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RESEARCH ARTICLE

Meat Quality of Recycled Layers during Molt and Post Molt Production Cycle: Proximate Composition and Organoleptic Properties of Breast Meat

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ABSTRACT

The present experiment was conducted to evaluate quality of breast meat in White Leghorn layers during molt and post molt production cycle. One hundred and twenty layers (72 week old) of uniform body weight (1.51±0.04) were taken for induction of molt through feed withdrawal method. Out of this flock 10 birds at pre molt and 10 at post fast (10 days of fasting) stage were randomly picked up, slaughtered and breast meat samples were collected for further processing. After 10 days of fasting, remaining 100 hens were offered cracked corn diet for 25 days. After the completion of molting, 10 more bird were slaughtered and breast meat samples were collected. The remaining hens were then provided *ad-libitum* layer ration during 2nd production cycle. Ten birds each at 50% egg production stage and at the end of 2nd production cycle were slaughtered and breast meat samples were collected. All samples were analyzed for proximate composition and organoleptic properties. Results regarding proximate composition of layer meat determined at different stages of molting and post molt production revealed that protein content (22.59±0.44%) of breast meat were significantly (P<0.05%) increased whereas, dry matter, ether extract and ash contents were significantly decreased at post fast stage with respect to other stages. Maximum color (7.57±0.21) score was found in breast meat at post molt while minimum (P<0.05%) color scores (6.67±0.11) was observed at 50% production stage. However, tenderness (6.38±0.22) and juiciness (6.52±0.18) were reduced to minimum (P<0.05) at post-molt stage and were maximum at the end of 2nd production cycle. These results indicate that breast meat of molted layer at the end of 2nd production cycle has almost similar nutritional values with more juiciness and tenderness.

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INTRODUCTION

Malnutrition is a serious public health problem in the developing countries of the world including Pakistan. This is mainly because the available foods are of poor quality and inadequate to meet the needs of the people. The diet of Pakistani people is grossly deficient in animal protein. At present the availability of animal protein indicates a shortage of about 30% (Javaid *et al.*, 2012). Among animal protein sources, chicken meat plays a vital role in providing high quality nutrition and it can help to fulfill the widening gap between increasing human population requirement and availability of animal protein. Chicken meat as a food is quick and easy to prepare and serve with a number of desirable nutritional and organoleptic properties (Panda, 1995). Breast meat is low in calories and high in protein in comparison to thigh meat. Cooked chicken breast meat contains 1.3% fat, 31.5% protein, 67.2% moisture in addition to 1366 food energy calories per kilogram (Manzoor *et al.*, 1999).

Availability of chicken meat at cheaper price to the low income people may help make up the deficiency of animal protein in Pakistan. Apart from broiler chicken, 50.1 million spent birds (39.9 million layers and 10.2 million breeders) are also under human consumption at the end of every egg production cycle contributing more than 63,000 tons to poultry meat per annum in Pakistan (Anonymous, 2014). Normally spent birds are available for meat purpose after completing 1st production cycle. However, the extensive use of induced molting technique for extending the productive life of the hen has changed its entire scenario as spent bird's meat is now available after two production cycles (Javaid *et al.*, 2012). Different methods have been used to induce molt but feed deprivation remains the most widely utilized method because it is simple, practicable and economical (Yousaf and Ahmed, 2006).

A common thinking prevails that technique of induced moult with extensive fasting may have adverse effects on meat composition and organoleptic qualities which might not recover and meat remains inappropriate for human consumption at the end of 2nd production cycle. During molt induction process and post molt production cycle some changes in meat composition has been observed in different studies. During molting period, birds mobilized body fat which reduced to minimum at post fast phase (Zia-ul-Hasan *et al.*, 2000). Dry matter, Ether Extract (EE) and ash contents of breast and thigh meat reduced to minimum at early post-moult stage. However, these contents were restored in the later stages (Javaid *et al.*, 2012). In contrast to this, the protein percent of the meat increased to maximum at post fast stage and then became normal at later stages (Akram, 1998; Javaid *et al.*, 2012).

Though some studies have been conducted to evaluate meat quality during molt and at the end of 2nd production cycle but the information regarding proximate composition and organoleptic properties of breast meat during induced molt and at the end of 2nd production cycle was not fully known. Therefore, present study was undertaken to determine the meat quality in terms of proximate composition and organoleptic properties during molting and post molt production cycle.

MATERIALS AND METHODS

One hundred and twenty White Leghorn layers (72 weeks old) at the end of first production cycle, having uniform body weight (1.51±0.04 kg) were placed in individual cages in an insulated, fan ventilated, light-tight building. These hens were given 7 days of adjustment period during which these were provided *ad-libitum* layer ration and water with 24 hours light. The hens were also dewormed, vaccinated against New Castle Disease and given antibiotics to prevent secondary infections. At the end of adjustment period, 10 hens were randomly selected, slaughtered and meat samples were drawn from both sides of breast after removing the feathers and skin (Jull, 1976) and pooled separately. One part of these samples was separated for organoleptic qualities while other part was saved in labeled plastic bags and stored in freezer for further analysis. The remaining hens were induced to molt by withdrawal of feed for 10 days, simultaneously reducing the light from 24 hours to 6 hours (Akram and Zia-ur-Rehman, 1998). Following a 10 days fast, 10 hens were selected at random, slaughtered and breast meat samples were stored as previously described.

The remaining 100 layers were given cracked corn diet for 25 days with same light pattern as was in fasting. Thereafter, 10 more birds were slaughtered and breast meat samples were stored. This was followed by *ad-libitum* feeding of layers ration containing 17% protein and 2900 metabolizable energy and provision of natural day-light (14 hours). Afterwards, day-light was increased in half an hour increments per week to 16 hours for the remaining entire period of the experiment. The ingredients and chemical composition analysis of layer ration and cracked corn diet are shown in table 1. Ten birds each at 50% egg production stage and at the end of 2nd production cycle hens were randomly selected, slaughtered and breast meat samples were stored for further analysis.

The frozen breast meat samples were thawed and then ground in a meat grinder using a die with 0.5 cm diameter holes. A part of each sample was dried by mixing with anhydrous sodium sulfate in 1:4 ratios, ground in pestle mortar and then used for proximate analysis. The remaining of each sample was used for determination of Dry Matter (DM) content. Proximate composition (DM, crude protein, ether extract and ash) of samples was determined by methods of AOAC (1990). The breast meat samples were roasted according to Passmore (1978) and were evaluated organoleptically for color, flavor, taste, juiciness, tenderness, chewability and acceptability (Larmond, 1977).

The data thus collected were subjected to analysis of variance technique in completely randomized design (Snedecor and Cochran, 1976). Treatment means were reported using the method of Duncan's Multiple Range test (Steel *et al.*, 1997) at 5 percent level of probability.

RESULTS AND DISCUSSION

Results regarding proximate composition and organoleptic properties of breast meat at different stages of molt and post molt production cycles are presented in table 2 and 3, respectively.

Table 1: Composition of corn diet and layer ration

Ingredients	Corn diet	Layer ration
Ground corn	100	40.0
Rice broken	--	17.0
Rice polishing	--	6.0
Wheat bran	--	2.0
Cottonseed meal	--	4.0
Rapeseed meal	--	5.0
Sunflower meal	--	3.0
Corn gluten meal 30%	--	2.0
Corn gluten meal 60%	--	5.3
Fish meal	--	6.0
Blood meal	--	1.0
Lime stone	--	4.5
Dicalcium phosphate	--	0.7
Molasses	--	2.0
Soybean oil	--	1.0
Vitamin-mineral premix	--	0.5
Total	100	100
Chemical analysis (%)		
Crude protein	9.23	17.04
ME (kcal/kg)	3400	2896
Crude fiber	2.49	3.79
Calcium	0.03	2.05
Phosphorous	0.08	0.33
Lysine	0.24	0.65
Methionine	0.21	0.35

Table 2: Proximate composition (%) of breast meat in White Leghorn layers at different stages of molt and post molt production cycle

Proximate composition	Stages				
	Pre molt	Post fast	Post molt	50% Production	End of Trial
Dry matter	28.74±0.64^{A}	27.12±0.57^{B}	27.47±0.71^{AB}	28.39±0.66^{AB}	29.03±0.62^{A}
Crude protein	21.80±0.49^{AB}	22.59±0.44^{A}	21.41±0.39 ^{B}	21.76±0.42 ^{AB}	21.89±0.51 ^{AB}
Ether extract	2.31±0.18^{A}	1.85±0.14^{B}	2.11±0.17^{AB}	2.24±0.13^{A}	7.28±0.17^{A}
Ash	1.44±0.08^{A}	1.15±0.09^{B}	1.25±0.10^{AB}	1.36±0.09^{AB}	1.41±0.10^{A}

^{A,B}Means within a row lacking a common superscript differ (P<0.05)

Table 3: Organoleptic properties (Means±SE) of breast meat in white leghorn layers at different stages of molt and post molt production cycle

Organoleptic parameters	Stages				
	Pre molt	Post fast	Post molt	50% Production	End of Trial
Color	7.38±0.19^{A}	6.67±0.16^{B}	7.57±0.21^{A}	7.29±0.16^{A}	7.33±0.14^{A}
Flavor	7.00±0.19	7.19±0.24	6.81±0.19	6.86±0.22	7.29±0.25
Chewbility	6.90±0.21	7.10±0.28	6.71±0.22	7.24±0.23	7.27±0.27
Tenderness	7.14±0.26^{A}	7.05±0.21^{A}	6.38±0.28^{B}	6.86±0.23^{AB}	7.19±0.18^{A}
Juiciness	6.71±0.16^{AB}	6.81±0.18^{AB}	6.52±0.18^{B}	7.14±0.19^{A}	7.27±0.21^{A}
Taste	6.85±0.18	7.05±0.15	7.38±0.21	6.97±0.24	7.14±0.19
Acceptability	7.10±0.22	6.90±0.19	6.86±0.21	7.14±0.26	7.38±0.23

^{A,B}Means within a row lacking a common superscript differ (P<0.05).

Proximate composition

Proximate composition of breast meat at various stages of molt and production indicates significant (P<0.05) differences in DM content at different stages (Table 2). Dry matter percentage of breast meat was lower (27.12±0.51%) at post fast stage compared to pre molt stage (28.74±0.54%) however; it increased with increase in age and was found maximum (29.03±0.62%) at the end of 2nd production cycle. Fasting during molting resulted in depletion of body reserves like fat, protein and ash contents reflecting decrease in dry matter, hence, moisture percentage of meat increased. Significant decrease in DM percentage of hens as a result of fasting during molting and then increasing trend has also been reported by Hoyle and Garlich (1987); Akram (1998) and Javaid *et al.* (2012).

Maximum (P<0.05) protein content (22.59±0.51%) of breast meat was recorded at post fast stage and minimum protein content (21.41±0.39%) at post molt stage. However, after post molt stage there was significant increase in protein content of breast meat at 50% egg production stage as well as at the end of production cycle (21.89±0.0.51%). This highest protein content in breast meat at post fast stage was due to depletion of fat and ash contents of meat as a result of fasting. With the resumption of restricted feeding after fasting there was increase in mostly the fat content of the meat that resulted in decreased percent protein of the meat at post molt stage. Then with the provision of *ad libitum* layer ration after molting there was increase in protein percentage of breast meat due to more protein availability from the feed. Our results are also supported by the findings of Akram (1998) and Javaid *et al.* (2012) who also observed significant increase of protein percentage of breast meat at post fast stage compared to post molt stage.

Maximum (P<0.05) EE content (2.31±0.18%) was observed at pre molt stage whereas minimum EE content (1.85±0.14%) was noticed at post fast stage in breast meat. This drastic decrease in EE content at post fast stage was due to the utilization of body fat to provide energy to the bird during fasting. However after fasting, with the provision of corn diet, there was increase in EE content at post molt stage. And thereafter, due to resumption of *ad libitum* feeding during production period there was increasing trend in EE content at 50% egg production stage and even at the end of 2nd production cycle due to more availability of energy. Significant decrease in EE content of breast meat after fasting and then increasing trend after molting and at the end of post molt production cycle was also reported in other studies (Akram, 1998: Javaid *et al.*, 2012).

Ash content followed the pattern similar to EE i.e. significantly (P<0.05) lower value (1.15±0.09%) in breast meat after fasting as a result of depletion of ash along with other meat components. Then with the resumption of feeding, after fasting, ash content again increased. These results are in line with the findings of Akram (1998) and Javaid *et al.* (2012) who also reported a decrease in ash content after fasting and then increasing trend thereafter.

Organoleptic Properties

Significant differences (P<0.0.5%) were found in mean values of color score in cooked breast meat of layers examined at different stages of molt and post molt production cycle (Table 3). Maximum (7.57±0.21) color score was observed at post molt stage and minimum (6.67±0.16) at post fast stage. The poor color score observed at post fast stage was probably due to depletion of body reserves during fasting. After fasting, corn diet was provided to the layers that might have improved color score in the birds. Similar trends in color score has also been reported by Manzoor *et al.* (1999).

Significant difference was noticed in mean values of tenderness score in breast meat of layers at different stages. Maximum tenderness score (7.19±0.18) was observed at the end of 2nd production cycle and minimum (6.38±0.28) at post-molt stage. The results of the present study revealed that decrease in tenderness during molting might have occurred due to depletion of body fat. Rafiq *et al.* (1999) also reported that low fat contents led to decrease tenderness of the meat.

Juiciness score of breast meat followed the similar trend as was in case of tenderness i.e. maximum value (7.27±0.21) was observed at the end of 2nd year life and minimum (6.52±0.18) at post molt stage. The difference in mean values of juiciness score in breast meat of layers was significant (P<0.05%). Since, fasting for 10 days and corn feeding for 25 days during revitalization process led to depletion of body fat; therefore minimum fat content resulted in decreased juiciness at post molt. But prior to revitalization and at the end of 2nd production cycle, the birds developed ample fat due to *ad libitum* feeding of layer ration which apparently caused juiciness (Akram, 1998). Results regarding flavor, chewability, taste and acceptability of breast meat were found to be non-significant with respect to different stages of molt and post molt production cycle.

Conclusion

It can be concluded from the present study that no doubt fasting during molt drastically decreased proximate content in breast meat but their levels were restored with the passage of time and ultimately became normal at the end of second production cycle whereas, juiciness and tenderness of meat improve after 2nd production cycle.

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