



Chemical and microbial analysis of dry meat

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ABSTRACT

The study was aimed to determine the quality of dry meat following chemical and microbial analysis. For this purpose beef sample was used. The beef was processed to make flat pieces for drying. The meat was dipped in salt solution (14% common salt) and dried at 70-80° C for 8 hours in oven. The different chemicals analysis such as protein, fat, moisture and microbial analysis were done. The P^H values of dry beef was 5.4 to 6.0 and muscle tissue 7.0 to 7.2. The prepared goods have been tasted for physical, chemical and instrumental test. In chemical analysis moisture content was 12%, fat content was 0.13%, ash content was 2.11% protein content was 85.76%. In microbial analysis maximum value of mould count was 2.84 log cfu/ml & maximum value of bacteria count was 2.84 log cfu/ml. The study suggests that the study suggests that dry meat would be safe and nutritious for human consumption if the quality of the finished product is ensured.

INTRODUCTION

Meat can be defined as animal flesh used for human consumption. Usually, the skeletal muscle and the fat attached to it are referred to as meat, but some organs, like, lungs, liver; kidneys, brain, skin, bone marrow, etc. are also included in this term. It is a collective term, used to denote a wide range of meat, obtained from different animals and birds.

The most common sources of meat are domesticated animal species such as cattle, pigs and poultry and to a lesser extent buffaloes, sheep and goats. In some regions other animal species such as camels, yaks, horses, ostriches and game animals are also eaten as meat. To a limited extent, meat is also derived from exotic animals such as crocodiles, snakes and lizards.

For thousands of years, poultry supplied meat and eggs, cattle, sheep and goats provided meat and milk, and pigs provided a source of meat. These species are the main sources of animal protein for humans. The meat derived from cattle is known as beef, meat derived from pigs as pork and from chickens as poultry.

In physical terms, drying is the lowering of the water activity *a_w* in meat and meat products. Water activity is the measure of free unbound water available for microbial growth. Microorganisms need certain amounts of free water for growth, and their growth is halted below defined minimum levels of moisture. Minimum levels vary from species to species of microorganisms.

Meat drying is not a clearly defined technology. Drying may be done for the single purpose of dehydrating fresh meat for extension of storage, but it may also be one of various processing steps during the manufacture of specific meat products.

The manufacture of fermented meat products, such as raw hams or dry sausages is an example, where drying is one processing component amongst several others. To have an extended shelf life, fermented products need to lose moisture during their fermentation, they are dehydrated or “dried” to a certain extent. Drying and fermentation must go hand in hand to achieve the desired flavor and shelf life. The drying of such products is mostly

done in climatized chambers with exact temperature and humidity parameters. Drying under natural conditions is increasingly rare. Another example is the drying of meat preparations in ovens with temperatures in the range of 70-80°C, to become fast-dried products such as beef sticks formed of ground, salted and flavored meat. Furthermore, for a number of indigenous meat products, moderate drying is part of the manufacturing technique with the aim of lowering the water activity (a_w), thus curbing microbial growth. The study was conducted for chemical and microbial analysis of dry meat following processing and preservation.

MATERIALS AND METHODS

The experiment was conducted in the laboratory of the Department of Food Engineering & Technology, State University of Bangladesh.

Preparation of meat for drying

The beef meat was exposed to the open air and intermittent solar radiation that lead to quickly lose substantial amounts of its tissue moisture. In order to accelerate the drying process in particular from the inner layers of the meat, the meat was cut in narrow strips or in flat pieces.

Sun drying

The basic traditional drying method is called sun drying, characterized by direct solar radiation and natural air circulation on the product. In this process meat pieces were cut into strips or flat leaf-shaped pieces as described above. Then the cut pieces was suspended in the open air or spread on drying trays made of fibre or wire mesh with a wooden or metallic frame. For sun drying, in particular for the suspension method, the meat was sometimes dipped in salt solution (approx. 14% common salt). This helps to limit microbial growth on the meat surfaces and protects to some extent against insects. The drying of such products was mostly done in climatized chambers with exact temperature and humidity parameters.

Chemical analysis of dry meat

Chemical analyses were performed to determine the content of protein, fat, water and minerals (ashes) of processed meat products were carried out to establish the nutritive and economic value of the products. Samples of the meat product were finely ground and weighed accurately for each respective chemical analysis.

The determination of the moisture content (or water content) was done by drying an appropriate amount of the sample. The difference in weight between the fresh and dried samples represented the water content. For rapid determination of moisture content a microwave oven was useful.

Moisture analysis

Samples were dried in a microwave oven and the loss of weight upon drying was expressed as percent moisture content.

Approximate drying times for sample sizes of meat

Sample size	Approximate Time	Drying
3 x 10g	3.5 – 4.5 min	
3 x 25g	7.5 – 9.5 min	
2 x 50g	8.5 – 11 min	

Weight of crucible = A

Weight of crucible + sample = B
(before drying) in grams

Weight of crucible + sample = C
(after drying) in grams

% Moisture = $(B-C)/(B-A) = (\text{weight of sample}) \times 100$

The sample was prepared by mincing or chopping as described in sample preparation. The oven was preheated and fixed the heating time necessary to completely dry the samples in the microwave oven. About 10 grams meat sample was weighted and spread the samples into a thin layer around the lower wall of the container with spatula or spoon. The samples were then placed in the preheated oven. The heated sample was then cooled in desiccators and accurately weighted the dried sample. The drying was repeated until constant weight is obtained.

Fat analysis

Fat from the dried sample was estimated inside the sox let extraction tube connected to the sox let flask. The sample was extracted in ether for 10 hours, at 3-4 drops per second. After extraction, the defatted sample was taken out from the extraction tube and air dried the sample for traces of ether. The sample was dried again in an oven at 100°C and cooled in a desiccator.

The percent fat was calculated according to the formula:

$$\% \text{Fat} = \frac{\text{Weight of dried sample} - \text{Weight of defatted sample}}{\text{Original weight of the sample}} \times 100$$

Ash determination

The defatted sample was placed in a constant weight porcelain crucible with cover. The crucible was then placed in a muffle furnace and ignited for two hours at a temperature of 600°C. After ignition the crucible was placed in the oven to bring down the temperature for about 30 minutes, and then cooled in a desiccator for another 30 minutes. The sample was then weighed to constant weight according to the formula-

$$\% \text{ Ash} = \frac{\text{Wt. of crucible with cover + ash} - \text{wt. of crucible with cover}}{\text{original wt. of sample}} \times 100$$

Protein content

Calculation of the approximate protein content for pure meat and meat products as per formula:

$$\% \text{ Protein} = 100\% - (\% \text{ water} + \% \text{ ash} + \% \text{ fat})$$

Microbiological analysis

Total Plate Count (using)

For determination of the number of viable or living microorganisms the meat sample (10 grams meat + 90 ml sterile distilled water or 0.1% peptone water) was homogenized in stomacher. Ten fold dilution up to 10⁶ was prepared. The diluted sample was placed onto the solidified

nutrient agar and spread on the surface by means of a sterile bent glass stick. Then the sample was incubated for 12 to 24 hours at 35 to 37°C and the colony forming units (CFU) was count.

RESULTS AND DISCUSSION

Moisture content (%)

$$\begin{aligned} \text{Weight of crucible} &= A = 10\text{gm} \\ \text{Weight of crucible + sample} &= B = 10\text{gm} + 2\text{gm} = 12\text{gm} \\ &\text{(before drying) in grams} \\ \text{Weight of crucible + sample} &= C = 10\text{gm} + 1.76\text{gm} = 11.76\text{gm} \\ &\text{(after drying) in grams} \\ \% \text{ Moisture} &= \frac{(B-C)}{(B-A)} \times 100 \\ &= \frac{12\text{gm} - 11.76\text{gm}}{12\text{gm} - 10\text{gm}} \times 100 \\ &= \frac{0.24\text{gm}}{2\text{gm}} \times 100 \\ &= 0.12\text{gm} \times 100 \\ &= 12 \end{aligned}$$

From the above calculation it was found that the moisture content of the dried meat was only 12%.

Fat content (%)

$$\begin{aligned} \% \text{Fat} &= \frac{\text{Weight of dried sample} - \text{Weight of defatted sample}}{\text{Original weight of the sample}} \times 100 \\ \text{Fat \%} &= \frac{1.76\text{gm} - 1.74\text{gm}}{14.66\text{gm}} \times 100 \\ &= \frac{0.02\text{gm}}{14.66\text{gm}} \times 100 \\ &= 0.13 \end{aligned}$$

The calculated value of fat was 0.13% in the proceeded dry meat.

Ash content (%)

$$\begin{aligned} \% \text{ Ash} &= \frac{\text{Wt. of crucible with cover + ash} - \text{wt. of crucible with cover}}{\text{original wt. of sample}} \times 100 \\ &= \frac{11\text{gm} + 0.31\text{gm} - 11\text{gm}}{14.66\text{gm}} \times 100 \\ &= \frac{0.31\text{gm}}{14.66\text{gm}} \times 100 \\ &= 0.021\text{gm} \times 100 \\ &= 2.11 \end{aligned}$$

The ash percentage of the dry meat was found 2.11%.

Protein content (%)

Calculation of the approximate protein content for dry meat as follows

$$\begin{aligned} \% \text{ Protein} &= 100\% - (\% \text{ water} + \% \text{ ash} + \% \text{ fat}) \\ &= 100\% - (12\% + 2.11\% + 0.13\%) \\ &= 100\% - 14.24\% \\ &= 85.76\% \end{aligned}$$

pH value

The pH values of the dry beef meat was 5.4 to 6.0 and muscle tissues 7.0 to 7.2. are related to the concentration of hydrogen.

Relative humidity

The relative humidity of dry meat was 53%.

Microbial analysis

Results of the microbial analysis showed that bacteria, mold, fungi were present in the sample as safe level (Table 1, 2, 3).

Table 1

Mould count of dry meat.

Sample	Mould count (log cfu/ml)
S1	1.35
S2	1.68
S3	2.22
S4	2.84

Table 2

Bacteria count of dry meat.

Sample	Bacterial count (log cfu/ml)
S1	1.39
S2	1.84
S3	2.11
S4	2.84

Results obtained for moisture content 12%, fat 0.13%, ash 2.11%, protein 85.76%. 12% Moisture content is suitable for increasing the self-life of the

dry meat product. Protein content 85.76% is well enough to provide better nutrition for human health. The amount of fat and ash was also in essential level for human health. In microbial analysis maximum value of mould count was 2.84 log cfu/ml and maximum value of bacteria count was 2.84 log cfu/ml. altogether the study suggests that dry meat would be safe and nutritious for human consumption if the quality of the finished product is ensured.

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