

# Effect of Freeze Storage on some Physical and Chemical Properties of Turkey (*Meleagris gallopavo*) Breast Meat

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**Abstract-**The objective of this study was to examine the effect of freeze storage on physical properties and chemical composition of turkey meat. Seven breast meat samples of turkey were randomly selected out of 15 breast meat samples obtained from turkeys kept under semi intensive system of management and slaughtered at the age of 28 weeks at the University of Bahri farm, Khartoum North. Samples were examined for their physical properties and chemical composition immediately after slaughter and then after seven months of storage in a deep freezer at -18°C. A significant ( $p < 0.01$ ) decrease in the values of water holding capacity (WHC), cooking loss, chemical composition and color intensity (lightness, redness and yellowness values) due to storage. On the other hand, a significant ( $p < 0.01$ ) increase in the values of pH at seven month of storage was observed.

It is concluded that freeze storage of turkey breast meat improves some physical properties which are useful for further processing.

**Index Terms-** Turkey, Breast meat, Storage

## I. INTRODUCTION

Meat is one of the most nutritious foods used for human nutrition. It is a concentrated source of protein which is not only of high biological value but also its amino acid composition complements that of cereal and other vegetable proteins. Moreover, it is a good source of iron and zinc and several B vitamins [1]. Additional merits such as low cholesterol content and high dressing percentage that could amount to 87% of slaughter weight can be obtained from turkey carcasses [2]. In the Sudan, turkey rearing was initiated using British united Turkey commercial breed that gave satisfactory results under the semi-intensive and extensive systems [3, 4] which can encourage its commercial use under the intensive system of production. The idea of rearing turkey is adopted to spare red meat form cattle and sheep for

export and to provide another alternative to solve the problem of red meat shortages and their high prices in the dry season .as a new venture of poultry production in the Sudan, turkey producers and processors need more information about the useful methods of turkey's meat storage that could preserve meat during the time of abundant production and add value to the final product. Freeze storage is one of the best methods of meat preservation and deep frozen meat is characterized by better sensory and technological properties and therefore, preferred by many consumers [5]. Currently there is no information on the effect of freeze storage on the physical properties and chemical composition of turkey's meat in the Sudan. Such knowledge will help in the evaluation of the efficiency of freeze storage as a mean of turkey meat preservation under Sudan conditions and provide information on the possible alterations to poultry meat after freezing and thawing.

The objective of this study therefore was to examine the Effect of freeze storage on the physical properties and chemical composition of turkey breast meat.

## II. MATERIALS AND METHODS

### *Experimental site, management and duration*

This study on turkey (*Meleagris gallopavo*) under semi intensive system of management was conducted at the College of Natural Resources Farm, University of Bahri, Khartoum North, from June to November 2011. The semi intensive system was a deep litter open sided poultry house where turkeys were accommodated inside experimental pens each of 1×2×3 meters dimensions made of strong iron expanders. Turkey growers of the British United Turkey (BUT Big 6) breed hatched from fertile eggs

brought from France and brooded under Sudan condition were used. Rearing and feeding were done in accordance with, [6] guide from one day through brooding up to 16 week of age and from then up to the end of week 28. Birds were allowed free access to feed and water during the entire period of the study.

**Experimental meat samples:**

The breasts of 15 turkeys slaughtered at the age of 28 weeks were separated as described by [7]. Seven breast meat samples were then randomly selected and used as experimental samples. Physical and chemical analysis of the selected breast meat samples were determined immediately after slaughtering and then stored in a deep freezer at -18°C for seven months. Similar analyses were also done after storage and the results were compared with those obtained at zero storage.

**Physical Analysis**

**Water holding capacity**

This is determined in accordance with the method described by [9]. Duplicate samples of one gram from the turkey breast were used. Each sample was placed on humidified filter paper and pressed between two Plexiglas plates for 1 minute at 25kg/cm<sup>2</sup> load. The meat filter area was allowed to dry. Meat and moisture area was measured with a compensating Planometer. The resulting area that covered by the meat were divided by the moisture area to give a ratio expressed as water holding capacity of the meat as shown by the following equation.

Water Holding capacity = loose water area –meat film area / meat film area.

**Cooking loss**

The cooking loss of meat samples was determined as follow. The weighted meat sample was placed in a polythene bag and totally immersed in water bath at 80°C for 90 minutes. After cooking each sample was

cooled with running tap water for 20 minute in its exuded fluids and then removed and dried with paper towel. Cooking loss was determined as the difference in weight of sample before and after cooking and expressed as a percentage of the weight before cooking.

Cooking loss = wt. before cooking – wt. after cooking /wt. before cooking

**pH determination**

pH value of turkey breast meat sample was determined immediately after the preparation of the samples. Ten grams of the sample was blended with 100 ml distilled water at high speed for one minute and then the reading of pH value was recorded using pH meter.

**Color measurement:** the color of turkey breast meat sample such as Lightness (L\*), redness (a\*), and Yellowness (b\*) values were determined using Hunter lab tri-stimulus color meter model D25 m.2 optical sensor machine.

**Chemical analysis**

The moisture, protein, fat, and ash percentage of turkey breast samples were determined by standard methods of analyses using [8].

**Statistical Analysis**

The data obtained were analyzed using T- Test, according to [10].

**III. RESULTS AND DISCUSSION**

The physical properties of breast meat sample (WHC, cooking loss and pH) are indicated in (Table 1). The Water holding capacity (WHC) and cooking loss values of breast meat samples were significantly (p< 0.01) lower at zero month of storage than seven month of storage. On the other hand, pH values were significantly higher (p 0.01) at seven month of storage than that of zero storage.

**Table 1: Effect of Freezing Storage on Physical Properties of Turkey Breast Meat.**

Parameters	Treatment				Level of significance
	Zero storage mean SD		7-month storage mean SD		
WHC%	2.25	0.27	1.77	0.35	**
Cooking loss%	38.16	1.53	32.03	2.26	**
pH	5.48	0.08	5.78	0.12	**

\*\*= highly significant

The color intensity of breast meat sample was examined for lightness (L\*), redness (a\*), and yellowness (b\*) as shown in (Table 2). The lightness of breast meat sample was significantly higher (p< 0.01) at zero storage than seven month of storage.

However, the redness (a\*) and the yellowness (b\*) of breast meat samples were significantly (p< 0.01) lower at seven month of storage than zero storage. An inverse relationship was seen between breast meat lightness and pH and Water Holding Capacity.

**Table 2: Effect of Freezing Storage on Color Intensity of Turkey Breast Meat.**

Parameters	Treatment				Level of significance
	Zero storage mean SD		7-month storage mean SD		
(L*)	38.31	2.34	35.47	1.68	**
(a*)	16.74	0.67	14.21 ± 0.74		**
(b*)	5.61	0.50	4.11	0.30	**

\*\* =highly significant

L\* Lightness

a\*Redness

b\*Yellowness

The chemical composition of breast meat samples (moisture, crude protein, fat and ash %ages) are shown in (Table 3).Results indicated a significant (p<

0.01) decrease from zero storage to seven month of storage in all parameters tested.

**Table 3: Effect of Freezing Storage on Chemical Composition of Turkey Breast Meat**

Parameters (%)	Treatment				Level of significance
	Zero storage mean SD		7-month storage mean SD		
Moisture	75.45 ± 0.72		71.27 ± 0.92		**
Ash	0.95 ± 0.02		0.76 ± 0.04		**
E.E	0.97 ± 0.10		0.87± 0.08		**
CP	17.27± 0.57		15.85± 0.50		**

\*\*= highly significant

E.E = Ether Extract

CP = Crude protein

The results of this experiment clearly demonstrated the significant effects of freezing storage on the physical properties and chemical composition of turkey breast meat. The WHC and cooking loss percentages were significantly decreased (improved) while the pH was significantly increased, the larger WHC value (larger spread water due to pressing), the poorer or weaker WHC of meat sample.

This result agrees with [11] who reported that poultry meat with low pH has been associated with the decrease in water holding capacity, which resulted in increased cooking and drip loss that is mainly attributed to reduction in reactive (charged) groups of muscle proteins, which are responsible for attracting and binding water molecules [12]. This result also agrees with [13] who indicated that low pH meat had the lowest water holding capacity, and that high pH meat had similar or better functional properties than normal pH meat.

The colour intensity of the experimental samples, the lightness (L\*) and redness values were significantly (P<0.01) decreased during storage. This agrees with [14] who found that the Lightness (L\*) and Redness (a\*) values were decreased in breast and leg muscles of chicken during storage. The decrease in Redness (a\*) value can be attributed to loss of heme pigment during storage [15].

The yellowness (b\*) was also decreased with storage time in the present study, which agrees with [15] who showed that the yellowness (b\*) value was increased during the first 4 days of storage and then decreased after 7 days of storage. On the other hand, the values of redness (a\*) and yellowness (b\*) were in line with the results of [16] who indicated that their values in turkey were decreased during storage (-18°C) up to 180 days. Taken together these results indicated that freeze storage improves both of lightness and yellowness of breast meat samples. This improvement in lightness is a good virtue according to [17] who suggested that L\* value may be a better predictive tool than pH for sorting fillets for potential functionality. On the other hand, the negative relations noted between lightness and pH accords well with [12].

As far as the chemical composition is concerned, results obtained under this study accords well with [18] who showed the same trend of decrease in stored chicken meat. The loss or decrease in nutritive value of frozen meat can be attributed to the loss of water soluble nutrients in the drip during thawing of frozen meat including salts, amino acids, some proteins and peptides, and water soluble vitamins [12].

## VI. CONCLUSION

In conclusion freeze storage of turkey breast meat had negative effects on chemical composition, pH and redness and improved some physical properties like (WHC and cooking loss) which are considered as good processing characteristics.

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