

Improving tenderness of off-layer chicken meat using dried papaya (*Carica papaya*) leaves dietary supplementation

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Abstract

This experiment was carried out at Gezira University Poultry Farm to evaluate the effect of adding papaya dry leaves to off-layer chicken diet before slaughter. Forty eight hens were used, half of them fed a concentrate ration containing 10% dried papaya leaves (DPL), and the other half fed a normal layer ration (Control) for ten days. After slaughter two methods of cooking were used (oven and moist cooking). The cooked parts (breast, thigh and drumstick) were subjected to a panel test evaluation according to a designed questionnaire. Results showed that addition of dried papaya leaves powder to spent layer hens ration significantly ($p < 0.05$) increased the level of meat tenderness. There were significant ($p < 0.05$) differences among the different parts (breast, thigh and drumstick) and between different treatments for the different sensory attributes. Moist cooking had significantly ($p < 0.05$) improved meat tenderisation compared to oven cooking in both experiments. There was no significant difference ($p > 0.05$) with respect to application time.

Key words: Meat tenderness, moist cooking. papaya leaves, spent hens

Résumé

Cette expérience a été réalisée à la ferme avicole de l'université de Gezira pour évaluer l'effet de l'ajout de feuilles sèches de papayer à l'alimentation des poules non-pondeuses avant l'abattage. Quarante-huit poules ont été utilisées, la moitié d'elles recevait une ration concentrée contenant 10% de feuilles de papayer séchées (DPL), et l'autre moitié recevait une ration normale des pondeuses (contrôle) pendant dix jours. Après l'abattage, deux méthodes de cuisson ont été utilisées (la cuisson au four et la cuisson humide). Les parties cuites (la poitrine, la cuisse et le pilon) ont été soumises à une évaluation sous forme de test selon un questionnaire conçu. Les résultats ont montré que l'addition de la poudre des feuilles sèches de papayer à la ration dépensée des poules pondeuses a augmenté de manière significative ($p < 0,05$) le niveau de tendresse de la viande. Il y

avait des différences significatives ($p < 0,05$) entre les différentes parties (poitrine, cuisse et pilon) et entre les différents traitements pour les différents attributs sensoriels. La cuisson humide avait significativement ($p < 0,05$) amélioré l'attendrissage de la viande par rapport à la cuisson au four dans les deux expériences. Il n'y avait pas de différence significative ($p > 0,05$) par rapport au temps d'application.

Mots clés: Tendresse de la viande, cuisson humide, feuilles de papayer, poules utilisées

Background

The poultry industry is one of the most important sectors of agriculture in Sudan. The industry is often faced with a large number of off-layers that are normally sold as old chicken at a lower prices than broiler chickens (Sulieman, 1996). Off-layers have one disadvantage of having hard meat. The usually recommended practices of improving tenderness of off-layer meat through post-slaughter manipulations are costly, labor intensive large storage area and require longer storage time. Therefore, they are impractical and not economically viable. This study investigated the use of papaya leaves to improve off-layer meat tenderness.

Literature Summary

Papain is used in biochemical research involving the analysis of proteins, in preparations of various remedies for indigestion, in tenderising meat, and in enzyme action cleaning for soft contact lenses. It is used to shrink or dissolve ruptured disks in certain kinds of lumbar spine injuries, and otherwise as a digestant of protein (Encyclopedia Britannica, 2009). Papaya latex is a complex mixture of chemical compounds with diverse chemical activities (El Moussaoui *et al.*, 2001). It serves as an excellent meat tenderiser (Huet *et al.*, 2006). Sensory evaluation of papain treated off-layer hens revealed significantly higher score for juiciness, tenderness and overall acceptability (Mendiratta, *et al.*, 2002). They added that there were no significant differences in percent cooking loss, pH, moisture, protein and fat percentage. It was concluded that dietary supplementation of 2% papaya leaf meal in off-layer hens for a few days before slaughter improved meat quality in terms of meat tenderness and juiciness (Navid, *et al.*, 2011).

Study Description

This experiment was carried Animal Production Unit of the Faculty of Agricultural Sciences, Gezira University. The main objective was to study the effect of feeding spent layer hens a layer diet containing 10% of dried papaya leaves powder, on

the tenderness of their meat. Forty eight off-layer hens were randomly selected according to their average body weight. The hens were divided into two treatments of three replicates each. One group received a normal layer ration (0% dried papaya leaves); while the other group received a diet contained 10% dried papaya leaves powder (Table 1). Rations were formulated according to NRC (1994). The feeding period was extended for 10 days. The two groups were fed *ad-libitum*.

Table 1. Ingredient and chemical composition of the layers rations.

Ingredient%	Control	Treated
Sorghum	54	46
Groundnut cake	16.5	16
Wheat bran	15	14
Oyster shell	9	9
Salt	0.5	0.5
Papaya	0	10
Super concentrate*	5	4.5
Total	100	100
Calculated chemical composition		
Dry matter (DM) %	90.4	85.5
Crude protein (CP)%	18.8	18.4
Crude fibre (CF)%	5	5.8
Ether extract (EE)%	3.3	3.3
Metabolisable energy (ME) kcal/kg**	2850	2800
Calcium (Ca)%	4.2	4.5
Phosphorus available (Pav.)%	0.4	0.5

* Super concentrate contains the following: 35% CP, 2% EE, 4% CF, 10% calcium, 4.5% available phosphorus, 5.7% lysine, 4.5% methionine and 4.9% methionine + cystine. Metabolisable energy 2000 kcal/kg, 2.6% Sodium with added vitamins and minerals.

** Metabolisable energy was calculated according to the formula derived by Lodhi *et al.* (1976). $ME = 1.549 + 0.0102 Cp + 0.0275 oil + 0.0148 NFE - 0.0034 fibre$.

Measurements taken included. Feed intake was recorded daily and the total feed intake later computed. The total egg production and total egg weight for each group was recorded. At the end of the feeding period, the average body weight and body weight gain were obtained. Twelve hens from each group were selected according to their average body weight for further studies. Then the hens were slaughtered by severing the two Jugular veins, the esophagus and the trachea. Post slaughter body weight, carcass weight, some internal organs weight (gizzard, liver, abdominal fat pad) and some carcass parts

weights (breast, drumstick and thigh) was taken. The different parts were cooked by two methods, braising in an electric oven or cooking in a pot (moist cooking) using a gas burner.

Sensory evaluation of meat. A questionnaire was prepared to facilitate the evaluation of cooked parts attributes. These included colour, flavour, juiciness and tenderness.

Statistical analysis. Data collected was subjected to analysis of variance as described by Steel and Torrie (1980) under completely randomised design using MSTAT-C (Russelle and Eisensmith, 1983). Duncan's Multiple Range Test (1955) was used to determine the differences among the treatments means.

Research Application

The inclusion of dried papaya leaves powder in feed of spent layer hens had no significant ($p > 0.05$) effect on the dry matter intake (Table 2). However, the hens fed on diets supplemented with papaya leaves had significantly ($p \leq 0.05$) higher live body weight, carcass and abdominal fat pad weights and dressing percentage. There were no significant effects ($p > 0.05$) on other organs (liver, gizzard, breast, thigh and drumstick) weights. In evaluating off-layer hens' meat prepared by oven cooking method, the breast had significantly ($p \leq 0.05$) the best quality attributes followed by the thigh then the drumstick in both treatments (Table 3). Moist cooking led to further improvement on the different traits addressed by the study compared with the oven cooking (Table 4).

Table 2. Average carcass weight of selected internal organs weight and some selected carcass parts of off-layer chicken.

Item	Treated group	Control group
Total feed intake (g)	1100 a	1150 a
Final body weight (g)	1500 a	1420 b
Carcass weight (g)	885 a	845 b
Dressing %	59.0 a	59.5 a
Liver (g)	21a	20a
Gizzard (g)	31a	30a
Abdominal Fat pad (g)	28 a	25 b
Breast (g)	250a	245a
Thigh (g)	150a	140a
Drumstick (g)	125a	120a

Means in rows followed by the same letter are not statistically significant according to Duncan's Multiple Range Test (1950).

Table 3. Effect of dried papaya leaves dietary supplementation to spent layers on the sensory attributes of meat prepared by oven cooking.

Quality attributes	Treated group			Control group		
	Breast	Thigh	Drum stick	Breast	Thigh	Drum stick
Color	17 a	15 a	14 b	16 a	14 a	11 b
Flavor	15 a	15 a	13 b	16 a	13 b	12 b
Juiciness	16 a	14 b	12 c	15 ab	12 c	11 c
Tenderness	17 a	15 b	14 b	15 a	15 a	11 b
Total points	65 a	59 b	51 d	62 ab	54 c	45 e

Means in rows followed by the same letter are not statistically significant according to Duncan's Multiple Range Test (1950).

Table 4. Effect of dried papaya leaves dietary supplementation to off-layer chicken on the sensory attributes of meat prepared by moist cooking.

Quality attributes	Treated group			Control group		
	Breast	Thigh	Drum stick	Breast	Thigh	Drum stick
Color	18 a	16 b	16 b	16 b	15 b	16 b
Flavor	17 a	16 b	15 b	16 a	15 a	15 a
Juiciness	17 a	16 a	16 a	16 a	15 a	15 a
Tenderness	17 a	16 a	15 a	15 b	14 b	15 a
Total points	69 a	64 ab	62 ab	63 ab	59 c	61 b

Means in rows followed by the same letter are not statistically significant according to Duncan's Multiple Range Test (1950).

Recommendation

It is recommended that off-layer feed be supplemented with dry papaya leaves to improve their meat quality.

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