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THE EFFECT OF DIFFERENT TYPES OF SOY ISOLATES ON EFFECTIVE VISCOSITY AND WATER-BINDING ABILITY OF MODEL GROUND MEAT WITH DIFFERENT QUALITY CHARACTERISTICS

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ABSTRACT

A comparative research project has been conducted on the influence of addition of different soy isolates -- "Ardex-DHV" (the ADM Company), "Bekaplus" (the BK Ladenburg Company), "Supra-500 E" (the PTI company -- on the effective viscosity value and water-binding ability (WBA) of model ground meat.

It has been shown that:
1. The effective viscosity value and WBA of uncured ground meat from so-called "normal meat have the tendency to increase when soy isolates are added. "Bekaplus" has shown certain advantages in this respect.
2. Pre-curing of meat has negative effects on both studied paramters at room temperature. However, the system of ground meat-soy protein has less meat juice losses due to the presence of soy.
3. Addition of soy isolates greatly improve both effective viscosity value and WBA of PSE pork. For this type of meat, the isolate "Supra-500 E" is most effective.

INTRODUCTION

Utilization of soy isolates during manufacutring of meat products (first of all it refers to cooked sausages, pates and half-finished products) is widely spread in many countries of the world. Addition of purified vegetable proteins into meat products manufactured abroad allows the production of low-fat and low-sodium products possessing good organoleptical properties.

In Russia, besides the problem of so-called "healthy foods" there exists also deficiency of raw meat material and a lot of PSE meat. These drawbacks can be partly levelled by the utilization of soy proteins.

Viscosity is a very important parameter of ground meat condition especially for production of emulsion-type products. As ground meat is partially a colloid system, its important features -- namely consistency and stability of water-fat-protein emulsion -- are mostly defined by viscosity characteristics and firstly by effective (dynamic) viscosity value (η).

MATERIALS AND METHOD

In the present study, dynamic viscosity values, water-binding ability and thermal losses were measured in model ground meat samples (minced *m.longissimus dorsi*) prepared from pork and beef with normal pH (5.8-6.2) and from PSE pork (pH<5.8) with the addition of different levels of soy isolates of three types and water. For the experiment, the following soy isolates were used:

ARDEX-DVA, the ADM Company, USA;
BAKAPLUS, the BK Ladenburg Company, Germany; and
SUPRA-500 E, the Protein Technologies International Company, Belgium.

The studies were conducted on chilled meat and though pre-curing. The level of added soy isolates varied from 1 to 5% to the weight of the meat; the amount of added water -- 30 or 45%. Soy isolates were added in the form of pre-made water suspension in the ration of 1:4. Mixing with twice ground meat was performed in a homogenizer during 1 to 2 minutes at 140 to 160rpm. Curing (when cured meat was used) started the day before with the following ingredients: table salt, 2.5%; sodium nitrite, 0.03%; sugar, 0.3%; and water, 30%.

Measurements of the effective viscosity value were done on a rotating viscosimeter "Reotest-2" (GDR), water-biding at room temperature was determined by filter paper press method of Grau-Hamm, and heat losses by thermogravemetric method using a "Q-Derivatograph" (Hungary).

The aim of the present study was to determine the optimum amount and type of soy isolate for introduction into meat systems, this optimum being dependent on dynamic viscosity level, water-binding ability and heat losses values.

RESULTS AND DISCUSSION

Experiments with different levels of soy protein and water added to chilled beef with pH6.3 have shown that with increase of isolates share from 1 to 5%, and of water from 30 to 45%, the effective viscosity value increase progressively (Figure 1. Here, and on all the curves, the effective viscosity value of control is taken to be 100%). The best viscosity characteristics were observed in ground meat containing "BEKAPLUS" especially when the amount of added water was increased to 45%. Significant difference in the influence of the other two isolates on the effective viscosity level has not been discovered (Figures 1a and 1b). Similar results were obtained for WBA values. Here also comparative advantages were shown by "BEKAPLUS" isolate, increases in the amount of added soy protein caused increases of WBA. However, increases in the amount of added water from 30 to 45% did not change the WBA (Figures 1c and 1d).

Heat losses of ground meat samples containing soy isolates fell (as compared to controls) when the share of added water increases. This is most evident in the range of technologically important temperatures for meat processing -- 70 to 75°C. If heat losses of control ground meat constitutes 100%, then we can note that after addition of 5% soy isolates and 30% of water, heat losses at 70°C reached 80% and at 75°C, 77.5%. If the amount of added water was increased to 45% at the same level of soy isolates, heat losses constitued 75.5 and 73.6% respectively. Thus, the increase of the effective viscosity level is accompanied by increase of WBA and decares of meat juice losses during heating.

When we compared the influence of soy isolates on effective viscosity and WBA of normal (pH1=6.3) and PSE (pH1=5.4) meat, strange results were obtained. As is shown in Figures 2a and 2b, addition of 5% soy isolates and of 30% water in both cases causes increases of effective viscosity values and WBA too. However, PSE meat shows greater increase of these parameters and their absolute values after addition of soy proteins and water grow bigger than in the case of so-called normal meat. This fact can hardly be explained right at the momment and further research in this direction is needed. It is necessary to note that in the case of PSE pork, "SUPRA-500 E" soy isolate shows some advantage while for normal meat, "BEKAPLUS" has a more pronounced effect.

Soy isolates influence the effective viscosity level and WBA of pre-cured ground meat in a different way. In this case, addition of soy proteins at room temperature reduces effective viscosity values in comparison with control meat (cured ground meat without soy isolates) (Figure 4a). Water-binding ability (WBA) of soy isolate-ground meat system in our studies was practically similar with control. In other words, advantages in WBA value gained in meat due to curing were practically levelled by the addition of soy isolates (Figure 4b). In this series of experiments, definite advantages were shown for the "BEKAPLUS" soy isolate. During heating, the picture changes. The value of meat juice losses during heating of ground meat with soy protein decreased as compared to control. Thus, the value of heat losses during heating

to 90°C of ground meat containing 5% isolates was 1.5 times lower than in the case of raw meat material containing 3% protein.

CONCLUSIONS

The conducted studies proved positive effect of the addition (to 5%) of soy isolates on the technologically important properties of ground meat -- on effective viscosity and WBA. We discovered certain advantages of the German soy isolate "BEKAPLUS" (BK Ladenburg) over other isolates in most cases. Increase of the effective viscosity value and of WBA of ground meat upon addition of soy isolate is obviously due to the greater ability of soy protein to bind water as compared to meat. During heating, this proerty of soya is revealed most vividly.

Absolute values of heat losses of ground meat-soy protein system grow when the amount of added water is increased. However, relative values of juice losses, as compared to control, are reduced.

Pre-curing of meat has a negative effect on the effective viscosity level and, in general, on all ground meat-soy protein systems at room temperature. Probably this is caused by poor solubility of soy protein in the native meat protein under effect of NaCl. However, during heating at 90°C, soy proteins are likely to combine with meat proteins forming a stable gel structure which has a strong capacity to hold water (initial and added). Thus, in case of pre-cured ground meat, containing soy proteins, we come across a contradiction between effective viscosity value and WBA at room temperature and a value of heat-induced juice loss. Probably, the change of heat losses in the system of cured ground meat-soy protein is caused by heat-induced formation of a complex meat myosin and globular proteins as components of the soy isolates.

Positive effect of soy proteins on the effective viscosity value and WBA of PSE meat is very important. As proteins of PSE meat are initially partly denaturated, they are unable to form a stable water-fat-protein emulsion. In this case, soy proteins probably behave as an intermediate agent which helps to stabilize this emulsion.

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