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Influence of Different Cooking Methods on Quality Attributes of Chicken Breast Meat

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Abstract

Chemical and instrumental textural attributes of chicken breast meat cooked by using different techniques were evaluated in this research. Blanching, cooking in convection oven and microwave cooking methods were used. It was determined that there were significant differences among Hunter a* and b* color values of the samples ($P<0.05$), whereas cooking loss values of the samples were not different from each other ($P>0.05$). As determined by using TA-XT texture analyzer, hardness and gumminess values of the samples were significantly different from each other ($P<0.05$), whereas there were no significant differences observed among the chewiness and springiness values of the samples ($P>0.05$). As results of chemical and textural analyses, it is determined that most appropriate method for cooking chicken breast was blanching. Chicken breast meat cooked by blanching is determined to be more soft and chewable.

Keywords — Chicken breast meat, Convection oven, Microwave oven, Blanching, Texture, Quality

1 Introduction

Today, physical, chemical and microbiological characteristics of foods are of great importance in terms of conformance for consumption as well as their sensorial attributes. It is important to use novel techniques and processes for manufacturing high quality and nutritional value foods [1]. Cooking directly affects the physical characteristics of meat as well as its chemical, sensorial and microbiological attributes. Different techniques can be used for cooking meat, but in general, basic principles of heat and mass transfer are almost the same in all cooking methods [2].

Heat transfer in meat cooking can be achieved by three different ways; conduction, convection and radiation. On the other hand, meat cooking techniques can be grouped under three different titles as dry cooking, wet cooking and electronic cooking[2]. In dry coking process, there is not any modification occurred in meat samples, whereas in wet cooking meat is cooked in water. In microwave cooking technique, meat is cooked by using microwave energy in a microwave oven. Microwave cooking is known as an electronic cooking technique and meat losses important amount of water during cooking period. Blanching can be given as an example for wet cooking method. Generally water is used in wet cooking. On the other hand, in convection oven cooking technique, high amount of cooking loss is occurred.

According to Johnston and Baldwin [3], average water contents of foods cooked in microwave oven are same or less than the water contents of foods cooked by using traditional methods like blanching and convection oven technique. So it can be concluded that cooking loss amount of food samples in microwave oven coking is higher. But in convection oven method, cooking efficiency is higher when compared to microwave oven cooking, whereas coking time, loss in nutritional value and sensorial analysis scores are higher. Besides that, as Howatt et al. [4] reported, microwave oven technique is known as a fast cooking method with less energy consumption. But in this type of cooking more loss in flavor, inadequate meat color and tenderness formation are occurred. These are known as the disadvantages of this type of cooking.

From that point of view, in this research it was aimed to determine the effect of cooking type on several chemical, sensorial and instrumental textural attributes of chicken breast meat samples.

2. Materials and Methods

Chicken meat used in the research was obtained from Keskinoğlu Company. Breast meats of chickens were cut and extracted in the laboratory. Three types of cooking method were used in the research; cooking in microwave oven **(MO,** 720 kW, 15 minutes**)**, blanching **(BL,** in boiling water for 30 minutes**)** and cooking in convection oven **(CO,** at 175ºC for 45 minutes**)**. Hunter *L*, a** and *b** color values of the samples were determined by using Hunter colorimeter (Minolta, Osaka, Japan) [5]. pH values of the samples were determined according to Obuz and Cesur [5] with a digital pH-meter, whereas cooking loss of the samples were determined by calculating the gravimetric difference among the weights of raw and cooked breast meat. Water contents of the samples were determined by drying the samples at 105ºC for 4-5 hours [6]. For determination of the instrumental textural attributes of chicken breast samples, TA.XT2 Plus Texture Analyzer (Stable Microsystem, UK) was used. The analyze technique was compression whereas hardness, chewiness, gumminess and springiness values of the samples were calculated according to Obuz and Cesur [5]. All analyses were repeated three times and data obtained from experiments were evaluated by SAS statistical analyses programme. The procedure was PROC MIXED.

3. Results

Average pH value and water content of raw chicken samples were determined as 6.87 and 69.20%. As seen from Table 1, average pH values of the samples cooked by using different cooking techniques were determined as 7.23, 7.19 and 7.25 for the samples CO, BL and MO. It was observed that pH values of the chicken samples were increased after cooking and it was understood from statistical analyses results there were no significant differences among the final pH values of the samples after cooking. Average final water content of bleached chicken meat (64.48%) was significantly higher than the sample cooked in convection oven (59.74%) and the sample cooked in microwave oven (59.16%) ($P<0.05$), whereas there were no statistically significant difference observed among the final water contents of MO and CO ($P>0.05$).

Similarly there were no statistically significant difference observed among the cooking loss of the chicken meat samples cooked by different techniques ($P>0.05$). As seen from Table 1, cooking loss values of CO, BL and MO were 29.36%, 27.46% and 33.75% respectively, and there were no significant difference was observed among the cooking loss values of the samples. Cooking method showed no important affect on the coking loss values of the samples ($P>0.05$).

Table 1. pH, water contents and cooking loss values of chicken meat samples

Sample	pH	Water (%)	Cooking loss (%)
CO	7.23	59.74a	29.36
BL	7.19	64.48b	27.46
MO	7.25	59.16a	33.75

As seen from Table 2, average *L*, a** and *b** color values of the chicken breast meat samples were 59.07, 11.42 and 14.39 respectively. After cooking by using different methods, average L* values of the samples CO, BL and MO were 70.46, 73.03 and 74.61.

As results of the statistical analyses, there were no differences observed among average *L** values of chicken meat samples. On the other hand, *a** (redness) values of the samples were significantly different from each other ($P<0.05$) and *a** value of the chicken breast meat sample which was cooked in convection oven (3.92) was significantly higher than the other samples ($P<0.05$), whereas there were no significant differences observed among the *a** values of the samples BL and MO ($P>0.05$). Average *b** values of the samples were different from each other ($P<0.05$).

Table 2. Hunter *L*, a** and *b** color values of chicken meat samples

Sample	*L**	*a**	*b**
CO	70.46	3.92a	29.57a
BL	73.03	0.13b	16.46c
MO	74.61	0.85b	21.26b

Instrumental textural attributes of chicken breast meat samples were given as Table 3. Hardness values of samples CO, BL and MO were 13.28 kg, 9.32 kg and 16.16 kg respectively. Highest hardness value was calculated for the sample MO which was cooked by using microwave oven, whereas lowest hardness score was calculated for BL.

Chewiness score of chicken meat sample which was cooked by blanching was the lowest. But there was no significant difference was observed among the chewiness scores of the samples ($P>0.05$).

Table 3. Instrumental textural attributes of chicken meat samples

Sample	Hardness (kg/s)	Gumminess	Chewiness	Springiness (s)
CO	13.28a,b	11.27a,b	53.41	4.73
BL	9.32b	6.70b	29.26	4.52
MO	16.16a	16.05a	61.40	3.63

4. Discussion and Conclusion

As results of chemical and textural analyses, it is determined that most appropriate method for cooking chicken breast was blanching. Chicken breast meat cooked by blanching is determined to be more soft and chewable.

It is determined that because of high cooking loss amount during cooking, MO was the sample having the highest hardness value. Cross and Fung [7] reported cooking in microwave oven had an important affect on hardness values of meat samples because of the high amount of water loss during cooking. Because of this high amount of water loss, structures of myofibrils become harder. Also microwave cooking is a faster cooking method when compared to other cooking methods like cooking in convection oven and blanching, so in this shorter cooking period enough collagen-gelatin transformation cannot be achieved sufficiently. Because of these factors, tenderness of meat is less than the tenderness of the meat cooked by using these two other cooking methods.

Highest springiness was observed for the sample which was cooked by microwave oven. It is determined this was occurred because of the cooking loss during cooking[8]. Springiness values of the other two samples are similar to each other. As results of statistical analyses, there was no difference was observed among the springiness values of the samples ($P>0.05$).

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