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308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorijps@gmail.com

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Using Different Methods to Tenderize Spent Hens Meat

N.A. Nadia Al-Hajo
Department of Animal Resource, College of Agricultural, University of Baghdad, Baghdad, Iraq

Abstract: The aim of this study is tenderizing spent hens meat by using cheap local materials such as bitter orange juice, vinegar, salt and sugar for 1,2, 3 and 4h, distill water is used (T_1) in curing to make it as standard. Bitter orange juice (acidity of 1.5) (T_2), vinegar (acidity of 7) (T_3), table salt (2%) (T_4) and sugar (2%) (T_5) were used. The processed meat was storied under -18°C ± 2°C for a month to investigate the influence of the type of treatment and the periods of storing and submersion on the sensory properties and chemical qualities through estimating the percentage of moisture, hydrogen number pH, volume of the released extract. A sensory properties evaluation of the qualities of flavor, juiciness, tenderness and overall acceptance was carried out. Results of curing in the different solutions revealed a decreased pH value in (T_2) and T_3 ; while the highest significant differences ($p<0.05$) was in samples T_4. Besides, there were no significant differences concerning the periods of curing. As far as the period of freezing is concerned, a significant increase in pH of the samples was noticed, T_4 had the upper degree. There were no significant differences concerning the periods of curing. The percentage of moisture increased significantly ($p<0.05$) of the treatment groups compared with T_1. The highest significant differences ($p<0.05$) were found in T_4. A significant ($p<0.05$) increase occurred in the percentage of moisture when it was frozen and cured. Besides, there were significant differences ($p<0.05$) concerning the period of curing. A decrease was noticed of the volume of the released extract. The highest significant ($p<0.05$) difference was in T_1 and the lowest one was in T_4. It was also noticed that significant ($p<0.05$) increase of the frozen sample, the highest significant difference ($p<0.05$) was in T_1 and the lowest one was in T_4. Results of sensory evaluation indicated the improvement of the sensory qualities of the samples treated with the different solutions especially of tenderness and juiciness. These results were reflected on the quality of general acceptance by the consumer of the samples. Results of sensory evaluation revealed that T_2 and T_4 was the best sample. Significant differences ($p<0.05$) as far as the periods of curing were noticed. Thus we can recommend using 2% salt and bitter orange juice (1.5 acidity) in curing spent hens meat.

Key words: Chicken meat, curing methods, freezing, volume of the released extract sensory evaluation

INTRODUCTION

Curing is an important method for improving tenderness of spent hens meat (Richard, 1998). Acid solution was used in curing to tenderize and improve flavor and texture and thus called marinade, acids, salts, sugar, spices were used in curing. The acids used in the process of tenderizing meat effect the collagen of the connective tissue (Seuss and Martin, 1993). Acids blow up myofibrils (Offer and Trinick, 1983). Genaro *et al.* (1989) found that acids such us acetic, citric and lactic acid act on collagen and led to dissolved the collagen and decreased the shear value.

Vinegar is a weak carboxy acid, it contain 6-10% acetic acid (AL-Jalili *et al.*, 2004). bitter orange juice contain 87.8% water and 10.2% carbohydrate and 68 mg/100 g vitamin C and its pH 2-2.4 (AL-Sakini, 1997). Joslyn (1978) observed that bitter orange juice contain 6.33% citric acid and 0.32% malic acid.

The researcher notice that citric acid improved tenderness and its other qualitative characteristics. Salt solution used too in curing, chloride ion increase the electrostatic state between molecular as of protein (Offer and Trinick, 1983).

The use of calcium chloride in solution (0.3 M) and sodium chloride (0.6 M) injection a breast meat led to decrease the shear value.

Long time ago in many parts of the civilized world man learned how to preserve meat for future consumption, the most widely used method was by salting and then drying the meat (Al-Ani, 1986). Curing used as a method of preservation, Since then several meat curing methods has been developed to a suitable way to increase getting a homogenize curing components and minimize the presence of any unfavorable ingredient in the curing process such as the unfavorable color or any degradation of the meat cuts (Leverentz, 2001; Kutas, 2002).

The aging of meat in the plant led to increase the coasts because of holding the meat in storage which causes lost of moisture and then decreased the quality of meat (Goll *et al.*, 1962). Further research is needed to study these curing methods to improved the quality of spent hens meats.

MATERIALS AND METHODS

This study was conducted at the college of Agriculture/ University of Baghdad. The broilers (48-52 months) were

brought from a local market then slaughtered and cut the thighs for our research.

Bitter orange juice (acidity of 1.5) as citric acid, vinegar as acetic acid, table salt (sodium chloride) 2% and sugar 2% were used. The processed meat was stored in -18°C ± 2°C for a month. The thighs then washed with tab water and immersed in the solution, small sample is taken to investigate the influence of the type of treatment and the periods of curing and freezing.

The samples of the standard treatment were immersed in distill water and conducted the same process on it. The pH was estimated according to Jeacocke (1977), the percentage of moisture was determined according A.O.A.C. (1980), Extract release volume was estimated according to Pearson (1976). The degree of sensory evaluation of flavor, tenderness, juiciness and overall acceptance of cooked meat by boiling determined according to Levie (1970). A 9-point hedonic scale (9-like extremely, 1-dislike extremely) was used to evaluate the following attributes. Ten staff members of the college of agriculture and graduate students most of whom had participated in previous consumer panels work as panelists, were given the details about this panel and we do a primary panel before the essential test which we adapted in this study. We depending the standard point to control on varieties which may effect the degree of panel: Time of the test in 11 O'clock (A.M.), degree of cooking temperature, time between cooking and test, drinking water in 25°C between the test and other, finally the size of the pieces which we tested (Lee *et al*., 1997).

Statistical analysis: The data were analyzed using Complete Randomized Design and Multiple Regression. The calculation was preformed by the SAS package programmers (SAS, 2001). LSD test was used to determine significant differences.

RESULTS AND DISCUSSION

The effect of curing poultry meat with different methods and submersion for the periods 1, 2, 3 and 4 h on the value of hydrogen number (pH) are summarized in Table 1. The data revealed that there were significant differences ($p<0.05$) between curing methods (bitter orange juice, vinegar, salt and sugar) and during curing periods, while as there where no significant differences between the periods of curing except when used the bitter orange juice, it was found no significant differences between treatment 1 and 2, and between treatment 3 and 4, while there were significant differences ($p<0.05$) among the periods of curing. pH of chicken meat before treatments was 6.91. A significant ($p<0.05$) decrease in pH occurred in the treatment (T_2) and (T_3), this decrease depended on the acidity, it was found that Sample 4 which was treated with salt maintained significantly ($p<0.05$) the highest level.

Freezing effect (Table 2) for 30 days notes when the pH increased for all treatments, because of the natural hydrolysis of meat protein and the separation of amines groups (Assaf and Bratzler, 1966).

The data in Table 3 revealed a significant differences ($p<0.05$) of the percentage of moisture for all treatments, which increased as the periods of curing increased, because of the changes of the protein structure induced by cathapsins which causes the binding of the water. The bacteria also produced a complex compound named Amino sugar which causes the increased of water binding (Jay, 1972). Busboom (2002) and AL-Hajo (2008) reported that percentage of moisture of curing meat has been increased.

Curing in salt T_1 (Table 3) increased significantly ($p < 0.05$) the percentage of moisture while it decreased the another treatment T_2, T_3 and T_5, no significant differences among them were observed, the increased could be because of the diffusion which led the salt to

Table 1: Effect of Curing meat with different methods and submersion for a period of 1, 2, 3 and 4 hours on pH

Method of curing	Curing Period (hours) 1	2	3	4
T_1	6.40^{Ba}	6.56^{Ba}	6.56^{Ba}	6.53^{Ba}
T_2	5.60^{Da}	5.50^{Da}	5.20^{Db}	5.20^{Db}
T_3	4.93^{Ea}	4.86^{Ea}	4.56^{Ea}	4.43^{Ea}
T_4	7.13^{Aa}	7.20^{Aa}	7.23^{Aa}	7.33^{Aa}
T_5	6.00^{Ca}	5.90^{Cb}	6.56^{Cb}	5.70^{Cb}

Means followed by the same small latter (Row) and means followed by the same big latter (columns) are not significant.

Table 2: Effect of freezing curing meat with different methods and submersion for a period of 1, 2, 3 and 4 hours on pH

Method of curing	Curing Period (hours) 1	2	3	4
T_1	6.65^{Bb}	6.76^{Bab}	6.83^{Ba}	6.83^{Ba}
T_2	5.70^{Ca}	5.46^{Db}	5.16^{Dc}	5.16^{Dc}
T_3	5.10^{Da}	4.93^{Ea}	4.70^{Ea}	4.33^{Ea}
T_4	7.16^{Aa}	7.16^{Aa}	7.33^{Aa}	7.46^{Aa}
T_5	6.23^{Ba}	6.16^{Ca}	6.10^{Ca}	6.03^{Ca}

Means followed by the same small latter (Row) and means followed by the same big latter (columns) are not significant.

Table 3: Effect of curing meat with different method and submersion for a period of 1, 2, 3 and 4h on the percentage of moisture

Method of curing	Curing Period (hours) 1	2	3	4
T_1	66.73^{Cd}	67.81^{Cc}	68.55^{Cb}	69.53^{Ca}
T_2	72.40^{Bd}	73.44^{Bc}	74.28^{Bb}	75.61^{Ba}
T_3	72.43^{Bb}	73.45^{Bb}	75.00	75.83
T_4	74.49^{Ab}	75.27^{Ab}	76.49^{Ab}	77.28^{Aa}
T_5	72.45^{Bc}	73.47^{Bb}	73.93^{Bab}	74.78^{Ba}

Means followed by the same small latter (Row) and means followed by the same big latter (columns) are not significant.

•The percentage of moisture before treatment was 65.58.

penetrate into the tissues of the meat and mixed with the molecular water because of the increased of negative charges of meat protein and the increased of spaces among them which cause some binding of molecular water which consider a polarized molecules (Lawrie, 1974).

As for the effect of freezing (Table 4), no significant differences were noticed among treatments T_1, T_2 and T_5 while there were significant differences ($p<0.05$) among treatments T_3 and T_4. There were significant differences ($p<0.05$) concerning the periods of curing. The meat in treatment T_4 (salt) increased ($p<0.05$) of the percentage of moisture. In conclusion, the percentage of moisture increased ($p<0.05$) when submersion and freezing compared with fresh treatment.

Table 5 showed the effect of curing poultry meat with different methods and for the periods of 1,2,3 and 4h on the volume of the released extract, the treatment with different solution achieved an increased in the ability of meat to retain water. This is reflected in the increased in the volume of the released extract. It was notice that T_4 had the lowest value and then T_5, T_2 and finely T_3. Significant ($p<0.05$) decreased was revealed of the released extract of the frozen sample treated with the solution compared with T_1. No significant differences were noticed between freezing and the periods of curing. The reason of low value of the released extract of the treated group was either to the increase in pH or its decrease of the isoelectric value of the actomyocine which causes the increase of its ability to retain water and thus decreases the extract (Gault, 1958).

Table 4: Effect of freezing meat with different methods and submersion for the period of 1, 2, 3 and 4h on the percentage of moisture

Method of curing	Curing Period (hours) 1	2	3	4
T_1	75.25^{Bd}	76.13^{Bc}	76.94^{Bb}	77.30^{Ba}
T_2	75.19^{Bd}	75.67^{BCc}	76.56^{Bb}	77.21^{Ba}
T_3	73.96^{Cc}	75.09^{Ccb}	76.25^{ab}	77.12^{Ba}
T_4	77.67^{Aa}	78.41^{Aa}	78.48^{Aa}	79.22^{Aa}
T_5	75.67^{Ba}	76.12^{Ba}	76.54^{Ba}	76.89^{Ba}

Means followed by the same small latter (Row) and means followed by the same big latter (columns) are not significant.

Table 5: The effect of curing meat with different methods and submersion for the period of 1, 2, 3 and 4h on the volume of the released extract

Method of curing	Curing Period (hours) 1	2	3	4
T_1	24.86^{Aa}	24.12^{Ab}	23.85^{Ab}	23.12^{AC}
T_2	15.78^{Ca}	15.41^{Cb}	15.10^{Cc}	15.10^{Bc}
T_3	16.73^{Ba}	16.10^{Bab}	15.83^{Bb}	15.63^{Bb}
T_4	12.83^{Ea}	12.60^{Ea}	12.46^{Da}	11.90^{Ca}
T_5	14.70^{Da}	14.80^{Da}	14.83^{Ca}	15.0^{Ba}

Means followed by the same small latter (Row) and means followed by the same big latter (columns) are not significant.

Table 6: Effect of freezing curing meat with different methods and submersion for the period of 1, 2, 3 and 4h on the volume of the released extract

Method of curing	Curing Period (hours) 1	2	3	4
T_1	20.34^{Aa}	23.34^{Aa}	23.11^{Aa}	32.00^{Aa}
T_2	16.03^{ABc}	16.40^{Bb}	12.82^{Ba}	16.82^{Ba}
T_3	16.30^{ABa}	16.10^{Ba}	15.90^{Ca}	15.53^{Ca}
T_4	13.16^{Ba}	13.06^{Da}	12.80^{Ea}	12.43^{Ea}
T_5	13.56^{Ba}	13.63^{Ca}	13.76^{Da}	13.93^{Da}

Means followed by the same small latter (Row) and means followed by the same big latter (columns) are not significant.

The effect of curing meat with different methods and submersion for the period of 1, 2, 3 and 4h on flavor of boiled meat presented in Fig. 1, which indicated that T_1 decreased in sensory score while another treatment increased, T_2 and T_4 have upper degree than T_3 and T_5. Significant differences ($p<0.05$) were noticed among the periods of submersion.

Tenderness (Fig. 2) improved the curing treatment compared with T_1, but T_2 and T_4 have upper degree compared with T_3 and T_5. There were significant differences ($p<0.05$) of the period of curing.

Figure 3 showed the effect of curing meat with different methods and submersion for the periods of 1, 2, 3 and 4 hours on juiciness treatment had a significant differences ($p<0.05$) in juiciness compared with T_1, but T_2 and T_4 have upper degree compared with T_3 and T_5. There were no significant differences for the periods of curing.

Overall acceptance (Fig. 4), the results showed improved ($p<0.05$) in the sensory evaluation, thus led to improved acceptance of curing meat compared with T_1. T_2 and T_4 have a higher score for overall acceptance, there were a significant differences ($p<0.05$) for the periods of submersion.

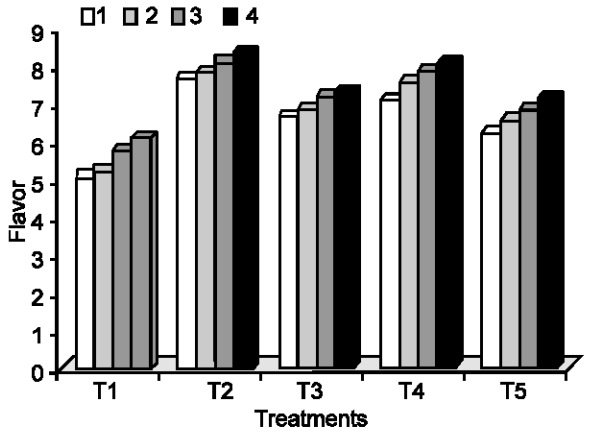

Fig. 1: Effect of curing meat with different methods and submersion for a period of 1, 2, 3 and 4h on flavor

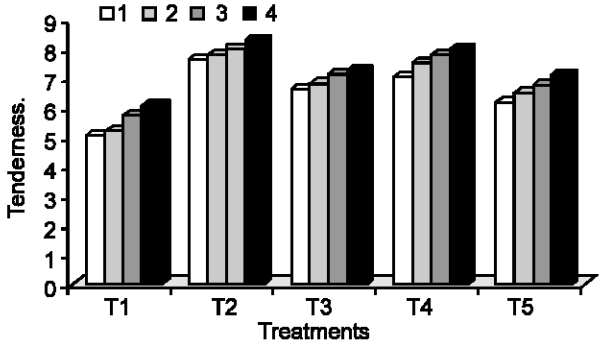

Fig. 2: Effect of curing meat with different methods and submersion for a period of 1, 2, 3 and 4h on tenderness

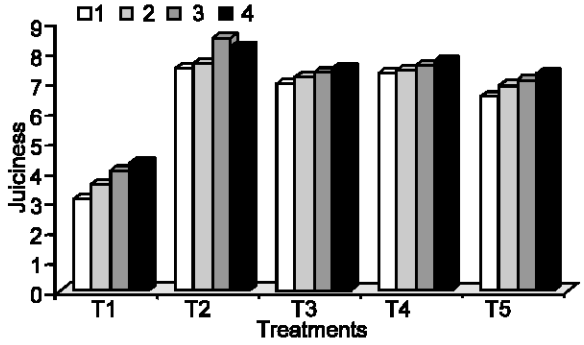

Fig. 3: Effect of curing meat with different methods and submersion for a period of 1, 2, 3 and 4h on juiciness

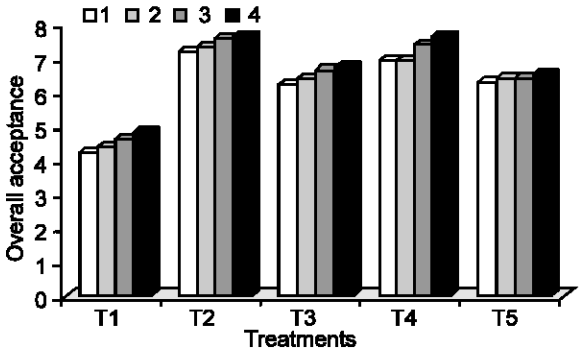

Fig. 4: Effect of curing meat with different methods and submersion for a period of 1, 2, 3 and 4h on overall acceptance

Conclusion: In conclusion, we can recommend using salt and bitter orange juice in curing on large scale basis and the best of periods of submersion was 1 h.

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