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Developing the Process and formulations of soft wafers using orange fibers "Citri-Fi"

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ABSTRACT

Soft wafers are a favorite product not only of children but also of adults. In our work to enrich soft wafers with useful substances we used the fibers which were added to the dough in the form of orange gel. The orange gel was prepared by adding water to the fibers at the temperature of 100 ^{0}C. As a result of earlier studies, the optimal ratio of fibers and water is 1:7 respectively. Fibers swell and form a gel. In the course of our work we changed fatand fiber ratio. With increasing the gel dosage from 5 to 20 % the humidity of dough and of finished product decreases. The soaking of the finished products depends on their humidity. In taste and organoleptic characteristics the optimal samples are soft wafers with orange gel dosage of 15 % to the weight of fat. On the basis of our research we have developed the formulation of soft wafers "Piece of happiness". The research carried out has shown that if we replace fat by orange food fibers it makes it possible to obtain wafers having high consumer properties, these wafers being just as good as references. On production of soft wafers "Piece of happiness" is taken out the patent of the Russian Federation for the invention "Structure for preparation of soft wafers" and "A way of production of soft wafers".

Key words: Food fibers, Soft wafers, zhiroyemkost, range, prevention, obesity.

INTRODUCTION

In Russia for several decades the aggravation of health status of the population, especially of children and adolescents is noted. These negative changes are primarily associated with high learning loads of pupils, with stresses and with the deteriorating quality of nutrition. The excess of pungent, fried, salty and sweet food brings about the diseases of gastrointestinal tract; high calorie diet causes obesity and other metabolic diseases, lack of fluoride and calcium contributes to the development of caries; lack of iron, vitamins and proteins causes the development of anemia. To be healthy, the man needs food fibers, vitamins, microelements, mineral substances, unsaturated fatty acid, etc (Gibson and Williams, 2000, Ohlhorst *et al*., 2012).

Nutrition is one of the most important factors influencing the population's health. In Russia like in many other countries of the world the first places among the diseases which cause mortality are occupied by cardiovascular and ontological diseases.

Prolongation of the length of human life may be the result from the substitution of full-value foodstuffs for some non-balanced ones on the basis of vegetable raw material.

In Russia the use of such products as nuts, vegetables and fruit as well as the products from whole milled grain, the goods containing bran and citrus peel is not sufficient. And the tendency of consuming bakery and confectionery goods from high grade flour is increasing. These products are low in food fiber content. For this very reason the

manufacture of bakery products enriched with food fibers is becoming very actual (Bayskhanova and Omarov, 2012).

Some food fibers are not digested in the human gastrointestinal tract at all or they are digested only in the colon. They have low energy value. Their importance in the diet is significant. Therefore the diet should contain from 30 to 40 grams of food fibers per day (Pershakova *et al*., 2014, Tarasenko and Krasina, 2014).

Overweight and obesity are a serious medical and social as well as economics problems in the majority of economically developed countries including Russia. According to WHO experts in 2010 the world had 1.5 billion people aged 20 and older who were overweight, among them 200 million men and 300 million women were obese. In many countries over the past 10 years the prevalence of this disease has grown in average by 2 times. The rate of growth of the number of people suffering from obesity is so high that the prevalence of this disease has acquired the character of non-infectious epidemic. The leading position in the prevalence of obesity belongs to the USA where more than 60 % of the population are overweight and 31.1 % of men and 33.2 % of women suffer from obesity. According to sample surveys carried out in Russia obesity prevalence among men and women at the age of 25 to 65 years was 22.6 % and 20.5 % respectively (Rose, 2000).

Obesity is accompanied by severe attendant pathology, it causes reduced life expectancy, requires significant financial expenses. The risk of developing diabetes of Type 2 is known to increase progressively increases with the growth of body weight, 90 % of patients having Type 2 diabetes being obese varying with degrees of severity. Violating carbohydrate metabolism also leads to diabetes. Food fibers modify carbohydrate metabolism by altering the transit of chime in the stomach and small intestine, by slowing down the absorption of simple carbohydrates, by glycolysis and by the changes of incretion of insulin and hormones.

The investigations carried out show that controlled reduction diet of the caloric value, mainly due to the reduction of its fat component makes it possible to significantly reduce body weight in patients having obesity and Type 2 diabetes. Due to the reduction of body weight the development of the complex of pathological changes leading to the progression of Type 2 diabetes is slowed down thereby preventing the development of possible severe vascular complications.

Lipid metabolism violation leads to diseases of the cardiovascular system. Food fiber content helps to increase HDL cholesterol and lowers the level of cholesterol of blood by its adsorption, by the increase of bile acid excretion and by restoration of the balance between the formation and removal of cholesterol. The ability of food fibers to reduce cholesterol concentration in the bile and to prevent the occurrence of cholesterol gallstones is well known (Siro *et al*., 2008).

In the world practice during the last years the products of processing stevia are employed to add functional properties to the foodstuffs. One of these products is stevioside. It is a natural sweetener of intensive type having the sweetness coefficient which is 300 times higher than glucose sweetness. It contains few calories, has a nice taste, therefore it may replace carbohydrates in the dietary nutrition. It does not contain substances which might do harm to the human body.

Soluble and insoluble food fibers affect the function of the digestive tract indirectly. In the gastrointestinal tract there are no enzymes which split food fibers, that is why fibers reach the large intestine unchanged. In their turn, colonic bacteria possess the enzymes capable to metabolize food fibers, primarily soluble ones. Pectins and most of the hemicellulose are destroyed from 60 to 84 %; lignin and cellulose are resistant to bacterial attack (they are from 30 to 40 %) and are turned into feces. Insoluble components of food fibers, are not affected by bacterial enzymes, they stimulate motor activity of the intestine (Pashchenko *et al*., 2012).

In the structure of causes of death the leading place belongs to oncological diseases caused by malnutrition. The indexes of health and anthropometric characteristics of children, adolescents, and the elderly are deteriorating. The

number of nutrition-related diseases, initiated by the violation of intestine microecology is growing steadily (Pool-Zobel and Sauer, 2007).

The use of food fibers in the confectionery industry makes it possible not only to reduce the energy value of the goods, but also to enrich them with the necessary biologically valuable components.

Currently, at the Russian market wafer products are becoming very popular. They are characterized by good consumer properties, tenderness and refinement.

This confection has a rich history. Appearing in the Middle Ages, it still enjoys high consumer demand. The assortment of wafers is huge – classic and soft wafers, British and Belgian ones, cakes and rolls. But at the domestic market soft wafers have became a relatively new product (Hu and Kim, 2006, Kim *et al*., 1998, Tarasenko, 2010).

Lately food additives having various principles of action find wide application in producing confectionery products from flour. The necessity of using these additives is caused by unstable flour quality, by the variety of functional properties of the processed raw material, by the increase of the assortment of the time of storing the product freshness.

Very important trend in the development of confectionery industry is focused on solving the problem of introducing new procedures enabling to ensure the manufacture of competitive confectionery products including the products of specific function, i.e. the products having special properties. Confectionery products of specific function first of all are intended for dietary and functional nutrition (Siro *et al*., 2008).

Manufacturing functional produce is an urgent task of the specialists of the food industry. Developing the products of this group is one of the ways of implementing the concept of the state policy in the field of healthy nutrition of the population of RF (Sepulchral and Shaltumayev, 2014).

Soft wafers are a favorite product not only of children but also of adults. This is quite a frequently used product, so the use of citrus food fibers in their manufacture is a promising trend in creating a confectionery product haring balanced composition as the use of this raw material in the manufacture of pastry product makes it possible not only to reduce their calorific value and cost, to enhance their flavor and aroma but also to enhance significantly their biological value at the expense of high content of ballast substances (Mineeva *et al*., 2014).

In this connection, the development of the process of manufacturing soft wafers of functionalpuprose using citrus food fiber is actual.

It is also noted that with the constant and substantial consumption of food fibers their negative effects on the human body is seen. This is displayed in reducing the energy value of the consumed food and in decreasing food substances absorption. Prolonged intake of food fibers in increased quantities adversely affects the balance of vitamins and mineral substances. A buse of food fibers tends to reduce the adsorption of calcium, iron, zinc, magnesium as well as to intensify the excretion of nitrogen from the body. That is why in enriching the products with recommended food fibers additional incorporation of vitamins and mineral substances or the use of additional types of food raw material, the sources of these micronutrients, are recommended.

Food fibers have a positive effect on the human body. They contribute to the treatment and prevention of obesity, diabetes and cardiovascular diseases, improve blood circulation and prevent blood clot formation, increase the biological activity of beneficial intestinal microflora. They also reduce the content of cholesterol, lipids, blood glucose, they increase the content of globulins, hemoglobin and erythrocytes in blood, promote iron absorption, possess antibacterial and antimutagenic properties, promote binding and removing toxins, bile acids from the body, contribute to cleaning the intestines, to facilitating the passage of food, renewal of the intestinal epithelium (Kiselyova *et al*., 2008).

Object of research

"Citri-Fi" is a citrus dietary fiber, which is extracted from the cellular material of dried orange pulp by mechanical treatment without using chemicals and by expanding the structural cell of orange fiber. The main functional and technological property of food fibers is their moisture absorption ability. The study of moisture absorption ability of these fibers has shown that while in aqueous solution they have the ability to absorb water and to retain it. The higher the water temperature, the better the moisture is absorbed. It has been proved that one part of fiber connects up to 13 parts of water.

Outwardly, fiber is a powder of light-cream color with neutral taste and odour. In the production of bakery and confectionery goods "Citri-Fi" is used as a natural stabilizer, emulsifier, structure-forming agent, it increases the product yield and shelf life, improves food value of the product due to the presence of cellulose which is very useful for health. In addition, incorporating citric fibers into the formulation of fancy goods makes it possible to reduce their oil and fat phase content to 50 %, to improve their taste and structural and mechanical properties (one part of fibers and 10 parts of water replace up to 50 % of fat) (Tarasenko and Krasina, 2014).

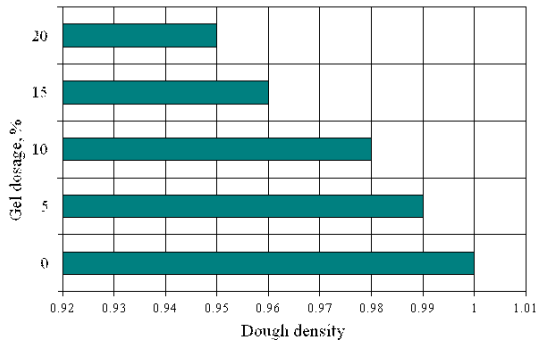

Fig. 1: Influence of introduction of orange gel on the relative density of wafer dough

The innovative manufacturing process and high technological properties of "Citri-Fi" combined with its biological value make it a unique substance compared to other types of food fibers.

Furthermore, the use of food fibers "Citri-Fi" reduces costs. Currently, due to the rising prices of fats, emulsifiers and stabilizers incorporating orange fiber makes it possible to reduce the prime cost of the finished product.

The objects and tasks of the graduation work are:

- Determining the optimal ratio of water and food fibers;
- Determining the physico-chemical properties of the dough and of finished product.

To achieve the stated object it was necessary to investigate the effect of the utilized additives on the consumer properties of finished wafers and on the rheological properties of semi-finished products.

To determine the adequacy of the developed wafer samples with the substitution of orange fiber for fat, the sensory evaluation of test samples was carried out compared to the reference.

METHODS

In carrying out experimental studies generally accepted and special methods confectionary industry have been used as well as modern physico-chemical methods of analysis, structural and mechanical properties of model systems were measured by reotest and CT-1 structure meter (Jakhimova, 2009, Wilson and Crawford, 1974, Kurakin *et al*., 2014).

Table 1: Physical and chemical indicators of soft wafers

Indicators	Gel dosage, %				
	0	5	10	15	20
Humidity of dough, %	32,75	35,5	33,88	31,6	31,5
Humidity of wafers, %	12,07	15,8	14,6	13,7	12,8
Soaking, %	218,3	220,6	228,4	235,1	241,2

Experiments were performed in replicates of five times, providing reliable results and mathematical treatment of the results of experiments was performed using Statistica 6.0 package in accordance with the recommendations (Vosnesenskiy, 1981).

In our work to enrich soft wafers with useful substances we used the fibers which were added to the dough in the form of orange gel (Nikonovich *et al.*, 2012). The orange gel was prepared by adding water to the fibers at the temperature of 100 ^{0}C. As a result of earlier studies, the optimal ratio of fibers and water is 1:7 respectively. Fibers swell and form a gel. In the course of our work we changed fatand fiber ratio, i.e. we added orange gel to the dough in the ratios of 5, 10, 15, 20 % to the mass of fat. The product with no fibers added was considered to be the reference.

RESULTS

Incorporating orange gel affects the physical and chemical properties of the goods. At the dosage of fibers from 5 to 20 % to the weight of fat dough density decreases (Fig.1).

With increasing the gel dosage from 5 to 20 % the humidity of dough and of finished product decreases. The soaking of the finished products depends on their humidity. With the dosage increase soaking increases (Tabl.1).

The investigation of elastic and plastic deformations was carried out on the penitrometre. When fat was replaced by orange gel the plastic deformations increase and elastic deformations decrease. Also, due to the incorporation of orange food fibers the shelf life of wafers increases.

DISCUSSION

The practical significance of the results obtained is that the products consist of natural ingredients, it helps reduce their cost, they have low calorific and fat value as well as increased food and biological value. Thanks to this the population's quality of life and health will improve due to wide utilization of such confectionery goods. In taste and organoleptic characteristics the optimal samples are soft wafers with orange gel dosage of 15 % to the weight of fat. On the basis of our research we have developed the formulation of soft wafers "Piece of happiness". The research carried out has shown that if we replace fat by orange food fibers it makes it possible to obtain wafers having high consumer properties, these wafers being just as good as references.

CONCLUSION

In our opinion it is a promising direction in the manufacture of confectionery goods of balanced composition, as utilizing this raw material in the manufacture of wafers provides an opportunity not only to reduce their energy value, to improve their taste, but also to significantly increase their biological and nutritional value. Healthy lifestyle which includes proper nutrition is the cheapest and most efficient way of improvingbg human health, the possibility not to spend money on future treatment. That is why, lately, intensive developing the products having low energy value taking into account the demands of science about nutrition has become so actual.

On production of soft wafers "Piece of happiness" is taken out the patent of the Russian Federation for the invention "Structure for preparation of soft wafers" and "A way of production of soft wafers". The practical significance of the results obtained is that the products consist of natural ingredients, it helps reduce their cost, they have low calorific and fat value as well as increased food and biological value. Thanks to this the population's quality of life and health will improve due to wide utilization of such confectionery goods.

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