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Study on the iron content of chicken nuggets incorporated with different levels of blood

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Abstract
The present study was undertaken to study the utilization of chicken whole blood for preparation of chicken nuggets and study the iron content of the developed product. The study was conducted in the Department of Poultry science, Assam Agricultural University, Khanapara, Guwahati-781022.The iron content significantly (P<0.01) increased in proportion to the increasing level of blood incorporation in chicken nuggets. Highest iron content was found in T_3 (174.51±1.86) and lowest in T_0 (57.83±1.06) group. The blood incorporated nuggets showed a significant (P<0.01) difference between the control and treatment groups. However no significant (P>0.05) difference was observed between T_2 and T_3 groups. Thus it can be concluded that whole blood can successfully be used for preparation of chicken nuggets for better iron and protein content in the nuggets.

Keywords: Iron content, blood, nuggets

Introduction
The poultry sector in India is broadly divided into two sub-sectors, one with a highly organized commercial sector and the other being unorganized comprising of backyard farming system. In developing countries most of the slaughter house blood getting wasted including India or only negligible quantity is used for human consumption. Slaughterhouse blood is an inevitable part of the meat production food chain and represents a rich source of protein. Blood has a good source of nutrients, has a high content of essential amino acids and high bioavailability of iron namely heme iron and it is considered as non-allergenic protein when compared to dairy and soy proteins (Sorapukdeand Narunatsopanon 2017) [9]. Blood, is the first by-product obtained after the slaughter of an animal, has long been used in European and Asian countries as an ingredient in traditional foods such as blood sausages, puddings, blood soups, breads and crackers (Mandal *et al.*, 1999) [7].

For many years US slaughter houses used to discard blood as an unwanted by-product (Halliday. 1973) [2] but its high nutritional value, coupled with serious disposal issues, has fueled recent research and industrial efforts to incorporate blood proteins into a wide range of food products. Animal blood has a high level of protein and heme iron, and is an important edible by-product (Wan *et al*., 2002) [13]. Because of the high protein content of blood, generally about 18%, it is sometimes referred to as "liquid protein" According to the Meat Inspection Act of the United States, blood is approved for food use when it has been removed by bleeding an animal that has been inspected and passed for use in meat food products. It is known that blood is a rich source of iron and proteins of high nutritional and functional quality.

India reportedly tops the list of nations with most anaemic women and children (Indiaspend, Oct. 27 2016). India has the highest number of cases of anaemia in the world, according to the NFHS-III undertaken in 2005-2006. The reasons range from high cost of healthcare facilities, poor food quality and the low status of women. The survey further revealed that among the states, Assam is the worst affected with 72% of married women being anaemic, followed by Haryana (69.7%) and Jharkhand (68.4%). The prevalence of malaria in states like Assam was cited as one of the chief reasons for this sorry state of affairs [National Family Health Survey (NFHS-III), 2005]. Anaemia remains to be major cause of maternal mortality and low birth weight in India [WHO, Geneva, (2000)] [12]. It has also appeared that the Nutritional Anaemia Prophylaxis Programme of issuing a weekly iron tablet to adolescent girls and boys could not be able to solve the problem of anaemia. Iron is an important mineral in our diets, diets lacking iron can contribute to the deficiency condition known as anemia. The recommended dietary allowance (RDA) of Fe for adult males and for women over 50 years is 8 mg/day.

For women aged 19-50, the recommended dietary allowance (RDA) of iron is 18 mg/day (it's higher to compensate for menstrual losses). In case of children RDA of iron is 7-10mg per day (Institute of Medicine, Food and Nutrition Board, Washington, DC: National Academy Press, 2001). Chicken meat provides nearly 70 mg of iron per 100g of meat. So in order to fulfill the requirement of iron, the meat industry uses the bulk of the blood proteins employed as ingredients in the food industry, mainly as a binder but also as natural colour enhancers, emulsifiers, fat replacers and meat curing agents. Therefore blood can be incorporated in human diet to address the iron deficiency problem specially among the women and children.

Keeping the above points in mind, the present study has been undertaken with the following objectives

1. To develop the technology of preparation of chicken nuggets incorporated with chicken blood at the level of 11, 14 and 17 per cent.

Materials and Method

The research was carried out in the Department of Poultry Science, College of Veterinary science, Assam Agricultural University, Khanapara to utilize the chicken whole blood for preparation of chicken nuggets and study of the iron content. In the present experiment standardization was tried for preparation of broiler chicken meat nuggets with extender, binder and different levels of blood and to arrive at a suitable formulation with long shelf life. The entire process of experiment was standardized with the best suitable formulation with extender, binder, spices, condiments, vegetable oil, ice flakes and suitable level of whole blood inclusion at 0, 11, 14 and 17 per cent.

Nugget formulation

Chicken nuggets were formulated with broiler chicken meat, refined wheat, soya flour, vegetable oil, spice mix, salt, condiments (ginger-garlic paste). Salt of 1.5 g was added to each group.

Table 1: Formulations of broiler chicken meat nugget incorporated with various levels of blood

Ingredients	Control T_0 (%)	Treatment T_1 (%)	Treatment T_2 (%)	Treatment T_3 (%)
Lean meat	74	63	60	57
Vegetable oil	5.0	5.0	5.0	5.0
Extender	5.0	5.0	5.0	5.0
Binder	5.0	5.0	5.0	5.0
Blood	0	11	14	17
Spice mix	1.5	1.5	1.5	1.5
Condiments	3.5	3.5	3.5	3.5
Ice flakes	6	6	6	6
Total	100	100	100	100

Extender and Binders

Refined wheat was used as an extender and soya flour was used as binder.

Collection of Blood

Blood from healthy chickens were collected hygienically. Anticoagulant (sodium citrate) was added at the rate of 0.5% (Del Rio De Rays *et al*. 1980) to the blood at the time of collection.

Preparation of chicken nuggets

The broiler chicken meat was cut into small pieces to facilitate easy mincing and these were further subjected to thorough mincing by using a meat mincer. The procedure for preparation of nuggets has been shown in flow chart.

Cooking of nuggets

The meat emulsion of 300 g each was filled in steel mould and were cooked for 30 minutes using steam to an internal 100 ºC temperature of 90 ± 1 °C as indicated by the temperature probe. The meat blocks, thus formed were immediately chilled and sliced into nuggets of uniform size of 4.0 X 1.5 X 1.5 cm**.**

Iron Content

Weighed out about 2.5 g of the nuggets and placed in a crucible. The crucible was heated with a hot burner flame until the nuggets turned to ash. This took approximately 5-20 minutes depending on the food sample used. The burner was removed and allowed the ash to cool. When cooled the contents were transferred to a small beaker. A total of 10 ml of 2.0 M HCl was added and carefully stirred for one minute. Ten milliliter of distilled water was added. The content was stirred and the mixture was filtered to collect the filtrate. A total of 2.5 ml of 0.1 M KSCN was added and mixed well. For absorbance a spectrophotometer was used at a wavelength of 458 nm. Each standard solution and food solution were placed into a separate cuvette. The absorbance of each solution was measured and recorded.

Experimental findings

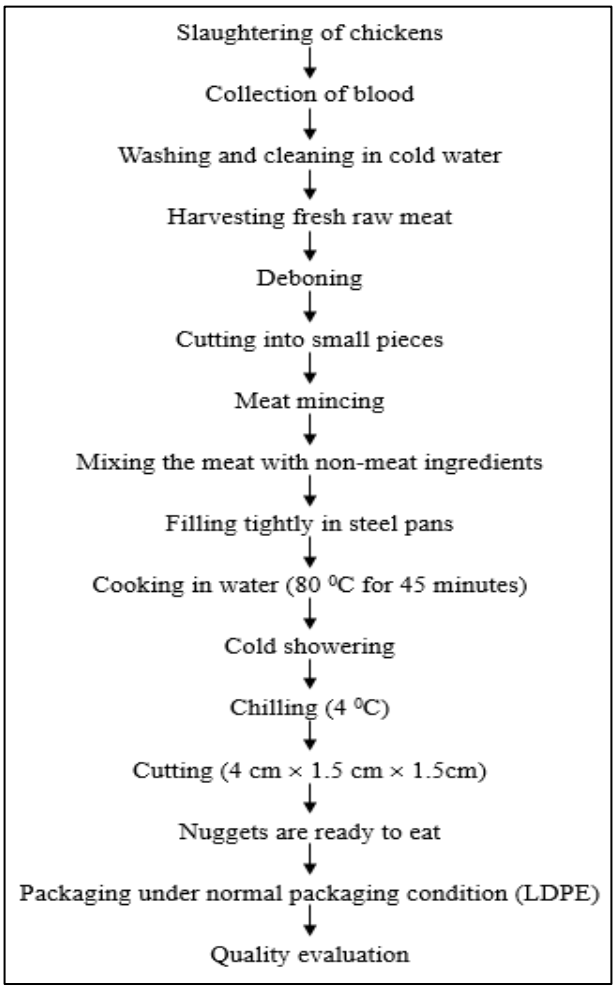
The present work on the "Utilization of chicken whole blood for preparation of chicken nuggets" was conducted using different levels of whole blood of broiler chicken for preparation of chicken nuggets. The data collected were analyzed and presented under different Table 2 and 3.

Iron content

The mean (±SE) value of iron content (mg/100mg) in chicken nuggets under different treatment groups has been presented in Table 2, and their analysis of variance in Table 3 and Fig.1.

The mean values of iron content of chicken nugget incorporated with 0 per cent blood (T_0), 11 per cent blood (T_1), 14 per cent blood (T_2) and 17 per cent blood (T_3) were found to be 57.83±1.06, 158.64±4.44, 168.34±3.75 and 174.51±1.86 respectively. The iron content significantly ($P<0.01$) increased in proportion to the increasing level of blood.

The analysis of variance revealed a significant difference ($P<0.01$) between the control and treatment groups. However, no significant ($P>0.05$) differences were seen between T_2 and T_3 groups.



Flowchart for preparation of chicken nuggets

Cooking of nuggets

The meat emulsion of 300 g each was filled in steel mould and were cooked for 30 minutes using steam to an internal 100 ºC temperature of 90 ± 1 °C as indicated by the temperature probe. The meat blocks, thus formed were immediately chilled and sliced into nuggets of uniform size of 4.0 X 1.5 X 1.5 cm**.**

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The analysis of variance revealed a significant difference (P<0.01) between the control and treatment groups. However, no significant (P>0.05) differences were seen between T_2 and T_3 groups.

Table 2: Mean (±SE) values of iron content (mg/100mg) in chicken nuggets under different treatment groups

Group	T_0	T_1	T_2	T_3
Value	57.83^{C} ±1.06	158.64^{B} ±4.44	168.34^{A} ±3.75	174.51^{A} ±1.86

Figures with different superscript in a row differ significantly (P<0.01)

Table 3: Anova of iron content (mg/100 mg) in chicken nuggets under different treatment groups

Source of variation	df	Mean Square	F value
Treatments	3	15156.365	315.59**
Error	16	48.025	

****highly significant (P<0.01)

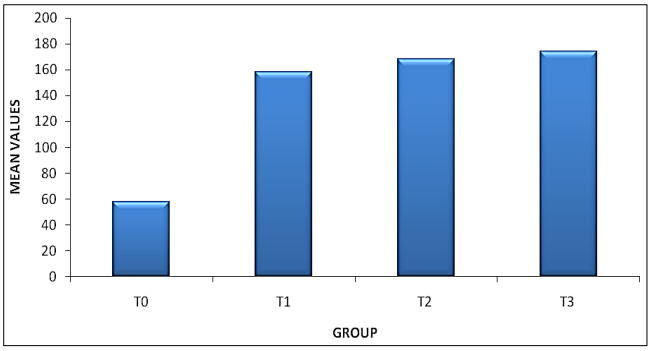

Fig 1: Graphical representation of mean values of iron content under different levels of blood incorporated in chicken nuggets

Discussion

Iron content

In the present study it was found that T_1, T_2 and T_3 group recorded significantly (P<0.05) higher iron content with increased level of incorporation of blood. The higher iron content was found in T_3 (174.51mg/100 mg) and lowest was found in T_0 (57.83mg/100 mg) group respectively. The findings of the present study aresimilar to the findings of Sorapukdeeand Narunatsopanon (2017) [9] who also observed that chicken blood is a good source of nutrient which has high content of essential amino acids and high bioavailability of iron namely heme iron. Similarly Oellingrathand Slinde (1985) [8] also reported that meat loaves with blood, blood emulsion, or mechanically deboned meat (MDM) have approximately 70% of the iron in theblood emulsion with extractable hemoglobinas heme iron. MDM contained approximately 55% iron notbound as extractable hemoglobin or myoglobin. Kikafundaand Sserumaga (2005) [3] also studied that heme iron is better absorbed than non-heme iron.

Conclusion

A study was conducted in the Department of Poultry Science, College of Veterinary science, Assam Agricultural University, Khanaparato develop iron enriched chicken nuggets by incorporating whole blood for better iron content in the nuggets. A total of five replicates of chicken nuggets comprising of four different formulations with different blood levels *viz*. T_0 (0 %), T_1(11%), T_2 (14%) and T_3 (17%) were prepared with extender, binder, oil, spices, condiments and ice flakes and cooked at 80ºC for 45 minutes. The nuggets were then sliced, packed in normal packaging (low density poly ethylene) and stored under refrigeration. The iron content of the product under normal refrigeration temperature (4ºC) was studied. The mean values of iron content of chicken nugget was found to be significantly ($P<0.05$) higher in iron content with increased level of incorporation of blood. The higher iron content was found in T_3 (174.51±1.86) and lowest in T_0 (57.83±1.06) group. The blood incorporated nuggets showed a significant ($P<0.01$) difference between the control and treatment groups. However, no significant ($P>0.05$) difference were seen between T_2 and T_3 groups.

References

1. Del Rio De Rays MTE, Constantinides SM, Sgarbieri VC, El-Dash AA. Chicken blood plasma proteins: physiochemical, nutritional and functional properties. J. Food Sci. 1980;45:17-20.
2. Halliday DA. Blood-source of proteins. Process Biochemistry. 1973;8(12):15-17.
3. Kikafunda JK, Sserumaga P. Production and use of a shelf-stable bovine blood powder for food fortification as a food-based strategy to combat iron deficiency anaemia in subsaharan Africa. African Journal of Food, Agriculture, Nutrition and Development, 2005, 5(1).
4. Kondaiah N, Anjaneyulu ASR, Lakshmanan V. Utilization of spent hen components in chicken nuggets. Indian Journal of Poultry Science. 1993;28:144-146.
5. Konwar D. Utilisation of slaughter house by-product of pig for preparation of value added meat product. M.V.Sc. Thesis, Assam Agricultural University, Khanapara, Guwahati, 2001.
6. Kongkachuichai R, Napatthalung P, Charoensiri R. Heme and nonheme iron content of animal products commonly consumed in Thailand. Journal of Food Composition and Analysis. 2002;15(4):389-398.
7. Mandal PK, Rao VK, Kowale BN, Pal UK. Utilization of slaughter house blood in human food. Journal of Food Science and Technology (Mysore). 1999;36(2):91-105.
8. Oellingrath IM, Slinde E. Color, pigment and iron content of meat loaves with blood, blood emulsion, or mechanically deboned meat added. Journal of Food Science, 1985;50(6):1551-1555.
9. Sorapukdee S, Narunatsopanon S. Comparative study on compositions and functional properties of porcine, chicken and duck blood. Korean journal For Food Science of Animal Resources. 2017;37(2):228.
10. USDA. Livestock and Poultry: World Markets and Trade. Foreign Agricultural Service, 2017.
11. Warriss PD, Rhodes DN. Haemoglobin concentrations in beef. Journal of the Science of Food and Agriculture. 1977;28(10):931-934.
12. WHO. Geneva, World Health Organisation, 2000. https://www.who.int/whr/2000/en/
13. Wan Y, Ghosh R, Cui Z. High-resolution plasma protein fractionation using ultrafiltration. Desalination. 2002;144(1-3):301-306.
14. Warhadpande RM, Dutta KK, Mahanta JD, Hazarika M. Effect of incorporation of chicken blood plasma on physico-chemical properties of cakes. Journal of Food Science and Technology. 2010;47(6):693-696.