استهلاك العلف(,4387g, 4255.7g و 4394.8 g) للمعاملات التي تحتوي علي 2.5% ، 5% و7.5% من مسحوق مخلفات اسماك البحر الاحمر أعلي بالمقارنة مع المجموعة الضابطة (3957.3g) .كان الوزن المكتسب أعلي بشكل ملحوظ في الطيور التي تمت تغذيتها علي (7.5%)(2215.7g) وتليها 2.5% (2162.5g) ثم 5% (2119.8g) واخيرا المجموعة الضابطة . لم تلاحظ اي فروق ذات دلالة احصائية في نسبة تحويل الأعلاف بين جميع المعاملات . تشير النتائج التي تم الحصول عليها من تحليل خصائص الذبيحة الي ان التغذية علي مسحوق مخلفات اسماك البحر الاحمر لم يكن له تأثيرات معنوية علي نسبة التصافي ووزن الجناح ومن ناحية اخري فإن التغذية علي مسحوق مخلفات اسماك البحر الاحمر ادي الي تحسين وزن الظهر ،الصدر وعص الطبل ووزن الفخذ مقارنة مع تلك التي تمت تغذتها علي العليقة الضابطة .لم يكن للتغذية علي مسحوق مخلفات اسماك البحر الاحمر اي تاثير معنوي علي وزن الطحال ،الكبد ، القلب والقانصة .التحليل الميكروبي لمحتويات الامعاء اظهر عدم وجود بكتريا السالمونيلا والكولاي. بإعتبار وزن الجسم والزيادة في وزن الجسم يحبذ إضافة مسحوق مخلفات اسماك البحر الاحمر في علائق فراخ اللاحم حتي 7.5%.