INFLUENCE OF CHICKPEAS FLOUR INCORPORATION ON THE PHYSICOCHEMICAL AND SENSORY PROPERTIES OF MEAT PASTE PREPARATIONS

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Summary: It was found that the degree of water and fat retention increases with the rate of incorporation of chickpea flour. Mass losses during cooking cutlets with added chickpea flour are 20-27% and are smaller than those of the control sample (28-34%). The flour incorporation increase cohesion, hardness and elasticity of cutlets and did not significantly affect the cutlets consistency and chewability. Comparative analysis of the results shows that cutlets with added chickpea flour (10.7%) did not differ significantly from the control sample.
Key words: chickpea flour, water retention, fat retention, sensory parameters.

Introduction

Pasta for culinary products and industrial products of shredded meat is a complex colloidal mixture of protein and fat. Myosin and actin are primarily responsible for binding water and fat particles and for the formation of three-dimensional matrix. The formation of this matrix is the result of protein-water, protein-protein and protein-lipid interactions, in which the main components are the proteins [1].

In order to balance the quality and quantity of protein, to enhance the stability, the texture, taste, nutritional value and technological efficiency in the minced meat mass are added various exogenous proteins of plant origin. These proteins, along with myosin and actin have the effect of stabilizing the emulsion, reducing fat and water losses during cooking.

The literature shows numerous studies that have experienced additions of flour, soy protein concentrates and isolates, peas, beans, lentils, wheat (denatured gluten) and others [2,3,4].

In this work are presented the results of addition of chickpea flour influence on some physicochemical and organoleptic properties of the paste of minced meat and cooked cutlets from this paste.

Materials and methods

As stuff was used chickpeas of 2013 crop that was harvested at the Institute of Plant, Balti, Republic of Moldova. Chickpea samples used for analysis, according to the requirements STAS 8758-76, representing spherical grains with one end slightly elongated, from yellow to brown, without odors (mold) and impurities.

To prepare the paste it was used pork (neck), purchased from commercial chain, then minced at volf through 4 mm sieve.

The water retention and fat retention was calculated using the formula proposed by Kurt & Osman Şükrü Kilinççeker (2012) and are based on thermal treatment yield, the humidity, the fat content in the cooked finished product.

The fat content was determined by Soxhlet method (GOST 5899-85). Sensory quality assessment was based on scale score of 5 points (ISO 6658: 2005).

Results and discussion

Water retention capacity of the mass of shredded meat is a determining factor in quantitative yield, consistency and juicy of minced meat products. In the experiences was used chickpea flour with particle size ≤ 226 μm and ≤500, dry or beforehand hydrated. The figures below shows the values of the water retention degree of meat paste (Figure 1) and quantitative yield of meat paste preparations after the heat treatment (Figure 2) depending on the amount of added chickpea flour.

The results show that the water retention degree is directly related to the amount of flour quantity in minced meat mass and is higher in the case of flour grain size ≤ 226, which otherwise has a high protein content.

It should also be noted that the highest values of water retention degree have the flour samples (≤ 226μm) previously hydrated (1: 1.5) [5].
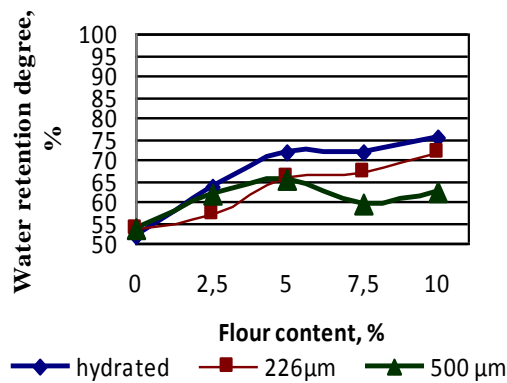

Fig. 1. The water retention degree dependence of granularity and concent- rations of chickpea flour added in minced meat preparations
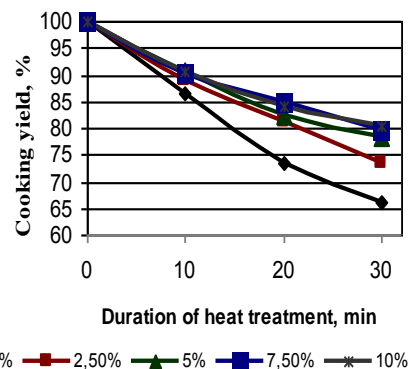

Fig. 2. The technological efficiency dependence of duration of heat treatment (baking 180 °C for different concentrations of chickpea flour with granularity 226μm)

Increase of water retention degree is due primarily to chickpeas proteins which have a greater affinity for water and can absorb up to 200-300% of water related to protein mass, thereby forming a visco-elastic chain [4,5].

The interaction of proteins with water also depends of the medium pH. At higher or lower values than the isoelectric point, the protein are in the form of polyanions or polycations with a more pronounced degree of hydration, and the hydration in alkali is higher than in the acid medium [1].

Another factor which affects the hydration of proteins is the ionic strength of the environment. Salt ions interact with ionogene groups of protein and diminishes the electrostatic interaction between neighboring groups with opposite charges. But at high salt concentrations, water is largely immobilized by salts and the protein hydration decreases [5].

Heat treatment of minced meat preparations induces dehydration and protein denaturation, which essentially influences the yield of finished products [6]. The results presented in Figure 2 show that incorporation of chickpea flour reduce weight loss during cooking and increases the cutlets technological efficiency.
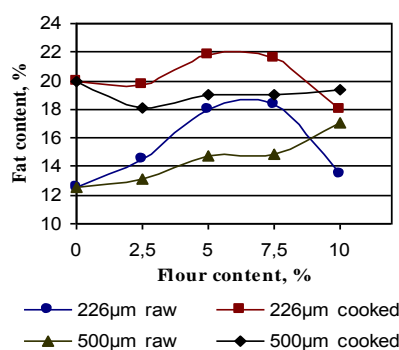

Fig. 3. The fat content dependence of granularity and concentrations of chickpea flour added in minced meat preparations
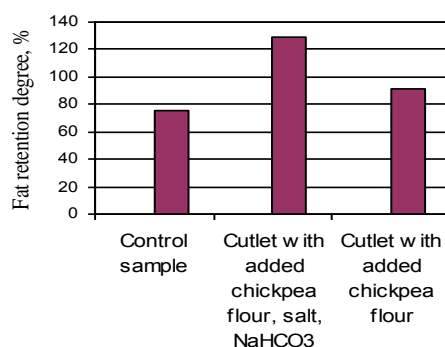

Fig. 4. The fat retention degree in minced meat preparations

During heat treatment myofibrillar proteins, which provides water retention, coagulate and lose their solubility. Water retention capacity decreases and there are losses of juices, in which there are also minerals, vitamins, peptides, amino acids and others.

The juice recess occurs in two phases:

- Fixed water phase absolution by myofibrillar proteins in native state under the action of thermal effect (protein denaturation)
- phase of juice expulsion as a result of endomysial tissue contracting

Collagen gelatinization (associated with water adsorption) has a moderate effect on juice loss.

Depending on the content of chickpea flour, increases the cutlets technological efficiency of about 65% (in reference sample) to 80%.

When heated (70-100 ^{0}C), chickpeas proteins coagulate and form a gel, which provides the water in different proportions, depending on the duration of heating, the environment temperature and the environement nature [5,7].

Fats of the shredded meat mass contribute to preparations texture and taste and are a significant source of energy.

The foodstuffs ability to retain fat during heat treatment depends on the content and the emulsifying properties of proteins, and the presence of other ingredients.

Fat retention capacity is due to the physical properties of proteins to bind and maintain the fat in the protein molecule. In the minced meat preparations with increasing mass fraction of vegetable components, increases the pH of minced meat mass. This affects the hydrophilicity of the meat proteins, thus causing an increase in water and fats retention capacity [8].

The results shown in figures 3 and 4 show that the addition of chickpea flour up to 7.5% leads to a significant increase in the fat retention from 75 % (in the blank test) to 90%. It was found that the addition of salt and sodium bicarbonate increases the indicator to 95%. This is partly due to the fact that the incorporation of chickpea flour changes the minced meat mass consistency from viscous to viscous-plastic [9]. Secondly, chickpeas proteins (and other vegetable seeds) have similar emulsifying capacity to Na-caseinate and forme fairly stable emulsions in the heat treatment, including sterilization [5].

Finally, chickpea flour contains significant amounts of dietary fiber, which are considered interesting ingredients for food products development with a high capacity to retain fat at high heat treatment [9,10, 11].

Cutlets organoleptic quality was assessed by the following indicators: appearance, taste, smell, color and consistency [12, 13, 14]. Results analysis (Figure 5) shows that the organoleptic indices of cutlets with added chickpea flour are basically similar to the reference pointers cutlets, and the highest points accumulated samples containing 7.5% of chickpea flour.
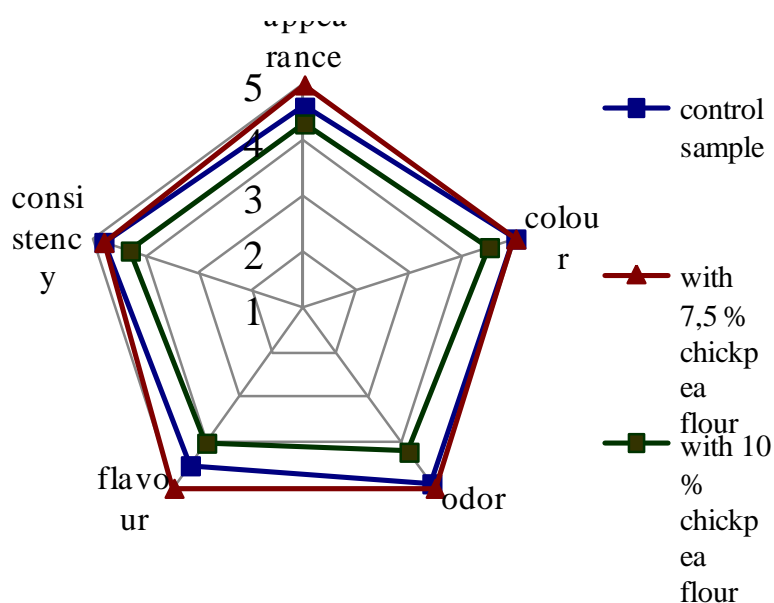
Fig.5. Organoleptic parameters of minced meat cutlets with added chickpea flour

Conclusions

Addition of chickpea flour in minced meat improves the taste and nutritional quality and the technological efficiency of the achieved culinary products. The technological efficiency increase after thermal treatment of preparations is due to the positive impact of the addition of flour on water and fat retention.

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