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Effect of processed castor oil bean (*Ricinus communis* L.) meal and DL-methionine on carcass and organ characteristics of broiler finisher

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Abstract

The effects of graded levels of processed castor oil bean (*Ricinus communis* L) meal (CBM) and DL-methionine on carcass and organ weights of broiler finishers were investigated for 4 weeks. One hundred and eighty six week old boiler birds (Anak strain) were randomly divided into 12 groups of 15 birds each and assigned to 12 isocaloric (2.90 Mcal/kg ME) and isonitrogenous (21.00% CP) diets in a 4 x 3 factorial arrangement involving four CBM levels (0, 10, 15 and 20%) and three DL-methionine levels (0, 0.25 and 0.5%). Each treatment was replicated 3 times with 5 birds per replicate. At the 10th week of the experiment, 3 birds per treatment (one per replicate) were randomly selected, weighed and slaughtered for carcass and organ evaluation. Results showed that body weight, carcass yield, organ and relative organ weights reduced significantly ($P<0.05$) as the level of CBM in the diets increased beyond 15%. However, the inclusion of DL- methionine in the CBM-containing diets reversed the adverse effects observed at the 15 and 20% CBM inclusion levels. It was concluded that 15% processed CBM supplemented with DL-methionine can be included in broiler finisher diet without adverse effects on carcass and organ weights.

Keywords: Castor bean meal; DL-methionine; broiler finishers; carcass weight; organ weights

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Introduction

The castor oil plant (*Ricinus communis* L.) is an angiosperm that belongs to the Spurge family of plants, the Euphorbiaceae (Phillips and Martyn, 1999; Weiss, 2000). Castor oil, the primary product of the castor oil plant, makes up about 50% of the weight of the seeds. The oil is mostly constituted of ricinoleic acid, with small amounts of dihydroxystearic, linoleic, oleic, and stearic acids. The main uses of castor oil include the industrial production of coatings based on dehydrated alkyd resins, but it is also used in the manufacture of pharmaceuticals, cosmetics and laxative (CIREP, 2007). The hydrogenated oil serves as a lubricant in jet fuels and aircraft hydraulics. The food grade oil is a standard lubricant in food processing plants and is also used in the textile and leather industries, and for manufacturing plastics, fibres, soaps, printing inks, wetting agent (Weiss, 2000). Most of the global oil extraction occurs in the countries in which castor oil bean is produced and many new products that contain castor oil or its derivatives have been developed. Among such products are nylon, weather resistant paints and cosmetics (Anonymous, 2006). Cultivation of castor oil plant in Nigeria is prevalent in the southern states where seeds are processed and used as condiment locally referred to as "ogiri" in Igbo. The seeds with the hulls removed contain 35 to 55% oil and 35.22 to 40% crude protein (Ani and Okorie, 2006; Ani, 2012). Castor oil bean meal (CBM) is a by-product obtained from the castor oil bean (*Ricinus communis*) oil extraction industry. Castor oil bean meal has been used in the feeding of poultry, rabbits, pigs, sheep and cattle (Ani and Okorie, 2004; Adedeji et al., 2006; Aslani, 2007; Ani and Okorie, 2009a; Oso et al., 2011). According to Ani and Okorie (2004), Ani and Okorie (2005) and Ani (2012) 10 to 15% of the meal could be satisfactorily used in poultry rations if properly detoxified. Detoxification becomes very necessary because of the presence of some toxic substances (ricin

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and ricinine) and castor allergens in the raw bean (Darby et al., 2001; Olsnes, 2004; Ani and Okorie, 2006). The large-scale utilization of castor oil bean meal in livestock feeds has therefore been limited substances and by its high level of abrasive fibre. Many physical and chemical methods for detoxifying castor seed meal have been investigated. Physical treatments included soaking (3, 6 and 12 hours), steaming (30 and 60 min), boiling (30 and 60 min), autoclaving (15psi, 30 min; 15psi, 60 min) and heating (100°C 30 min; 120°C 25min), while the chemical methods consisted of treatment with ammonia (Anandan et al., 2004; Benge, 2006; Martinez-Herrera et al., 2006; Nsa and Ukachukwu, 2007; Ani, 2012). However, dry heat treatment could lead to the destruction of some amino acids, particularly lysine, threonine, tyrosine, cystine and methionine and the consequent reduction in the protein quality of the castor oil bean meal tend to limit the suitability of the method. Against this back drop and recognizing that castor oil bean meal can serve as an alternative source of vegetable protein in animal feed, the present study was therefore, conducted to determine the effects of graded levels of dehulled and cooked CBM and DL-methionine on carcass and organ characteristics of broiler finisher.

Materials and Methods

The study was conducted at the Poultry Unit of the Department of Animal Science Research and Teaching Farm, University of Nigeria, Nsukka.

Processing of Castor Oil Bean Seeds

Castor bean seeds used in this feeding trial were the large mottled variety that was purchased from Orba market near Nsukka in Enugu State. The seeds were dehulled manually by carefully cracking them between two stones. Decorticated seeds were obtained by separating the hulls from the cotyledons. The dehulled seeds were cooked in two stages at 100^0C for 50 min as described by Ani and Okorie (2006) and Ani (2012). The seeds were cooked in two stages to ensure proper detoxification. The cooked samples were dried overnight in the oven at 100^0C, ground in a hammer mill and defatted using a mechanical oil press. The processed castor oil bean meal was used to formulate the broiler finisher diets. The percentage composition of the diets is presented in Table 1 while Table 2 shows the proximate composition of the experimental diets.

Animals and Management

One hundred and eighty six-week old boiler birds (Anak strain) were randomly divided into 12 groups of 15 birds each and assigned to 12 isocaloric [2.90 Mcal /kg metabolizable energy (ME)] and isonitrogenous [(21.00% crude protein (CP)] diets in a 4 x 3 factorial arrangement involving four levels (0, 10, 15 and 20%) of processed castor oil bean meal and three DL-methionine levels (0, 0.25 and 0.5%). Each treatment was replicated 3 times with 5 birds per replicate. Feed and water were supplied *ad libitum* from 42 to 70d of age. The experiment lasted for four weeks during which feed and water were provided *ad libitum*. The birds were subjected to routine broiler management procedure.

Carcass and Organ Evaluation

At the 10^{th} week of the experiment, 3 birds per treatment (one per replicate) were randomly selected and weighed for carcass and organ evaluation. The birds were starved overnight and slaughtered by severing the jugular veins, scalded in warm water for about a minute, and the feathers were plucked manually. The birds were eviscerated and weighed to obtain their dressed carcass weights. The kidney, liver, gizzard, heart, spleen and abdominal fat were removed and weighed using a sensitive electronic scale. The Dressed carcass weight and the organ weights were expressed as percentages of the live weight.

Proximate Analysis of Feed Samples

Diets were analyzed for proximate composition using the methods of AOAC (2006). Gross energy of diets was determined in a Parr oxygen adiabatic bomb calorimeter.

Statistical Analysis

Data collected were subjected to analysis of variance (ANOVA) for completely randomized design (CRD) as described by Akindele (2004) using a Stat Graphic Computer Package (SPSS, 2007) Model. Significantly different means were separated using Duncan's New Multiple Range Test as outlined by Obi (2002). Simple regression and correlation analyses were also done to quantify the relationships between dietary castor oil bean meal (CBM) level and the response parameters.

Results and Discussion

Table 3 shows the effects of graded levels of CBM and supplementary DL-methionine on body weight at 10weeks, carcass yield, organ weight and relative organ weight of broiler finishers. There significant differences ($P<0.05$) among treatments in body weight, dressed carcass weight, carcass dressing percentage, liver weight, relative liver weight, kidney weight, relative kidney weight, spleen weight, heart weight, empty gizzard weight and relative empty gizzard weight. Birds on treatments 1-6 and 9 (0, 10 and 15% CBM with 0-0.5% methionine) had similar and significantly ($P<0.05$) heavier body weights and dressed carcass weights than birds on other treatments. Birds on

Table 1: Percentage composition of broiler finisher diets containing cooked castor oil bean meal supplemented with DL-methionine.

Castor oil bean meal levels (%)		0			10			15			20	
DL-methionine levels (%)	0	0.25	0.5	0	0.25	0.5	0	0.25	0.5	0	0.25	0.5
Ingredients (%) Treatment	1	2	3	4	5	6	7	8	9	10	11	12
Maize	58.42	58.51	58.56	54.22	55.43	54.41	52.33	52.32	52.31	50.21	50.21	50.21
Wheat offal	7.25	7.25	7.25	7.25	7.25	7.25	7.25	7.25	7.25	7.25	7.25	7.25
Soya bean meal	23.08	22.74	22.44	17.28	16.82	16.59	14.17	13.93	13.69	11.29	11.04	10.79
Castor oil bean meal	0.00	0.00	0.00	10.00	10.00	10.00	15.00	15.00	15.00	20.00	20.00	20.00
Fish waste (33.5% CP)	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50
DL-methionine	0.00	0.25	0.50	0.00	0.25	0.50	0.00	0.25	0.50	0.00	0.25	0.50
Bone meal	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Iodized salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Vit./Min. Premix *	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.00	100.0	100.00	100.00
Calculated Analysis:												
Crude protein (%)	21.03	21.03	21.04	21.06	21.01	21.05	21.00	21.03	21.07	21.02	21.05	21.08
Energy (Mcal/kg ME)	2.93	2.93	2.92	2.95	2.95	2.94	2.97	2.96	2.95	2.98	2.97	2.96

* To supply the following per kg of diet : vitamin A, 12,500 IU; vitamin D_3, 2500 IU; vitamin E, 50.00mg; vitamin K_3 2.50mg; vitamin B_1, 3.00mg; vitamin B_2, 6.00mg; vitamin B_6, 6.00mg; niacin, 40mg; calcium pantothenate, 10mg; biotine, 0.08mg; vitamin B_{12}, 0.25mg; folic acid, 1.00mg; chlorine chloride, 300mg; manganese, 100mg; iron, 50mg; zinc, 45mg; copper, 2.00mg; iodine, 1.55mg; cobalt, 0.25mg; selenium, 0.10mg; growth promoter, 40.00; antioxidant, 200mg.

Table 2: Proximate composition of broiler finisher diets

Castor oil bean meal levels (%)		0			10			15			20	
DL-methionine levels (%)	0	0.25	0.5	0	0.25	0.5	0	0.25	0.5	0	0.25	0.5
Components (%)/Diets	1	2	3	4	5	6	7	8	9	10	11	12
Crude protein	21.03	21.05	21.08	21.00	21.02	21.04	21.00	21.01	21.02	20.99	21.00	21.01
Ether extract	4.75	4.55	4.50	6.75	6.70	6.65	8.55	8.50	8.45	13.55	13.15	13.05
Crude fibre	7.16	7.38	7.22	7.75	7.69	7.62	7.81	7.78	7.76	7.83	7.82	7.81
Ash	10.47	10.20	10.11	10.09	9.97	9.61	10.12	10.13	10.08	10.56	7.52	7.21
Nitrogen-free extract	48.1	48.29	49.20	45.37	45.50	46.08	43.85	44.07	4.37	37.89	38.64	39.50
Dry matter	91.51	91.47	92.11	90.96	90.88	91.00	91.33	91.49	91.68	90.82	91.13	91.58
Gross energy (Kcal /kg)	4574	4573	4574	4585	4587	4586	4598	4596	4594	4603	4601	4601

treatments 10–12 (20% CBM with or without methionine) had the least body weights and dressed carcass weights. Birds on treatments 1-9 (0, 10 and 15% CBM with and without methionine supplementation) had similar higher dressing percentage and this was significantly (P<0.05) higher than the dressing percentage of birds on treatments 10-12. Birds on treatments 1-3 had significantly (P<0.05) higher liver weights than birds on other treatments. Birds on treatment 10 had higher (P<0.05) relative liver weight relative liver than birds on other treatments. Birds on treatments 1-6 and 9 had the smallest relative liver weight. Birds on treatments 2 and 3 had higher (P<0.05) kidney weight than birds on other treatments. Birds on treatments 1-9 had similar relative kidney weight and this was significantly (P<0.05) higher than that of birds on treatments 10-12. Birds on treatments 2 and 3 had significantly (P<0.05) higher spleen weight than birds on other treatments. Birds on treatments 1-9 had similar and significantly (P<0.05) higher relative spleen weight than birds on treatments 10-12. Birds on treatments 1-3 had comparable heart weight with those on treatments 4-9 and this differed significantly (P<0.05) from the heart weight of birds on treatments 10-12. Birds on treatments 1-9 had higher (P<0.05) relative heart weight than birds on treatments 10-12. Birds on treatments 2 and 3 had comparable empty gizzard weight with those on treatments1, 4, 5 and 6, and this differed significantly (P<0.05) from the empty gizzard weight of birds on other treatments. Birds on treatment 10 had significantly (P<0.05) higher relative empty gizzard weight than birds on other treatments. Birds on treatments 1-6 and 9 had the smallest relative empty gizzard weight. The abdominal fat weight of birds on treatments 10 to 12 differed significantly (P<0.05) from that of birds on treatments 1-6. The relative abdominal fat weight of birds on treatment 10 differed significantly (P<0.05) from that of birds on other treatments. While there were no CBM x DL-methionine interaction on dressing percentage, kidney weight, relative kidney weight and abdominal fat weight. Significant (P<0.05) interactions existed between CBM and methionine levels on body weight, dressed carcass weight, liver weight, relative liver

Table 3: Effects of processed castor oil bean meal and supplementary DL-methionine on body weight, carcass yield and organ characteristics of broiler finishers

Castor oil bean meal levels (%)	0			10			15			20			
DL-methionine levels (%)	0	0.25	0.5	0	0.25	0.5	0	0.25	0.5	0	0.25	0.5	
Parameters	1	2	3	4	5	6	7	8	9	10	11	12	S.E.M.
Body weight (g)	2546.28	2548.71^{a}	2554.16^{a}	2505.46^{a}	2526.17^{a}	2529.84^{a}	2345.46^{b}	2378.43^{b}	2498.43^{a}	1750.17^{d}	1841.84^{c}	1883.47^{c}	22.35
Dressed carcass	1905.25^{a}	1909.1^{a}	1913.70^{a}	1870.07^{a}	1887.58^{a}	1892.63^{a}	1731.88^{b}	1760.40^{b}	1849.51^{a}	1241.39^{d}	1319.76^{c}	1354.77^{c}	23.75
weight (g)	74.81^{a}	74.92^{a}	74.92^{a}	74.63^{a}	4.71^{a}	74.80^{a}	73.84^{a}	74.02^{a}	74.02^{a}	70.93^{b}	71.66^{b}	71.93^{b}	0.38
Dressing %	55.79^{a}	55.84^{a}	55.92^{a}	54.94^{c}	54.95^{c}	55. 24^{b}	54.02^{e}	54.29^{d}	54.81^{c}	46.07^{g}	46.18^{g}	47.03^{f}	0.08
Liver weight (g)													
Liver wt. as % of body wt.	2.19^{d}	2.19^{d}	2.19^{d}	2.19^{d}	2.17^{d}	2.18^{d}	2.30^{c}	2.28^{c}	2.20^{d}	2.63^{a}	2.51^{b}	2.50^{b}	0.02
Kidney weight (g)	11.92^{ab}	11.96^{a}	12.03^{a}	11.79^{ab}	1.85^{ab}	11.89^{ab}	11.27^{b}	11.37^{ab}	11.56^{ab}	6.02^{c}	6.11^{c}	6.24^{c}	0.2
Kidney wt. as (%) of body wt.	0.47^{a}	0.47^{a}	0.47^{a}	0.47^{a}	0.48^{a}	0.48^{a}	0.48^{a}	0.48^{a}	0.46^{a}	0.34^{b}	0.33^{b}	0.33^{b}	0.01
Spleen weight (g)	5.02^{b}	5.11^{a}	5.18^{a}	4.66^{d}	4.84^{c}	4.94^{b}	4.36^{f}	4.46^{e}	4.62^{d}	3.15^{h}	3.21^{gh}	3.29^{g}	0.03
Spleen wt. as % of body wt.	0.20^{ab}	0.20^{ab}	0.20^{ab}	0.19^{cd}	0.19^{bc}	0.20^{ab}	0.12^{bcd}	0.19^{bcd}	0.18^{ef}	0.18^{eg}	0.18^{eg}	0.17^{g}	0.01
Heart weight (g)	13.00^{a}	13.04^{a}	13.09^{a}	12.61^{c}	12.72^{bc}	12.90^{ab}	12.27^{d}	12.31^{d}	12.55^{c}	8.58^{f}	8.67^{ef}	8.85^{e}	0.07
Heart wt. as % of body wt.	0.51^{abc}	0.51^{abc}	0.51^{abc}	0.50^{bcd}	0.50^{bcd}	0.52^{abc}	0.52^{abc}	0.52^{abc}	0.50^{bcd}	0.49^{d}	0.47^{e}	0.47^{e}	0.01
Empty gizzard weight	54.71^{abc}	54.88^{ab}	54.94^{ab}	54.02^{bcd}	54.07^{abcd}	54.19^{abcd}	53.64^{d}	53.37^{d}	53.99^{cd}	46.67^{f}	46.93^{ef}	47.52^{e}	0.27
Empty gizzard wt. as % of body wt.	2.15^{d}	2.15^{d}	2.15^{d}	2.16^{d}	2.14^{d}	2.14^{d}	2.29^{c}	2.26^{c}	2.16^{d}	2.67^{a}	2.54^{b}	2.52^{b}	0.02
Abdominal fat weight (g)	25.51^{bc}	25.50^{bc}	25.00^{c}	25.70^{b}	25.67^{b}	25.60^{bc}	26.06^{ab}	26.10^{ab}	26.03^{abc}	26.66^{a}	26.58^{a}	26.59^{a}	0.21
Abdominal fat wt. as % of body wt.	1.00^{de}	1.00^{de}	0.98^{e}	1.03^{d}	1.02^{de}	1.03^{d}	1.11^{c}	1.10^{c}	1.04^{d}	1.51^{a}	1.44^{b}	1.41^{b}	0.01

$^{a\text{-}f}$ means on the same row with different superscripts are significantly ($P < 0.05$) different. SEM. = Standard error of the mean

Table 4: Simple regression equations and correlation coefficients relating body and organ weights (Y) of broiler finishers to % dietary castor oil bean meal (X)

Predictand (Y)	Prediction equation	r	R^2	Syx	Probability of sig.correlation
Body weight (g)	Y = 2897.38 – 228.67X	-0.86	0.73	64.89	P<0.01
Dressed carcass weight (g)	Y = 2198.58 – 191.55X	- 0.86	0.74	53.22	P<0.01
Dressing %	Y = 76.49 – 1.09X	0.83	0.68	0.35	P<0.01
Liver weight (g)	Y = 60.16 – 2.89X	-0.85	0.73	0.84	P<0.01
Liver wt as % of body weight	Y =2.01 + 0.11X	0.82	0.68	0.04	P<0.01
Kidney weight (g)	Y =14.83 – 1.80X	-0.82	0.67	0.59	P<0.01
Kidney wt as % of body weight	Y =0.54 – 0.04X	-0.73	0.53	0.02	P<0.01
Spleen weight (g)	Y =5.90 – 0.06X	-0.92	0.85	0.12	P<0.01
Spleen wt as % of body weight	Y =0.21 - 0.01X	-0.85	0.72	0.002	P<0.01
Heart weight (g)	Y =15.06 – 1.34X	-0.85	0.72	0.39	P<0.01
Heart wt as % of body weight	Y =0.53 - 0.01X	-0.59	0.35	0.006	P<0.01
Empty gizzard weight (g)	Y = 58.37 – 2.37X	-0.84	0.70	0.73	P<0.01
Empty gizzard wt as % of body weight	Y = 1.94 + 0.14X	0.83	0.69	0.04	P<0.01
Abdominal fat weight (g)	Y = 24.86 + 0.42X	0.83	0.68	0.14	P<0.01
Abdominal fat wt as % of body weight	Y = 0.78 + 0.14X	0.86	0.73	0.04	P<0.01

weight, spleen weight, relative spleen weight, heart weight, relative heart weight, empty gizzard weight, relative empty gizzard weight and relative abdominal fat weight. Methionine supplementation significantly (P<0.05) improved body weight and dressed carcass weight of the birds at the 15 and 20% levels of CBM inclusion. Increased liver weight and heart weight at the10, 15 and 20% levels of CBM inclusion decreased relative liver weight, empty gizzard weight and abdominal fat weight. Increased spleen weight at the 0, 10, 15 and 20% levels of CBM inclusion decreased relative spleen weight. At 10 and 15% levels of CBM relative heart weight decreased and empty gizzard weight at the 20% level of CBM inclusion increased.

The Table of regression (Table 4) shows the correlations between CBM levels and all the parameters. There were significant (P<0.01) correlations between CBM levels and body weight (r = - 0.86), dressed carcass weight (- 0.86), dressing% (r= 0.83), liver weight (r = -0.85), relative liver weight (r = 0.82), kidney weight (r = - 0.82), relative kidney weight (r = - 0.73), spleen weight (r = - 0.92), relative spleen weight (r=-0.85), heart weight (r = - 0.85), relative heart weight (r = -0.59), empty gizzard weight (r = -0.84), relative empty gizzard weight (r = 0.83), abdominal fat weight (r= 0.83) and relative abdominal fat (r= 0.86).

As shown in Table 3, body weight, carcass yield, organ and relative organ weights reduced significantly (P<0.05) with increasing levels of CBM in the diets. Ani and Okorie (2008) reported similar reductions in carcass yield and organ weight of broiler birds that were fed diets containing more than 10% CBM. Carew et al. (2000) and Carew et al. (2003) also reported reduction in the body weight and relative organ weights of broiler birds that consumed raw velvet beans (*Mucuna pruriens*). Reduction in liver weights of broilers fed high level of pigeon pea seed meal had earlier been documented (Etuk and Udedibie, 2006). The observed reduction in body weight, carcass yield and organ weight may be attributed to depressed feed intake that led to low availability of nutrients needed for tissue, organ and body development. Iyayi and Yahaya (1999) had earlier reported that reduced metabolizable energy content of feed tends to have the effect of reducing the weight of carcass, intestine, gizzard and liver of birds. Ani and Omeje (2008) showed that body weight, dressed carcass weight and carcass dressing percentage decreased significantly with increase in the level of raw bambara nut waste in the diets and attributed the decrease to the presence of anti-nutritional factors (ANFs) in the raw bambara nut waste. Emenalom et al. (2004) also attributed reduction in carcass weight of broiler birds to the presence of ANFs in raw velvet bean (*Mucuna pruriens*). The presence of residual ricin in the processed CBM might therefore have contributed to the reduction in body weight, carcass yield and organ weight observed in the present study. Ani and Okorie (2006) and Ani (2012) reported the presence of residual ricin in two-stage cooked CBM. Ricin has been shown to interfere with the digestion and absorption of nutrients in the gastro-intestinal tract or inhibits protein synthesis (Ani and Okorie, 2004; Ani and Okorie, 2005; Bisiriyu, 2005; Ani and Okorie, 2009b; Ani, 2012). Perhaps the residual ricin might have increased in concentration with increase in the level of CBM in the diets. Ani and Okorie (2009) showed that there was a concomitant increase in the concentration of residual ricin with increase in the level of castor bean meal in the diets of broiler finishers. Emenalom (2004) also reported that the carcass weight of broiler birds decreased significantly as the concentration of ANFs increased with increase in the level of Mucuna seed meal inclusion in the diets. Interestingly, the carcass dressing percentage values (70.93- 74.92%) obtained in the present study are higher than the values (65.9-69.4%) reported by Ferriera et al. (2003), and compares with the values (69.1-72.6%) reported by Omojola and Fagbuaro (2005). Although castor oil bean meal significantly (P<0.05) reduced body weight, carcass yield and organ weight and increased the abdominal fat weight of the broiler birds, the inclusion of DL-methionine in the CBM-containing diets reduced the adverse effects at the 15 and 20% CBM inclusion. DL-methionine may have contributed to the improvement of the body weight, carcass yield and organ weight of the broiler birds by improving the quality of the castor oil bean protein. DL-methionine might also have provided labile methyl groups, which might have been involved in further detoxification of the CBM, particularly as both ricin and ricinene, the toxic components of castor oil bean are known to be pyrimidine based (Ani and Okorie, 2007; Ani, 2012). It was observed (Table 3) that abdominal fat weight increased significantly (P<0.05) as the level of CBM in the diets increased above 15%. The observed increase could have been the result of the increase in the residual oil content of dietary CBM, especially at the 20% CBM inclusion level (Table 2). It does seem that birds fed 20% CBM may have converted much of the CBM carbohydrate into fat rather than flesh. Udedibie et al. (2004) made a similar suggestion. The increase observed in abdominal fat weight of birds fed the 20% CBM diets may negate the inclusion of up to 20% CBM in broiler finisher diets. Adeniji (2004) earlier indicated that low abdominal fat content might be an incentive to both producers and consumers, as less wastage and tougher broilers are anticipated due to low fat deposition in the broiler chicken.

Conclusion

It is evident from the results of the study that 15% processed CBM supplemented with DL-methionine can be included in broiler finisher diet without any adverse effects on carcass and organ weights of broiler finishers.

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