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# Physio-chemical, storage and sensory characteristics of chicken drumstick dried powder

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**Abstract**
The present investigation was to evaluate the physiochemical, storage and sensory characteristics of chicken drumstick dried powder. Drumstick pieces were separated equally into four types of variables which help to find the good one. They were raw chicken meat; raw chicken grounded meat, cooked chicken meat and cooked grounded chicken meat. Constant temperature of 50 ˚C was maintained for cooking the chicken meat. The cooking temperature plays a main role in loss of nutrient content during cooking. Then with the help of mixer grinder two samples of both raw and cooked were grounded for further drying purpose. In the mean time, moisture content of raw meat was also calculated. Then, drying process of chicken meat had been done at the three different temperatures such as 70 ˚C, 75 ˚C and 80 ˚C to optimize the apt product. After 4- 5 hours of drying, it had been grounded into fine powder with the help of mixer and screened for clearing the impurities. Generally the pre analysis of chicken powder mainly TPC, protein and fat helps to optimize the temperature for further usage. Among four types of samples at three temperature, at 75 ˚C had nutritional values of protein (89.9%), fat (4.96%) and total plate count deducted for that sample was 30 colony forming unit exactly. Based on this study, it was optimized that, the sample dried at 75 ˚C was apt for chicken powder. Then the mass production of chicken powder had been done at the temperature 75 ˚C for storage and shelf life studies. Aluminium package and low density poly ethylene were the type of packages used for determine the characteristics of chicken powder in storage condition with the application of nutritional analysis.

**Keywords:** Drumstick chicken, Sensory analysis, Drying, Storage, Soup, Noodles.

## Introduction
Nowadays, the consumer demand for specialty, high quality poultry meat products is growing. The chicken (*Gallus gallus domesticus*) is a domesticated fowl, a subspecies of the fowl. As one of the most common and wide spread domestic animals with a population of more than 24 billion in 2003, there are more chickens in the world than any other species of bird. Humans keep chickens primarily as a source of food, consuming both their meat and their eggs. The meat of chicken has divided into mainly three parts such as breast, leg and wing. The breast is white meat and is relatively dry. The leg comprises two segments the drumstick and thigh. Former one is dark meat and is the lower part of the leg and the later is also dark meat and is the upper part of the leg. The third important part is the wing. It comprises three segments first one is the drumette shaped like a small drumstick, the second one is the middle flat segment, containing two bones, and third one is the tip, sometimes discarded. The chicken drumstick is lower in kilojoules compared to all other cuts of meat included in the analysis except veal leg roast and lower in protein than all other cuts of meat included in the analysis. Dried chicken, in cubic form, can be used as an ingredient for ready-to-eat noodles and soup. There is a no need of additional ingredients especially mono sodium glutamate. Because of dried nature, the microbial activity was very lesser when compared to the raw chicken. The pH of meat has a great impact on three sensory quality characteristics of muscle foods: appearance/color, texture/tenderness, and flavor, all of which affect the consumer acceptance of meat [1, 2].
Colour is an important quality attribute that influences consumer acceptance of many food products, including poultry meat. They will reject products in which the colour differs from the expected normal appearance. Colour is everywhere and that psychological responses to colour, as they relate to appetite, are considered as important to processors and consumers also colour is often used to determine economic value of food [3]. Differences in breast meat colour have been attributed to the preslaughter condition and handling practices of poultry.Colour defects of raw and cooked poultry meat have been a problem for the poultry industry for many years. The darker-coloured breast meat from birds that were allowed to struggle freely during slaughter when compared to breast meat from anesthetized birds [4, 5]. Sensory analysis is unequivocally assigning in the scientific methods. It is one of the oldest means of quality

control, but in principle is an essential part of the compulsory test of food quality, while also checking the deeper study of the interdependence between physiological and psychological phenomena in the very process of perception of sensory qualities. Sensory analysis has to allowing manufacturers to identify, understand and respond to consumer preferences more effectively [6, 10] and in addition the identification of sensory characteristics and consumer preferences, helping manufacturers to increase competition in the market for other producers [11, 15].

Chicken soup is a soup made from chicken, simmered with various other ingredients. The classic chicken soup consists of a clear broth, often with pieces of chicken. Chicken soup is prepared using old hens too tough and stringy to be roasted or cooked for a short time. In modern times, these fowl are difficult to come by, and broiler chickens (young chickens suitable for broiling or roasting) are often used to make soup; soup hens or fowl are to be preferred when available. A study determined that prolonged cooking of a bone in soup increases the calcium content of the soup when cooked at an acidic, but not at a neutral pH. Chicken soup has long been touted as a form of folk medicine to treat symptoms of the common cold and related conditions. The work has briefly depicted as chicken drumstick pieces were separated and collected from boneless chicken meat. Because it has moderate content of both protein and fat when compare to other parts such as breast and wings. So it doesn't have adverse effect of high fat. Mainly chicken drumstick powder has been used for soups and noodles preparation. Thus, in this context the current study aims at the physiochemical, storage and sensory characteristics of chicken drumstick dried powder.

## 2. Materials and methods

### 2.1. Selection of chicken drumstick pieces

Chicken pieces were purchased from local meat shop. Colour of the chicken pieces was considered as one of the important quality parameter in the production of chicken powder. It was fully washed with fresh water and skin were removed, bones and unnecessary parts. Chicken drumstick pieces were separated and collected from boneless chicken meat. Because it has moderate content of both protein and fat when compare to other parts such as breast and wings. So it doesn't have adverse effect of high fat. Generally meat was again kept in deep freezer at the temperature 0 °C till usage.

### 2.2. Equipment used

Tray drier, Hot air oven (The ILE Co.), Weighing balance, Hunter colour meter (Hunter associates laboratory Inc.), pH potentiometer(Eutech Instruments, India), Kjeldahl digestion flask (Labconco), Desiccator, Gas stove and Centrifuge (Remi centrifuge), Blue Star Chest freezer, Model CHF 200 B, India.

### 2.3. Production of Chicken powder

The production of dried chicken powder involved certain steps which has been mentioned here as shown in Fig.1

Raw material (chicken meat)
↓
Chopping
↓
Cooking (50 °c for 20 minutes)
↓
Drying
↓
Grinding
↓
Sieving
↓
Meat powder

**Fig 1:** Flow chart for the production of Chicken drumstick powder production

### 2.4. Chopping of chicken drumstick meat

Chopping of chicken drumstick pieces was easy due to its condition of being soft. This condition was obtained due to keeping it in room temperature for few minutes. It was chopped with a sharp kitchen knife of 2.5 to 5 mm size. Marble slab was used for chopping surface which was well cleaned prior to chopping. Then after this process, two of the samples were gone into grinding process.

### 2.5. Cooking of chicken drumstick meat

Chopped chicken meat was cooked in warm water at temperature of 50 °C. Cooking was done to eliminate any kind of enzymatic activity and reduce any microbial count. It was done in heating mantle using a beaker. Equal amount of water and chicken drumstick pieces were taken. For cooking the meat at 50 °C, the water alone is taken and allowed to reach the temperature around 55 °C, so that when meat is put inside the beaker there will be a drop in temperature. To avoid this, and to maintain the temperature it is been done. A stopwatch is been used for noticing time. Then after cooking period, the water was separated from meat solids and allowed to attain room temperature. It was continued for grinded chicken drumstick pieces also. In another process, raw chicken pieces as both grinded and as such pieces were get ready for further drying process.

### 2.6. Drying of chicken drumstick meat

Cooked meat and raw meat in the state of both as such and grinded were weighed again and kept in a plate in well spread manner. Weigh of the plate and meat was again taken and noted down. Tray drier (Plate no 3.1) was switched on and sufficient time given to raise the temperature to the required level (70 °C, 75 °C and 80 °C). Weighted meat was kept in tray drier at three different temperatures 70 °C, 75 °C, 80 °C. The weight of the plate with meat was note down for every 30 mins. The weight was noted down and the weight loss was calculated. The drying process was stopped once the weight was found to be constant for 2 consecutive readings that is more or less 5% moisture. Then with the reference of nutritional analysis the chicken drumstick meat in the state of cooked grinded was optimized product. It has again dried at the temperature of 75 °C in the tray drier. Likewise, the proximate analysis the weight was noted down for the optimized product.

### 2.7. Grinding of dried chicken drumstick meat

Dried meat was ground in a kitchen grinder. Care was taken to grind till fine powder was obtained. Powders were obtained and kept separately in poly packs.

### 2.8. Sieving of chicken drumstick powder

Ground meat powder was sieved using sieve available in department laboratory. Sieving was done to remove any coarse material if available in powder. Four different samples

such as raw as such, raw grounded chicken as such and chicken grounded were sieved separately and kept in different packs.

### 2.9. Physiochemical analysis
The moisture, ash, total protein, fat, carbohydrates and fiber were determined by official method [16]. pH was determined by using pH potentiometer.

### 2.10. Microbial Analysis
Microbial analysis by using standard total plate count method [17].

### 2.11. Colour measurement
The colour value (L*, a*, b*) was measured using hunter lab colorimeter with colour measuring attachment (colour quest XE, Hunter lab colorimeter, Software - QC). This axis – "b" to + "b" represents from blue to yellow and luminance is vertical axis from black (L=0) to white (L = 100). The instrument was standardized each time with white and black ceramic tiles. The experiment was repeated and the mean "L","a","b" values were recorded.

### 2.12. Sensory evaluation
For the purpose of sensory analyses of chicken drumstick powder, it has been applied to the two different related products, such as noodles and soup. 9-Point Hedonic scale was mainly used for sensory evaluation process. In sensory analysis of powder using noodles, one sample was incorporated by chicken pieces, it was considered as control and another one was incorporated by chicken drumstick powder and it was considered as unknown sample. Similarly, it was continued for the soup preparation, and the same hedonic scale was helped to done the sensory analysis of chicken drumstick powder.

### 2.13. Storage studies
Storage studies helps to find the shelf life of the product. Here two types of packages were used such as low density poly ethylene and aluminium package. It has various characteristics which shown the nature of the powder distinctly after the storage period. The nutritional analysis played a main role during storage studies to find the type packaging is highly efficient.

## 3. Result and discussion
### 3.1. Proximate and microbial analysis of dried chicken drumstick powder
The proximate analysis of chicken drumstick powder gives the idea about the nature and amount of the nutritients present in the sample It was taken in the all three samples dried at the three different temperatures such as 70, 75, 80ºC. The general nutrition ingredients such as protein, fat and microbial analysis total plate count helped to found the sample which has been used for mass production. Mostly microbial count presented in the ratio of 10 colony forming unit (cfu) to 70 colony forming unit (cfu). RG has more protein content of 89.85% and the fat content in CG was 3.96%. It is because of lesser temperature (Table 1). Chicken powder dried at the temperature of 75ºC, the values of the protein, fat and the microbial analysis such as total palate count and E.coli were found out. Here, total plate count found the colony forming unit was found between 30 cfu to 80 cfu. The fat content also found higher in the cooked grounded sample (4.46%) when compare to the other samples and the protein content also high (89.96%) But overall the cooked grounded product has been depicted as finalized optimized product. In 80 ºC total plate count found the colony forming unit exceeds the limit of 300 cfu. CG has higher amount of protein of 90.25% and low fat content of 2.26 because of extreme high temperature.

**Table 1:** Proximate and microbial analysis of chicken powder at different temperature

| Type | Temperature (° C) | Nutritional Parameters | | Microbial Activity |
|---|---|---|---|---|
| | | Protein | Fat | TPC (cfu) |
| RA | 70 | 86.58 | 3.01 | 70 |
| | 75 | 84.58 | 3.96 | 80 |
| | 80 | 85.91 | 2.87 | 450 |
| RG | 70 | 89.85 | 3.11 | 40 |
| | 75 | 88.36 | 3.17 | 50 |
| | 80 | 89.86 | 2.69 | 240 |
| CA | 70 | 84.66 | 3.76 | 50 |
| | 75 | 85.36 | 4.06 | 60 |
| | 80 | 83.17 | 2.76 | 480 |
| CG | 70 | 87.16 | 3.96 | 10 |
| | 75 | 89.96 | 4.46 | 30 |
| | 80 | 90.25 | 2.28 | 520 |

### 3.2. Effect of color changes of chicken drumstick powder
CG value has higher than other samples as 81.62 it denoted darkness because of both cooking and drying (Table 2). It's a* value was 2.21(Figure 1). It denoted that CG sample was far away from bluish green color. This analysis gives the chicken drumstick CG powder is an optimized product. The pH of the CG is 6.93 (Figure 2). There are only slight differences among the all chicken drumstick samples. Lesser pH value was come for RA. This analysis stated that CG was an optimized product.

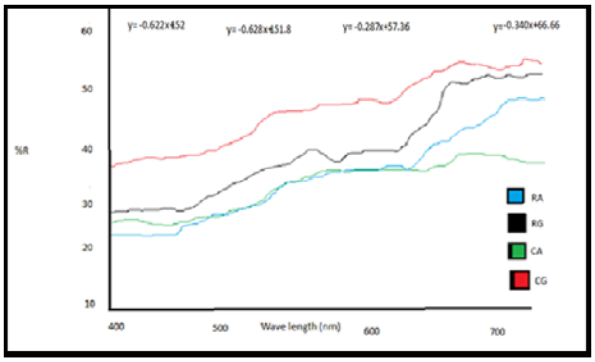


**Fig 1:** Color differences of chicken drumstick powder

**Table 2:** Colour measurement and pH of chicken drumstick powder

| Type | L* | A* | b* | dE* | pH |
|---|---|---|---|---|---|
| RA | 78.49 | 4.63 | 22.50 | 26.60 | 5.91 |
| RG | 79.37 | 4.56 | 22.41 | 26.00 | 5.93 |
| CA | 77.11 | 3.28 | 20.21 | 25.46 | 6.81 |
| CG | 81.62 | 2.21 | 17.98 | 20.76 | 6.93 |

L* = lightness to darkness (0 to 100)
a* = red to green (+100 to -100)
b* = yellow to blue (+100 to -100)

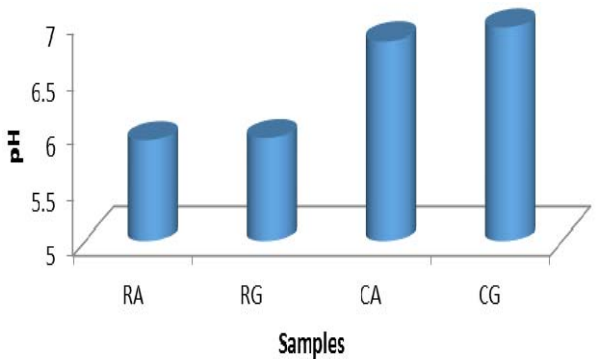


**Fig 2:** pH of chicken drumstick sample

### 3.3. Sensory analyses of optimized product

There are two products were made by using optimized chicken powder. The products such as noodles and soup. Noodles was prepared by using the plain noodles with the chicken powder and as well as the chicken meat. In both products, first one was considered as unknown sample and later one was considered as control sample. Chicken meat was incorporated into plain noodles and cooked as normal one and in another sample chicken powder has been applied to it. For soup, chicken pieces, carrot, onion was cooked in a large closed pot until bones falls out than, salt and pepper could be added on it. It similarly done at the preparation of chicken soup with the optimized product powder. The optimized chicken drumstick sample was used for the sensory analysis. Mostly, it was good in mouth feel and colour. The sample 1 consider as control one. It has well in taste and appearance when it compare to the sample 2 (Table 3).

**Table 3:** Sensory analyses of optimized product in noodles and Soups

| Parameters | Noodles | | Soup | |
|---|---|---|---|---|
| | Sample 1 (chicken pieces) | Sample 2 (chicken powder) | Sample 1 (chicken pieces) | Sample 2 (chicken powder) |
| Taste | 8.37 | 8.00 | 8.12 | 8.39 |
| Texture | 7.75 | 8.09 | - | - |
| Appearance | 7.11 | 7.91 | 8.22 | 7.80 |
| Colour | 7.12 | 8.13 | 8.15 | 8.19 |
| Mouth feel | 8.38 | 8.08 | 8.01 | 8.30 |
| Flavor | 8.09 | 8.01 | 8.11 | 8.10 |
| Overall acceptability | 7.99 | 8.05 | 8.07 | 8.10 |

### 3.4. Storage studies

Storage studies of the optimized chicken drumstick powder have been revealed under the two types of packages such as aluminum packaging and low density poly ethylene. It has been studied in the interval of 10 days. Nutritional tests helped to know the storage nature and shelf life study of the optimized chicken drumstick powder. The moisture content in the aluminum pack is higher compared to LDPE due to moisture absorbing capacity. Protein in LDPE was 84.39%, 84.93%, 84.99%, little bit higher than the sample in the aluminum pack at the 3 batch of days as 5$^{th}$ and 15$^{th}$ and 25$^{th}$ respectively (Figure 3-5). It suggests that LDPE is far better than aluminum packaging (Table 4).

**Table: 4** Storage studies of optimized product at different days

| Parameters | 5$^{th}$ day | | 15$^{th}$ day | | 25$^{th}$ day | |
|---|---|---|---|---|---|---|
| | Aluminum | LDPE | Aluminum | LDPE | Aluminum | LDPE |
| Moisture (%) | 4.92 | 4.96 | 4.86 | 4.28 | 4.80 | 4.00 |
| Total ash (%) | 2.93 | 2.29 | 2.53 | 2.47 | 2.03 | 2.93 |
| Crude fiber (%) | 0.00 | 0.002 | 0.002 | 0.001 | 0.003 | 0.001 |
| Fat (%) | 7.88 | 8.01 | 8.04 | 8.17 | 8.54 | 8.34 |
| Protein (%) | 83.60 | 84.39 | 83.73 | 84.93 | 83.93 | 84.99 |
| Carbohydrate (%) | 0.67 | 1.54 | 0.84 | 0.69 | 0.99 | 0.59 |

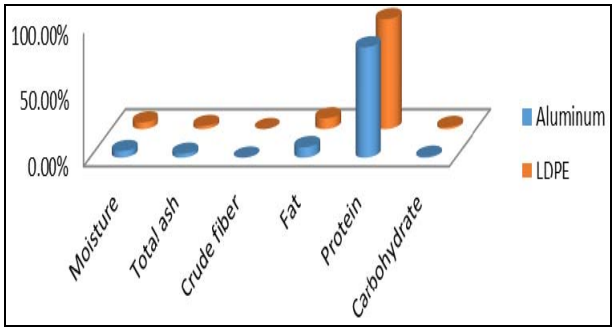


**Fig 3:** Storage studies of optimized product at 5$^{th}$ day

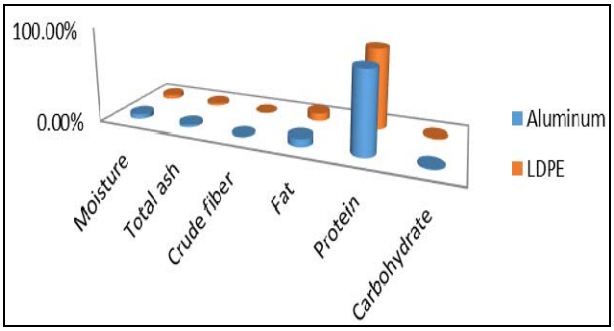


**Fig 4:** Storage studies of optimized product at 15$^{th}$ day

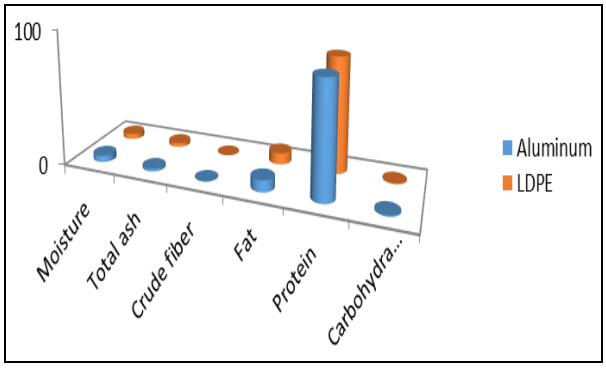


**Fig 5:** Storage studies of optimized product at 25th day

## 4. Conclusion

The physio chemical analysis followed by the nutritional analysis helped to found optimized chicken drumstick powder. It has been include pH analysis (6.5) color and sensory of the sample, and acidity content of the sample. Then final analysis has been done for the optimized chicken drumstick powder at the temperature of 75°C. It includes both physio chemical analysis and the nutritional analysis. Then the sensory analysis has been evaluated for the optimized chicken drumstick powder applied products such as noodles and soup. Storage studies have given the information about shelf life of the optimized chicken drumstick powder. The basic packaging materials such as low density poly ethylene (LDPE) and aluminum packaging were used. Nutritional values and microbial count have been evaluated at the interval of 10 days. It depicted that the low density poly ethylene packaging was comparably good for the dried product ie, optimized chicken drumstick powder. This work concluded that 75° C temperature dried product was optimized one for the production of chicken drumstick powder which has been used as ingredients in the products such as noodles and soup. This work suggested that the packaging in LDPE small pouches is far better than the large packages in case of reduce the head space to minimize the oxidizing effect. Then drumstick pieces are to be preferred for the production of drumstick powder for the concern of nutritional ingredients.

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