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Original

Meat and carcass quality in broilers that intake *Roystonea regia*

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ABSTRACT

Objective. To study meat and carcass quality in broilers fed *Roystonea regia* (royal palm nut) fruits meals. **Materials and methods.** A total of 40 broilers distributed according to a completely randomized design were used in four treatments: control (corn-soybean paste) and the inclusion of 5, 10 and 15 % royal palm nut meal. The carcass yield, abdominal fat and meat quality (technological and fatty acid composition (FA)) were studied. For the appearance parameters, a non-parametric analysis of simple classification was performed. **Results.** There were no differences between treatments for carcass weight and pH at 45 minutes and 24 hours *postmortem*. There was a reduction in abdominal fat by 5 and 15 % compared to the control (13.00 and 11.96 vs. 17.02 g / kg), while 10 % did not differ from the rest (15.10 g/kg) ($p<0.01$). There were no differences in color, except for the luminosity in the drumstick that was superior with the inclusion of 10 and 15 % (48.62 and 49.22) with respect to 5 % (45.32) and the control did not differ between treatments (47.53) ($p<0.05$). The composition of FA in the different edible portions showed that the broilers deposited oleic, linoleic and palmitic acids in higher proportions. **Conclusions.** The inclusion of royal palm nut meal in broiler diets does not change the carcass yield, reduces abdominal fat and positively affects meat quality indicators.

Keywords: Poultry; fatty acids; meats; palm (*Source: CAB thesaurus*).

RESUMEN

Objetivo. Estudiar la calidad de la canal y la carne en pollos de ceba que consumen harina de frutos de *Roystonea regia* (palmiche). **Materiales y métodos.** Se utilizaron 40 pollos de ceba distribuidos según diseño completamente aleatorizado en cuatro tratamientos: control (maíz-pasta de soya) y la inclusión de 5, 10 y 15% de harina de palmiche. Se estudió el rendimiento de la canal, grasa abdominal y la calidad de la carne (tecnológicos y composición de ácidos grasos). Para los parámetros de apariencia se realizó análisis de varianza no paramétrico de clasificación simple. **Resultados.** No se encontraron diferencias entre tratamientos para el peso de la canal y pH a los 45 minutos y 24 horas *postmortem*. Hubo reducción de la grasa abdominal con 5 y 15 % respecto al control (13.00 y 11.96 vs 17.02 g/kg), en tanto que el 10% no difirió del resto (15.10 g/kg) ($p<0.01$). No se encontraron diferencias en el color, excepto para la luminosidad en el muslo que fue superior con la inclusión de

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10 y 15% (48.62 y 49.22) respecto al 5% (45.32) y el control no difirió entre tratamientos (47.53) ($p<0.05$). La composición de ácidos grasos en las diferentes porciones comestibles mostró que las aves depositaron los ácidos oleico, linoleico y palmítico en mayor concentración. **Conclusiones.** La inclusión hasta el 15 % de harina de palmiche a las dietas de pollos de ceba no modifica el rendimiento de la canal, reduce la grasa abdominal e incide positivamente en los indicadores de calidad de la carne.

Palabras clave: Aves; ácidos grasos; carnes; palma (*Fuente: CAB thesaurus*).

INTRODUCTION

Poultry meat meets the current consumer demand for being low in fat, with a high degree of unsaturation in its fatty acids (FA) and low levels of sodium and cholesterol. It can also be considered as a "functional food", providing bioactive substances with favorable effects on human health, such as conjugated linoleic acid, vitamins and antioxidants and a balanced ratio of n-6 to n-3 (1). However, for these characteristics to be achieved, the use of food sources with a good balance of FA is essential.

The Cuban subtropics are the natural habitat of palms and oaks, which are locally available sources of fat, which are traditionally used in pig rearing (2). However, although different nutritionists have assumed about its inclusion in the birds diet, little is known. According to Rodríguez et al (3) and Marrero et al (4) the whole fruit oil of the royal palm (*Roystonea regia*) known as royal palm nut, is richer in unsaturated FA, so it could be a good source of lipids for poultry meat.

Of all the quality attributes, appearance is the most critical to the selection of many foods. Consumers often select or reject a product based only on its appearance as this one often affects other sensory properties. Color has long been known to be an important selection criterion for fresh birds and meat products, as well as for end-product satisfaction (5). For this reason, the objective of this study was to study quality indicators of the carcass and meat of broilers that intake *Roystonea regia* fruits meal (royal palm nut).

MATERIALS AND METHODS

Animals and diets. A total of 40 male broilers (hybrid HE_{21}) of average weight 704.2 ± 27.78 g and age 8 days were used. They were randomly housed in individual galvanized wire metabolism cages whose dimensions were 40 x 40 x 40 cm. During the entire experimentation time, the animals had free access to water and food.

The experimental treatments consisted of four experimental diets for starting, growing and finishing according to the requirements of the NRC (6): Control (corn-soybean paste) and the inclusion of 5, 10 and 15 % of royal palm nut meal. These are showed in tables 1, 2 and 3, respectively. The diets were weekly prepared to avoid the quality loss of the royal palm nut meal.

Obtaining the royal palm nut. The kernel of the royal palm nut was obtained from different palm groves in Mayabeque province, Cuba. After the branches were cut off, they were placed in the sun until ripe. Subsequently, they were spread on a drying dish until they reached a brownish-brown color and were stored in bags until they were used. In this way, rancidity that the oil content could cause was avoided. This process was carried out at the facilities of the Unidad Integral Avícola of the Instituto de Ciencia Animal. At the time of their use for the preparation of the experimental diets, the dried kernels were ground in a hammer mill (JF 2D, Brazil) to a particle size of 3 mm and later they were mixed with the rest of the food ingredients.

Experimental procedure. The experiment was carried out at the facilities of the Instituto de Ciencia Animal, Mayabeque, Cuba. At 42 days, the animals were weighed and slaughtered two hours and thirty minutes after ingestion of food. They were stunned with an electric shock and then bled by the jugular vein. Later, the abdominal cavity was opened, the skin and feathers were eviscerated and manually separated. Carcasses and abdominal fat were weighed on a brand technical scale (SARTORIUS, Germany). For statistical analysis, weights were expressed as relative to live weight (LW, g/kg).

Table 1. Experimental diets corresponding to the starting period (8-21 days).

Ingredient	Control	Royal palm nut 5%	Royal palm nut 10%	Royal palm nut 15%
Corn meal	48.60	43.00	39.00	32.50
Soybean meal	41.08	41.37	40.74	41.74
Vegetable oil	6.00	6.40	6.40	6.75
Mono calcic phosphate	1.80	1.65	1.52	1.40
Calcium carbonate	1.50	1.55	1.56	1.55
Common salt	0.35	0.35	0.35	0.35
DL-methionine	0.24	0.13	0.13	0.13
Choline	0.13	0.25	-	0.28
Premixture mineral vitamin[1]	0.30	0.30	0.30	0.30
Royal palm nut meal	0	5	10	15
Calculated composition , %				
CP	21.96	21.94	22.00	21.96
ME, kJ/kg	12.95	12.94	12.92	12.83
CF	3.04	4.47	5.87	7.32
Pd	0.50	0.50	0.50	0.50
Ca	1.00	1.00	1.00	1.00
Met.+Cys.	0.890	0.880	0.880	0.880
Lysine	1.22	1.22	1.22	1.22

[1]Vitamin supplement: vitam. A, 10 000UI; vitam. D3, 2 000 UI; vitam. E, 10 mg; vitam. K, 2 mg; thiamine, 1 mg; riboflavin, 5 mg; pyridoxine, 2 mg; vitam. B12, 15.4 µg; nicotinic acid, 125 mg; calcium pantothenic, 10 mg; folic acid, 0.25 mg; biotin, 0.02 mg. Mineral supplement: selenium, 0.1 mg; iron, 40 mg; copper, 12 mg; zinc, 120 mg; magnesium, 100 mg; iodine, 2.5 mg; cobalt 0.75 mg.

Table 2. Experimental diets corresponding to growing period (22-35 days).

Ingredient	Control	Royal palm nut 5%	Royal palm nut 10%	Royal palm nut 15%
Corn meal	55.40	50.29	44.65	38.92
Soybean meal	35.21	35.00	35.25	35.55
Vegetable oil	5.50	5.80	6.15	6.55
Mono calcic phosphate	1.58	1.60	1.60	1.63
Calcium carbonate	1.40	1.40	1.40	1.38
Common salt	0.30	0.30	0.30	0.30
Methionine	0.18	0.18	0.13	0.13
Choline chloride	0.13	0.13	0.22	0.24
Premixture mineral vitamin[1]	0.30	0.30	0.30	0.30
Royal palm nut	0	5	10	15
Claculated analysis				
CP	19.87	19.72	19.72	19.74
ME, kJ/kg	13.17	13.15	13.12	13.10
CF	2.84	4.25	5.67	7.10
Pd	0.45	0.45	0.45	0.45
Ca	0.91	0.92	0.92	0.93
Met.+Cys.	0.780	0.776	0.782	0.781
Lysine	1.07	1.06	1.05	1.05

[1]Vitamin supplement: vitam. A, 10 000UI; vitam. D3, 2 000 UI; vitam. E, 10 mg; vitam. K, 2 mg; thiamine, 1 mg; riboflavin, 5 mg; pyridoxine, 2 mg; vitam. B12, 15.4 µg; nicotinic acid , 125 mg; calcium pantothenic , 10 mg; folic acid, 0.25 mg; biotin, 0.02 mg. Mineral supplement: selenium, 0.1 mg; iron, 40 mg; copper, 12 mg; zinc, 120 mg; magnesium, 100 mg; iodine, 2.5 mg; cobalt 0.75 mg.

Tabla 3. Experimental diets corresponding to the finishing period (36-42 days).

Ingredient	Control	Royal palm nut 5%	Royal palm nut 10%	Royal palm nut 15%
Corn meal	60.52	55.51	50.36	45.49
Soybean meal	30.12	30.18	30.28	30.15
Vegetable oil	5.40	5.50	5.70	5.85
Mono calcic phosphate	1.50	1.35	1.25	1.20
Calcium carbonate	1.50	1.50	1.45	1.35
Common salt	0.35	0.35	0.35	0.35
Methionine	0.18	0.18	0.18	0.18
Choline chloride	0.13	0.13	0.13	0.13
Premixture mineral vitamin[1]	0.30	0.30	0.30	0.30
Royal palm nut	0	5	10	15
Calculated analysis				
CP	18.03	18.00	17.98	17.88
ME, kJ/kg	13.39	13.33	13.30	13.25
CF	2.66	4.08	5.50	6.92
Pd	0.43	0.43	0.43	0.43
Ca	0.92	0.93	0.92	0.91
Met.+Cys.	0.732	0.727	0.718	0.718
Lysine	0.941	0.935	0.936	0.936

[1]Vitamin supplement: vitam. A, 10 000UI; vitam. D3, 2 000 UI; vitam. E, 10 mg; vitam. K, 2 mg; thiamine, 1 mg; riboflavin, 5 mg; pyridoxine, 2 mg; vitam. B12, 15.4 µg; nicotinic acid , 125 mg; calcium pantothenic , 10 mg; folic acid, 0.25 mg; biotin, 0.02 mg.. Mineral supplement: selenium, 0.1 mg; iron, 40 mg; copper, 12 mg; zinc, 120 mg; magnesium, 100 mg; iodine, 2.5 mg; cobalt 0.75 mg.

Meat quality indicators. Technological and appearance indicators were determined in the main edible portions: drumstick, leg, breast and abdominal fat.

Technological. pH was measured with a brand digital pH meter (HANNA, Romania) at 45 minutes after slaughter. Then, they were kept refrigerated at 4ºC until 24 hours, where the indicator was measured again. Subsequently, the meat was separated from the bone in each of the portions to determine the appearance parameters and fatty acid composition.

Appearance. Color was determined from the qualitative variables L * (luminosity), a * (red pigments) and b * (yellow pigments). The analyzes were carried out in triplicate in each of the portions, with a brand colorimeter (Cromamater®, USA) with CIELAB scale.

Fatty acid composition. The concentration in the meat of lauric (12: 0), myristic (14: 0), palmitic (16: 0), palmitoleic (16: 1), oleic (18: 1), linoleic (18: 2) and linolenic (18: 3) was determined. Mixtures of the different portions and the abdominal fat of three animals were made to form three samples per treatment. The FA were determined as methyl esters according to the procedure described by Rodríguez et al (3). A GC-14B gas chromatograph (SHIMADZU, Japan) was used, coupled to a computer system, with a flame ionization detector and a BPX-70 capillary column (30 mx 0.53 mm, 1 µm Df, SGE, Australia). The temperature program was 1 min at 100 °C, from 100 °C to 220 °C at 10 °C/min and 2 min at 220 °C. The detector and injector temperature was 220 °C, and the carrier gas flow (H_2) was 8.6 mL/min. The analyzes were carried out in triplicate. The FA standards (Sigma, USA) and reagents and solvents (Merck, Germany) were pure for analysis.

The quantitative analysis of the fatty acids was carried out by the internal standard method. The methyl esters in the test sample were initially identified by comparing the relative retention of each component. The concentrations were calculated with respect to the retention time of the internal standard, with the relative retention of each reference methyl ester.

Statistical methods. A completely randomized design was used with four treatments that consisted on the experimental diets and ten repetitions of an animal. For the analysis of the carcass performance, abdominal fat and meat quality indicators (technological and fatty acid composition), the mean values were compared using the Duncan's test (7) for $p < 0.05$, when necessary. For the appearance parameters, a non-parametric analysis of variance of simple classification was carried out and Conover's test (8) was applied for $p < 0.05$, when necessary. The computerized statistical program INFOSTAT (9) was used.

RESULTS

Table 4 shows the results of the final live weight and the carcass yield that did not show differences between treatments. The weight of the abdominal fat was reduced in treatments 5 and 15 % with respect to the control, while the 10 % of royal palm nut did not differ from the rest (Table 4).

Table 4. Final live weight, carcass yield and abdominal fat of broilers that intake royal palm nut meal.

Indicator	Treatments				SE±	p-value
	Control	R 5%	R 10%	R 15%		
Final live weight (kg)	2.24	2.36	2.34	2.15	0.15	0.7506
Carcass weight (g/kg)	532.78	568.99	547.76	579.44	0.09	0.9646
Abdominal fat (g/kg)	17.02^{b}	13.00^{a}	15.10^{ab}	11.96^{a}	1.08	0.0106

R=R-Royal palm nut meal; $^{a,b:}$ Different letters show significance differences for p<0.05 (7).

There were not differences between treatments for pH in the different edible sections of the broiler carcass when including royal palm nut meal in the ration at 45 minutes and 24 hours *postmortem* (Table 5).

Table 5. Performance of the pH in the different edible sections of broilers that intake royal plan nut meal *postmortem*.

pH	Treatments				SE±	p-value
	Control	R 5%	R 10%	R 15%		
Drumstick 45 minutes	6.35	6.44	6.37	6.34	1.09	0.3670
Drumstick 24 hours	6.31	6.23	6.25	6.32	1.50	0.2317
Leg 45 minutes	6.36	6.40	6.35	6.35	0.19	0.9054
Leg 24 hours	6.23	6.33	5.95	6.35	1.08	0.3708
Breast45 minutes	6.23	6.17	6.20	5.83	1.24	0.3087
Breast 24 hours	6.05	6.03	5.98	6.01	0.48	0.6971

R=R-Royal palm nut meal.

Table 6 shows the results of the different pigments in the edible sections of broilers. There were not differences for the indicators, except for the luminosity in the drumstick, which was higher with the inclusion of 10 and 15 % of royal palm nut in the ration (p<0.05) with respect to 5 % and the control did not differ between treatments.

Table 6.|Coloration parameter in the different edible sections of broilers that intake royal palm nut meal after 24 hours of slaughter.

Variables	Treatments				p-value
	Control	R 5%	R 10%	R15%	
Drumstick					
L*	20.60[ab] (47.53) SD=3.69	12.05[a] (45.32) SD=2.23	23.70[b] (48.62) SD=2.90	25.65[b] (49.22) SD=3.26	0.0478
a*	24.90 (9.50) SD=9.57	21.70 (9.27) SD=8.65	19.10 (8.92) SD=8.64	16.30 (8.26) SD=8.16	0.3984
b*	16.90 (2.57) SD=2.35	24.90 (3.93) SD=4.03	17.60 (2.80) SD=3.34	22.60 (3.28) SD=4.05	0.3472
Leg					
L*	17.60 (46.52) SD=2.92	18.00 (47.89) SD=2.67	22.40 (47.96) SD=3.05	24.00 (46.68) SD=1.51	0.5254
a*	23.75 (9.61) SD=1.44	18.70 (8.94) SD=2.13	22.05 (9.26) SD=1.84	17.50 (8.71) SD=1.79	0.6053
b*	17.10 (1.87) SD=2.09	24.05 (3.22) SD=1.60	15.30 (1.86) SD=1.31	25.55 (3.16) SD=1.18	0.1320
Breast					
L*	16.70 (47.63) SD=2.49	21.70 (48.92) SD=2.20	23.10 (49.18) SD=3.10	20.50 (48.96) SD=3.50	0.6466
a*	27.45 (6.80) SD=0.51	14.90 (5.71) SD=1.41	22.20 (6.57) SD=1.39	17.45 (5.89) SD=1.08	0.0813
b*	17.70 (6.31) SD=1.61	25.40 (7.23) SD=1.70	18.20 (6.31) SD=2.02	20.70 (6.58) SD=1.63	0.4368

R=R-Royal palm nut meal. [a,b]: Different letters show significance differences for p<0.05 (8) () Original means

Tables 7 to 10 show the results of fatty acid composition in drumstick, leg, breast and abdominal fat of broilers that intake royal palm nut meal, respectively. In general, an increase in lauric and myristic acids was observed, while palmitic, palmitoleic and oleic decreased with respect to the control and linoleic and linolenic did not differ between treatments.

Table 7. Fatty acids in the drumstick of broilers that intake royal palm nut meal.

Fat acid (%)	Treatments				SE±	p-value
	Control	R 5%	R 10%	R 15%		
Lauric (12:0)	0.30[a]	1.10[b]	1.66[bc]	2.06[c]	0.18	0.0005
Myristic (14:0)	0.79[a]	1.52[b]	1.89[bc]	2.16[c]	0.14	0.0007
Palmitic (16:0)	21.54[b]	21.29[b]	20.67[ab]	19.71[a]	0.42	0.0582
Palmitoleic (16:1)	5.90[b]	4.12[a]	4.26[a]	4.06[a]	0.32	0.0104
Oleic (18:1)	39.65[b]	37.79[ab]	36.83[a]	35.67[a]	0.70	0.0215
Linoleic (18:2)	23.12	25.13	26.12	27.47	1.17	0.1388
Linolenic (18:3)	2.11	1.91	2.12	2.26	0.16	0.5062

R=R-Royal palm nut meal. [a,b]: Different letters show significance differences for p<0.05 (7)

Table 8. Fatty acids in the leg of broilers that intake royal palm nut meal.

Fat acid (%)	Treatments				SE±	p-value
	Control	R 5%	R 10%	R 15%		
Lauric (12:0)	0.22[a]	1.01[b]	1.86[c]	2.18[c]	0.14	<0.0001
Myristic (14:0)	0.70[a]	1.37[b]	2.16[c]	2.24[c]	0.05	<0.0001
Palmitic (16:0)	22.43	22.36	21.56	21.33	0.47	0.3209
Palmitoleic (16:1)	5.27[b]	3.69[a]	3.82[a]	3.40[a]	0.31	0.0105
Oleic (18:1)	39.51	37.08	36.72	36.42	0.79	0.0843
Linoleic (18:2)	23.30	25.09	25.21	25.52	1.30	0.6380
Linolenic (18:3)	1.91	1.95	2.04	1.87	0.16	0.8968

R=R-Royal palm nut meal. [a,b]: Different letters show significance differences for p<0.05 (7)

Table 9. Fatty acids in the breast of broilers that intake royal palm nut meal.

Fat acid (%)	Treatments				SE±	p-value
	Control	R 5%	R 10%	R 15%		
Lauric (12:0)	0.31[a]	1.20[b]	1.97[c]	2.59[c]	0.21	0.0003
Myristic (14:0)	0.85[a]	1.59[b]	1.99[b]	2.66[c]	0.17	0.0005
Palmitic (16:0)	24.39[c]	23.77[bc]	21.83[a]	22.43[ab]	0.50	0.0239
Palmitoleic (16:1)	5.89[b]	4.19[a]	3.87[a]	3.96[a]	0.31	0.0053
Oleic (18:1)	43.10[b]	39.71[a]	38.77[a]	39.54[a]	0.68	0.0085
Linoleic (18:2)	17.29	20.66	23.29	20.41	1.44	0.1003
Linolenic (18:3)	1.33	1.55	1.66	1.61	0.19	0.6574

R=R-Royal palm nut meal. [a,b:] Different letters show significance differences for $p<0.05$ (7).

Table 10. Fatty acids in the abdominal fat of broilers that intake royal palm nut meal.

Fat acid (%)	Treatments				SE±	P-value
	Control	R 5%	R 10%	R 15%		
Lauric (12:0)	0.43[a]	1.03[a]	2.40[b]	2.68[b]	0.20	0.0001
Myristic (14:0)	0.86[a]	1.41[b]	2.50[c]	2.55[c]	0.14	0.0001
Palmitic (16:0)	22.93[c]	22.77[bc]	21.85[ab]	21.46[a]	0.30	0.0227
Palmitoleic (16:1)	5.63[b]	4.83[ab]	4.15[a]	4.24[a]	0.33	0.0477
Oleic (18:1)	42.02[b]	39.31[a]	39.51[a]	38.50[a]	0.52	0.0074
Linoleic (18:2)	20.44	23.11	21.83	22.88	0.90	0.2186
Linolenic (18:3)	1.58	1.45	1.56	1.46	0.10	0.7153

R=R-Royal palm nut meal. [a,b:] Different letters show significance differences for $p<0.05$ (7)

DISCUSSION

The lack of detection of differences between treatments for the final live weight and the carcass yield indicates that the use of royal palm nut in broilers diet up to 15%, does not affect the indicators. For this reason, it can be considered an unconventional source of locally available food that can be used for birds.

The reduction in abdominal fat could be explained by the high fiber values reported in the oilseed meal, since this fraction in birds rations has a reducing effect at the intestinal level on the absorption of cholesterol and lipids (10,11). According to Caro et al (12) and Arias et al (13), the royal palm nut meal has high NDF values: 53.98 %, ADF: 45.48 %, lignin: 10.70 % and CF: 45.92 %, respectively.

According to Petracci et al (14) before slaughter, poultry meat has pH 7 and decreases between 5.8 and 6 from 6 hours *postmortem*, in which it develops rigor (*rigor mortis*). The inclusion of royal palm nut meal in the ration did not modify the indicator, so this performance may be related to the genetic characteristics of the hybrid that was used in the study. Attia et al (15) stated that the decline rate varies between genetic lines and that normal values are between 6.2 and 6.6 as reported in this experiment.

The meat color correlates with the pH of the drumstick (16). This is because in meat, when the pH is above the isoelectric point of myofibrillary proteins, the water molecules are tightly joins so that more light is absorbed into the muscle and it becomes darker (17). A high pH increases the importance of myoglobin in the selective absorption of green light, resulting in meat that appears redder and less yellow (18), as was observed in this study.

The birds that were fed with the royal palm nut meal deposited oleic, linoleic and palmitic acids in a higher proportion in relation to the rest of the FA that were studied in the different portions. Similar results were reported by Lara et al (19) when they studied different sources of lipids in the broilers diet. According to Khalifa et al (20), the oleic acid is associated with a decrease in the risk of cardiovascular diseases by reducing serum cholesterol levels due to the decrease in LDL cholesterol. Furthermore, linoleic acid is associated in humans with anticarcinogenic action, improvement of immune function and reduction of body fat as well as preventing atherosclerosis (21). These results show that when using the ingredient in the feed of broilers up to 15%, lean and healthy carcasses are obtained for human consumption, all of which gives added value to the meats.

The increase in the concentration of saturated acids and the reduction of unsaturated ones with the increase of the royal palm nut in the ration can be explained by the proportions of these in the diet and/or by their synthesis in the liver. Several authors suggest that the composition of fatty acids in the carcasses is modified according to the profile of fatty acids in the source that is added to the diet (1,22). According to Rodríguez et al (3), in the oil that is extracted from the whole fruit of the Cuban royal palm, the individual acids in the highest proportion are oleic (32.9 %), lauric (23.3%), linoleic (15.4%), palmitic (12.6%) and myristic (11.0 %).

On the other hand, according to Ajantha et al (21) and Toomer et al (23) it was shown that in the liver the activity of the liver complex 9-desaturase responsible for the synthesis of saturated fatty acids during the digestion of unsaturated fatty acids is modified, which affects the composition of body fat in birds. Furthermore, linoleic acid can decrease oleic and palmitoleic acid concentrations in broilers (24).

It is concluded that the inclusion of royal palm nut meal to broiler diets does not modify the carcass yield, reduces abdominal fat and has a positive impact on the meat quality indicators.

Conflict of interests

The authors of this study declare that there is no conflict of interest with the publication of this manuscript.

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