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Effect of Dietary Incorporation of Sugar Cane Molasses and Sexing on Broiler Performance and Carcass Characteristics

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Abstract

The study was conducted to evaluate the effect of partial replacement of sorghum grains by cane molasses on broiler performance and to compare the performance of male broiler chicks with unsexed one. A factorial (2 × 3) arrangement was used in a completely randomized design to study the effect of two sexing pattern (male and unsexed chicks) and three dietary levels of molasses (0, 10 and 24%) on broiler performance. A total of six treatments were employed and each treatment was replicated three times with six birds each. The experiment lasted for 42 days; the feed consumption, weight gain, and feed conversion ratio (FCR) were recorded. Carcass weight, weight of internal organs and carcass cuts were measured. Blood samples were collected for determination of cholesterol, triglycerides, total protein (TP) and potassium. The results revealed that significant improvement ($P< 0.05$) in feed consumption, body weight gain and FCR as the level of molasses increased. The feed consumed and the weight gain were significantly ($P< 0.05$) high in birds fed diets incorporated with 24% molasses. Males had better weight gain and feed consumption than unsexed birds while no differences in FCR. The highest value of serum TP and potassium were recorded in birds fed 24% molasses. Sexing had no significant effect ($P> 0.05$) on blood constituents. The weight of carcass, thigh, drumstick and breast were not affected by the experimental treatments. It is concluded that sugar cane molasses could be used as alternative energy source up to 24% in broiler diets without negative impact on performance. The males are advisable to be adopted for commercial broiler production than unsexed one.

Key words: *molasses, sex, broiler performance.*

المستخلص

أجريت هذه التجربة لدراسة أثر الإحلال الجزئي للذرة بالمولاس على أداء الدجاج اللاحم ومقارنة أداء ذكور الدجاج اللاحم مع غير المجنسة. استخدمت تجربة عاملية (3×2) بتصميم كامل العشوائية لدراسة اثر نمطين من التجنيس (ذكور؛ غير مجنس) وثلاث مستويات من المولاس (% 24, 10, 0) علي أداء الدجاج اللاحم. تم استخدام ست معاملات وتم تكرار كل معامله ثلاث مرات باستخدام ستة طيور لكل. استمرت التجربة 42 يوم; تم تسجيل الغذاء المستهلك والوزن المكتسب ومعدل التحول الغذائي. تم تسجيل وزن الذبيح وأوزان الأعضاء الداخلية وأجزاء الذبيحة. تم جمع عينات دم لقياس الكولسترول والجيلسريدات الثلاثية والبروتين والبوتاسيوم. أشارت النتائج إلى تحسن معنوى (P< 0.05) في استهلاك الغذاء والوزن المكتسب ومعدل التحول الغذائي عندما ترتفع نسبه المولاس في العلائق. استهلاك الغذاء واكتساب الاوزان كانت معنويا (P< 0.05) أعلى فى الطيور التي استهلكت الغذاء المحتوي على مولاس بنسبة 24%. الذكور كانت الأفضل من ناحية اكتساب الوزن واستهلاك الغذاء مقارنة بغير المجنسة بينما لم يكن هنالك فروق في معدل التحول الغذائي. مستويات البروتين الكلي والبوتاسيوم في الدم كانت أعلي في الطيور التي تغذت على علائق تحتوي على % 24 مولاس. التجنيس ليس له أثرمعنوي (P> 0.05) على مكونات الدم. أوزان الذبيح، الفخذ،الدبوس والصدر لم تتأثر بمعاملات التجربة. وخلصت الدراسة الحالية انه يمكن استخدام المولاس كبديل من بدائل الطاقة حتى 24% دون اثار سالبة . يُنصح بـاستخدام ذكور الدجاج اللاحم في الإنتاج التجاري لأفضليتها مقارنة بغير المجنسة.

الكلمات المفتاحية: *مولاس، ، التجنيس، اداء دجاج اللاحم*

Introduction

In recent years there has been a noticeable growth in the poultry industry in the Sudan. The flexibility and variability of this business has induced a lot of people to invest in this industry which covers chicks, egg, broiler and feed production. However, most of the expansion in the poultry industry in the Sudan is directed towards egg production. Nevertheless, the very recent years have witnessed a growing interest in broiler production. The demand for animal production had increased with the improvement in the living standards (FAO, 2010). Since 1970 the poultry production had been faced with many problems such as high cost of ration ingredients (Banerjee, 1992). For instance, sorghum grains and protein concentrates represent the greatest amount and the highest cost in poultry rations in Sudan. In modern poultry production, nutritionists worked hard to define nutrients requirements for maximum growth and optimum egg and meat production. The inadequate quantities and higher prices of the main feed ingredients such as energy and protein resources feedstuffs encourage the poultry nutritionist and scientists to search other alternatives. These goals could be achieved through various nutritional methods including the use of feed additives, growth promoters and non-conventional feedstuffs. In Sudan, the production and prices of cereal grains such as sorghum are fluctuated according to seasonal rains and the competition between humans and livestock. So, many available alternative sources of energy that could be used in Sudan such as sugar cane molasses which is produced as agro-industrial by-product in large amounts due to the presence of six sugar companies. Total production of molasses is estimated to be more than 700,000 tons per year (Sudanese Sugar Company, 2009). Molasses is a thick or heavy brown liquid by-product of the sugar refining industry. It has high density of 1.4 gm /cm^3. It contains 20 -30 % water, 50-60% sugar and up to 20% Ash. The energy content of the molasses is about 2.8 - 2.9 Mkcal, ME/Kg. Molasses has been used heavily in ruminants feed since 1950s. However, few attempts had been made to introduce molasses in poultry feeds. The major problem of using high level of molasses is the very high potassium content (2.5-3.5 %), which has laxative effect on birds. While most birds performed well when fed on balanced diet, containing up to 2% molasses (lesson and Summers, 2005). Energy produced from molasses could be lower in cost than cereal grains due to its higher content of soluble carbohydrates such as sugars (Eissa, 1996). Moreover, the data concerning the convenient dietary inclusion level of molasses in poultry diets is contradicted and need more research to be determined and recommended. So, the current study was conducted to investigate the effect dietary inclusion of sugar cane molasses as a partial source of energy on performance of broiler chickens and carcass characteristics.

The effect of poultry strains, body weight, carcass weight, nutrition, sex, age, and environmental conditions on the yield of broiler parts and carcass composition is well documented (Peebles *et al.,* 1999; Le Bihan-Duval *et al.,* 2001; Young *et al.,* 2001; Mehaffey *et al*., 2006; Abdullah *et al.,* 2010; Lopez *et al.,* 2011). Cahaner and Leenstra (1992) assumed that it is preferable to use unsexed broilers or female's broilers than males because they are sensitive due to their higher weight gain and other sex factors especially under high ambient temperatures. Commercially in Sudan, broilers are reared unsexed. So, this assumption needs to be re-assessed. Based on that, the current research was conducted to evaluate the effect of sexing pattern on broiler performance under Sudanese arid-hot conditions.

Materials and methods

Experimental site and duration

The experiment was carried out at private farm beside Elshukaba Village, 10 kilometers south of Wad Medani in the Gezira state, Sudan. During the entire experimental period, the prevailing temperature of day length ranged from 13Cº to 24Cº and from 12 Cº to 16Cº at night time. The study lasted for six weeks during the period from January to February 2017.

Birds' housing and management

A total of 108 day-old broiler chicks (Ross 308) were brought from Commercial hatchery. The birds were divided into two groups (males and unsexed chicks). The cockerels were selected according to wing feather growth. All birds were weighed and distributed to 18 pens (6 chicks each) according to their average weights. The average weight of chicks in all pens was approximately the same (40±2 grams). A total of 18 small pens were constructed inside an open sided house with deep litter system. The pens dimensions were 1.0 x 1.5 x 1.0 meter width, length and height, respectively. The area of constructed pen was covered with wood shavings. Before the arrival of the birds, the house was cleaned by water and soap, burned and disinfected. Each pen was provided with a plastic water drinker and a metal feed trough. The broilers were exposed to 24 hours lighting throughout the experimental period. The day length was partially depending on the natural day light. After the sun set, the lighting was provided using electric florescent lamps (40 watts). During the first two weeks those lamps were used as source of heat for warming the chicks as well.

Chemical composition and preparation of molasses

The molasses was brought from Algenaid Sugar Company in central Sudan. Molasses is a thick and heavy brown liquid by-product of the sugar refining industry. Samples of molasses were collected and subjected to proximate analysis according to (AOAC, 2005) (Table 1). The incorporation of the molasses in ration was done through traditional method. All ingredients were initially mixed together, and then the calculated amounts of molasses were added and gently mixed with them. Then each prepared and mixed ration was spread on separate wide plastic sheets for drying within 2 – 3 days. Each dried ration was then collected separately in a plastic sac after the large clumps has been crushed.

Table 1: The chemical composition of sugar cane molasses

Items	Molasses
DM %	72.60
Crude Protein %	3.90
Crude Fibre %	0.00
Fat %	0.14
Ash%	12.22
NFE%	57.02
ME* (MJ/kg)	11.00

*ME was calculated according to the modified equation of (Ellis, 1981).

Experimental diets

The experimental diets were formulated iso-energetic and iso-nitrogenous to meet or exceed the requirements of broilers according to (NRC, 1994). The experimental diets were based on sorghum and groundnut meal as main sources of energy and protein, respectively. The levels of dietary inclusion of molasses in the current experiment were 0, 10 and 24%. Table 2 and 3 showed the calculated and determined composition of experimental diets which were used during the starter and finisher, respectively. During the entire experimental period, feed and water were offered *ad libitum*.

Experimental design

A (2 X 3) factorial arrangement was used in a completely randomized design to study the effect of two sexing patterns (male and unsexed chicks) and three levels of molasses (0, 10 and 24%) on broiler performance and carcass characteristics. A total of 6 treatments were employed and each treatment was replicated three times with six birds each. The control treatment consisted with unsexed birds fed on 0% of molasses.

The 10% and 24% were adopted in this experiment as higher levels because the data concerning the highest level causing laxative droppings is contradict.

Table 2: The composition and analysis of experimental diets (% as fed) containing different levels of molasses during starter period (0 -21 days)

Ingredients	Levels of molasses		
	0%	**10%**	**24%**
Sorghum	64.0	54.0	40.0
Groundnut cake	16.1	16.1	3.6
Wheat bran	7.0	2.5	0.3
Molasses	0.0	10.0	24.0
Meat meal	5.4	8.7	22.2
Super- concentrate [1]	5.0	5.0	5.0
Di-calcium phosphate	0.4	0.4	0.4
Sodium chloride	0.2	0.2	0.2
Vegetable Oil	1.5	2.7	3.9
Premix[2]	0.4	0.4	0.4
Total	100	100	100
Calculated analysis			
ME[3] (Kcal/kg)	3233.9	3203.3	3149.5
Protein (%)	24.2	24.2	23.9
Analyzed			
ME Kcal/kg	2988	2933	2873
Protein (%)	21.2	21.7	21.1

Super-concentrate provided the following as percentage: 40 CP, 3.9 fat, 1.44 fibre, 10 Ca. 6.4 nonphytate P, 3.0 methionine and 10 lysine. Also supplied 1950 ME kcal/kg.[2]Vitamin - mineral premix provided the following per kilogram of diet: Vitamin A (retinyle acetate), 10,000 IU; cholecalciferol, 2,500 IU;"-tocopheryl acetate, 60 mg; mendione sodium bisulfite complex, 15 mg; thiamine hydrochloride, 2 mg; riboflavine, 8 gm; pyridoxine hydrochloride, 4 mg; cyanocobalamin, 0.04 mg; pantothenic acid, 15 mg; nicotinic acid, 40 gm; folic acid, 1.5 mg; biotin, 0.2 mg;choline chloride, 200 mg; iron, 50 mg; manganese, 50 mg; copper, 10 mg; zinc, 50 mg; calcium, 352 mg; iodine, 1.46 mg; cobalt, 0.5 mg; selenium, 0.2 mg.Values and metabolizable energy calculated according to (Ellis, 1981).

Table 3: The composition and analysis of experimental diets (% as fed) containing different levels of molasses during finisher period (22 -42 days)

Ingredients	Levels of molasses		
	0%	**10%**	**24%**
Sorghum	65	54.5	40
Groundnut cake	10.4	11.0	3.2
Wheat bran	16.1	11.3	6.3
Molasses	0.0	10.0	24.0
Meat meal	1.0	4.0	15.0
Super- concentrate [1]	5.0	5.0	5.0
Di-calcium phosphate	0.4	0.4	0.4
Sodium chloride	0.2	0.2	0.2
Vegetable Oil	1.5	3.2	5.5
Premix[2]	0.4	0.4	0.4
Total	100	100	100
Calculated analysis			
ME[3] (Kcal/kg)	3247.8	3243.3	3244.9
Protein (%)	20.3	20.4	20.4
Analyzed			
ME Kcal/kg	3123.1	3111.6	3143.1
Protein (%)	20.3	21.4	22.5

[1]Super-concentrate provided the following as percentage: 40 CP, 3.9 fat, 1.44 fibre, 10 Ca. 6.4 nonphytate P, 3.0 methionine and 10 lysine. Also supplied 1950 ME kcal/kg.[2]Vitamin - mineral premix provided the following per kilogram of diet: Vitamin A (retinyle acetate), 10,000 IU; cholecalciferol, 2,500 IU;"-tocopheryl acetate, 60 mg; mendione sodium bisulfite complex, 15 mg; thiamine hydrochloride, 2 mg; riboflavine, 8 gm; pyridoxine hydrochloride, 4 mg; cyanocobalamin, 0.04 mg; pantothenic acid, 15 mg; nicotinic acid, 40 gm; folic acid, 1.5 mg; biotin, 0.2 mg;choline chloride, 200 mg; iron, 50 mg; manganese, 50 mg; copper, 10 mg; zinc, 50 mg; calcium, 352 mg; iodine, 1.46 mg; cobalt, 0.5 mg; selenium, 0.2 mg.[3]Values and metabolizable energy calculated according to (Ellis, 1994).

Parameters measured

Feed consumption and weight gain were measured and feed conversion ratio (FCR) was calculated. At the end of the experiment, two birds from each pen were selected according to their closed to the average weight of the birds in the particular pen and slaughtered. The slaughtered birds were feather plucked, and the head and shanks were removed. Carcass weight and weights of abdominal fat pad, heart, spleen, pancreas, and proventriculus, liver and empty gizzard were recorded using electronic sensitive balance. All weights were expressed in relative to live body weight. The length of intestinal tract was measured using tape scale. Two blood samples from each pen were collected from the jugular vein immediately after slaughtering the birds into containers for analysis of protein, potassium, cholesterol and triglyceride. Blood samples were centrifuged for 10 minutes (Hetlich EBA 20 – Germany) at 2000 *rpm* at room temperature and then serum samples were collected and stored at -20 C° for later analysis. All tested blood cholesterol; blood protein; triglyceride and potassium were determined by spectrophotometer using commercial kits. Blood parameters values were expressed as milligrams per 100ml. Economical study have been carried out to evaluate the feasibility of using the dietary inclusion of sugar cane molasses.

Statistical analysis

Experimental data presented as mean ± standard errors of the mean. Statistical analyses were carried out by using Statistical Package for Social Science 11.0 (SPSS, 2010). The significance of the differences among means has been determined by Duncan's multiple range tests (Petrie and Watson, 1999).

Results

Broiler performance during entire experimental period

Table 4 showed the influence of dietary inclusion of molasses and sexing on broiler performance during overall period (1- 42 day of age). Molasses treatment affected the weight gain and feed consumption in similar pattern. The greatest feed consumed and the highest weight gain was observed in group of birds consumed diets incorporated with 24% of molasses. No significant (P > 0.01) differences between control and 10% treatment in weight gain and feed consumption. The birds consumed diets containing 24%molasses and control had the best FCR. Males (m) were better in weight gain and feed consumption than unsexed birds (un), while FCR was not affected by sexing. There were interaction effects between molasses and sexing treatments on weight gain and FCR (P < 0.01).Whereas the feed consumption was not affected (P > 0.05). The interaction explains that males gained more weight as the dietary level of molasses increased. While the unsexed birds had higher weight gain when fed diets containing 0 and 24% molasses. Moreover, the results showed similar pattern of interaction effect for FCR. The best weight gain was recorded with (24% m) treatment while the lowest weight gain value was recorded with (10% uns) treatment.

Blood parameters

Table 5 showed the influence of dietary inclusion of molasses and sexing on some broiler blood constituents. Significant higher level of total blood protein was observed with birds fed 24% molasses while the lowest values were recorded with birds fed on control and 10% molasses diets (P < 0.01). In contrast, birds fed on diets containing molasses had higher cholesterol content when compared with birds fed on diet free of molasses (P < 0.01). The highest level of blood triglyceride was recorded with birds fed diet without molasses. There were no significant differences (P > 0.05) between 10% and 24% treatments in blood triglyceride. On the other hand, the greater potassium level was observed with birds fed on 10 and 24% molasses treatment. Sexing had no significant effect on blood constituents (P > 0.05). Moreover, there were no interaction effects between molasses and sexing treatment on blood constituents.

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Table 4 : Effect of dietary incorporation of sugar cane molasses and sexing on average daily feed consumption, average daily weight gain and FCR in overall period (1-42 d of age).

Treatments	**Feed Consumption (g)**	**Weight gain (g)**	**Feed Conversion ratio (g:g)**
0% m 1	123.00	64.00	1.90
0% uns 2	117.00	66.00	1.80
10% m 3	123.00	68.00	1.80
10% uns 4	114.00	61.00	1.90
24% m 5	128.00	72.00	1.80
24% uns 6	12200	68.00	1.80
SEM	1.11	0.59	0.02
Molasses effect			
0%	120.00[b]	65.00[b]	1.70[a]
10%	119.00[b]	65.00[b]	1.90[b]
24%	125.00[a]	70.00[a]	1.70[a]
SEM	0.78	0.42	0.03
Sig	**	**	**
Sexing effect			
Male	125.00[a]	68.00[a]	1.80
Unsexed	118.00[b]	65.00[b]	1.80
SEM	0.63	0.34	0.02
Sig	**	**	N.S
Molasses X sexing	NS	**	**

[a,b] Mean values within a column with no common superscript differ significantly (P < 0.05).
**= (P < 0.01). NS= not significant

Table 5: Effect of dietary incorporation of sugar cane molasses and sexing on blood constituents for overall period (1-42 d of age).

Treatments	**Cholesterol (g/dl)**	**Triglyceride (%)**	**Total protein (g/dl)**	**Potassium ppm**
0% m 1	100.42	37.30	2.4	4.95
0% uns 2	111.40	36.10	2.5	4.62
10% m 3	131.40	25.10	2.6	6.30
10% uns 4	201.30	28.20	2.8	5.90
24% m 5	149.00	31.40	3.2	6.30
24% uns 6	128.70	22.00	3.2	6.10
SEM	18.13	4.16	0.13	0.51
Molasses effect				
0%	105.90^{b}	36.70^{a}	2.50^{B}	4.80^{b}
10%	166.4^{a}	26.60^{b}	2.70^{B}	6.12^{a}
24%	138.9^{ab}	26.70^{b}	3.2^{A}	6.19^{a}
SEM	12.8	2.94	0.09	0.36
Sig	**	*	**	*
Sexing effect				
Male	126.9	31.3	2.73	5.9
Unsex	147.1	28.7	2.80	5.5
SEM	10.47	2.40	0.08	0.29
Sig	NS	NS	NS	NS
Molasses X sexing	NS	NS	NS	NS

^{a,b} Mean values within a column with no common superscript differ significantly (P < 0.05). .^{A,B} Mean values within a column with no common superscript differ significantly (P < 0.01).

NS= not significant (P>0.05). **= (P<0.01); *= (P< 0.05)

Slaughter measurements

Table 6 showed the impact of dietary inclusion of molasses and sexing on broiler internal organs. There were no significant effects (P > 0.05) of sexing treatment on all internal organs (P < 0.05). There were no significant effects of dietary molasses incorporation treatment on all internal organs. The only exception was observed with gizzard weight (P< 0.01). Birds fed on control diets had the largest gizzard, while 10 and 24% molasses treatments had the lowest values.

Moreover, Table 6 showed that no interaction effect between sexing and dietary molasses inclusion treatment on all internal organs, except for pancreas weight. When inclusion of dietary molasses increased the pancreas weight of male increased. In contrast, the pancreas weights of unsexed birds decreased. Table 7 showed the influence of dietary inclusion of sugar cane molasses and sexing on carcass cuts. There were significant effects of experimental treatments on final live body weights. Dietary molasses level had significant effects on broilers final body weight. When dietary inclusion of molasses increased, the final body weight increased ($P < 0.05$). Males had the greatest body weights ($P < 0.05$). Carcass, thigh, drumstick and breast weights were not affected by experimental treatments. There were no significant effects ($P > 0.05$) of sexing treatments. The only exception was observed with head weight ($P < 0.05$). Significant differences were reported ($P < 0.05$) for the head weights among dietary molasses levels. Molasses levels of (0 and 24%) had the highest head weights. The birds fed with 10% molasses reported the lowest head weight. Birds sexing treatment had no significant impact on head weight ($P > 0.05$). Shanks weight was not affected by dietary inclusion of molasses. However, male birds recorded the largest shanks' weights ($P < 0.05$). No interaction effect between sexing and molasses treatments on all carcass cut except the thigh weight which was affected significantly ($P < 0.05$).

Discussion

Broiler performance during entire experimental period

The significant difference ($P < 0.01$) in feed intake between the highest molasses level group and the control group was in agreement with the results reported by several researchers. Sharma and Paliwal (1973) reported that there was a significant increase in feed consumption when the molasses levels increased in layer rations. Abdel Rahman (1984) and Elshreef (2010) noticed that the higher feed intake associated with higher inclusion of molasses in the rations when compared with the control. The low energy content of the molasses compared to the sorghum grains lead to higher intake of rations containing molasses, because chicken feed intake is affected by the energy density of the feed. However, the results reported in the current study were contradicting to those obtained by Cuervo *et al.*, (1972) who demonstrated a negative effect of molasses addition to broiler chickens feed on feed consumption. This contradiction may be due to the levels of molasses used. The main problem of feeding high level of molasses laxative effect resulting from its higher potassium content (Leeson and Summers, 2005). Also, Cuervo *et al.*, (1972) concluded that extra use of K increased the diarrhea in the broiler chickens. No incidence of laxative effect of molasses in all experimental levels used in the current experiment was observed. Based on that, it could be included up to 24%. Ricci *et al.*, (1980) reported insignificant difference ($P > 0.05$) in feces moisture in conjunction with the addition of different levels of molasses and they suggested that molasses can be used at 15% and 20% in the finishing diet of broiler chickens. These findings agreed with the results of the current study. During the entire experiment, males significantly ($P < 0.01$) had greater weight gain than females. The greatest weight gain values were observed with the group fed on diet containing 24% molasses when compared to groups fed with diets containing 0 and 10% molasses.

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Table 6: Effect of dietary incorporation of sugar cane molasses on relative weights of internal organs

Treatments	Heart (%)	Liver (%)	Gizzard (%)	Small intestine(%)	Spleen (%)	Pancreas (%)	Abdominal fat pad (%)	Proventriculus (%)
0% m	0.47	1.5	1.9	3.9	1,6	1.8	1.4	0.96
0% uns	0.47	1.8	1.9	3.7	1.7	1.4	1.6	0.85
10% m	0.51	1.8	1.5	3.7	1.3	1.4	1.4	0.55
10% uns	0.56	1.6	1.7	3.5	1.6	1.9	1.5	0.55
24% m	0.47	1.7	1.5	4.2	1.5	1.7	1.5	0.62
24% uns	0.54	1.9	1.6	3.9	1.7	1.8	1.5	1.10
SEM	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.20
Molasses effect								
0%	0.47	1.6	1.9^{A}	3.9	1.6	1.6	1.5	0 .77
10%	0.54	1.7	1.6^{B}	3.6	1.4	1.6	1.4	0.55
24%	0.51	1.8	1.5^{B}	4.0	1.6	1.7	1.5	0.83
SEM	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1
Sig	NS	NS	**	NS	NS	NS	NS	NS
Sexing effect								
Male	0 .49	1.7	1.6	3.9	1.5	1.6	1.4	0.62
Unsexed	0.52	1.8	1.7	3.7	1.6	1.7	1.5	0.81
SEM	0.04	0.1	0.1	0.1	0.1	0.1	0.1	0.12
Sig	NS	NS	NS	NS	NS	NS	NS	NS
Molasses X sexing	NS	NS	NS	NS	NS	**	NS	NS

[a,b]Mean values within a column with no common superscript differ significantly (P < 0.05). [A,B]Mean values within a column with no common superscript differ significantly (P < 0.01). NS= not significant. **= (P < 0.01); *= (P< 0.05).

Table 7: Effect of dietary incorporation of sugar cane molasses and sexing on broiler final body weight, carcass weight and relative weights of carcass cuts.

Treatment	Final body wt (g)	Carcass wt (g)	Head (%)	Shanks (%)	Thigh (%)	Drumstick (%)	Breast (%)
0% m	2730	1876	6.56	3.53	9.36	3.53	19.1
0% uns	2753	1908	6.44	2.91	10.0	2.89	18.6
10% m	2939	2033	6.11	3.56	10.2	3.08	19.8
10% uns	2727	1910	5.98	3.31	8.90	2.95	19.3
24% m	3040	2074	6.74	3.49	9.97	3.39	20.6
24% uns	2838	1947	6.52	3.50	9.79	2.64	20.4
SEM	67.7	52.3	0.22	0.17	3.66	0.79	0.83
Molasses effect							
0%	2742^{b}	1892	6.50^{a}	3.22	9.68	3.21	18.90
10%	2833^{ab}	1972	6.04^{b}	3.44	9.56	3.01	19.50
24%	2939^{a}	2011	$6,63^{a}$	3.51	9.88	3.02	20.50
SEM	47.9	37.0	0.15	0.12	0.26	0.56	0.59
Sig	*	NS	*	NS	NS	NS	NS
Sexing effect							
Male	2903^{a}	1995	6,47	3.53^{a}	9.85	3.34	19.8
Unsex	2772^{b}	1921	6.32	3.24^{b}	9.57	2.83	19.4
SEM	39.1	30.2	0.13	0.10	0.21	0.46	0.48
Sig	*	NS	NS	*	NS	NS	NS
Molasses X sexing	NS	NS	NS	NS	*	NS	NS

[a,b]Mean values within a column with no common superscript differ significantly (P < 0.05). .[A,B]Mean values within a column with no common superscript differ significantly (P < 0.01). NS= not significant (P >0.05). **= (P < 0.01); *= (P< 0.05).

These results were in agreement with those reported by Elshreef (2010) who reported that a high significant difference (P < 0.05) in body weight gain was due to higher molasses intake. Elgilani (2007) reported that when the levels of dietary inclusion of molasses increased the weight gain of broilers increased. Although, they have used lower levels of molasses (0, 5, 10 and 15%), the positive effect of these treatments on weight gain was obviously clear. Robbin (1981) concluded that the growing broiler chickens utilized carbohydrates especially dextrose more efficiently than fat. So, the higher weight gain could be justified by higher utilization of energy. For overall experimental period, males were greatest than unsexed broilers in weight gain. Males are differing from females due to their different requirements. Dietary requirements of lysine, methionine, and threonine are higher for males than for females from 0 to 3 wk of age (Thomas *et al*., 1986; Thomas *et al* 1987; Han *et al*., 1993). Penz*et al*. (1997) noticed that the threonine requirement for maximum growth for male broilers estimated by 0.70% of the diet for the finisher period, whereas 0.60% was enough for female broilers. This difference in amino acid response between sexes is due to whole body composition, and males have greater deposition of protein (Han *et al*., 1993). The feed conversion ratio was not influenced by sexing treatment during entire experimental period. The results of the current study agreed with the findings of Elgilani (2007), who reported that the dietary inclusion of molasses of 15% were better in FCR for broiler. These results may be attributed to higher palatability and digestibility of molasses which reflected in the higher feed consumption and weight gaining**.**

Blood parameters

Blood chemistry is to some extent affected by the type of feed consumed by the animal. It was very clear that the addition of molasses increased significantly (P <0.01) the level of the serum cholesterol of the broiler chickens (105 vs 166 for control and molasses treatments, respectively). This result agreed with Elshreef (2010) who reported an increased in serum cholesterol as the level of molasses increased (168 vs 250 for control and molasses treatment, respectively). The blood K was significantly (P<0.05) increased as the level of dietary molasses increased. This may be attributed to the high molasses potassium content. Leeson and Summers (2005) reported that the higher content of potassium in molasses has laxative effect for broiler chickens. In the current research no incidence of laxative effect when using molasses up to 24%. Accordingly, it could be concluded that molasses inclusion up to 24% is optimal level to be an alternative energy source.

Slaughter measurements

The final live body weights of the broiler chickens were significantly (P <0.05) affected by the different levels of molasses. The group that received the higher levels of molasses had the highest final live body weights. The high dietary energy will substantially lead to fat deposition and consequently to obesity and heavy weight. Males had heaviest final body weights than unsexed birds. It was clear that, the (24% molasses level and male) treatment scored the highest body weight and carcass. Although the breast, thigh and drumstick were not affected by dietary molasses and sexing, the treatment (24% molasses level and males) numerically scored good records. The liver weight of the broiler chickens showed no significant differences (P > 0.05) among the different treatments. Nevertheless, the 24% molasses group numerically had the heaviest liver weight and the control group had the lightest liver weight. This may be attributed to the fact that the molasses contains more sugars and minerals that need to be metabolized, stored and execrated by the liver which eventually resulted in heavy liver. The current study concluded that, the sugar cane molasses could be used as alternative energy source up to 24% in broiler diets without negative impact in performance and broiler males were advisable to be adopted for commercial broiler production than unsexed one.

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