EVALUATION OF USING SOME UNTRADITIONAL ENERGY SOURCES IN BROILER CHICKEN DIETS ON PERFORMANCE, CARCASS CHARACTERISTICS AND ECONOMIC EFFICIENCY: 2- SCRAPE CRUDE CORN OIL

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SUMMARY

A total number of 180 unsexed 7 days old Hubbard broiler chicks were used in this study to assessment of using scrape crude corn oil (SCCO) as an alternative energy source in broiler diets on growth performance, carcass characteristics and economic efficiency. Chicks were divided randomly into six equal treatments (30 birds each). The experiment lasted from 7 to 40 days-old and contained 6 treatments diets which contained different levels of (SCCO) 0, 20, 40, 60, 80 and 100%, respectively. Results of this experiment showed that, no significant differences between experimental treatments for live body weight (LBW) and daily weight gain (DWG) during the experimental periods. There were no significant differences among treatments for daily feed consumption (DFC) and feed conversion ratio (FCR) during the experimental period. There was no significant effect in carcass traits among treatments. The results showed that the feed price of the diet decreased as the inclusion level of (SCCO) increased as compared to the control group. The relative economic efficiencies of the diets containing 60, 80 and 100% SCCO were higher than other groups. It can be concluded that, scrape crude corn oil can be completely replace corn oil in broiler diets from 7 to 40 days of age without adversely affecting on broiler performance, carcass characteristics and improved relative economic efficiency.

Keywords: *Chicks, scrape crude corn oil, performance, carcass and economic efficiency.*

INTRODUCTION

Fats and oils are chemically diverse group of compounds, which have the highest energy density among all macro nutrients. Other than having high caloric qualities, they are real sources of fundamental unsaturated fats (ω-3 and ω-6), fat dissolvable vitamins (A, D, E and K) and lecithin. Scott *et al.* (1982) concluded that the net amount of energy obtained by chicks is 60% of the ME (Kcal/Kg) of proteins, 75% of the ME (Kcal/Kg) of carbohydrates, and 90% of the ME (Kcal/Kg) of fats, underscoring the high effectiveness of ME (Kcal/Kg) contributed by fat.

In this respect, several authors had compared effect of dietary inclusion of corn oil with different type of fat from various sources. Thus, Hubert *et al.* (2000) showed that, chicks fed 8% corn germ oil sludge (CS) did not differ in weight gain and feed conversion from those fed 4% beef tallow (BT) or the free fat (control) diets. Also, Sadeghi *et al.* (2012) found no significant effect ($P > 0.05$) on body weight, daily gain, daily feed intake and feed conversion ratio of broiler chicks due to feeding on 5% of either corn oil as a control fat source or fish oil as a tested fat source. Similar trend was found on Japanese quail (Attia *et al.,* 2006 and Hamady 2012), Silver Montazah growing chicks (Ibrahim, 2005) and laying hens (Whitehead *et al.,* 1993; Whitehead, 1995).

To our knowledge and based on the available literatures, dietary addition of either traditional or untraditional fat sources in poultry diets did not affect the carcass traits. lara *et al.* (2006) carried out an experiment to assess the impact of various fat sources of diets (soybean oil, poultry fat, acidulated soybean oil soapstock and a blend of soybean oil in addition to poultry fat and soybean oil in addition to acidulated soybean oil soapstock) on carcass yield of broilers. Their results showed that lipid sources do not influence the carcass yield, viscera, cuts (breast and thigh) and percentage of abdominal fat ($P > 0.05$). Furthermore, Alizadeh *et al.* (2012) investigated the impact of two different levels (3 and 6%) of sunflower oil and acidulated sunflower oil soap stock (as a waste of plant oil production) on carcass

characteristics. Who showed that, there were no significant differences on carcass weight percent in all treatments.

Moreover, Balevi *et al.* (2001) reported that costs for acidulated sunflower soapstock (ASS), sunflower soapstock (SS) and volatile matters (VM) groups were calculated as a proximally 10 % lower than the cost of crude sunflower oil (CSFO). Likewise, Ibrahim *et al.* (2014) concluded that both palm oil (PO) as traditional fat sources and distillated fatty acids (DFA) as untraditional fat sources recorded the best economic efficiency compared with soybean oil (SBO) and other untraditional fat sources either fatty acids or dry fat (contained 30% fatty acids, 30% distillated fatty acids and 40% wheat bran as a carrier). On the other hand, Antunes *et al.* (2016) reported that corn oil diets showed worse values for feed cost per kilogram of live weight and the indexes of economic efficiency ($P < 0.05$) when compared to diets with soybean oil. The objective of this study was to evaluate the growth performance, carcass characteristics and economic efficiency of broilers fed scrape crude corn oil (SCCO) as an alternative energy sources in comparison to a control group fed a corn-soybean basal diet.

MATERIALS AND METHODS

This study was conducted at the Poultry Nutrition Farm, Poultry Production Department, Faculty of Agriculture, Ain Shams University, Shoubra El-kheima, Qalubia Governorate and laboratories of the Regional Center for Food and Feed, Agriculture Research Center, Giza Governorate, Egypt. 180 seven day old Hubbard broiler chicks were allocated randomly into 6 treated group with three replicates of 10 birds each. Six diets (Table 1) were formulated according to NRC (1994). The experimental diets were T1 containing corn oil (control) and T2-6 replacing 20, 40, 60, 80 and 100% of corn oil by scrape crude corn oil (SCCO), respectively. All chicks were reared under similar environmental, managerial and hygienic conditions. Feed and water were offered ad – libitum.

During all experimental period (7 – 40 days), productive performance: live body weight (LBW), daily weight gain (DWG), daily feed consumption (DFC), feed conversion ratio (FCR) and mortality rate were recorded and calculated for all birds in the various dietary treatments. At the end of the experiment (40 days of age), five birds representing each treatment were randomly assigned to be slaughtered, then carcass weight, giblets (liver, gizzard and heart) weight, bursa and spleen weight were recorded and calculated as percentages of live body weight.

Economic efficiency of broiler production was calculated from the input – output analysis which was calculated according to the price of experimental diets, body weight and feed cost (North, 1981).

Statistical analysis:

Collected data were subjected to statistical analysis as a one – way classification analysis of variance using the general liner modal procedure of **SAS, (2005)**. Duncan's Multiple Range Test **(Duncan, 1955)** was used to separate means when the dietary treatments effect was significant according to the following model: $Yij = \mu + Ti + eij$

Where:

Y_{ij} = the j observation of the i^{th} treatment;

μ = an effect of overall mean;

T_i = a fixed effect of i^{th} feeding treatment;

ε_{ij} = a random experimental error assumed NID $(0, \sigma e^2)$

The composition and calculated analysis of the experimental diets are presented in Table (1).

Table (1): Composition and calculated analysis of the experimental diets.

Ingredient%	Dietary treatment					
	7-21 days		22-35 days		36-40 days	
	Control C	100% SCCO	Control C	100% SCCO	Control C	100% SCCO
Yellow corn (7.7% CP)	53	54.2	56.1	58.2	60	63
Soybean meal (44 % CP)	35	31.4	33	26.8	28.1	20.4
Corn gluten meal (65.3% CP)	4.7	7	2.8	6.9	4.5	9
Scrape crude corn oil (SCCO)	0	3	0	4	0	4
Corn oil	3	0	4	0	4	0
Dicalcium phosphate	1.92	1.96	1.75	1.8	1.17	1.37
Limestone	1.24	1.24	1.37	1.4	1.38	1.28
Salt (Na cl)	0.3	0.3	0.3	0.3	0.3	0.3
Premix**	0.3	0.3	0.3	0.3	0.3	0.3
L-Lysine	0.25	0.3	0.18	0.15	0.1	0.2
DL- Methionine	0.29	0.3	0.2	0.15	0.15	0.15
Total	100	100	100	100	100	100
Calculated analysis***						
ME (Kcal/Kg)	3042.73	3025.64	3121.01	3081.91	3200.02	3180.41
CP %	23.020	23.096	21.001	21.047	20.130	20.032
Calorie/Protein Ratio (C/P)	132.14	131.0	148.6	146.4	158.96	158.7
Calcium %	1.051	1.052	1.053	1.061	0.905	0.895
Available phosphorous %	0.502	0.505	0.466	0.468	0.355	0.382
Lysine%	1.470	1.439	1.330	1.164	1.133	1.058
Methionine %	0.670	0.694	0.545	0.522	0.498	0.522
Meth. + Cys. %	1.073	1.103	0.915	0.905	0.861	0.894

** Chemical composition of Scrape crude corn oil (SCCO): 6630 ME (Kcal/kg), 4.2% (Moisture), 0.13 (CP), 11.87% (EE), 0.6 (ASH), 171 mg/l (Ca), 1232 mg/l (P), 155 mg/l (Na) and 200 mg/l (Mg).*
Treatments contained 0%, 20%, 40%, 60%, 80% and 100% replacing corn oil with SCCO.
*** Composition of vitamin and minerals premix. Each 3 kg. of premix includes: 12000000 I.U. VIT. A, 2000000I.U. VIT. D3, 10000 mg. VIT. E, 2000 mg. VIT. K3, 1000 mg. VIT. B1, 5000 mg. VIT. B2, 1500 mg. VIT. B6, 10 mg. VIT. B12, 10000 mg Pantothenate acid, 30000 mg. Nicotinic acid, 1000 mg. Folic acid, 50 mg. Biotin 60000mg. Mn, 80 mg. Zn, 50000 mg. Iron, 30000 mg. Cu, 10000 mg. Iodine , 1000 mg. Se 100 mg, cobalt 100 mg, carrier (CaCo3) add to 3 Kg.*
**** Calculated analysis of the experimental diets was done according to (NRC, 1994).*

RESULTS AND DISCUSSION

Productive performance

The effects of different dietary scrape crude corn oil (SCCO) levels on live body weight (LBW), daily weight gain (DWG), daily feed consumption (DFC) and feed conversion ratio (FCR) of broiler chicks from seven till 40 days old are presented in Table(2). Results showed that, the differences in LBW, DWG, DFC and FCR between chicken fed the control treatment and those fed scrape crude corn oil (SCCO) at replacement levels from 20 up to 100% were not significant (P>0.05). It is obviously noted that, the initial live body weight (LBW) of chicks at seven days old were nearly similar in all experimental treatments, ranged from 137.87 to 142.83 g. At the end of the experimental period (40 day old), birds fed on diets with (T2) 20% scrape crude corn oil (SCCO) were the highest in LBW and BWG, followed by those fed control diets (T1) compared with the other treatments. This result is in agreement with Hubert *et al.* (2000) who showed chicks fed 8% corn germ oil sludge (CS) did not differ in weight gain and feed conversion from those fed 4% beef tallow (BT) or the free fat (control) diets. In the same order, Sadeghi *et al.* (2012) in broiler and Hamady, (2012) in Japanese quail, who found no significant effect (P > 0.05) on body weight, daily gain and feed conversion due to feeding corn oil compared with either fish oil or soybean oil, respectively. Similarly, in a series of experiments conducted on male Ross broilers, Kessler *et al.* (2009) found no effect on weight gain and feed conversion when used corn oil (CO), acid corn oil

(ACO), linseed oil (LO) or coconut fat (CoF) in starter diets from one to nine day old in an experiment, and when used corn oil (CO), linseed oil (LO), coconut fat (CoF), soybean soapstock (SBS), acid soybean oil (ASO), or acid cottonseed oil (ACtO) in another experiment from 1 to 20 day old.

Daily feed consumption (DFC) values during the overall experimental period (7 – 40 days), birds group on diet containing 100% SCCO had significantly highest feed consumption/bird/day being, 90.27g, comparable to the bird fed on group. This might be due to the fact that CO contained higher energy compared to the other fat source (SCCO) and decreased feed consumption could be related to the fact that birds met their energy requirements by increasing feed consumption. According to Leeson and Summers (1991), birds have the ability to meet their energy requirements to certain extent by increasing feed consumption. Similar result was observed by Ali *et al.* (2014) who found that feed consumption was significantly increased by feeding distillated fatty acids (DFA) or (FA plus DFA) compared with those fed sunflower oil (SFO) or fatty acids (FA).

Table (2): Effect of replacing corn oil (CO) with different dietary scrape crude corn oil (SCCO) levels on live body weight, body weight gain, daily feed consumption and feed conversion ratio of broilers.

Items	100 % (CO) 0 % (SCCO) T_1	80 % 20% T_2	60 % 40 % T_3	40 % 60 % T_4	20 % 80% T_5	0 % 100 % T_6	Sig.
Live body weight (LBW) (g):							
7 days	137.87 ± 3.33	140.10 ± 3.38	140.89 ± 1.60	142.83 ± 2.18	140.29 ± 2.68	140.10 ± 2.43	NS
40 days	1987.93 ± 47.09	2008.24 ±55.9	1948.20 ± 69.3	1977.33 ± 37.17	1888.78 ± 29.8	1978.0 ± 51.21	NS
Daily weight gain (DWG) (g / day):							
7- 40 days	56.06 ± 1.15	56.61 ± 1.46	54.77 ± 1.73	55.59 ± 0.89	52.98 ± 0.71	55.71 ± 1.28	NS
Daily feed consumption (DFC) (g / day):							
7- 40 days	81.82ab ± 2.58	88.34a ± 3.74	88.22a ± 1.72	84.22ab ± 3.98	77.11b ± 2.60	90.27a ± 1.90	*
Feed conversion ratio (FCR):							
7- 40 days	1.46 ± 0.01	1.56 ± 0.08	1.61 ± 0.07	1.50 ± 0.08	1.46 ± 0.06	1.62 ± 0.05	NS
Mortality numbers	2	1	2	2	2	3	

*a, b Means within the same row with different superscripts are significantly different, Sig. = Significance, NS = Not significant, * (P≤0.05).*

Recently, Ayed *et al.* (2015) showed that feeding broiler chicks through 38 day trail on traditional oil sources whether, palm oil or soybean oil at 3% did not significantly affect feed consumption during the starter phase (1-16) day and thereafter.

Mortality rate

The current finding showed that mortality numbers were recorded 2, 1, 2, 2, 2 and 3, for treatment groups respectively between treatments from 0% to 100% SCCO, indicating that mortality numbers did not show any significant differences between the treatment groups and control one.

Carcass characteristics

Results presented in Table (3) showed that, insignificant (P≥0.05) differences were observed for the carcass weight and edible part weight percentages among all treatments, birds fed diet containing 100 % SCCO recorded the highest values being; 71.33% and 75.34%, respectively. While birds received 20 % SCCO had lowest percentages; 66.41 and 70.55, respectively. But these values did not significantly effect. Concerning the percentage of giblets (liver, heart and gizzard) as well as lymphoid organ relative

weights percentage the achieved results coincided with the aforementioned with the lack of significance (P>0.05) among treatments, though the existence of superiority was performed for all SCCO treatments regardless of the supplant level in favor of the control one. In consistent with our findings, several authors found no significant effect on carcass traits of broiler chicks (lara *et al.*, 2006; Moraes *et al.,* 2009; Alizadeh *et al.*, 2012; Pekel *et al.,* 2013) and local chickens (Ali *et al.,* 2014) fed on different types of fat whether from traditional or from untraditional sources.

Table (3): Effect of replacing corn oil with different dietary scrape crude corn oil (SCCO) levels on carcass characteristics of 40 day old broiler chicks.

Item%	100% (CO) 0% (SCCO) T_1	80 % 20 % T_2	60 % 40 % T_3	40 % 60 % T_4	20 % 80 % T_5	0% 100 % T_6	Sig.
Caracas weight	69.26 ± 1.06	66.41 ± 1.30	66.7 ± 3.34	68.16 ± 1.76	67.04 ± 2.38	71.33 ± 1.13	NS
EP weight	73.30 ± 1.20	70.55 ± 1.25	71.05 ± 3.58	72.28 ± 2.03	71.25 ± 2.57	75.34 ± 1.27	NS
Giblets	4.14 ± 0.14	4.14 ± 0.13	4.35 ± 0.16	4.12 ± 0.27	4.21 ± 0.25	4.01 ± 0.11	NS
Liver	2.02 ± 0.14	1.83 ± 0.16	1.95 ± 0.13	1.97 ± 0.16	1.93 ± 0.15	1.79 ± 0.10	NS
Heart	0.47 ± 0.06	0.53 ± 0.06	0.55 ± 0.05	0.44 ± 0.03	0.49 ± 0.01	0.53 ± 0.03	NS
Gizzard	1.53 ± 0.13	1.67 ± 0.05	1.72 ± 0.07	1.59 ± 0.10	1.67 ± 0.15	1.61 ± 0.05	NS
Bursa	0.15 ± 0.01	0.16 ± 0.01	0.18 ± 0.01	0.17 ± 0.01	0.16 ± 0.01	015 ± 0.01	NS
Spleen	0.12 ± 0.01	0.11 ± 0.01	0.13 ± 0.01	0.12 ± 0.01	0.11 ± 0.01	0.11 ± 0.01	NS

a, b Means within the same row with different superscripts are significant1y different. NS = Not Significant.
EP = Carcass weight + Giblets
Giblets = (Liver + Gizzard + Heart)

Economic evaluation

The calculation of economic efficiency in Table (4) showed that the feed price of the diet decreased as the inclusion level of scrape crude corn oil (SCCO) increased as compared to the control group. It can also be noticed that in the groups with a higher replacement level, broiler cost of feed was lower because the used SCCO as by-product is cheaper. With respect of economical point of view, the birds fed on diets containing SCCO at levels of 60, 80 and 100% had higher values of the relative efficiency percentage (106.25, 112.01 and 111.26; respectively) compared the control one. While, T2 (20% SCCO) and T3 (40% SCCO) had the lowest ones (97.34 and 96.23%). This result is similar **Ali *et al.* (2014)** showed that adding of fatty acid mixture or DF to local chicks' diet resulted in reducing of the calculated economic efficiency compared with addition of sunflower oil.

Table (4): Effect of replacing corn oil with dietary scrape crude corn oil (SCCO) levels on economic efficiency.

Item	100 % (CO) 0 % (SCCO) T_1	80 % 20 % T_2	60 % 40 % T_3	40 % 60% T_4	20 % 80 % T_5	0% 100% T_6
Price feed/Kg[1] (L.E.)	7.10	6.99	6.88	6.84	6.74	6.62
Total feed cost (L.E.)	18.05	18.77	18.09	16.79	14.73	16.05
Total costs[2]	35.05	35.77	35.09	33.79	31.73	33.05
Total revenus[3]	51.80	52.31	50.60	51.37	48.96	51.46
Net revenus[4]	33.75	33.53	32.52	34.58	34.23	35.41
Economic efficiency[5] (E.E.)	96.30	93.74	92.67	102.32	107.87	107.14
Relative efficiency[6]	100	97.34	96.23	106.25	112.01	111.26

[1]= based on average price of diets during the experimental all time.
[2]= Total costs= Total feed cost (L.E.) + Fixed cost (17 L.E.), while Fixed cost (price of labors, medication and electricity…etc.)
3= According to the local price of Kg LBW which was 28.00 L.E.
4= Net revenues per unit feed cost.
[5]= Net revenue/ total cost 100*
*[6]= R.E. (treatment)/ E.E. (control)*100*

CONCLUSION

It could be concluded from the present study that SCCO; as a kind of an oil industry by-product, could be used in broiler rations as untraditional energy source instead of the traditional ones, i.e., corn oil (CO) up to 100 % of SCCO without any adverse effects on broiler performance, carcass characteristics and improved the economic efficiency of broiler chicks.

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تقييم استخدام بعض مصادر الطاقة البديلة في علائق دجاج اللحم على الاداء الانتاجي و صفات الذبيحة و العائد الاقتصادي: 2- كواسح تنكات زيت الذرة

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*** المركز الاقليمي للاغذية و الاعلاف – مركز البحوث الزراعية – جيزة – مصر**

**** قسم انتاج الدواجن – كلية الزراعة – جامعة عين شمس –مصر**

استخدم 180 كتكوت هيبرد (غير مجنس) عمر 7 أيام لدراسة تأثير استبدال زيت الذرة بمخلفات كواسح تنكات زيت الذرة الخام على النحو التالي صفر % (كنترول) ، 20 ، 40 ، 60 ، 80 ، 100 % للمجموعات من (1 – 6) على التوالي في علائق كتاكيت التسمين على الاداء الانتاجي و صفات الذبيحة و العائد الاقتصادي.

أهم النتائج:

1. لم يتاثر الاداء الانتاجي للكتاكيت (الوزن الحي – معدل النمو اليومي – استهلاك العلف اليومي – معامل التحويل الغذائي) بالمعاملات المختلفة.
2. لم تتأثر صفات الذبيحة (% للذبيحة و % للجوانح (الكبد ، القانصة ، القلب)) بالمعاملات الغذائية المختلفة.
3. أوضحت الدراسة ان أفضل العلائق اقتصاديا من حيث الكفاءة النسبية هي العلائق المحتوية على 60 و 80 و 100 % استبدال من مخلف كواسح تنكات زيت الذرة الخام على التوالى مقارنة بالكنترول و المعاملات الاخري.

الخلاصة: يمكن استبدال زيت الذرة بكواسح تنكات زيت الذرة الخام في علائق كتاكيت اللحم بدون تأثيرات سيئة على الاداء الانتاجي و صفات الذبيحة مع افضل عائد اقتصادي بمعدل استبدال من 60 الى 100% 0