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Extended Abstract

The Effect of Coating with Tragacanth and Salep Gums and Osmotic Treatments on the Physicochemical Characteristics of Ostrich Meat Pieces

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Abstract
In this study, the effect of sodium chloride concentration and duration of osmotic treatment on physicochemical characteristics of meat pieces with treatment of tragacanth gum and salep gum was investigated. In order to increase the moisture transfer and decrease the solid gain, osmotic treatment of ostrich meat pieces (30×30×20 mm) was performed with concentrations of 5, 15 and 27% in 24 h with coating treatment of tragacanth at levels of 0.25, 0.5 and 1% and salep at 1, 2 and 3% levels. The water gain/loss and solid gain were significantly affected by osmotic and coating concentrations during the osmotic treatment (P<0.05). At a concentration of 5% water gain and at a concentration of 27% water loss, the coated samples were more than the control sample (P<0.05). This might be due to the polysaccharide structure and hydrophilic nature of tragacanth and salep that show a slight resistance to moisture because of their polar structure. 2% salep had the most ability of preventing the excessive entrance of solutes. The coating treatment had a significant effect on moisture content, WHC, water activity and performance index of ostrich meat pieces during the osmotic treatment (P<0.05). The performance index of coated meat samples was higher in most of the samplesat 5 and 15% concentrations and in all treatments at 27% concentration, compared to controls. At the end of osmosis, 2% salep gum treatment obtained the highest performance index. In other words, the coating treatment can control solid gain during the osmosis process while also facilitating moisture transfer.

Keywords: Coating, Osmotic treatment, Ostrich, Salep, Tragacanth

Introduction
Salting raw meat is the oldest method used to increase its shelf life since sodium chloride acts as a preservative and alters the water holding capacity (WHC) of the protein (Graiver, Pinotti, Califano, & Zaritzky, 2006). Low concentration of salt during a mild osmotic treatment with increasing WHC improves the organoleptic properties of meat, such as juiciness, texture, and taste, resulting in its hydration. On the other hand, a high concentration of salt causes protein denaturation, WHC decrease, and dehydration (Ozuna, Puig, García-Pérez, Mulet, & Cárcel, 2013; Schmidt, Carciofi, & Laurindo, 2008). Osmotic dehydration has such advantages as

enhanced preservation of color and taste, improved protection of the selective feature of the cell wall, and requirement of lower energy. However, the limited industrial development of osmotic dehydration is because of the difficulty of controlling the broad absorption of soluble substances that negatively affect the nutritional profiles and sensory characteristics of foods. Regarding this, a number of studies have targeted the reduction of the broad absorption of soluble materials using edible coatings prior to osmotic dehydration of food (Jalaee, Fazeli, Fatemian, & Tavakolipour, 2011; Khin, Zhou, & Yeo, 2007). The osmo-coating or osmotic membrane is performed to improve the quality of food during the osmotic process. During this process, food coating leads to dehydration with an artificial barrier on the surface, which probably prevents the permeation of soluble substances into the food; however, it does not affect the dehydration rate (Sabetghadam & Tavakolipour, 2015). However, very few studies have been conducted on meat coatings (Camirand, Forrey, Popper, Boyle, & Stanley, 1968; Tian, Zhao, & Shi, 2016). With this background in mind, the present study aimed to evaluate the effect of tragacanth and salep coatings, osmotic solution concentration and immersion time on water loss/gain and solid gain, WHC, water activity and performance index of ostrich meat pieces during the osmotic treatment.

Materials and methods

This study was performed on the thigh muscles of the blue neck ostrich. Meat pieces of 30×30×20 mm were prepared by making cuts parallel to the fibers. Tragacanth gum solutions were prepared at three concentrations of 0.25, 0.5, and 1% w/v (Izadi, Ojagh, Rahmanifarah, Shabanpour, & Sakhale, 2015; Zolfaghari, Mohebbi, & Khodaparast, 2013). In addition, salep solutions were prepared at the concentrations of 1, 2, and 3% w/v (Ekrami & Emam-Djomeh, 2014; Farhoosh & Riazi, 2007). The meat samples were then soaked in the prepared gum solutions in a mild alkaline environment (0.01 normal NaOH) for 2 min. Subsequently, they were dehydrated on a sterilized metal sieve (Bazargani-Gilani, Aliakbarlu, & Tajik, 2015). Moreover, they were immersed in calcium chloride solution, depending on the gum concentration for 30 min. They were kept for 5 min on a metal sieve at room temperature (Tian *et al.*, 2016). The osmotic treatment of ostrich meat pieces was performed with concentrations of 5, 15 and 27% w/v in 24 h at 15 °C (Dimakopoulou-Papazoglou & Katsanidis, 2017).

Results and discussion

In a 5% osmotic treatment, low salt concentration and formation of actin-myosin-salt network resulted in the partial denaturation of protein and swelling of myofibril in the meat samples, followed by the development of a protein network for water trapping and water gain. However, with an increase of up to 27% in salt concentration, chlorine ions produce high repulsion, and protein denaturation occurs in an extensive scope, which ultimately leads to the contraction of the protein network and water loss. At 15% NaCl concentration, there is a small degree of water loss and gain since the existing salt content is not sufficient to create a strong protein network to maintain moisture or create sufficient repulsion for protein depolymerization.

Fig. (1) illustrates the comparison of the meat samples osmified with tragacanth and salep coatings with control samples in terms of water loss. At 5% and 27% concentrations, the levels of water gain and loss were higher in the samples pre-treated with tragacanth and salep, compared to those in the control group ($P<0.05$). This might be due to the polysaccharide structure and hydrophilic nature of tragacanth and salep that show a slight resistance to moisture because of their polar structure. During osmotic treatment at 5% and 27%

concentrations, the levels of water gain and loss were respectively higher in the meat samples coated with salep, compared to those in the samples treated with tragacanth. This was indicative of the lower inhibitory effect of salep gum on moisture under the test conditions, compared to that of tragacanth gum. Tian *et al*. (2016) reported that the coated muscle samples had a higher water loss level, compared to the control samples, which was attributed to the chemical nature of the coating polysaccharides.

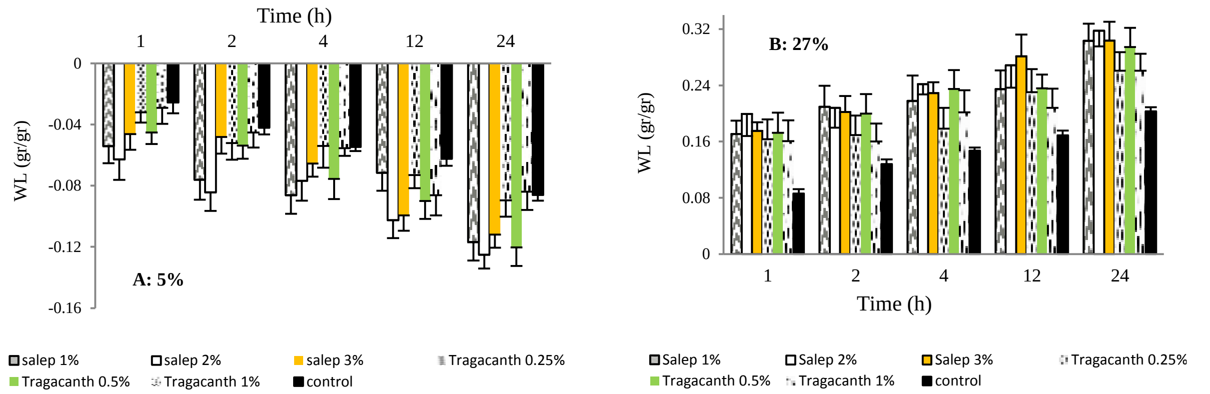

Fig. 1. Comparison of the meat samples osmified with tragacanth and salep coatings with control samples in terms of water loss/gain

The effect of osmotic solution on the solid gain of osmified meat samples was completely significant. There was a stepwise increase in solid gain by the enhancement of salt concentration. At 5, 15, and 27% concentrations, the samples coated with 2% salep had a lower level of solid gain, compared to the control samples (P<0.05). This is indicative of the proper performance of 2% salep; accordingly, coating with 2% salep could prevent the excessive entrance of solutes. Moreover, the coating with 0.5% tragacanth at 15 and 27% osmotic treatments had this positive feature as well. In addition, similar results were reported by Tian *et al*. (2016) regarding muscle tissue.

During the osmotic treatment, the weight changes of the samples were intensified in all three concentrations of NaCl, which was expected due to the hydrophilic structure of the gums and following the effect on the water loss of the samples. At 5 and 27% concentrations, the levels of WHC were higher in the samples pre-treated with tragacanth and salep, compared to those in the control group (P<0.05). Fig. (2) displays the relationship between water activity and dry matter of meat samples osmified with tragacanth and salep coatings. As can be seen, the coating treatment at each concentration in most treatments increased the water activity of the samples and the levels of water activity were higher in the meat samples coated with tragacanth, compared to those in the samples treated with salep, at 15 and 27% concentrations, in the same amount of dry matter, which was important in terms of safety and meat spoilage. The performance index of coated meat samples was higher in most of the samplesat 5 and 15% concentrations and in all treatments at 27% concentration, compared to that in the controls. In this regard, at the end of osmosis, 2% salep gum treatment obtained the highest performance index.

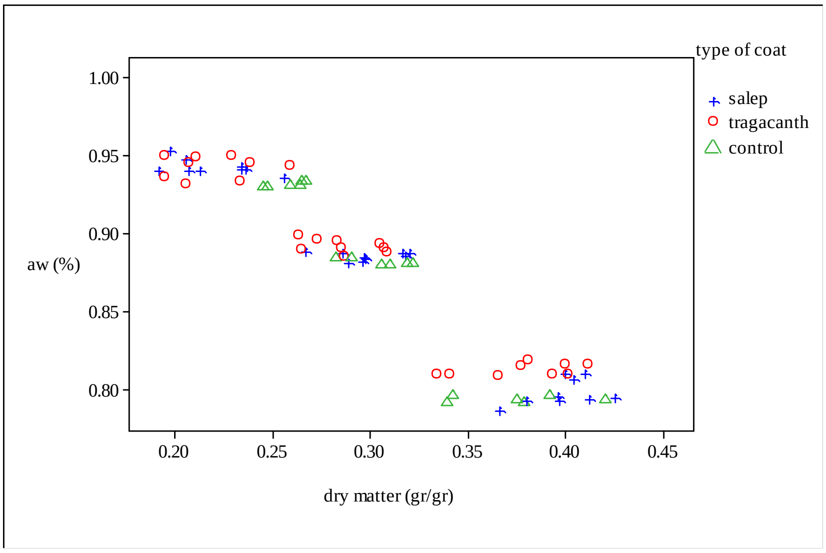

Fig. 2. The relationship between water activity and dry matter of meat samples osmified with tragacanth and salep coatings

Conclusions

Based on the findings of the current study, the coating process integrated with osmotic treatment in ostrich meat pieces was mostly affected by the concentration of the osmotic solution or the result of the actin-myosin-NaCl interactions. Water gain/loss and solid gain are significantly affected by the concentration of the osmotic solution and coating concentration during the osmotic treatment. The coating treatment also had a significant effect on moisture content, WHC, water activity and performance index of ostrich meat pieces during the osmotic treatment. Based on the findings, it can be concluded that coating treatment could control solid gain and facilitate water loss/gain of meat pieces during the osmotic treatment.

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Extended Abstract