

SCIENTIFIC-PRACTICAL SUBSTANTIATION OF INULIN USE AS A FAT SUBSTITUTE FOR MINCED MEAT PRODUCTS MANUFACTURE

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Abstract – The increasing rate of obesity sets a task for meat industry specialists regarding the development of the methods for fat reduction in meat products. The paper presents the results of the investigation of inulin allowing to substantiate the level of hydration, optimal dosage and the method of inulin addition in minced semi-finished products manufacture. The obtained results suggest the expediency of inulin use in a pre-hydrated form instead of the fat component of low-calorie minced semi-finished products.

Key Words – Water activity, Calorie content, Minced meat

I. INTRODUCTION

Due to the fast moving life styles and sometimes the absence of time for cooking of full value balanced food, most people, especially the residents of megalopolises, turn to fast food and semi-finished products containing high amounts of saturated fats. Unhealthy nutrition sooner or later affects efficiency, health condition, manifestation of various gastrointestinal and cardiac diseases. Of course, it would be completely wrong to say that fat, table salt, sugar etc. are absolutely harmful for our health. The main emphasis is placed on the consumption of these components in excessive amounts, i.e. in amounts that are higher than it is necessary for a normal function of an organism. No doubt that fats are important products being a source of energy, fat soluble vitamins, polyunsaturated fatty acids, not mentioning a role of fats in forming consumer properties of sausage products, namely, improvement of odor, taste, tender and juicy consistency. The problem of the excess fat content in products would not be so acute but for the growing problem of obesity of population. Reduction of the fat content in meat products at the cost of an increase in the muscle tissue content will inevitably lead to changes in consumer

properties expressed in deterioration of palatability and loss of tender consistency of products. In this connection, it is necessary to select ingredients capable of substituting a fat constituent without significant changes in organoleptic characteristics of meat products. Of great interest is the use of inulin as such component [1,2], which has a structure different from fat and in a hydrated form has properties allowing to imitate fat in a product - spreading consistency, white color, absence of off-odor and off-taste.

II. MATERIALS AND METHODS

In order to substantiate the levels of inulin hydration for its incorporation into the meat products compositions instead of a fat constituent, the comparative investigations of the model samples of minced meat products containing inulin gel in the inulin:water ratio 1:1, 1:2, 1:3 were carried out.

The model samples of minced meat were the subjects of research. The sample containing 70% beef and 30% backfat was used as a control sample of minced meat. In the experimental samples, 15% backfat was substituted for inulin gel in the inulin : water ratio 1:1 (experimental sample 1), 1:2 (experimental sample 2), 1:3 (experimental sample 3). From the obtained samples, the specimens were taken for the determination of moisture binding capacity (MBC) by press method, water activity by cryoscopic method using the AWK-20 instrument (Germany) and color characteristics in the CIELab system using the spectrophotometer "Spectroton". Organoleptic characteristics and shear stress on the universal testing machine Instron 3342 were determined in the final products after cooking.

In order to substantiate the optimal dosage and the method of inulin addition into meat products composition (in a dry or hydrated form), investigations of the functional-technological and

physico-chemical properties of minced meat were carried out. Organoleptic characteristics of semi-finished products made with different doses of inulin in the hydrated and dry forms with the additional water incorporation in the amount of 1 kg water per 1 kg inulin were studied after their cooking.

III. RESULTS AND DISCUSSION

The results of the comparative study of the functional-technological properties of minced meat showed that the substitution of 15% backfat for inulin gel in the ratio 1:1 and 1:2 (experiment 1 and experiment 2) in the minced meat composition resulted in reduction of the water activity value (Fig. 1). Moisture binding capacity (Fig. 2) of the control sample and experimental sample 1 did not differ and was 98%. The inulin addition with the hydration level of 1:2 and 1:3 led to the reduction of MBC by 4.4% and 9.3%, respectively.

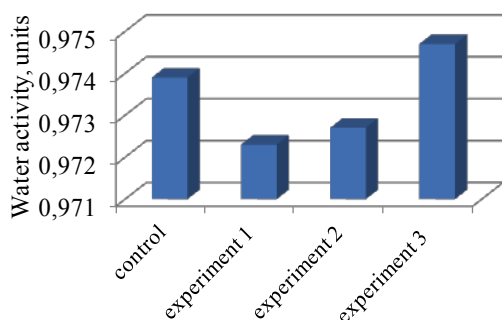


Figure 1. Water activity of the model samples of minced meat

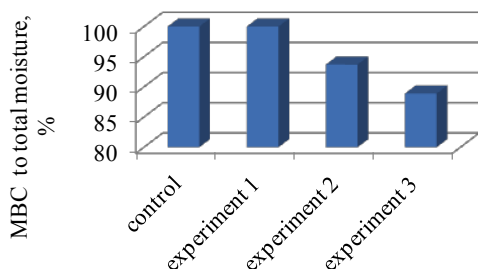


Figure 2. Moisture binding capacity (MBC) of the model samples of minced meat

In order to evaluate the influence of the level of inulin hydration on the color characteristics of minced meat, the color indices in the CIELab coordinates were detected. The color indices values presented in figure 3 suggest the absence of the significant differences in redness and yellowness of the control sample and experimental sample 1. The closest values of the lightness index to those of the control sample had experiment sample 3.

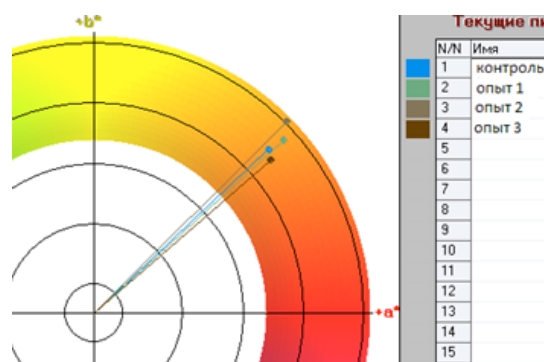


Figure 3. The color characteristics of the model samples of minced meat

Table 1 presents the results of the chemical composition determination of the model samples of minced meat.

Table 1 The influence of different fat substitutes on the chemical composition of the model samples of minced meat*

Samples	Mass fraction in minced meat, %			Calorie content, kcal
	protein	fat	carbo-hydrates	
Control	13.0	32.5	-	344.5
Experiment 1	13.0	18.9	5.5	243.7
Experiment 2	12.9	18.9	3.7	236.5
Experiment 3	12.9	18.9	2.8	232.9

*Data were obtained by a computational method

Fat mass fraction in the experimental samples was 13.6% lower compared to the control sample. Thus, the addition of inulin allowed to obtain the semi-finished products with fat content 41.8%

lower and calorie content 29.3-32.4% lower than their values in the similar products.

The results of the organoleptic evaluation of the formed semi-finished products after cooking suggest the high organoleptic quality of experimental samples 1 and 2.

The results of the comparative study of the minced meat samples made with addition of inulin with different levels of hydration allowed to recommend using inulin gel in inulin:water ratio 1:1 instead of the fat constituent (backfat) for meat products manufacture.

The method of inulin addition significantly influenced the functional-technological properties and organoleptic characteristics of the semi-finished products after cooking.

Pre-hydration of inulin led to the reduction of water activity (Fig. 4) by 0.0009-0.0031 units depending on the inulin concentration and to the increase in moisture binding capacity (MBC) of minced meat (Fig.5) by 2-12 % compared to the samples of minced meat, in which composition inulin in a dry form was added with the additional water incorporation.

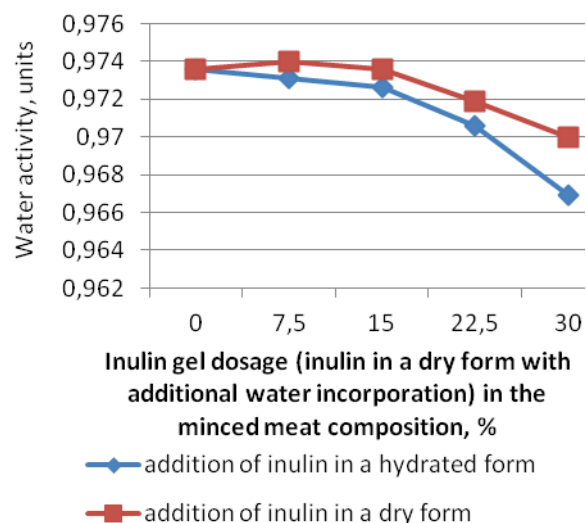


Figure 4. Water activity of the model samples of minced meat

Addition of inulin gel in the amount of 7.5%-22.5% did not influence the value of moisture binding capacity compared to the control; the increase in inulin dosage to 30% instead of backfat

led to the reduction in MBC by 6%. With that, it is necessary to note that the water activity values did not increase but, on the contrary, reduced, which could be explained by the cryoprotective properties of inulin.

Addition of inulin gel instead of backfat in the amount of 7.5% to 30%, which accounts for 15-100% of backfat content in the composition, allowed to reduce the calorie content by 50-201.7 kcal, i.e., by 14.6%-58.8% relative to the calorie content of the control sample not containing inulin gel.

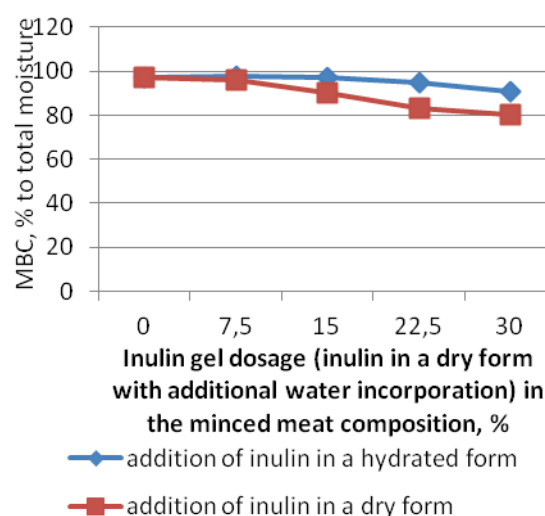


Figure 5. Moisture binding capacity (MBC) of the model samples of minced meat

Organoleptic characteristics of the formed semi-finished products after cooking suggested the high organoleptic quality of the semi-finished products made with inulin gel in the amount of 7.5 to 15%. The increase in the backfat substitution to the level of 75% and more of its content in the minced meat formulation led to the reduction of the organoleptic characteristics of the semi-finished products made from it.

IV. CONCLUSION

The analysis of the results of the research allowed to recommend using inulin in a pre-hydrated form for substitution of the fat constituent in the content of up to 50% of its content in a formulation, which would allow to reduce the amount of fat by 42.3% and the calorie content by

29.6% without deterioration of functional-technological properties of meat and organoleptic characteristics of final products.

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