D31

PROTEIN FUNCTIONALITY OF SALT SOLUBLE PROTEIN FROM MECHANICALLY DEBONED, WHITE AND DARK TURKEY MEAT

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Mechanically deboned turkey meat (MDTM) has been used for the past 20 years in a wide variety of meat products to replace the much more expensive muscle meat. It has not been used as a filler, but rather as a more economic source of good meat protein. MDTM has some disadvantages that limit its usage in many different processed products. The consumer expects to see the pink color in cured products like hot dogs, and a white color in non-cured products like breast roll, when using this type of meat undesirable grayish or brownish color may develop. MDTM also can impart undesirable flavors. However, its major disadvantage is the partial lack of muscle fibers. For this reason, there won't be any realignment of fibers during thermal processing, and the food will remain soft a characteristic that the consumer will notice (Hoogenkamp, 1987).

Protein functionality has been studied in many different meat products and model systems. It has been elucidated that from all proteins the myofibrillar fraction is the one that determines most of the final product quality (Acton and Dick, 1984). This functionality has been studied in terms of water retention, fat emulsification and gelation (Whiting, 1988; Xiong, 1994). These parameters are of economic importance to the meat processor.

It has been reported differences in protein functionality between animal species (Cunningham and Froning, 1972), and amongst the same species depending from which muscle protein is extracted, this is the case for turkey meat. Turkey meat presents different physical characteristics and functional properties depending on the muscle. Breast meat is lighter in color, and has better functional properties than the darker meat from leg (Foegeding, 1987; Xiong, 1994).

There is no knowledge on protein functionality of MDTM obtained from different anatomical parts. It is possible to make MDTM from those anatomical regions where muscles present better functionality to maximize it. The objective of this study was to evaluate functional behavior in a model system that consisted of salt soluble proteins from MDTM from different anatomical parts.

MATERIALS AND METHODS

Materials.- Turkeys were bought from Pavos Parson, Chihuahua, México. They were slaughtered, frozen, -20°C, and shipped to CIAD, Hermosillo, Sonora, México. They were thawed at 5°C and manually dressed. Four different treatments of MDTM were made from leg, wings, carcass (backbones and rib cage) and bones from the whole bird. A Paoli deboner (Model 22H, 611) was used. The temperature from the meat paste during the deboning never exceeded 5°C. To avoid oxidation reactions in the MDTM, a mixture of antioxidants BHA/BHT (Griffith) and citric acid were added. Samples of MDTM and meat manually deboned (wings, legs and breast) were stored at -20°C to evaluate salt soluble protein functionality.

Protein extraction and preparation.- Meat was homogenized (Camou et al., 1989) for 30 seconds using one part meat and 3 parts of a 0.56 M NaCl, 17.8 mM $Na_5P_3O_{10}$ and 1 mM NaN_3 solution. The homogenized mix was stored at 1°C for 1 hr, then centrifuged (Beckman model J2-21) at 12,000 x g, 2°C for 1 hr. Protein concentration (Biuret method) was adjusted to 20 mg/ml.

Gel formation.- Thirty grams of salt soluble protein were placed in a 100 ml beakers, and closed with foil to avoid evaporation during heating. Samples were allowed to equilibrate at room temperature before heat treatment in a water bath at 1°C/min until samples reached 70°C. Immediately afterward, gels were placed in ice and stored at 1°C overnight.

Gel strength.- Gel strength was measured with an Instron machine (Model 1132) equipped with a 35 mm compression plunger attached to a 50 Kg cell. Head velocity was 10 cm/min. Sample was compressed 80% of its height. Maximum peak was measured during compression in KgF.

Water loss.- After gels have been compressed, they were transferred to 50 ml tubes and centrifuged at 2,000 x g for 10 minutes. Water separated was weighed and expressed as grams of water loss per 30 gr gel.

Emulsifying capacity.- Emulsifying capacity was done accordingly to Pearce and Kinsella (1978). Salt soluble protein extracts were adjusted to a protein concentration of 0.1%. The emulsion was made with one part oil and three parts of protein extract. This sample was homogenized (Tissumizer, Tekmar Co.). Dilutions were made in the order of 1:100 and then absorbance was read at 500 nm in a spectrophotometer (Perkin Elmer UV/VIS Lambda 3B).

RESULTS AND DISCUSSION

Table 1 shows the results on functionality of salt soluble protein (SSP) suspensions. Significant differences ($P<0.05$) were observed in gel strength (GS) between MDTM and white and dark meat. GS of manually separated meat (MSM) was higher ($P<0.05$) for SSP extracted from white muscle (breast) than from dark muscle (leg), 0.38 and 0.22 KgF, respectively. White meat from the wings showed an intermediate value with respect to breast and leg, 0.28 KgF. This is in accordance

with the literature (Xiong, 1994). Apparently, this difference between white and dark muscle is due to the myosin isoforms inherent to a specific muscle. These protein isoforms present differences in the process of forming a gel (Xiong, 1994). This is closely related to their thermal transitions where the molecule starts to change its conformation (Foegeding et al., 1991) and interacts with other neighboring proteins. Xiong (1994) reported differences in thermal transitions between white and dark turkey muscles.

GS for MDTM from carcass (back & rib cage), wings, and legs was 0.09, 0.05 and 0.07 KgF, respectively. There were no significant differences ($P>0.05$) between the MDTM samples. GS from the control (bones from the whole bird) and commercial MDTM was 0.12 and 0.13, respectively, this might be because there was more meat left in the carcass. GS difference between gels made from MSM and MDTM shows the lesser amount of myosin present in the SSP extracts from MDTM as observed in the electrophoretic (SDS-PAGE) protein profile. Also, the process of separation causes protein to denature due to the mechanic effect and the heat that generates. The mechanic effect causes breaking of the cell and mixing of the cellular components, decreasing in this way protein solubility and promoting reactions with lipids.

Water loss was smaller for the gels made from whole muscles than the MDTM, 29 and 67%, respectively. The control and commercial MDTM also had smaller water loss, 59 and 51 respectively, than the MDTM from different anatomical parts. Water loss was higher in gels made from darker meat, 35%, than those made from white muscle, 28%.

The emulsifying capacity (EC) was expressed in terms of absorbance caused by turbidity of diluted emulsions. The higher the turbidity the better the EC. White meat from wings and breast had higher EC, 0.10 and 0.09 respectively, than dark meat from leg, 0.08. Similar results were reported by Foegeding (1987). On the other hand, EC was no different ($P>0.05$) for all of the MDTM, with an average of 0.06.

CONCLUSIONS

Functionality of SSP measured as gel strength, water loss and emulsion capacity was lower for MDTM than from white and dark meat. There were no significant difference ($P>0.05$) in functionality of SSP from MDTM of different anatomical parts. Dark meat, from leg, had lower functionality than white meat from breast and wings.

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Table 1. Gel strength, water loss and emulsion turbidity of SSP extracts from MDTM of different anatomical parts and white and dark muscles.

Sample	GS (KgF) x 10^{-2}	WL %	Turbidity (ABS 500 nm x 10^{-2})
Wing meat	28.77^{a}	24.40^{a}	10.41^{a}
MDTM from wings	5.47^{b}	66.00^{b}	6.10^{b}
Leg meat	22.70^{a}	35.10^{c}	8.49^{c}
MDTM from leg	7.50^{bc}	70.10^{b}	6.18^{b}
Breast meat	38.90^{d}	28.40^{ac}	9.54^{a}
MDTM from breast	8.98^{bc}	65.43^{bd}	5.86^{b}
MDTM control	12.43^{c}	59.00^{d}	6.15^{b}
MDTM commercial	13.72^{c}	50.90^{e}	6.80^{b}

Means with different letter within the same column are statistically different ($p<0.05$).
GS=gel strength, WL=water loss and Turbidity=measurement of emulsion capacity.