

**NIGERIAN JOURNAL
OF
ANIMAL PRODUCTION**



Published by
THE NIGERIAN SOCIETY FOR ANIMAL PRODUCTION

VOLUME 44

2017 NUMBER 4

Proximate composition of pre and post rigor broiler chicken

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Abstract

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This study examined the proximate composition of pre and post rigor poultry meat. A total of sixty (60) four weeks old broiler birds were randomly allotted into 2 treatments, 3 replicates per treatment and 10 birds per replicate. The proximate composition of the meat samples was determined. Data obtained were subjected to T-test. There were no significant differences ($P > 0.05$) in the crude protein content of the meat samples, although, female pre rigor meat had the highest value at 23.99%. The ether extract values of the female pre (4.80) and post rigor (4.90) meat were significantly different ($P < 0.05$) from male pre (4.27) and post rigor (4.46) meat samples. The ash content of male and female for both pre and post rigor were not significantly different ($P > 0.05$). Pre rigor poultry chicken meat proved to be the best for consumption, with this outcome from our research, household and fast food restaurants producing sausages are encouraged to use pre rigor broiler chicken meat as formulation ingredient.

Keywords: Pre-rigor; Post-rigor, broiler chicken, meat

Introduction

Poultry make a significant contribution to human nutrition and economic substances. They provide substantial amount of high quality protein in form of meat and table eggs. According to Okorie (1983) and Oluyemi *et al.* (1998), poultry yield the quickest returns of investment compared to livestock species. They are efficient feed converters to meat and eggs in a short period of time. Apart from their use as source of food, poultry provide useful by-products for manufacturing industries. The feathers are used in making pillows and mattresses, their dropping is used as manure which is very rich in plant nutrient. However, it exposes it's consumers to certain health risks like food poisoning, E.coli contamination, high cholesterol content when eaten with the skin, cancer risk protein level that is supposed to be

balanced with eating of fruits and so on. Having known all these, consumers need to know the best state that broiler chicken meat should be consumed either in pre or post rigor state. Some researchers have worked on rabbit, swine, fish while little or no work has been done on broiler chickens, hence this research.

Meat is an animal flesh that is used as food. Most often, this means the skeletal muscle and associated fat and other tissues, but it may also describe other edible tissues such as organs and offals. In the Anglosphere, meat is generally used by the meat packing industry in a more restrictive sense-the flesh of mammalian species (pigs, cattle, lambs, e.t.c) raised and prepared for human consumption, to the exclusion of fish, poultry, and other animals. Usage varies worldwide by culture, and some countries such as India have large populations that

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avoid the consumption of all or most kind of meat. Game or bush meat is also generally distinguished from that produced by agriculture (Lawrie, 1991).

Rigor mortis is the stiffening of the muscle after death, and is due to the formation of permanent cross bridge in the muscle between the actin and myosin filament. During the periods immediately after exsanguination, muscle is quite extensible. In the living animal, aerobic metabolism is used to obtain energy. However, under stressful conditions blood is transported to the liver, where it is re-synthesized into glucose and glycogen, or to the heart where it is metabolized to carbon dioxide and water. After an animal is slaughtered, blood circulation stops and muscles exhaust their oxygen supply. Muscle can no longer use oxygen to generate ATP and turn to anaerobic glycolysis, a process that breaks down sugar without oxygen to generate glycogen.

The breakdown of glycogen produces enough energy to contract the muscles, and also produces lactic acid. With no blood flow to carry the lactic acid away, the acid builds up in the muscle tissue. If the acid content is too high, the meat loses its water-binding ability and becomes pale and watery. If the acid is too low, the meat will be tough and dry, Bendall, J. R., 1973. Lactic acid build up also releases calcium which causes muscle contraction. As glycogen supplies are depleted, ATP regeneration stops and the actin and myosin remain locked in a permanent contraction called rigor mortis. Freezing the carcass too soon after death keeps the proteins all bound together resulting in a very tough meat.

So, allowing rigor mortis to take place will cause the enzymes in the muscle cells to break down the overlapping proteins and thereby making the meat tender. The

present study will examine the proximate composition of pre and post rigor poultry meat, product yield and organoleptic properties of sausages prepared from them.

Materials and methods

Experimental birds and management

The study was carried out at the poultry unit of the Teaching and Research Farm and the Meat Science Laboratory, University of Ibadan. A total of sixty (60) four weeks old broiler birds weighing 0.8- 1kg were purchased from a reputable farm in Ibarapa area of Oyo State and were acclimatized for two weeks. The rearing pens were previously washed and cleaned thoroughly with formaldehyde and potassium permanganate solution four days prior to the arrival of the birds. The birds were weighed individually and allocated on weight equalization into six (6) rearing units.

There were 2 treatments, 3 replicates per treatment and 10 birds per replicate. During the entire study, the broilers were fed with standard broiler diet and fresh water ad libitum for 6 weeks. The feed was compounded carefully to meet 23% Crude Protein (CP) and 3200K.Cal metabolizable energy (ME) for broiler starter and 20% CP and 3000K.Cal for broiler finisher. The broilers were housed in deep litter cages with wood shavings as bedding with the spacing of 6-7 birds/m² as recommended by Sonaiya *et al.* (2004). All experimental protocols complied with NIH guidelines, National Research Council, 1986 as approved by the ethical and research committee, University of Ibadan. All birds received necessary medication and vaccination.

Carcass analysis

At the end of 10 weeks, 5 broilers per replicate were selected for carcass analysis. Prior to slaughtering, the birds were starved for 12 hours in order to have an almost empty stomach so as to avoid faeces contamination

during evisceration. The birds were sacrificed by cervical dislocation, plucked and eviscerated after which the carcasses were then de-boned for further analysis.

Proximate composition

Proximate analysis was carried out using AOAC, 1990 models. The meat samples were analysed for moisture, crude protein, ash, fat.

Statistical analysis

Data obtained were subjected to T-test and the mean values showing significant ($P < 0.05$) differences were separated using Duncan's Multiple Range Test, Duncan *et al.* (1995).

Results and discussion

Proximate analysis was carried out using AOAC (1990) models. The meat samples were analyzed for moisture, crude protein,

ash and fat using standard procedures.

The result of proximate composition of pre and post rigor meat is presented in Table 1. The moisture of male post rigor meat (72.19%) was higher followed by male pre rigor meat (70.58%) while female post rigor and female pre rigor had 70.09% and 69.44% respectively. Female pre rigor meat had higher Crude protein content (23.99%) followed by female post rigor meat (23.44%). Male pre rigor had 22.92% Crude protein content while the lower crude protein was found in male post rigor meat (21.81%). Ether extract was significantly higher ($p < 0.05$) in female post rigor meat (4.80%) and female pre rigor meat (4.79%) while male post rigor meat and male pre rigor meat had 4.46% and 4.27% respectively. The ash content of male and female for both pre and post rigor were not significantly different ($P > 0.05$).

Table 1: Proximate Composition (%) of Pre & Post rigor Broiler Chicken Meat

Parameters	PRE RIGOR MEAT		POST RIGOR MEAT	
	Male	Female	Male	Female
Moisture	70.58±1.06	69.40 ± 0.79	72.19± 1.19	70.09± 2.03
Crude Protein	22.92± 0.82	23.99± 0.68	21.81± 0.82	23.44± 1.55
Ether Extract	4.27± 0.14 ^b	4.80± 0.08 ^a	4.46± 0.03 ^b	4.90± 0.05 ^a
Ash	2.22± 0.18	1.83± 0.18	1.51± 0.39	1.58± 0.44

a, b Means in the same row with different superscripts differ significantly ($p < 0.05$).

Mean ± SEM. (Values of 5 samples per treatment)

The meat composition was not influenced by the age but there was a relationship between ash and sex. Ash content in male pre-rigor meat was more than the female ones which indicated that mineral content of the meat was higher in male than the female. Our finding was in agreement with Prandl *et al.* (1994) that males present higher ash content as their muscle tissue increases. The minerals are associated with the organic compound involved in muscle contraction process and their value increases as animal grow. This may not be unconnected to the fact that the male broiler chickens do exercise a lot ranging from

mating to displaying territorial power among themselves. The male meat has less protein and high fibre content in their muscle, hence the high mineral content.

The result of the study showed that ether extract of the female pre and post rigor meat were significantly different from male pre and post rigor meat samples which is in accordance with Santoso *et al.* (1993) who reported that female broiler chickens tend to deposit more fat than male broiler chickens. The female broiler chickens exercise less despite the fact that they eat much, hence accumulating calories which will later be converted to fat deposit. Although, there was

no significant difference in crude protein in both sexes, the crude protein content of the meat sampled in both female pre and post rigor meat could be due to interaction of protein molecules (actin and myosin) in meat to form actinomyosin complex and increases in myofibrila proteins which have been covered by denatured sarcoplasmic protein.

The rate and quantity of protein in meat can be influenced by the time taken by the intact cytoskeleton to translate shrinkage of myofibrils into shrinkage of the whole cell. Our findings corroborated the report of Puolanne and Halonnem (2010) on increase in protein content of post rigor meat as a result of increase in myofibrila protein due to denatured sarcoplasmic protein as female pre rigor meat had the highest crude protein content and followed by female post rigor meat.

Conclusions and applications

Female pre rigor broiler chicken meat is the best followed by female post rigor meat.

Crude protein and ash content of female pre rigor meat indicates that the young female broiler chicken is recommended for household and commercial purpose.

Pre rigor poultry chicken meat is recommended for consumption.

Fast food restaurants producing sausages should be encouraged to use pre rigor broiler chicken meat as formulation ingredient.

Acknowledgements

We acknowledged the efforts Mr Taofeek and Mr Adelani for their technical assistance.

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Animal Production and Health. No
1. ISBN 92-5-105082-1.

Received: 10th May, 2017

Accepted: 21st August, 2017