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Determining the Nutritional Quality of Breast Meat of Revitalized Layers

M. AKRAM, NIGHAT BHATTY†, UZMA MANZOOR, J.I. SULTAN‡ SAIMA RAFIQ, FARIA SALEEM AND MEMONA
Departments of Poultry Husbandry, †Rural Home Economics and ‡Animal Nutrition, University of Agriculture, Faisalabad–38040, Pakistan

ABSTRACT

A project was conducted to determine the nutritional value of white meat (breast) of spent and revitalized layers fed different moult diets. The old layers were subjected to moulting procedure through the manipulation of three protein levels (14, 16, 18%) and two energy levels (2700 and 2900 Kcal kg^{-1} ME) as six moult diets with three replicates of eight hens each. For breast meat samples, one bird per replicate was randomly picked up and slaughtered at each five stages i.e., 1-pre-moult, 2-post-fast, 3-post-moult, 4-peak, 5-end of 2^{nd} production cycle. The breast meat samples collected at these stages were roasted and evaluated for proximate analysis. The chemical analysis was conducted for protein, crude fate, moisture and ash. Moisture content was maximum at the post fast stage and minimum at peak production. Maximum protein content was observed at post fast and minimum at the pre-moult stage. Maximum fat content as well as ash content were observed at the end of the trial.

Key Words: Nutritional quality; Breast meat; Revitalized layers

INTRODUCTION

Poultry meat as a food is quick and easy to prepare and serve, with a number of desirable nutritional and organoleptic properties. It is low in calories and high in protein, especially enriched with essential amino acids. In total protein availability, animal protein is of more importance than vegetable protein. Therefore, poultry meat is considered best source of animal protein, having high biological value due to availability of all essential amino acids required to promote human growth and health (Panda, 1995).

Fat contents vary with the age of the birds. Considering the chicken according to the percentage of various nutrients present in it, chicken meat contains 25-35% protein but cooked meat contains 1.38% fat, 31.5% protein and 68% moisture. Chicken meat contains low amount of cholesterol than other foods of animal origin. So it is an ideal food for infants, young children, adolescents, adults, old people, convalescents and also for those who are attempting to control their weight (Mountney, 1985).

For chicken meat supply besides broiler sector, 13 million commercial layers are also being used annually for meat purpose at the termination of their normal production cycle. Availability of spent layer meat at cheaper price to the low income people is a good source to make up the deficiency of animal protein in Pakistan. Normally after the completion of egg production cycle, spent layers are used for eating purpose. But now new technique of induced moult is used to rejuvenate the spent layers for another egg production cycle (Akram, 1998), since these spent layers are available after completing their two production years. Aging in birds deposit more fat in their tissues resulting into decreased protein content. Breast protein of chicken was considered relatively low in fat content with high proportion of protein percent. The nutritive value of spent layers meat at the end of second production or even first production year is unknown. So the need arises to evaluate the quality of breast part of spent layer meat at the end of 2^{nd} production cycle.

MATERIALS AND METHODS

This research was carried out to study the nutritional quality of white (breast) meat of revitalized layers in the Food and Nutrition Research Laboratory, University of Agriculture, Faisalabad. The spent layers at the termination of their normal production cycle were induced to moult through the manipulation of six different moult diets, having three protein (14, 16 & 18%) x two metabolizable energy (2700 and 2900 Kcal kg^{-1}) levels with three replications of each. Eighteen birds comprising one bird per replicate were randomly picked up and slaughtered at each 5 stages i.e., 1-pre-moult, 2-post-fast, 3-post-moult,4-peak, 5-end of 2^{nd} production cycle. Breast meat samples collected at these stages were roasted following Asian Cook Book. The breast meat samples were processed for proximate analysis.

The chemical composition of breast meat of revitalized layers was carried out by following methods of A.O.A.C. (1990) for moisture, crude protein, crude fat and ash contents. The data obtained was statistically analyzed by applying completely randomized design as described by Steel and Torrie (1980) for further interpretations.

RESULTS AND DISCUSSION

Moisture. The results of the moisture content of cooked light meat of revitalized layers at different stages of 2^{nd} year life are presented in Table I. Statistical analysis of the data revealed a significant ($P<0.05$) difference in the mean values of the moisture content at different stages, whereas, protein and energy levels separately or in interaction could not influence the moisture content. Maximum (52.06±0.18%) moisture content was observed at post fast stage, which might be due to withdrawal of feed for 10 days but free excess to water that resulted into more moisture tissues at this stage. Akram (1998) also observed significantly higher moisture content of breast meat of moulted hens at post moult stage. Maximum (51.80±0.15%) moisture content was observed in birds fed 18% CP and minimum (51.70±0.19%) in birds fed 14% proetin diet. These results were supported by Mark and Pesti (1984) who observed an increase of H_2O on high protein diet, water; feed intake ratio became wider which resulted in higher moisture percentage in birds than those which were fed low protein diet. In another study, Ferket and Sell (1990) also reported significantly higher moisture content of meat in birds fed high protein low energy diet and lower moisture content with low protein, high energy diet.

Protein. The results of the protein content of cooked light meat of revitalized layers at different stages of 2nd year life are presented in Table II. Statistical analysis of the data revealed significant (P<0.05) differences in the mean values of the protein content at different stages, with dietary protein and its interaction with energy levels. However, energy levels alone could not influence the protein content. Maximum (37.01±0.18%) protein content was observed at post fast stage. Similar results were reported by Ang and Hamm (1985), who noticed significant differences among the birds fasted for 8, 20 or 32 hours (water was withdrawn two hours after feed withdrawal (on protein whereas, minimum (26.61±0.21%) protein content was observed at pre moult stage. Protein percentage of breast meat was low at pre-moult stage as compared to post fast stage. Increase in per cent protein in breast meat at post fast stage was probably due to loss of other meat components like fat and ash content as a result of fasting. Increase in protein percentage of breast meat after fasting during induced moulting has also been reported by other workers with same reason (Akhtar, 1996; Akram, 1998).

Among stages after dietary treatments, protein content of breast meat were significantly lower at post moult stage, which was due to restricted feeding of moult diets. In another study, Akram (1998) working on moulted hens also reported lower protein contents of breast meat at post moult stage. Maximum (33.74±0.67%) protein content was observed in birds fed 18% CP and minimum (32.77±0.74%) in birds fed 14% protein diet. Hence dietary protein developed positive relation with protein content of the carcass. These results were supported by Spring and Wilkinson (1957), who found that increase in dietary protein from 22 to 28% led to increase in body protein from 18.3 to 18.8% and 21.3 to 21.8%, respectively.

Fat. The results of fat content of cooked light meat of revitalized layer at different stages of 2nd year life are presented in Table III. Statistical analysis of the data revealed significant (P<0.05) differences in the mean values of fat content at different stages, with dietary protein and its interaction with energy levels. However, energy levels alone could not influence the fat content. Maximum (7.51±0.24%) fat content was observed at the end of the 2nd production cycle and minimum (6.06 ± 0.05%) at the post fast stage. The lower fat content at post fast stage was due to the utilization of body fat to provide energy for the birds during severe fasting for 10 days. After dietary treatments, fat content of breast meat was minimum at post moult stage, however, it went on increasing with time and ultimately attained the maximum value at the end of trial. The lower

Table I. Moisture contents (%) of Breast meat of recycled layers fed diets varying in protein and energy levels

Protein (%)	Pre-Moult	Post-Fast	Post-Moult	Peak	End	Mean
14	51.00±0.16	52.83±0.10	51.80±0.40	51.05±0.46	51.84±0.43	51.70±0.19
16	51.28±0.26	51.45±0.29	52.69±0.26	51.37±0.42	51.26±0.28	51.70±0.16
18	51.86±0.21	51.90±0.26	51.56±0.35	51.17±0.33	52.56±0.32	51.80±0.15
Energy (Kcal kg^{-1})						
2700	51.22±0.27	51.98±0.22	51.99±0.28	51.84±0.25	52.03±0.27	51.81±0.12
2900	51.54±0.10	52.14±0.31	52.05±0.35	50.55±0.21	51.75±0.38	51.60±0.15
Mean	51.38^B±0.14	52.06^A±0.18	52.02^A±0.22	51.20^B±0.22	51.89^A±0.23	

Different alphabets on means show significant differences at P< 0.05

Table II. Protein contents (%) of breast meat of recycled Layers fed diets varying in protein and energy levels

Protein (%)	Pre-Moult	Post-Fast	Post-Moult	Peak	End	Mean
14	36.94±0.37	31.96±0.37	25.83±0.04	36.14±0.45	32.96±0.34	32.77^C±0.74
16	37.16±0.04	33.79±0.28	26.85±0.20	34.65±0.32	34.00±0.23	33.29^B±0.64
18	36.92±0.42	33.73±0.31	27.15±0.38	36.82±0.21	34.08±0.10	33.74^A±0.67
Energy (Kcal kg^{-1})						
2700	26.80±0.32	36.99±0.26	33.16±0.34	36.07±0.48	34.11±0.15	33.43±0.55
2900	26.42±0.27	37.01±0.26	33.15±0.36	35.66±0.33	33.25±0.26	33.10±0.56
Mean	26.61^E±0.21	37.00^A±0.18	33.16^D±0.24	35.87^B±0.29	33.68^C±0.18	

Different alphabets on means show significant differences at P< 0.05

fat content of breast meat at post moult stage was due to restricted feeding of moult diet to the birds. Because feed or energy restriction has significant effect on body fat content which tended to decrease with increasing restriction (Robinson & Robbee, 1992). In another study, Akram (1998) also reported that fat content reduced to minimum at post fast stage and then tended to increase at each stage and ultimately became the maximum at the end of production cycle. In the present study, increase in fat content at the end of trial was also due to age factor. Increase in fat content in meat with increase in age has also been reported by other workers (Robel, 1982; Ayorinde, 1990).

Maximum (7.13±0.21%) fat content was observed in birds fed 14% CP and minimum (6.58±0.15%) in birds fed 18% CP. However, similar results were reported by Summers *et al.* (1965) that when the level of dietary protein was increased, fat was decreased. In case of interaction, there was an increase with fat content in birds fed 2900 Kcal kg^{-1} ME and 14% CP. Moran *et al.* (1970) also supported these results that carcass of layer birds receiving high energy diet contained on an average 3.68% more fat. Decrease in fat contents of carcass with increase in dietary protein has also been reported by other workers (Twining *et al.,* 1978; Edwards, 1981; Pesti & Bakalli, 1997; Rosebrough *et al.,* 1999). However, in another study, non significant difference in fat content of the birds fed moult diets with varying protein levels has been reported (Hoyle & Garlich, 1987).

Ash. The results of the ash contents of cooked light meat of revitalized layer at different stages of 2^{nd} year life are presented in Table IV. Statistical analysis of the data revealed significant differences in the mean values of the ash contents at different stages with protein and interaction between protein and energy level. However, energy levels alone could not influence the ash content. Maximum (2.38±0.04%) ash content was observed at the end of the 2^{nd} production cycle and minimum (1.192±0.02%) at the pre moult stage, which might be due to increase in age.

These results were supported by Salgusa *et al.* (1987), who reported that ash content of broiler meat was significantly lower at six weeks of age than eight weeks of age. Maximum (1.78±0.09%) ash content was observed in birds fed 14% CP and minimum (1.52±0.08%) in birds fed 18% CP. In case of interaction, maximum (1.84±0.14%) ash content was found in birds fed 14% CP and 2700 Kcal kg^{-1} metabolizable energy (Me) and minimum (1.38±0.11) in birds fed 18% CP and 2900 Kcal kg^{-1} Me. Barker and Sell (1994) supported these results that carcasses of layer birds receiving high energy diet contained on an average 0.18% less ash.

CONCLUSIONS

1. Different moult diets could not influence the quality of white meat of spent and revitalized layers.
2. Maximum fat and ash contents were observed at end of 2^{nd} year life. This may also be attributed to age factor.

SUGGESTIONS AND RECOMMENDATIONS

1. As the results showed that quality and nutritive value of white meat of spent layers is similar to

Table III. Fat contents (%) of breast meat of recycled Layers fed diets varying in protein and energy levels

Protein (%)	Pre-Moult	Post-Fast	Post-Moult	Peak	End	Mean
14	5.84±0.10	7.42±0.08	8.19±0.36	6.24±0.31	7.95±0.39	7.13^{A}±0.21
16	6.20±0.01	6.78±0.33	6.93±0.49	6.53±0.22	7.69±0.30	6.83^{B}0.16
18	6.13±0.03	6.32±0.09	7.03±0.40	6.48±0.26	6.90±0.51	6.57^{C}±0.14
Energy (Kcal kg^{-1})						
2700	7.18±0.28	6.16±0.02	6.30±0.16	6.46±0.19	7.11±0.37	6.64±0.12
2900	7.59±0.46	5.95±0.08	6.53±0.25	7.22±0.17	7.92±0.27	7.04±0.16
Mean	7.38^{A}±0.26	6.06^{D}±0.05	6.42^{C}±0.15	6.84^{B}±0.15	7.51^{A}±0.24	

Different alphabets on means show significant differences at P< 0.05

Table IV. Ash contents (%) of white (breast) meat of recycled Layers fed diets varying in protein and energy levels

Protein (%)	Pre-Moult	Post-Fast	Post-Moult	Peak	End	Mean
14	1.32±0.04	1.30±0.04	1.69±0.10	2.11±0.08	2.45±0.11	1.77^{A}±0.09
16	1.08±0.01	1.21±0.08	1.61±0.00	1.55±0.06	2.41±0.04	1.57^{B}±0.08
18	1.19±0.00	1.08±0.01	1.62±0.08	1.40±0.18	2.26±0.03	1.51^{C}±0.08
Energy (Kcal kg^{-1})						
2700	1.21±0.05	1.24±0.04	1.78±0.04	1.71±0.08	2.45±0.06	1.68±0.07
2900	1.17±0.01	1.15±0.06	1.50±0.03	1.66±0.18	2.29±0.05	1.56±0.07
Mean	1.19^{D}±0.02	1.20^{D}±0.03	1.64^{C}±0.04	1.69^{B}±0.10	2.37^{A}±0.04	

Different alphabets on means show significant differences at P< 0.05

that of revitalized layers, therefore, layer meat can be used without any feeling of poor quality.

2. The nutritive value and quality of white meat of spent and revitalized layers was influenced by different dietary regimens and during different stages of 2nd year life was found satisfactory, so further research is needed to explore suitable package to improve nutritional quality through 3rd production.
3. As nutritive value of the revitalized layer meat was found satisfactory with respect to protein and fat contents, further research may be focused on the investigation of cholesterol, fatty acid and amino acid profile of cooked meat.

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