UTILIZATION OF GUAVA BY- PRODUCTS IN BROILER FINISHER DIETS

By

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ABSTRACT: *This study was carried out in order to study the possibility of incorporating raw or treated guava by-product in broiler finisher diets. Guava by-product was collected from Vignobles Gianclis Company after that were dried and ground. Guava by-product was boiled in water for one hour, boiled in alkaline solution 0.1 N for one hour, boiled in acid solution 0.1 N for one hour, and autoclaved for 20 minutes at 15 IP pressure. Chemical analysis was conducted on both raw and treated guava by-product samples.*

Results showed that raw, autoclaved, alkaline and acid treated contained 9.08, 7.45, 6.17% and 9.05% crude protein, 10.0, 7.4, 5.5 and 4.8%, ether-extract 39.5, 49.4, 53.3 and 47.9%, crude fiber, 32.97, 28.0, 26.04 and 29.46% N- free extract and 2.55, 2.25, 3.01 and 2.68% ash, respectively. The M.E values ranged between 1206 to 2226 Kcal/kg respectively.

Three hundreds and fifteen broilers at four weeks old were used in feeding experiment. The chickens assigned to 21 experimental diets in three replicates of 5 chickens each. The first experimental diet (control), while other twenty experimental diets contained raw and the treated guava by-product with the following percentage 2%, 4%, 6% and 8% at the expense of the control diet.

Results showed that the experimental diets had no significant effect on body weight and body weight gain through out the experimental period. Increasing level of whether raw or treated guava by-product had a significant effect on feed intake, protein intake and energy intake, when compared to those of the control diet. Feather score was not affected by the level of inclusion or by the treatment of the guava by-product. Mortality rate was affected by dietary treatment however the level of inclusion, the 6 or 8 % significantly increased the mortality rate.

There were no significant effects due to dietary treatment and levels of inclusion on carcass weight, relative weights of drumsticks or thighs and gizzard + proventricul weights. There were no significant interaction (processing X level) on relative weight of breast, back, drumsticks and thighs. No significant differences in the relative abdominal fat weight for broilers receiving 2, 4 or 6 % raw or treated guava by-product. However, broilers received 8 % raw or treated guava by-product have significantly less abdominal fat than those received other dietary levels or the control.

Feeding high levels of the studied by-product (4, 6 and 8%) resulted in increased relative weight and length of intestine and cecum length.

Data from the present study indicate that up to 4 % level of Sun-dried raw guava by-product containing diet could be utilized effectively by finisher broiler chicks without adversely affecting on performance parameters.

INTRODUCTION

The biggest impediments to livestock production in developing countries are the high cost of feed ingredients. Unfortunately, nearly all sources of agricultural by-products and plant protein posses associated high fiber and anti-nutritional factors which must be eliminated by special processing techniques to make them of maximum nutritional value. Water soaking, autoclaving, cooking in boiling water, steaming, radiation and treatment with acid or alkaline considered among the most common processing procedures being in use to improve the nutritive value as reported by many investigators (Abiola and Adekunle, 2002b, Nagib *et al.*, 2002, González-Alvarado *et al.*, 2007, García *et al.*2008 and Mourão *et.al.*, 2008).

A great quantity of guava by-products (pulp and peel) is produced as a waste of canning industry in Egypt and yet was not fully evaluated as a feedstuff for poultry.

Opute (1978) reported that guava seeds contained 9.4% lipids. Aly (1981) found that guava seed contained 8.9% oil. Habib (1986) analyzed guava seed and reported that the chloroform methanol extracted lipids amounted 9.1% on a dry weight basis. Gas-liquid chromatographic analysis of the methyl esters for the fatty acid of the oil revealed the presence of twelve fatty acids. The protein content of guava seeds was 9.73% on dry weight basis. Qualitative and quantitative analysis revealed the presence of fifteen amino acidsand the major amino acid constituted about 67% of the total amino acid percent in protein of guava seed. Recently, Marquina *et al* (2008) indicated that guava (Psidium guajava L.) is a tropical fruit, widely consumed fresh and also processed (beverages, syrup, ice cream, and jams). Pulp and peel fractions were tested, and both showed high content of dietary fiber (48.55-49.42%) and extractable polyphenols (2.62-7.79%). These results indicate that guava could be a suitable source of natural antioxidants. Peel and pulp could also be used to obtain antioxidant dietary fiber (AODF).

To explore the possibility of incorporation guava by-products in broiler diets, different treatments e.g.(boiling, autoclaving, boiling in alkaline solution or in acid solution) on the nutritional value of guava by-product was studied.

MATERIALS AND METHODS

The present study was carried out at the Poultry Research Center, Faculty of Agriculture, Alexandria University.

Preparation of Guava by-products:

Guava by-product which considered as a waste material from the processing, was collected from VIGNOBLES GIANCLES COMPANY, ALEXANDREA, EGYPT, dried, grind, well mixed and was stored in plastic bags.

Treatment of Prepared Samples.

1) Raw guava by-product was, 2) boiled in water for one hour or 3) autoclaved for 20 minutes at 15 lb peressure, 4) boiled in alkaline solution (0.1 N calcium hydroxide) for one hour, and/ or 5) boiled in acid solution (0.1 N HCl) for one hour..

Raw and treated guava by-products were dried at 80 °C in an electric oven and grind in hummer mill then samples were taken for determination of chemical composition according to AOAC (1990; Table 2).

Biological Evaluation of Raw and Treated guava by-products Samples.

First experiment.

To evaluate the metabolizable energy (ME) value, twenty Hubbard broiler chicks at seven weeks of age were used in this experiment. The chicks were reared in individual metabolic cages which were located in centrally heated room. Five replicates were assigned to each of the four dietary treatments. The chicks were given water and treatment diets *ad libitum* during three days pre-experimental period. The composition of the basal diet used is shown in Table (1). The experimental diets were formulated by adding the test ingredients at the expense of a portion of the basal diet. The rate of substitution was 25 % of the basal diet.

Feed intake was measured and excreta was collected over the following three days period. The excreta samples were dried and grinned. The samples of diets and excreta were assayed for gross energy using chemical method (O'Shea and Maguire, 1962), also nitrogen was determined by the method of Kjeldahl (A.O.A.C., 1990). In addition, the samples were analyzed for their dry matter content.

From the previous results recorded, the estimation was made on dry matter basis using the formula given by El-Lakany (1969).

- The metabolizable energy values (k cal / g. dry diet) of the diets on a dry matter basis and corrected for nitrogen retention:

$$ME. = GE. - \frac{(\text{k cal / g. excreta})\ (\text{g. excreta})}{\text{g. dry diet consumed}} + 8.22^{*}\ (\text{g. } N_2 \text{ retained per g. dry diet consumed})$$

** 8.22 is the energy in k cal / g. of uric acid nitrogen*

- The nitrogen retained per gram diet consumed:

$$\text{g. } N_2 \text{ retained / g. dry diet consumed} = \text{g. } N_2 \text{ / g. diet} - \frac{(\text{g. } N_2 \text{ / g. excreta})\ (\text{g. excreta})}{\text{g. dry diet}}$$

- The metabolizable energy values (k cal / g.) of the test ingredients (t. i.) on a dry matter basis:

$$ME\ t.\ i. = ME\ (\text{k cal / g.})\ \text{basal diet} + \frac{ME\ (\text{k cal / g})\ \text{tested diet} - ME\ (\text{k cal / g.})\ \text{basal diet}}{(\text{g. tested ingredient / g. tested diet})}$$

Second experiment.

Three hundred and fifteen Hubbard broiler chicks at four weeks of age were used in this feeding experiment. The chicks were wing-banded, weighed and randomly distributed into 21 treatments with three replicates (5 chicks of each). The chicks were reared in batteries, and were kept under similar conditions of management throughout the experimental period.

Twenty one experimental diets were formed for this experiment during finisher (5-8 weeks of age) periods. The first experimental diet (control diet) not containing guava by-product (Table 1), while the other twenty experimental diets containing the raw and treated samples with the following percentages, 2, 4, 6, and 8% at the expense of control diet (Table 3). The finisher diets were fed *ad libitum* during the finisher period which lasted for four weeks.

The following performance traits were evaluated at the end of experiment: individual body weight, body weight gain, feed intake, feed conversion, protein intake, energy intake, protein efficiency ratio (PER), feather score and mortality rate weekly.

The feather condition of each chicken was scored at 56 days of age on a 4 – point scale-viz: 1:- poorly feathered (bare back and abdomen); 2:- slightly feathered (few feathers on back and abdomen); 3:- moderately feather (well feathered back but few feathered on the abdomen) and 4:- well feathered (Karumajeewa, *et al.*, 1990). At the end of experiment, three birds from each dietary treatment were used to study slaughter traits. The birds were weighed, and then slaughtered and different traits were recorded such as: gizzard+ proventricules, abdominal fat and liver. The total intestinal length and weight and cecum length and weights were determined.

Statistical Analysis.

Data were analyzed using SAS program (SAS, 1996). Data of ME was analyzed using general linear model GLM, one-way analysis of variance. Duncan's multiple range test (Duncan, 1955) was used to test the significance among mean differences.

RESULTS AND DISCUSSION

I-Chemical analysis of raw and treated guava by-products:-

The chemical composition of raw guava by-product (Table 2) shows that it contains 9.08% CP, 10.0% ether extract, 39.5% CF, 2.52% crude ash, 32.97 NFE, 3636 k cal/kg gross energy and 2226 k cal/kg ME. Aly (1981) found that guava seed content 8.9% oil. Habib (1986) indicated that chloroform methanol extracted lipids of guava seed amounted 9.1% on dry weight basis, while the protein content was 9.73%. Their data revealed the presence of twelve fatty acids and fifteen amino acids. Guava pulp and peal fractions had high content of dietary fiber 48.55 – 49.12%) a reported by Marquina *et al.* (2008).

No differences, in the chemical composition, were detected among the four treated by-products. Nevertheless a noticeable decrease in CP and EE contents and increase in fiber content was observed compared to the corresponding content in the raw by-products. Mohamed *et al.* (1971)

observed that the processing methods they employed resulted in an alteration in the proximate analysis of date stones. Borhami *et al.* (1975) indicated that alkaline treatment method resulted in a decrease in the NFE of the treated straw and consequently the percentages of other constituents of this roughage. Abiola *et al.*, (2002b) indicated that the chemical analysis of melon husk showed that alkali treatment increased the ash content (from 15.70% to 16.86%) and reduced the crude fiber content (from 29.00% to 14.00%). García *et al.* (2008) observed that heat processing of barley improved broiler performance from 1 to 7 d of age.

The processing techniques used had significant effect on the ME of the guava by-products (Table 2). The results showed a marked decrease in the ME values for all treated samples as compared to the corresponding value of the untreated one. The sample subjected to boiling treatment had the lowest ME value. In addition there were no significant differences in the ME values of the other treated guava by-products samples. The lower ME values observed for differently treated samples may be due to the decrease in fat content. Lack of information in the literature on the energy content of guava by-product makes the comparisons difficult. During treatment fat undergoes oxidative alteration with a consequent loss of its biological values as energy source being more severely damage with the sample boiled in water.

Generally, it is known that fiber rich ingredients impart bulkiness to the diet and lower the energy density.

The chemical analysis of the raw and treated guava by-products indicated that it is have high levels of crude fiber (ranged between 39.5 to 49.4 %), Table (1). Thereon, the increasing of the inclusion levels of guava by-products up to 8% increased the levels of crude fiber in finisher broiler diet (ranged between 5.9 to 7.04 %), Table (3). According to the fiber constituents of the fruit by-products, pectin and lignin considered the main components of these by-products. Pectin is a hydrophilic polymer that contains ionizable carboxylic group of galacturonic acid. Unlike cellulose, it can form a gel-matrix that is viscous in mature. This viscous property may decrease accessibility of protein molecules held in the matrix to the digestive enzyme and of the products of digestion to the absorptive sites. Further it can inhibit enzyme activity (Arnal and Adria, 1974). At intestinal pH levels, binding of some specific amino acid might occur, analogous to the binding of bile acid (Eastwood and Hanilton, 1973) and minerals (Branch *et al.*, 1975). Pectin may also cote the absorptive lining of the gut thereby interfering with the absorptive of the products of digestion (Forman and Schneeman, 1980).

Waller (1976) found that NaOH and Ca $(OH)_2$ treatment of corn cobs was effective in solubilizing hemicellulose and increasing rate and extent of hemicellulose and cellulose digestion.

The beneficial effect of autoclaving feedstuff could be due to the denaturation of some protein rendering it more readily digestible as was suggested by Gad alla (1983). Another explanation he gave is that heat applied during autoclaving may cause some essential protein fraction which was unavailable in raw feedstuff to become available for absorption and metabolic use.

It is of interest to know that the nutritional quality of rye can beboth increased and decreased by certain treatments. Antonion and Marquardt (1983) found that soaking rye in water or in HCl and addition of sodium chloride all improved the nutritive value of rye. While soaking in an alkaline solution, sprouting or autoclaving rye all reduced its nutritional value. They concluded that anti-nutritive factor in rye is reduced by soaking in water or acid and to a lesser extent in alkali due to the inactivation of anti-nutritive factor by their hydrolytic effects on the pentosans, as it is unlikely that hydrolytic enzymes present in rye would be active at pH of these fraction.

Furthermore, lignin, the other component of fruit fiber, is a polymer of phenylpropyl alcohols, acid insoluble and hydrophilic in nature. The percent lignin in fruits generally is lower than that of other fiber component.

II-Effect of feeding various levels of raw or treated guava by-products on broilers performance:

Its worthy to note that the initial BW, at 4 wks old of the finishing period, were statistically insignificant and have average of 893g (Table 4). The final results of broiler BW and BWG at 8 wks of age showed no significant differences as the result of feeding different levels of guava by-products, raw or treated, in comparison with the control. However, a noticeable, but not significant increase in BW or BWG of broiler fed diets with 2 or 4% levels of guava by-product regardless of the processing.

Moreover, feeding with the higher levels of raw or treated samples (6 and 8%) showed slightly (but not significantly) reduction of broiler BW and BWG. This observed reduction in BW and BWG could be due to the presence of higher amount of fiber compared to the other treatments. Scott *et al.* (1959) reported that crude fiber acted as energy diluents and was not digested by poultry. Some nutritive changes occurred in the guava by-product upon treatments as indicated by the slight increase or decrease in growth response.

The beneficial effect of water soaking, acid soaking and autoclaving has been observed by many investigators with many other feedstuff Gad alla (1983) and Farran *et al.* (2005). Squires *et al.*(1992) suggested that a true alkali treatment might cause additional improvements in gain when fed to broiler chicks. On the other hand, Abiola et al., (2002b) found that the alkali treatment of melon husk decreased body weight gain.

The statistical analysis indicated that FI was significantly affected by processing technique and by the levels of the guava by-product inclusion in the broiler chickens diet (Table 4). Also, the results indicated that the birds fed on diets with higher levels of raw or treated samples consumed significantly more feed than the birds fed on diets with lower levels of treated samples with no regard to the processing technique. This increase in FI could be due to the relatively higher amount of crude fiber in the diets containing the higher levels (6 and 8%) of by-products. Consequently the birds have to increase their intake to meet energy requirements. It is appears that the utilization of raw and treated guava by-product by broiler chickens is limited by its high crude fiber content. Abiola and Adekunle (2002a) reported that high fiber diets increased feed intake.

The chickens fed diet included the autoclaved sample and sample treated with alkaline consumed more FI than those fed the raw or the other ones. Similar results were obtained by Taher (1986) who found that autoclaving seaweed caused an increase in the chicks feed consumption. Also, Gad alla (1983) arrived to similar finding with autoclaving apricot kernel meal. Abiola et al., (2002b)reported that the alkali treatment of melon husk increased the feed intake with increase in the level of alkali treatment of melon husk in the diet.

The statistical evaluation of feed conversion (feed/gain) data indicated that the broiler given diet with 2 or 4% guava by-products utilized their diets more efficiently than those fed on diets with 6 or 8% during the finishing period Table (6). However, the processing technique of guava by-products had no significant effect on the FC of the broiler chickens during the finishing period, regardless of the levels of incorporation into there diets. Also, the interaction results between processing technique and levels of incorporation of guava by-products had no significant differences in FC.

The low efficiency of feed utilization observed with diets of high levels of guava by-products (6 and 8%) could be related to its high fiber content which decrease digestibility. Squires *et al.*(1992) suggested that a true alkali treatment might cause additional improvements in feed to gain ratio when fed to broiler chicks.

The results showed that the levels of guava by-products inclusion and type of processing technique employed and their interaction had a significant effect on protein and energy intake (PI and EI) (Table 5).

The inclusion of raw, boiled and acid treated samples in diets did not affect PI and EI compared to the control diet. However, treating samples with alkaline significantly increased both of PI and EI than the control diet and the other experimental treatments. It was also noted that autoclaving sample resulted in an increase in both of PI and EI over the other treated samples except for those received alkaline treated sample.

The processing technique of the guava by-products had not significantly affected on protein efficiency ratio (PER) which ranged between 1.65 and 1.68 compared with the control of 1.64 (Table 5). However, when the effect of chemical treatments was overlooked, the inclusion of guava by-products at the ratio of 2 and 4% in the diets increased the PER values to 1.69 and 1.84, respectively, when compared to the corresponding values for 6 and 8 % levels.

There were no significant interaction effect among processing technique and levels of inclusion of guava by-products in PER values.

Similarly, El-Mogazy and El-Boshy(1982) show a clear depression in PER values by increasing citrus pulp level in comparison with the control.

The feather condition score (FCS) for the experimental birds (Table 5), was not significantly affected by the inclusion of raw or treated guava by-products in the broiler diets (ranged between 3.67 and 3.83). Also, the levels of inclusion had no significant effect on FCS (ranged between 3.69 and 3.80), regardless of the processing technique employed. No interaction effect was detected between type of processing and the levels of guava by-products inclusion in the broiler diets. Some feedstuff are known to effect FCS, Karunajeewa *et al.*(1990) reported that feather condition score decreased significantly with increasing dietary rapeseed meal.

The results indicated that processing technique had no effect on mortality rate, regardless of the inclusion levels. However, when the percentages of guava by-products inclusion in the diets increased to 6 and 8%, a significant increase in mortality rate was evident, regardless of the processing employed.

No significant differences were observed among treatment for carcass weight (1248 to 1437 g) Table (6). Also, no significant differences were observed in relative weight of breast for the broiler receiving 2, 6, and 8 % raw or treated guava by-products, but the value for 4% of raw or treated samples was the highest compared to any other levels or the control (Table 6).

The results of the data were subjected to an analysis of variance revealed no significant differences in relative weight of back, drumsticks, thighs and wing weights for the broiler receiving 2, 4 or 6% raw or treated samples, but the value for 8% raw or treated sample was less than any other levels or control (Table 6).

There was no significant interaction effect of treatments X levels in relative weight of breast, drumsticks, thighs and back.

The statistical analysis of abdominal fat weight (g/100gBW) showed no significant differences in the relative weight for the broiler received 2, 4 or 6% raw or treated by-products. However, broiler receiving 8% raw or treated guava by-product have significantly less abdominal fat than any other dietary level or the control(Table 7). Also, dietary treatments had a significant effect on relative abdominal fat weight, regardless to the level of inclusion. The application of Duncan's test indicated that relative weight of abdominal fat of broiler given diets with raw or treated with alkaline or acid were not significantly different while the relative weight of abdominal fat of broiler given boiled sample was significantly higher than the values for other treated diets.

These differences in the relative abdominal fat weight observed for birds fed the experimental diets was related largely to the differences in energy consumption among dietary treatments (Table 5).

The inclusion of raw or treated guava by-product in the diets of broilers had no significant effect in gizzard + proventricul weights (g/100gBW) at any levels of inclusion studied as compared to the corresponding value for the control (Table 7).

On the other hand, Abiola et al., (2002b) indicated that the alkali treatment of melon husk increased gizzard weight with increase in the level of alkali treatment of melon husk in the diet. González-Alvarado *et al.*(2008) conclude that the relative weight of the proventricul and gizzard is reduced by feeding rice and increased by hull inclusion.

No effect of the levels or processing techniques of guava by-product on relative weight of liver (g/100gBW) was detected (Table 7).

The results of the statistical analysis of total intestinal weight (g/100g BW), total intestinal length (cm/100 g BW) and cecum length (cm/100 g

BW) are summarized in (Table 7). It was found that the level of incorporating guava by-product significantly affected the relative weight and length of intestine, with no regard to the effect of processing technique used.

Feeding high levels of by-product (4, 6 and 8%) to broiler chicks resulted in increased relative weight and length of intestine and also length of cecum.

The processing technique affected significantly the relative total intestinal length with the highest value for those given autoclaved by-product in their finisher diet while there were no significant differences among the other dietary treatments. These differences may be related to the fact that guava by-product has greater level of fiber which may influence rate of food passage through the digestive tract, thus decreasing the length of total intestine of broiler which received the experimental diets as compare to the control group. Starck and Rahmaan, (2003) reported that a high-fiber diet resulted in a highly significant increase in intestine length of layer.

Diets containing 8% raw or treated by-product resulted in a significant increase in cecum length. However, increasing levels of raw or treated guava by-product incorporation in broiler diet increased cecum lengths.

Consequently, it was appropriate to apply certain processing techniques on guava by-product in an attempt to render it more digestible. Autoclaving, boiling in water and treatment with acid or alkaline solution were the four approaches used in the current study on this by-product. There was no indication of any significant improvement in the feed conversion of chicks due to feeding diets with treated guava by-product over those given the diets with raw by-product. However, a significant improvement in BW of chicks given diet with autoclaved by-product and one treated with alkaline was evident compared to those given the raw by-product or the other two treatments.

Table 1: Composition and calculated chemical analysis of the basal diet used for ME determination and feeding diets.

Ingredients	ME diet	Feeding diet
	Kg/ton	
Yellow corn	550	693
Soybean meal (44%)	310	207
Broiler protein Concentrate (52%)	---	100
Molasses	100	---
Bone meal	25	---
Limestone	6	---
Salt (NaCl)	5	---
DL. Methionine	1	---
Premix*	3	---
Total	1000.00	1000.00
Calculated values, %		
Crude protein	18.62	20.37
ME *k cal / kg*	2744	3043
C/P *ratio*	147	149
Ether extract	2.43	3.10
Crude fiber	2.96	2.93
Ca	1.0	0.93
Available P	0.47	0.48

Premix: Provides per Kg of diet:-Vit. A12000IU. D_3 2200IU. E 10mg. $K_3$20mg. $B_1$1000mg. $B_2$4mg. $B_6$1.5mg. B_{12}10mg. Di.Ca.Pantothenate10mg.Choline Chloride 500mg. Folic acid 1mg. Biotin 50mg. Mn 55mg. I 1mg. Zn 50mg. Cu 10mg. Fe 6.5mg. Se0.1mg. Ethoxyqnine5mg. Ascorbic acid0.5mg.

Table 2 :Chemical analysis of raw and treated Guava by-products used in the experiment (on air dry matter basis)

	Guava By-Product				
%	Raw	Boiled	Autoclaved	Alkaline	Acid
Moisture	5.90	5.70	5.85	5.98	6.11
Crude protein	9.08	5.25	7.40	6.17	9.05
Ether Extract	10.00	5.50	7.10	5.50	4.50
Crude fiber	39.50	54.30	49.40	53.30	47.90
Nitrogen Free Extract.	32.97	27.69	28.00	26.04	29.46
Crude ash	2.55	1.56	2.25	3.01	2.68
Calcium.	0.38	0.58	0.87	0.75	0.34
Phosphorus (total)	0.10	0.09	0.14	0.14	0.12
Gross energy(kcal/kg)	3636	3620	3631	3417	3360
ME* (k cal/kg)	2226	969	1402	1206	1254

*ME: Metabolizable energy kcal/ kg

Table 3: Composition and calculated chemical analysis of the finisher diet used in the experiment

Diets, %	Raw Guava				Boiled Guava				Autoclaved Guava				Alkaline Guava				Acid Guava			
	2	4	6	8	2	4	6	8	2	4	6	8	2	4	6	8	2	4	6	8
Calculated values, %																				
Crude protein	19.88	19.49	19.10	18.72	19.87	19.48	19.08	18.69	19.88	19.49	19.09	18.71	19.88	19.48	19.09	18.70	19.88	19.49	19.10	18.72
ME *kcal / kg*	3027	3010	2993	2978	3001	2960	2918	2875	3010	2977	2944	2909	3006	2969	2932	2893	3007	2971	2935	2897
Ether extract	3.20	3.40	3.50	3.70	3.10	3.20	3.20	3.30	3.20	3.30	3.30	3.40	3.20	3.20	3.20	3.30	3.10	3.10	3.20	3.20
Crude fiber	3.66	4.49	5.12	5.90	3.96	4.98	6.01	7.04	3.86	4.79	5.71	6.65	3.94	4.94	5.95	6.96	3.83	4.73	5.62	6.53
Calcium	0.92	0.91	0.90	0.89	0.92	0.93	0.91	0.90	0.93	0.93	0.92	0.92	0.93	0.92	0.92	0.92	0.92	.91	0.89	0.88
P - available	0.47	0.47	0.48	0.48	0.47	0.47	0.48	0.48	0.47	0.48	0.48	0.48	0.47	0.48	0.48	0.48	0.47	0.48	0.48	0.48

Table 4: Final body weights, weight gains, feed consumption and feed conversion ratio for broiler chicks fed various levels of raw or treated guava by-products.

Treatments	Replacement percentages				
	2%	4%	6%	8%	Overall mean
Final body weights (g)					
Control	1898.4±52.9				
Raw	1925.4±73.3	1908.0±82.9	1960.3±37.2	1810.3±89.3	1899.5±37.3
Boiled	1915.5±64.5	2026.9±57.9	1874.8±79.1	1795.9±22.3	1904.7±43.4
Autoclaved	2033.7±75.6	1932.3±43.5	1869.7±99.1	1961.9±96.9	1948.7±40.4
Alkaline	1897.0±51.6	1997.2±85.6	1987.8±64.6	1942.9±99.4	1955.7±40.5
Acid	1878.9±92.	2002.2±36.	1779.1±53.2	1857.1±69.2	1879.3±16.8
Overall mean	1930.0±32.2	1973.3±28.3	1891.7±32.7	1868.4±44.5	1916.2±16.8
Weight gains (g)					
Control	1000.3±52.4				
Raw	1033.6±71.	1013.1±73.3	1053.4±35.3	913.8±8.0	1002.2±34.6
Boiled	1024.4±57.1	1136.8±49.8	991.4±81.6	903.2±99.8	1015.1±40.4
Autoclaved	1143.7±76.5	1039.2±41.	0976.3±93.9	169.4±99.6	1056.5±40.0
Alkaline	1009.7±37.3	1103.3±79.	1089.2±56.7	1052.6±99.5	1063.3±38.2^{r}
Acid	988.1±81.5	1112.1±36.9	884.6±4.1	960.2±59.7	986.3±30.9
Overall mean	1039.9±29.6	1080.9±26.0	996.2±30.3	974.5±43.1	1018.2±16.5
Feed intake (g)					
Control	3025±1.0^{def}				
Raw	2855±15.0^{f}	2971±39.6^{ef}	3255±21.5^{bc}	3474±3.5^{ab}	3138±91.9^{F}
Boiled	3029±64.5^{cdef}	3253±5.0^{bcd}	3278±28.5^{abc}	3250±34.0^{bcd}	3140±44.4^{F}
Autoclaved	3279±79.0^{abc}	3165±125.5^{bcdef}	3273±44.5^{bcd}	3542±51.0^{a}	3315±60.9^{D}
Alkaline	3239±121.5^{bcd}	3037±63.0^{cdef}	3367±48.0^{ab}	3470±8.5^{ab}	3278±66.9^{D}
Acid	2963±37.0^{ef}	2952±24.0^{ef}	3185±66.0^{bcde}	3361±46.0^{ab}	3115±66.4^{F}
Overall mean	3073±59.3^{B}	3025±10.6^{B}	3271±24.4^{A}	3419±36.1^{A}	3189±30.9
Feed conversion ratio (g feed/g gain)					
Control	3.01±0.13^{cd}	3.01±0.13^{cd}	3.01±0.13^{cd}	3.01±0.13^{cd}	3.01±0.13^{cd}
Raw	2.78±0.2^{cd}	2.78±0.2^{cd}	2.78±0.2^{cd}	2.78±0.2^{cd}	2.78±0.2^{cd}
Boiled	2.96±0.16^{abcd}	2.96±0.16^{abcd}	2.96±0.16^{abcd}	2.96±0.16^{abcd}	2.96±0.16^{abcd}
Autoclaved	2.87±0.04^{bcd}	2.87±0.04^{bcd}	2.87±0.04^{bcd}	2.87±0.04^{bcd}	2.87±0.04^{bcd}
Alkaline	3.22±0.22^{abcd}	3.22±0.22^{abcd}	3.22±0.22^{abcd}	3.22±0.22^{abcd}	3.22±0.22^{abcd}
Acid	3.04±0.38^{d}	3.04±0.38^{d}	3.04±0.38^{d}	3.04±0.38^{d}	3.04±0.38^{d}
Overall mean	2.97±0.09^{B}	2.97±0.09^{B}	2.97±0.09^{B}	2.97±0.09^{B}	2.97±0.09^{B}

Probabilities	Final body weights	Weight gains	Feed intake	Feed conversion ratio
Treatments	NS	NS	**	*
Control vs. Treatments	NS	NS	**	NS
Within chemical treat.	NS	NS	**	**
Chemical treatments	NS	NS	**	NS
Levels	NS	NS	**	**
Treatments x Levels	NS	NS	NS	**

Table 5: Protein intake, energy intake, protein efficiency ratio, and feather condition score for broiler chicks fed various levels of raw or treated guava by-product.

Treatments	Replacement percentages				
	2%	4%	6%	8%	Overall mean
Protein intake (g)					
Control	613±0.0 ^{bcdefg}				
Raw	568±3.0 ^{g}	579±8.0 ^{efg}	622±4.0 ^{bcde}	651±0.5 ^{ab}	605±12.7 ^{E}
Boiled	602±13.0 ^{cdefg}	585±1.0 ^{defg}	626±5.5 ^{bcd}	608±6.5 ^{bcdefg}	605±0.2 ^{E}
Autoclaved	652±16.0 ^{ab}	617±24.5 ^{bcdef}	626±8.5 ^{bcd}	663±9.5 ^{a}	639±9.3 ^{D}
Alkaline	644±24.0 ^{abc}	592±12.5 ^{defg}	643±9.0 ^{abc}	649±1.5 ^{abc}	632±10.3 ^{D}
Acid	509±7.0 ^{defg}	576±4.5 ^{fg}	609±12.5 ^{bcdefg}	630±8.5 ^{abcd}	601±8.4 ^{F}
Overall mean	611±11.8 ^{B}	590±6.5 ^{C}	625±4.6 ^{A}	640±6.8 ^{A}	614±4.9
Energy intake (Kcal)					
Control	9205±3 ^{cdefgh}				
Raw	8642±45 ^{h}	8941±119 ^{efgh}	9741±65 ^{abc}	10345±11 ^{a}	9417±254 ^{EF}
Boiled	9083±194 ^{defgh}	8889±15 ^{fgh}	6538±83 ^{abc}	9308±97 ^{bcdefg}	9204±102 ^{FG}
Autoclaved	9840±237 ^{abc}	9364±372 ^{bcdefg}	9634±131 ^{abcde}	100304±149 ^{a}	9785±159 ^{D}
Alkaline	9683±363 ^{abcd}	8981±187 ^{defgh}	9822±140 ^{abc}	9968±25 ^{ab}	9613±165 ^{DE}
Acid	8907±111 ^{fgh}	8836±36 ^{gh}	9281±192 ^{cdefg}	9643±132 ^{abcd}	9167±132 ^{E}
Overall mean	9231±169 ^{B}	9002±90 ^{B}	9603±76 ^{A}	9913±136 ^{A}	9426±78
Protein efficiency ratio					
Control	1.64±0.07 ^{bcde}				
Raw	1.75±0.06 ^{abcd}	1.75±0.08 ^{abcd}	1.69±0.70 ^{abcde}	1.52±0.16 ^{cde}	1.68±0.05
Boiled	1.71±0.11 ^{abcde}	1.94±0.03 ^{a}	1.59±0.01 ^{cde}	1.49±0.14 ^{de}	1.68±0.07
Autoclaved	1.76±0.03 ^{abc}	1.69±0.07 ^{abcde}	1.56±0.14 ^{cde}	1.62±0.08 ^{bcde}	1.66±0.04
Alkaline	1.57±0.01 ^{cde}	1.87±0.03 ^{ab}	1.55±0.15 ^{cde}	1.63±0.06 ^{bcde}	1.65±0.06
Acid	1.68±0.21 ^{abcde}	1.94±0.06 ^{a}	1.46±0.08 ^{e}	1.53±0.03 ^{cde}	1.65±0.08
Overall mean	1.69±0.05 ^{B}	1.84±0.04 ^{A}	1.57±0.04 ^{BC}	1.55±0.04 ^{C}	1.66±0.03
Feather condition score					
Control	3.76±0.7				
Raw	3.67±0.10	3.78±0.07	3.52±0.10	3.71±0.07	3.67±0.04
Boiled	3.67±0.10	3.65±0.10	3.80±0.07	3.79±0.10	3.72±0.05
Autoclaved	3.82±0.09	3.93±0.03	3.75±0.08	3.83±0.09	3.83±0.04
Alkaline	3.84±0.09	3.90±0.04	3.66±0.11	3.77±0.07	3.79±0.04
Acid	3.86±0.05	3.73±0.08	3.71±0.75	3.62±0.12	3.73±0.04
Overall mean	3.77±0.04	3.80±0.03	3.69±0.04	3.74±0.04	3.75±0.02

Probabilities	Protein intake	Energy intake	Protein efficiency ratio	Feather condition score
Treatments	**	**	NS	NS
Control vs. Treatments	NS	NS	NS	NS
Within chemical treat.	**	**	*	NS
Chemical treatments	**	**	NS	NS
Levels	**	**	**	NS
Treatments x Levels	**	**	NS	NS

Table 6: Carcass, breast, and drumstick relative weights for broiler chicks fed various levels of raw or treated guava by-product.

Treatments	Replacement percentages				
	2%	4%	6%	8%	Overall mean
Carcass (g)					
Control	1296.7±18.8				
Raw	1407.0±52.8	1262.3±21.0	1269.3±45.1	1348.3±52.7	1321.8±35.4
Boiled	1358.3±42.7	1388.7±71.3	1364.0±52.3	1326.0±47.7	1358.8±25.9
Autoclaved	1435.3±58.1	1326.0±29.1	1350.7±48.8	1374.7±16.7	1371.7±26.3
Alkaline	1284.7±45.7	1316.0±49.1	1363.7±63.8	1437.0±51.1	1350.3±28.4
Acid	1248.0±29.1	1347.0±26.8	1277.0±13.9	1412.7±34.2	1321.2±22.5
Overall mean	1346.7±31.8	1327.6±19.7	1324.9±024.4	1379.7±21.2	1342.4±11.9
Breast (g/100g carcass weight)					
Control	25.76±1.16				
Raw	27.29±0.60	27.41±0.88	25.98±0.58	25.08±1.06	26.44±0.45
Boiled	26.39±0.84	28.30±2.77	24.75±2.31	26.90±0.24	26.59±0.88
Autoclaved	26.22±0.89	28.51±0.82	27.67±0.58	23.79±1.86	26.55±0.73
Alkaline	27.09±0.12	27.17±0.83	26.54±1.38	25.45±0.28	26.23±0.41
Acid	28.80±0.61	27.36±0.94	25.98±1.57	26.77±0.44	27.23±0.52
Overall mean	25.69±1.68[B]	2775±0.57[A]	26.18±0.60[B]	25.60±0.49[B]	26.28±0.47
Drumsticks (g/100g carcass weight)					
Control	14.53±0.58				
Raw	15.40±0.49	14.92±0.64	15.18±0.74	14.61±0.75	15.03±0.29
Boiled	14.16±0.41	13.40±0.46	16.71±2.52	14.26±0.26	14.63±0.67
Autoclaved	13.62±0.45	13.69±0.31	14.143±1.20	13.70±1.17	13.79±0.38
Alkaline	14.77±0.50	13.40±0.35	14.73±0.47	14.76±0.86	14.42±0.30
Acid	13.74±0.51	13.68±0.64	15.60±0.84	15.36±0.54	14.59±0.39
Overall mean	14.34±0.25	13.82±0.24	15.27±0.56	14.34±0.33	14.49±0.19

Probabilities	Carcass	Breast	Drumsticks
Treatments	**	**	NS
Control vs. Treatments	NS	NS	NS
Within chemical treat.[3]	**	**	*
Chemical treatments	**	**	NS
Levels	**	**	**
Treatments x Levels	**	**	NS

Table 7: Thigh, back and wings relative weights for broiler chicks fed various levels of raw or treated guava by-product.

Treatments	Replacement percentages				
	2%	4%	6%	8%	Overall mean
Thigh (g/100g carcass weight)					
Control	18.17±1.67				
Raw	15.45±0.39	16.19±0.73	15.87±0.65	16.68±0.77	16.05±0.31
Boiled	16.98±0.91	16.41±1.06	15.10±0.99	17.76±0.49	16.56±0.45
Autoclaved	17.75±0.75	16.96±0.22	16.88±0.57	16.32±2.02	16.98±0.50
Alkaline	15.82±0.51	16.01±0.34	16.99±0.92	17.38±0.65	16.50±0.34
Acid	17.14±0.41	16.70±0.71	17.14±0.44	16.70±0.68	16.92±0.26
Overall mean	16.63±0.331	16.45±0.27	16.39±0.35	16.97±0.43	16.69±0.18
Back (g/100g carcass weight)					
Control	21.29±0.53 ^{abcde}				
Raw	22.03±0.19^{abcde}	22.04±0.31^{abcde}	23.55±0.36^{a}	21.74±0.29^{abcde}	22.34±0.25
Boiled	22.48±0.78^{abcd}	21.91±0.91^{abcde}	23.44±1.10^{ab}	20.47±0.57^{cde}	22.08±0.49
Autoclaved	22.78±0.90^{abc}	2107±0.13^{bcde}	20.50±0.64^{cde}	19.66±1.545^{e}	20.10±0.53
Alkaline	21.84±0.22^{abcde}	22.89±0.50^{abc}	22.17±0.72^{abcd}	20.05±0.87^{de}	21.74±0.41
Acid	20.93±0.46^{bcde}	22.30±0.48^{abcd}	20.43±0.70^{cde}	20.98±0.84^{bcde}	21.16±0.35
Overall mean	22.01±0.28 ^{A}	22.04±0.26 ^{A}	22.02±0.46 ^{A}	20.58±0.40 ^{B}	21.65±0.19
Wings (g/100g carcass weight)					
Control	12.98±0.41 ^{abcd}				
Raw	12.15±0.30^{abcd}	12.05±0.06^{abcd}	12.03±0.28^{abcd}	12.17±0.41^{abcd}	12.10±0.13 ^{EF}
Boiled	11.26±0.43^{de}	12.22±0.56^{abcd}	11.26±.0.31^{de}	12.28±0.22^{abcd}	11.76±0.23 ^{EF}
Autoclaved	11.95±0.18^{bcd}	12.26±0.34^{abcd}	12.49±0.32^{c}	10.59±0.48^{cde}	11.82±0.27 F
Alkaline	12.73±0.28^{abc}	12.93±0.15^{ab}	13.39±0.73^{a}	11.53±0.38^{abcd}	12.65±0.28 ^{D}
Acid	12.04±0.38^{abcd}	12.37±0.24^{abcd}	13.21±0.25^{ab}	12.41±0.41^{abcd}	12.51±0.19 ^{DE}
Overall mean	12.03±0.18	12.37±0.15	12.48±0.26	11.79±0.23	12.16±0.10

Probabilities	Thigh	Back	Wings
Treatments	NS	*	**
Control vs. Treatments	NS	NS	NS
Within chemical treat	NS	*	**
Chemical treatments	NS	NS	**
Levels	NS	**	**
Treatments x Levels	NS	NS	NS

Table 8: Abdominal fat, liver and gizzard + proventricul relative weights for broiler chicks fed various levels of raw or treated guava by-product.

Treatments	Replacement percentages				
	2%	4%	6%	8%	Overall mean
Abdominal fat (g/100g BW)					
Control	1.49±032 ^{bcde}				
Raw	1.96±0.28 ^{bcd}	1.98±0.50 ^{bcd}	1.77±023 ^{bcde}	1.23±0.32 ^{cde}	1.73±0.18 ^{E}
Boiled	3.39±.0.28 ^{ab}	1.95±0.43 ^{bcde}	4.07±0.05 ^{a}	1.12±0.18 ^{cde}	2.63±037 ^{D}
Autoclaved	1.95±0.76 ^{bcd}	1.47±0.28 ^{cde}	1.67±0 28 ^{cde}	1.98±0.03 ^{bc}	1.77±0.20 ^{F}
Alkaline	2.01±0.42 ^{bc}	2.08±0.07 ^{bc}	1.39±0.04 ^{cde}	0.45±0.26 ^{de}	1.48±0.24 ^{E}
Acid	1.75±0.05 ^{cde}	1.96±074 ^{bcd}	0.82±0.43 ^{cde}	0.31±0.31 ^{e}	1.21±0.30 ^{F}
Overall mean	2.21±0.24 ^{A}	1.89±0.23 ^{A}	1.95±0.32 ^{A}	1.02±0.19 ^{B}	1.75±0.13
Liver (g/100gBW)					
Control	2.53±0.10				
Raw	2.22±0.14	2.34±0.23	2.67±0.31	2.27±0.26	2.36±0.11
Boiled	2.06±0.37	2.21±0.17	2.23±0.07	1.86±0.08	2.09±.0.10
Autoclaved	2.51±0.33	2.20±0.12	1.91±0.05	2.48±0.65	2.27±0.17
Alkaline	2.00±0.25	2.20±0.26	2.32±0.35	1.95±0.09	2.12±0.12
Acid	1.93±0.15	1.71±0.15	2.24±0.32	2.08±0.19	1.98±0.11
Overall mean	2.15±0.11	2.13±0.09	2.27±0.11	2.13±0.14	2.18±0.06
Gizzard + proventriculas (g/100g BW)					
Control	3.43±0.34				
Raw	3.29±0.28	2.99±0.31	3.40±0.11	2.89±0.33	3.14±0.34
Boiled	2.89±0.48	3.08±0.34	2.87±0.18	3.05±0.10	2.98±0.25
Autoclaved	2.85±0.23	3.10±0.06	3.01±0.34	2.86±0.32	2.96±0.24
Alkaline	2.88±0.24	2.93±0.18	2.87±0.31	2.87±0.24	2.89±0.25
Acid	2.97±0.29	2.87±0.22	2.78±0.12	2.84±0.35	2.87±0.22
Overall mean	2.98±0.24	3.01±033	2.99±0.24	2.90±0.24	2.98±0.24

Probabilities	Abdominal fat	Liver	Gizzard + proventriculas
Treatments	**	NS	NS
Control vs. Treatments	NS	NS	NS
Within chemical treat.	**	NS	NS
Chemical treatments	**	NS	NS
Levels	**	NS	NS
Treatments x Levels	**	NS	NS

Table 9: Intestinal weight, and length and cecum length for broiler chicks fed various level of raw or treated guava by-product.

Treatments	Replacement percentages				
	2%	4%	6%	8%	Overall mean
	Total intestinal weight (g/100g carcass weight)				
Control	4.74±0.35^{a}				
Raw	3.96±0.36^{abcde}	3.42±0.03^{cdef}	4.58±0.17^{ab}	3.77±0.31^{abcdef}	3.93±0.18^{DE}
Boiled	3.12±.0.24^{def}	2.88±0.35^{f}	4.14±0.11^{abcd}	3.96±0.32^{abcde}	3.52±019^{F}
Autoclaved	3.77±0.05^{abcdef}	4.47±0.34^{abc}	4.26±0.27^{abc}	4.38±0.10^{abc}	4.22±0.12^{D}
Alkaline	3.58±0.34^{abcdef}	3.40±0.13^{cdef}	3.83±0.29^{abcdef}	3.93±0.19^{abcde}	3.68±0.12^{E}
Acid	3.46±0.23^{bcdef}	3.02±0.15^{ef}	4.61±0.28^{a}	4.44±0.31^{abc}	3.88±0.23^{DE}
Overall mean	3.58±0.13^{B}	4.34±0.18^{A}	4.28±0.12^{A}	4.09±0.12^{A}	3.80±0.08
	Total intestinal length (cm/100g BW)				
Control	9.97±0.23^{ab}				
Raw	8.07±0.38^{e}	8.87±0.15^{bcde}	9.27±047^{abcde}	8.87±0.62^{bcde}	8.77±0.22^{DE}
Boiled	8.07±.0.47^{e}	8.67±0.15^{bcde}	8.87±0.34^{bcde}	8.80±0.23^{bcde}	8.60±0.17^{DE}
Autoclaved	8.63±0.37^{cde}	9.60±0.20^{abc}	9.37±0.64^{abcde}	10.50±0.35^{a}	9.53±0.27^{D}
Alkaline	9.50±0.59^{abcd}	8.73±0.22^{bcde}	9.50±0.23^{abcd}	8.67±0.50^{bcde}	9.10±0.21^{DE}
Acid	8.20±0.35^{de}	8.93±0.12^{bcde}	9.93±0.43^{abc}	9.23±0.32^{abcde}	9.08±0.23^{E}
Overall mean	8.49±0.22^{B}	8.96±0.11^{AB}	9.39±0.19^{A}	9.21±0.24^{A}	9.06±0.10
	Cecum length (cm/100g BW)				
Control	2.19±0.20^{abcd}				
Raw	2.58±0.37^{a}	2.02±0.12^{bcde}	2.20±007^{abcd}	2.11±0.31^{abcde}	2.23±0.13
Boiled	1.58±.0.10^{e}	1.89±0.15^{bcde}	2.02±0.17^{abcde}	2.14±0.08^{abcde}	1.91±0.09
Autoclaved	1.90±0.10^{bcde}	2.13±0.08^{abcde}	1.75±0.13^{de}	2.42±0.07^{ab}	2.05±0.09
Alkaline	1.98±0.15^{abcde}	2.03±0.16^{abcde}	2.11±0.09^{abcde}	2.35±0.34^{abcd}	2.11±0.09
Acid	1.41±0.11^{abcde}	1.79±0.09^{cde}	2.39±0.03^{abc}	2.07±0.27^{abcde}	1.91±0.13
Overall mean	1.89±0.13^{B}	1.97±0.06^{B}	2.09±0.07^{AB}	2.22±0.01^{A}	2.05±0.05

Probabilities	Cecum length	Total intestinal	
		length	weight
Treatments	*	**	**
Control vs. Treatments	NS	*	**
Within chemical treat.	**	**	**
Chemical treatments	NS	*	**
Levels	*	**	**
Treatments x Levels	*	NS	NS

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الملخص العربي

أستخدام مخلفات الجوافة فى الأعلاف الناهية لكتاكيت اللحم

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اجريت هذة الدراسة بمركز بحوث الدواجن بكلية الزراعة – جامعة الأسكندرية بهدف بحث أمكانية أستخدام مخلفات تصنيع الجوافة فى أعلاف كتاكيت اللحم فى فترة التشطيب و تاثير اضافة هذه المخلفات فى صورتها الخام او المعاملة على الصفات المختلفة لكتاكيت اللحم.

تم الحصول على مخلفات تصنيع الجوافة من شركة الكروم (الأسكندرية) وتشمل هذة المخلفات على اللب والبذور والثمار الغير صالحة للتصنيع وتم تجفيفها شمسيا ثم طحنت وبعد ذلك اجريت مجموعة من المعاملات منها الغليان فى الماء العادى لمدة ساعة و التسخين تحت ضغط لمدة ٢٠ دقيقة على ضغط ١٥ رطل /بوصة مربعة والغليان فى محلول قلوى ٠,١ عيارى لمدة ساعة والغليان فى محلول حامضى ١ , ٠ عيارى لمدة ساعة ثم جففت بصورتها الكاملة فى مجففات على درجة حرارة ٦٠ درجة منوية. و اجرى التحليل الكيميائى للعينات فى صورتها الخام وكذلك المعاملة.

أوضحت نتائج التحليل الكيميائى أن المخلف الخام والمعامل بالغليان العادى والمعامل بالتسخين تحت ضغط والمعامل بالقلوى والمعامل بالحامض أنه يحتوى على بروتين خام ٩,٠٨ % ، ٥,٢٥ % ، ٧,٤٠ % ، ٦,١٧ % ، ٩,٠٥ % على الترتيب وكانت نسبة الدهن الخام ١٠,٠ % ، ٥,٥٠ % ، ٧,١٠ % ز ٥,٥٠% ، ٤,٨٠ % والألياف الخام ٣٩,٥% و ٥٤,٣% ، ٤٩,٤ % ، ٥٣,٣% ، ٤٧,٩% ، والكربوهيدرات الغير ذائبة ٣٢,٩٧ % و ٢٧,٦٩% ٢٨,٠% و ٢٦,٠٤% ، ٢٩,٤٦% والرماد ٢,٥٥% ، ١,٥٦% ، ٢,٢٥% ، ٣,٠١% ، ٢,٦٨% على التوالى. كذلك تم تقدير الطاقة الممثلة للمخلف الخام والمعامل بالغليان العادى والمعامل بالتسخين تحت ضغط

والمعامل بالقلوى والمعامل بالحامض وكانت قيمتها كالتالى ٢٢٢٦ و ٩٦٩ و ١٤٠٢ و ١٢٠٦ و ١٢٥٤ كيلو كالورى/ كجم على التوالى.

أستخدم فى هذه الدراسة عدد (٢١٠) مئتان وعشرة كتكوت لحم عمر ٤ أسابيع وزعت عشوائيا وقسمت الى (٢١) أحدى وعشرون معاملة غذائية وكل معاملة مكررتان وكل مكررة تحتوى (٥) خمسة كتاكيت. المعاملة التجريبية الأولى غذيت على عليقة مقارنة (كنترول) خالية من اى مخلف بينما المعاملات العشرون التالية احتوت على المخلف فى صورته الخام وكذلك فى الصورة المعاملة وذلك بالنسب التالية ٢ و ٤ و ٦ و٨ %وذلك استبدالا من العلف المقارن.

واوضحت النتائج انه لايوجد أى أختلافات معنوية خلال فترة الدراسة وذلك بالنسبة لوزن الجسم وكذلك للوزن المكتسب عند نهاية فترة الدراسة(فترة التشطيب). لوحظ وجود أختلافات معنوية داخل المعاملات وأن هناك تأثير واضح لنسبة الأستبدال على أستهلاك العلف و أستهلاك البروتين و استهلاك الطاقة وذلك مقارنة بالمعاملة المقارنة. وان الكتاكيت التى غذيت على علف يحتوى على نسبة ٢ و ٤ % من مخلف الجوافة لها كفاءة تحويلية واستخدامية للعلف افضل من كتاكيت المعاملات الغذائية الأخرى.

درجة التريش للكتاكيت لم تتأثر سواء بالمعاملات الكيميائية المختلفة اوبمسويات الأستبدال المستخدمة. تأثرت نسبة النفوق بالمعاملات وكانت اعلى نسبة نفوق مع المستويات المرتفعة للأستبدال ٦ و ٨ %. لوحظ عدم وجود فروق او أختلافات معنوية بين وزن الذبيحة. كذلك لم يكن هناك فروق معنوية فى وزن الصدر وذلك نسبة الى وزن الذبيحة وذلك للكتاكيت التى غذيت على مستوى ٢ و ٦ و ٨ % من المخلف فى صورته الخام او المعامل وبصفة عامة يعتبر الوزن النسبى لصدر الطيور التى غذيت على نسبة ٤ % من المخلف فى صورته الخام او المعامل هى اعلى وزن نسبى مقارنة بالمستويات الأخرى او بالمجموعة المقارنة. لوحظ عدم وجود فروق معنوية فى الوزن النسبى للفخذ والدبوسان والكبد وكذلك الوزن النسبى للقونصة+ المعدة الغدية. وجدت اختلافات فى وزن الدهن البطنى فبينما لايوجد فروق معنوية بين الكتاكيت التى غذيت على النسب ٢ و ٤ و ٦ % من المخلف فى صورته الخام او المعامل الا ان الكتاكيت التى غذيت على مستوى ٨ % من المخلف فى صورته الخام او المعامل ينخفض وزن الدهن البطنى لها بصورة معنوية مقارنة بالمستويات الأخرى او المجموعة المقارنة.

<u>الخلاصـــة</u>: من هذه الدراسة يتضح أنه يمكن استخدام مخلفات تصنيع الجوافة الخام حتى نسبة أستبدال ٤% من مكونات العلف الناهى لكتاكيت اللحم دون حدوث أى أضرار خلال فترة التشطيب على أداء الطيور .