EVALUATION OF USING SOME UNTRADITIONAL ENERGY SOURCES IN BROILER CHICKEN DIETS ON PERFORMANCE, CARCASS CHARACTERISTICS AND ECONOMIC EFFICIENCY: 1- CAKE BY-PRODUCT.

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SUMMARY

A total number of 210 unsexed 7 days old Hubbard broiler chicks were used in this study to assessment of using cake by-products (CBP) as an alternative energy source in broiler diets on growth performance, carcass characteristics and economic efficiency. Chicks were divided randomly into seven equal treatments (30 birds each) contained 0%, 15%, 30%, 45%, 60%, 75% and 100% replacing yellow corn with CBP. Results of this experiment showed that, chicks' performance including live body weight (LBW), daily weight gain (DWG), daily feed consumption (DFC) and feed conversion ratio (FCR) didn't significantly differ between treatments at different periods and overall period. Carcass traits were not significantly affected among treatments. Economic study indicated that 100% CBP treatment is the most profitable diet among experimental diets. In conclusion, cake by-products (CBP) can be used with broiler chicks' diets without any negative effect on bird performance, carcass traits and improved the relative economic efficiency.

Keywords: *Chicks, cake by-products, performance, carcass and economic efficiency.*

INTRODUCTION

Waste product from bakeries had been considered as one of the non-traditional ingredients has been used in the last few years as an alternative energy source to substitute corn in poultry diets. The American Association of Feed Control Officials defined this ingredient under the official name of "dried bakery product" (DBP). The DBP is a mixture of surplus and unsalable materials (bread, cakes, crackers, rolls, cookies, pastries and even unbaked dough) collected from bakeries and other food processors. Moreover, the basic ingredients of bakery products are wheat flour, oil (mostly palm oil), salt, shortening, sugar, yeast, chemical leavening agents and bread improvers (Mousa *et al.,* 1992).

The DBP was also called bakery by- product (BBP). The BBP could replace corn for its relatively lower cost in poultry diet formulation. Further, some of these by-products may be due to fermentation processes thrown in the garbage, resulting in environmental pollution (EI-Yamny *et al.,* 2003; AI-Tulaihan *et al.,* 2004; Ragab *et al.,* 2006 and Afzalzadeh *et al.,* 2007).

Studies conducted on BBP revealed that it could be replaced up to 100% of corn in broiler chicks diet without any adverse effects on their productive performance, offering economic benefits for both bakery and poultry producers (Al-Ruqaie *et al.,* 2011; Torki and Kimiaee, 2011 and Ayanrinde *et al.,* 2014). Those authors added that, although the beneficiary of BBP as a good alternative source of energy, its high content of salt (NaCl) limits its use in poultry diet formulation. Also, Ayanrinde *et al.* (2014), Adeyemo *et al.* (2013), Zand and Foroudi (2011) and Ragab *et al.* (2006) concluded that, bakery by- products BBP can completely replace corn in broiler diets from day to 35 days of age without adversely affecting on carcass characteristics which included live body weight,carcass weight, edible offal (liver + heart + gizzard).

Moreover, Madiya *et al.* (2003) concluded that the use of BBP in broiler production resulted in a reduction of feed costs by nearly a third, and consequently had a positive impact on the total cost of production. In a line with these reports, Adeyemo *et al.* (2013), Al-Ruqaie *et al.* (2011) and Ragab et al. (2006) showed that costs of feed intake and feed for the production of a kg live weight of chickens at 35

days of age were significantly linearly diminished with substitution of either 20, 40, 60, 80 or 100% bakery waste product (BWP) instead of corn, when contrasted with those fed the control diet (0% BWP).

The aim of this present study was to assess the dietary inclusion of cake by-products (CBP) as alternative energy sources, on growth performance, carcass characteristics and economic efficiency of broiler chicks.

MATERIALS AND METHODS

The current study was carried out 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. Pretreatment of bakery by-product: tested (CBP) was pretreated before adding to experimental diets as follow: A quantity of (CBP) was brought from Edita Company (6^{th} October City, Giza), then spread on an oven for drying at 60 □. After complete dryness produced dried (CBP), then grounded in hummer mill to 1.0 mm in size without any special treatments and stored until formulating experimental diets. Proximate analysis according to (AOAC, 2012) was done on samples of (CBP) table 1.

Birds and management

Two hundred and ten unsexed day old of Hubbard broiler chicks were obtained from commercial hatchery (EL-ADLIA, Sharkia Governorate), randomly divided into 7 treatments and each treatment comprised of 30 chicks in five replicates of six chicks each. During the first week of age chicks were let for free feeding on the basal control diet of experiment. At seven day old, chicks were randomly allotted on the experimental groups (30 chicks each) in a completely randomized design.

All chicks were kept under the same managerial, hygienic and environmental conditions throughout the entire experimental period that lasted for 40 days of age.

The experimental diets

Diets were formulated in mash form to contain 3025, 3100 and 3200 ME (Kcal/Kg) energy with 23, 21 and 20% CP for starter, grower and finisher diets, respectively. In this experiment, the chicks were assigned to seven experimental diets during the period from 7 to 40 days as follows:

T1: Birds were fed corn-soybean diets (C) as control basal diets.

T2-7: Replacing 15, 30,45,60,75, and 100% corn of the basal diets by (CBP).

Measurements

Productive Performance and carcass characteristics:

Live body weight, daily body weight gain, daily feed consumption and feed conversion ratio were determined and recorded from 7 to 40 days of age. At 40 days of age, five live birds from each treatment were randomly chosen and slaughtered after fasting for 12 hrs. After sacrificing, internal organs (liver, heart, gizzard, spleen and bursa) were removed and weighed. After the removal of blood, feathers, head, viscera, shanks and edible parts (gizzard, heart and lever) the rest of body was weighted to determine the dressed weight.

Economic Evaluation:

The economic evaluation of the end product was based on the difference between growth rate and feeding cost. The economic efficiency traits were calculated according to North (1981) in relation to the price of local market.

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

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

Ingredients%	Dietary treatments					
	7-21 days		22-35 days		36-40 days	
	Control C	100% CBP	Control C	100% CBP	Control C	100% CBP
Yellow corn (7.7% CP)	50.00	0.00	55	0	60	0
Soybean meal (44 % CP)	38.00	38.00	30.25	31.5	25.1	26.2
Corn gluten meal (65.3% CP)	3.00	3.50	4.4	4.5	6.1	6
Cake by-product (6.25 CP)*	0.00	50.00	0	55	0	60
Wheat bran (13.5% CP)	0.40	3.00	1.85	3.2	0.7	2.5
Soybean oil	4.35	1.20	4.5	1.6	4.5	1.6
Dicalcium phosphate	1.94	2.08	1.7	1.98	1.6	1.73
Limestone	1.21	1.15	1.4	1.3	1.1	1.1
Salt (Na cl)	0.30	0.30	0.3	0.3	0.3	0.3
Premix**	0.30	0.30	0.3	0.3	0.3	0.3
L-Lysine	0.20	0.22	0.1	0.12	0.15	0.15
DL- Methionine	0.30	0.25	0.2	0.2	0.15	0.12
Total	100.00	100.00	100.00	100.00	100.00	100.00
Calculated analysis***						
ME (Kcal/Kg)	3029.3	2997.3	3099.6	3105.59	3200.9	3218.29
CP %	22.99	22.95	20.91	20.93	20.01	19.78
Calorie/Protein Ratio (C/P)	131.75	130.60	148.23	148.37	159.96	162.70
Calcium %	1.050	1.057	1.047	1.071	0.895	0.920
Available phosphorous %	0.508	0.490	0.455	0.456	0.429	0.399
Lysine%	1.486	1.440	1.194	1.168	1.112	1.052
Methionine %	0.668	0.615	0.554	0.556	0.500	0.467
Meth. + Cys. %	1.067	1.095	0.928	1.010	0.869	0.920

** Chemical composition of cake by-product (CBP) 3718 ME (Kcal/kg), 90% (DM), 6.25 (CP), 0.5% (CF), 12.03% (EE), 1.6 (ASH), 69.62 (NFE) and 1.15 (NaCL).*

Treatments contained 0%, 15%, 30%, 45%, 60%, 75% and 100% replacing yellow corn with CBP.

*** 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).*

Statistical analysis:

Data collected in this study was statistically analyzed using the general linear models (GLM) of SAS, (2005) using one-way analysis of variance. Duncan's Multiple Range Test (Duncan, 1955) was used to separate means when separation was relevant. The following statistical model was applied:

$$Yij = \mu + Ti + eij$$

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, σe^2)

RESULTS AND DISCUSSION

Productive performance of live body weight (LBW) and daily weight gain (DWG):

The effect of replacing different levels of cake by-products on productive performance are presented in Table (2). The initial live body weights (at 7day-old) were nearly similar that ranged from 139.53 to 140.96 g, which due to the effect of randomize procedure. During the overall period (7-40 d of age), data

showed that gained nearly the same between all treatments. Also, the values of DWG during the all periods show no significant differences. However, the highest live body weight and daily body weight gain were recorded by birds on treatment 30% and 45%, CBP respectively could be as a result of the high feed intake and to the lesser crude fiber content in cake by product. The outcome hence recommends that wheat (the significant part of CBP) is thermolabile, in this way supporting the perception by Williams *et al.* (1997) who reported expanded accessibility of protein, energy and degradation of anti-nutritional factors amid wheat preparing which enhanced the performance of broilers. The higher temperature required in feed preparing may have significantly contributed to the decrease of the detrimental effects associated with non-starch polysaccharides (NSP) contained in the wheat by-products. Heat handling had been accounted for to influence physical qualities of NSPs [Cowieson, (2005) and Gonzalez-Alvardo *et al.* (2008)]. The mean (DWG) and mean total weight gain (TWG) values corresponded with the mean total feed intake (TFI) and mean daily feed intake (DFI) values since high feed intake of a well-balanced diet usually result in high growth rate as indicated by Sotolu and Byanyiko, (2010). Similarly,(Rita *et al.* (2009), Al-Ruqaie *et al.* (2011) and Adeyemo *et al.* (2013)) demonstrated that there were no significant differences ($p \geq 0.05$) for all treatments on average weight gain when broiler chicks were fed diets containing 0, 25, 50, 75 and 100 % biscuit waste (BW) respectively.

Table (2): Effect of replacing yellow corn with different dietary cake by-products (CBP) levels on live body weight, daily weight gain, daily feed consumption and feed conversion ratio of broilers.

Item	100% Corn 0% (CBP) T_1	85 % 15 % T_2	70 % 30 % T_3	55 % 55 % T_4	40 % 60 % T_5	25 % 75 % T_6	0 % 100% T_7	Sig.
Live body weight (LBW) (g):								
7 days	139.53 ± 6.95	140.40 ± 6.19	140.63 ± 5.86	140.96 ± 5.54	140.66 ± 4.48	140.20 ± 3.86	139.96 ± 3.74	NS
40 days	1980.68 ± 34.33	1970.54 ± 68.15	2133.22 ± 54.83	2019.50 ± 81.11	1940.50 ± 37.35	1900.54 ± 40.65	1963.74 ± 21.05	NS
Daily weight gain (DWG) (g / day):								
7- 40 days	55.82 ± 0.97	55.46 ± 1.68	60.38 ± 1.35	56.93 ± 2.06	54.54 ± 1.01	53.34 ± 0.96	55.27 ± 0.58	NS
Daily feed consumption (DFC) (g / day):								
7- 40 days	101.21 ± 2.82	102.91 ± 1.84	110.40 ± 2.17	105.56 ± 5.35	103.05 ± 5.66	103.14 ± 3.50	107.18 ± 1.90	NS
Feed conversion ratio (FCR):								
7- 40 days	1.82 ± 0.07	1.86 ± 0.06	1.83 ± 0.05	1.86 ±0.10	1.89 ± 0.13	1.93 ± 0.04	1.94 ± 0.04	NS
Mortality numbers	2	1	2	4	4	1	0	

a, b Means within the same row with different superscripts are significantly different, Sig. = Significance, NS = Not significant.

Daily feed consumption (DFC) and feed conversion ratio (FCR):

Results presented in Table (2) showed that no significant (P>0.05) differences between groups of birds fed different dietary treatments in DFC or FCR values at 7-40 days of age. However, data demonstrated that birds fed diet containing 30% CBP had highest DFC value (110.40 g) and birds fed control diet had lowest DFC value (101.21 g) compared with other treatments. The highest numerical values for feed consumption recorded in treatments containing CBP compared to control group could be as a result of sweet nature and smell. These results are in agreement with those obtained by Al-Ruqaie *et al.* (2011), Torki and Kimiaee (2011) and Ajasin *et al.* (2010) they reported that the substitutions of dietary corn from 0 % up to 100% with Biscuit waste by-product (BWP) no adverse effect on feed intake FT or FCR.

Mortality rate:

Conditions of the present study were kept firmly under control which made all birds appear healthy and vigorous. Mortality numbers were recorded 2, 1, 2, 4, 4, 1 and 0, respectively between treatments from T1 to T7 indicating that mortality numbers did not show any significant differences between the experimental treatments and the control one. The results are in agreement with other studies where bakery wastes did not show any

significant difference on mortality in broilers [Madiya *et al.* (2003), Al-Tulaihan *et al.* (2004), Ragab *et al.* (2006), Najafabadi *et al.* (2007), Omole *et al.* (2013) and Ironkwe *et al.* (2015)].

Carcass characteristics:

As shown in Table (3) no significant (P > 0.05) differences were observed in percentages of carcass between all treatments. Numerically, the birds fed diet containing 45% CBP followed by diet containing 30% CBP had the highest percentages of carcass (71.95% and 71.73%, respectively) while, birds fed diet containing 30% CBP followed by birds fed diet containing 45% CBP had the highest percentages of total edible parts (76.30% and 75.70%, respectively) compared with other treatments and birds fed diets containing 75% CBP had lowest percentages of carcass and total edible parts (66.65 and 70.93 %, respectively).

Table (3): Effect of replacing yellow corn with different dietary cake by-products (CBP) levels on carcass characteristics at 40 days of age.

Item%	100% Corn 0% (CBP) T_1	85 % 15 % T_2	70 % 30 % T_3	55 % 55 % T_4	40 % 60 % T_5	25 % 75 % T_6	0 % 100% T_7	Sig.
Caracas	68.84 ± 0.72	69.62 ± 0.63	71.73 ±2.08	71.95 ±0.77	69.45 ±0.53	66.65 ±1.92	69.72 ± 1.98	NS
EP	72.91 ± 0.65	74.49 ± 0.72	76.30 ± 1.87	75.70 ± 0.77	73.41 ± 0.31	70.93 ± 2.25	73.67 ± 2.07	NS
Giblets	4.07 ±0.27	4.78 ±0.51	4.57 ±0.22	3.75 ±0.14	3.96 ± 0.23	4.27 ± 0.35	3.95 ± 0.14	NS
Liver	1.99 ±0.09	2.63 ± 0.35	2.33 ±0.54	1.81 ± 0.06	2.25 ± 0.17	2.41 ± 0.32	1.97 ± 0.31	NS
Heart	0.52 ±0.05	0.61 ± 0.09	0.50 ±0.02	0.60 ± 0.05	0.49 ± 0.04	0.46 ± 0.06	0.47 ± 0.04	NS
Gizzard	1.41 ± 0.19	1.44 ± 0.16	1.62 ±0.13	1.25 ± 0.11	1.09 ± 0.09	1.26 ± 0.13	1.37 ± 0.19	NS
Bursa	0.11 ± 0.01	0.14 ±0.02	0.14 ±0.01	0.13 ± 0.01	0.14 ± 0.02	0.11 ± 0.01	0.14 ± 0.01	NS
Spleen	0.14 ±0.01	0.12 ±0.01	0.12 ±0.01	0.11 ±0.01	0.12 ± 0.01	0.13 ± 0.01	0.12 ±0.01	NS

a, b Means within the same row with different superscripts are significantly different, Sig. = Significance, NS = Not significant.; EP = Carcass + Giblets; Giblets = (Liver + Gizzard + Heart).

Economic evaluation:

Table (4) represents economic efficiency of Hubbard broiler chicks fed different experiment diets for 40 days of age.

Table (4): Effect of replacing yellow corn with different dietary cake by-products (CBP) levels on economic efficiency.

Item%	100% Corn 0% (CBP) T_1	85 % 15 % T_2	70 % 30 % T_3	55 % 55 % T_4	40 % 60 % T_5	25 % 75 % T_6	0 % 100% T_7
Price feed/Kg[1] (L.E.)	6.99	6.80	6.64	6.47	6.30	6.10	5.79
Total feed cost (L.E.)	21.59	21.86	22.85	21.89	20.73	20.67	19.45
Total costs[2]	38.59	38.86	39.85	38.89	37.73	37.67	36.45
Total revenus[3]	51.58	51.24	55.78	52.58	50.37	49.28	51.04
Net revenus[4]	29.99	29.38	32.93	30.69	29.64	28.61	31.60
Economic efficiency[5] (E.E.)	77.70	75.59	82.64	78.91	78.57	75.93	86.68
Relative efficiency[6]	100	97.28	106.35	101.56	101.11	97.72	111.56
Price feed/Kg[1] (L.E.)	6.99	6.80	6.64	6.47	6.30	6.10	5.79

[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.*

Results showed that, the birds fed on diets containing CBP at levels of 30, 45, 60 and 100% had higher values of the relative efficiency percentage (106.35, 101.56, 101.11 and 111.56; respectively) compared the control. While, T2 (15% CBP) and T6 (75% CBP) had the lowest ones (97.28%) and (97.72%). This result is similar to those observed by Madiya *et al.* (2003); Al-Ruqaie *et al.* (2011) and Adeyemo *et al.* (2013) in their feeding trials with broiler chicks in which they fed diets containing varying levels of CBP as a replacement for maize. The absolute values clearly show that feed cost per kg live weight gain decreased with increasing levels of CBP, similar to the trend observed for the cost of the various diets. The decline in the feed cost as the amount of maize in the diet was reduced by replacement with CBP was mainly due to the huge price disparity between maize (LE 4.73 / kg) and the CBP (LE 3.0 / kg).

CONCLUSION

It could be concluded that CBP; can be used as a 100% substitute for yellow corn in the rations of Hubbard chicks without negative effects on the productive performance and carcass characteristics, while achieving the best economic return.

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تقييم استخدام بعض مصادر الطاقة البديلة في علائق دجاج اللحم على الاداء الانتاجي و صفات الذبيحة و العائد الاقتصادي:1 مخلفات تصنيع الكيك.

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

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

استخدام 210 كتكوت هيبرد (غير مجنس) عمر 7 ايام لدراسة تاثير استبدال الذرة الصفراء بمخلفات تصنيع الكيك في العلائق على الاداء الانتاجي و صفات الذبيحة و العائد الاقتصادي.

قسمت الكتاكيت على 7 معاملات غذائية (30) كتكوت في المعاملة، والتي استبدل فيها الذرة الصفراء بمخلف تصنيع الكيك بنسب صفر، 15، 30،45،60، 75 ، 100 % على التوالي.

أهم النتائج

- لم يتاثر صفات الاداء الانتاجي للكتاكيت (الوزن الحي- معدل النمو اليومي – استهلاك العلف اليومي – معامل التحويل الغذائي) بالمعاملات الغذائية المختلفة.
- لم تتاثر صفات الذبيحة من حيث % للذبيحة و % للحوائج (الكبد ، القانصة ، القلب) بالمعاملات الغذائية المختلفة.
- أوضحت الدراسة ان أفضل العلائق اقتصاديا من حيث الكفاءة النسبية هي العلائق المحتوية على 30 و45 و60 و 100 % مخلف كيك على التوالى مقارنة بالكنترول و المعاملات الاخري.

الخلاصة مخلفات تصنيع الكيك يمكن استخدامها بديلا للذرة الصفراء بنسبة 100% في علائق كتاكيت الهيبرد بدون تاثيرات سيئة على الأداء الأنتاجي و صفات الذبيحة مع تحقيق افضل عائد اقتصادي.