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ON THE ROLE OF FATS IN BAKED FLOUR GOODS

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Abstract: The role of fats in developing the structure of dough and baked bread goods and pastries is considered. Criteria of choosing fatty materials by their nutritional value and physical state for obtaining safe and quality products are presented. A method of producing pastries with liquid vegetable oils and natural biopolymer-based stabilizing food additives is proposed.

Key words: fats, oils, dough, baked flour goods, food additives.

Flour goods are a wide-range group of flour-based products, different in their recipe com-position, production technology, and consumer attributes. Baked bread goods are bread, buns, pies, and doughnuts. Pastries include cookies, hardtacks, crackers, gingerbread goods, wafers, fruitcakes, jelly and cream rolls, small cakes, cakes, Oriental sweets, etc. They are charac-terized by high gustatory qualities, a pleasing appearance, and convenience in consumption and storage.

Pastries and baked bread goods are a weighty group of mass consumption foods, which enjoy persistent and stable demand. Their variety is ensured by variations in the quality and relation of recipe components, as well as by the diversity of technological methods, regimes, and equipment. At the same time, there are common features characteristic of flour baked goods, such as the use of the same raw materials (flour, sugar, fats, etc.), analogous semiprepared goods (emulsion, dough, baked semiprepared products, etc.), and similar technological operations (kneading, baking, etc.).

The raw components that form a complex system during the preparation and structure de-velopment of flour baked goods play the decisive role in the formation of their consumer attrib-utes. Their relation is determined by the recipe – the aggregate of critical and additional raw materials. The critical raw materials in the production of pastries are flour, sugar, and fats, while those used in the production of bread goods are flour, yeast, salt, and water. In addition, the recipes include a large list of other raw materials, such as dairy products, egg products, fruit and berry products, leavening agents, flavorings, and so on.

Depending on the formula, the quality of the critical and additional raw materials, and technological methods and regimes, one gets dough with various structural and mechanical properties, which, after baking, yield products with different textures. In other words, the diversity of baked flour goods is mainly determined by the development of different types of dough. Each dough type is prepared under strictly established relations of recipe components and the observance of the technology that ensures obtaining a product with specified properties.

The majority of baked flour goods and their semiprepared products are multicomponent disperse systems, in which particles of the disperse phase are distributed in a dispersion medium of a complex composition. They are characterized by a high concentration of the disperse phase in dispersion media and a strongly developed interphase surface. The properties of such disperse systems are determined primarily by surface phenomena at interphase boundaries, such as processes occurring at interfaces: moistening, adsorption, adhesion, and others. Spatial structures emerge in the systems, whose type is determined by the type of contacts between particles of the disperse phase and the composition of the dispersion medium.

A large number of works study how dough is formed from wheat flour [1–5]. The best studied is the development of bread-baking dough. Mechanisms of developing different types of pastry dough are less studied. This is due both to the diversity of dough types and raw components and to different conditions of their interaction. Fats, along with flour and sugar, are important ingredients of pastry dough, which affect its structural and mechanical properties and the texture of products. The properties of fats are very complicated and diverse.

This paper gives an analysis of hypotheses about the role of fats in developing the structure of dough and baked flour goods, aimed at elaborating a pastry production technology involving liquid vegetable oils for obtaining safe and competitive goods.

Fats in pastry production are critical raw materials. Fat is quantitatively the third compo-nent in recipes after flour and sugar and is the most expensive one. Despite the fact that pastries are not essential foods, they are traditionally in high demand. Pastries are characterized by high food energy and low nutritional value. This is determined by the fact that their composition in-cludes many lipids and carbohydrates and few vitamins, macro- and microelements, proteins, food fibers, and so on.

Today's healthy diet vogue affects the development of the pastry market. Buyers are be-coming fastidious and pay increasingly more attention to the quality composition of the foods that they consume. At present, the assortment of pastries is widening due to the creation of new low-calorie and high-nutrition products. This problem can be solved through the development of innovative technologies and the use of nontraditional types of raw materials, which make it possible to decrease the weight fraction of sugar and fat, to increase their nutritional value, and to enrich the products with physiologically functional food ingredients.

At present, much attention is paid to the choice of fats for baked goods. The criteria for choosing fatty products are their physicochemical and organoleptic properties, resistance to oxidative spoilage, nutritional value, and safety, especially with regard to the content of saturated fatty acids and transisomers of fatty acids.

The nutritional value of fats is determined by their fatty-acid composition and the presence of accompanying compounds. The recipe formulas of baked goods usually employ margarines and specialized fats that include solid fats obtained through the hydrogenation of vegetable oils. However, such fats contain considerable amounts of saturated fatty acids and fatty acid transisomers. In addition, food additives with a limited acceptable consumption level, such as preservation agents, stabilizers, emulsifiers, and flavorings, are often introduced in the composition of fats for baking.

The World Health Organization has established that eating foods containing many saturated fatty acids and fatty acid transisomers has an adverse effect on the human organism. There exists the opinion that transisomers, as well as saturated fatty acids, are digested by the human organism worse than unsaturated ones, decrease its resistance to oncological diseases, increase the risk of diabetes, and lead to cardiovascular disorders [6, 7].

At present, we witness the trend toward decreasing the content of saturated fatty acids and fatty acid transisomers in all foods. For example, the US Institute of Health stated the necessity to achieve the zero consumption of transisomers with a simultaneous decrease in the dose of saturated fatty acids in developing healthy diets [7, 8]. In Russia, the level of transisomers (no more than 8%) is limited only in the production of spreads and margarines for retailing.

Many researchers have studied the technological role of fatty products in pastry production [3–5, 9–15]. It is shown that not only the chemical composition of fat but also its physical state is significant in the development of the necessary structure of dough and baked goods. To prepare pastry dough, it is recommended using solid fats (butter, margarine, specialized fats, palm oil, and others), which are introduced into dough in a melted and plasticized state.

Flour plays the leading role in dough development. Pastry production uses wheat flour, from which cohesive dough is obtained due to the ability of its proteins to form gluten. Other types of flour are rarely used, but today increasingly more attention is paid to improving the nutritional value of flour goods; in this context, the assortment of goods made of various types of flour from cereals, legumes, and oilseeds is widening.

Rheological properties of dough are primarily determined by the ability of flour hydro-philic colloids to bind water under definite moistening. Water molecules not only interact with such colloids on the surface but also penetrate deep into them, which makes them swell. The formation of a desired dough structure is connected with the directed effect on the mechanism of interaction between recipe components, which form a complicated system, where each of them plays a definite role. The most important point for the formation of desired dough proper-ties and consumer attributes of flour goods is to forecast the behavior of flour under its interac-tion with water, fats, and sugar solutions at temperatures and pH values corresponding to the conditions of making dough and baked products.

During dough kneading, water and fat compete in their interaction with flour particles and other components. The structural and mechanical properties of dough are ultimately determined by the relation and properties of high-molecular hydrophilic polymers (proteins, starch, gluten, pectins, etc.) and low-molecular hydrophilic and hydrophobic compounds (sugars, fats, and amino acids). The structure of dough is influenced by the chemical composition and the strength of contact interaction between its ingredients. The recipe formula of each type of flour products should represent an optimal set of components able to form desired structural and mechanical dough properties because any deviations affect the texture and quality of baked semiprepared and fully prepared products.

Water interacts with the flour protein, forming gluten as a bound extensible structure. If flour is covered with fat, this chain is interrupted, and, after baking, the product turns to be crisper and less hard. If the content of fat is high, little water is needed to obtain the desired consistency, gluten formation, swelling, and starch gelatinization being limited. Such dough is easily torn under stretching, weakly bound, and plastic. In addition, with a high content of sugar, fat hinders the transformation of sugar syrups into a hard amorphous mass under cooling. Fatty products make flour products soft and add delicate flavor to them owing to better dough aeration and the lubricating effect in the mouth [3, 4, 15].

During the development of the desired dough properties and structure of baked products, not only the chemical composition of fat but also its physical state is important. Important technological characteristics of fats used for baking are the content of dry substances, melting and congelation temperatures, firmness, and the number and size of solid-phase crystals at dif-ferent stages of the process of making and storing flour products.

The content of the solid phase in fatty products is determined by the fat's melting and congelation temperatures and by the ambient temperature, and the conditions under which fat transforms from the liquid state into the solid one affect the size of its crystals. If fats are cooled in the static state, a firm mass consisting of large crystals is formed. Large fat crystals can gather into conglomerates; as a result, the mass is perceived as more solid than that with fine crystals. Under the subsequent mixing, large crystals are destroyed and the mass becomes much softer and more plastic. A fat with fine crystals is called plasticized and is a mixture of solid and liquid phases in a definite relation.

Fats are mixtures rather than pure compounds and, hence, have no clear melting characteristics. The melting and congelation temperatures of different fat triglycerides do not coincide, which is determined by the presence of several crystal modifications. The more diverse the set of fatty acids in a fatty product, the wider the melting temperature range is. Melting characteristics of fatty products can be established through determining the amount of the solid fat fraction (solid fat index) at different temperatures. In this context, there is the notion of the slip melting point – the temperature range in which fat is liquid with a certain amount of the solid phase.

In choosing fatty products for flour goods, it is necessary to account for their solid indices at the following temperatures: ambient temperature (it affects the firmness of ready products), the temperature of technological operations with the use of fat (it affects the consistency of fat when it binds with other dough ingredients), semiprepared product temperature (it determines the state of fat under the formation of dough pieces and baked semiprepared products), and hu-man body temperature (it determines how much fat will melt in the mouth during eating and, respectively, how much solid fat can give a waxy flavor to the product).

Despite the wide diversity of fats, dough types, flour products, and technological methods of making them, there are few hypotheses on the role of fats in the development of the properties of different dough types and the structure of flour products, which, basically, supplement one another and are applicable to different types of flour products.

The traditional view on the role of fats in the kneading of pastry dough is that they are distributed in the form of films among flour particles; are adsorbed by the surface of protein molecules and starch grains; block hydrophilic groups, hindering their interaction with water; prevent the swelling of flour colloids; and increase the content of the dough liquid phase. Fats tear secondary protein bindings, penetrate between macromolecules, and block active centers. As a result, the binding between flour particles becomes weaker, the continuity of gluten and starch is violated, and dough acquires plastic properties. The thinner the fat films and the larger their number in dough, the more porous and crisper the structure of ready products is [3, 4, 14, 15].

Obviously, fats in the liquid state are better distributed over the dough volume. Hence, in a number of technologies of pastry preparation, it is recommended introducing fats in dough in the melted state in the form of a well-dispersed emulsion. In this state, during dough kneading, fat particles are more uniformly distributed between flour particles and, during dough piece baking, favor the formation of the laminated structure of the products. In the technology of making sugar and dry cookies and crackers, it is recommended adding fat in the melted state. However, adverse effects are possible in this case due to overheating during the melting of solid fat. This can increase the temperature of the dough, affect its structure, and cause a premature reaction of the leavening agent.

Interaction of fats with dough components largely depends on the chemical composition and properties of a fat in question. For example, glycolipids play the role of structural lipids: they participate in the construction of cellular membranes and in the formation of gluten, which determines the baking quality of flour. As is known, fats can change the structure of protein particles by interacting with different chemical groups of protein macromolecules or through adsorption on the surface of protein molecules. Under dough kneading, fats change the properties of starch as a result of the formation of complexes with an amylase fraction. Some lipid molecules turn to be closed in the amylase helix, while others form a film on the surface of starch particles. An important role in this respect is played by saturated and unsaturated fatty acids in fat composition. It is noted that unsaturated fatty acids interact with flour biopolymers to a greater extent than saturated ones [1, 2].

In studying the influence of fats on baking dough properties and dough quality, it has been established that fat substantially affects the rheological properties of gluten and dough and the quality of bread. As is established, the more unsaturated fatty acids in a fat, the more complex compounds with proteins it forms, which makes gluten more elastic, decreases dough viscosity and adhesiveness, increases dough gas retaining ability, improves the structure of the crumb, and increases the specific weight of bread [2, 11, 16]. This action of fat is more expressed in bread-baking and pastry dough with a low fat content.

Under a long maturation of bread semiprepared products, fat is subjected to hydrolytic splitting, which leads to the accumulation of free fatty acids, di- and monoglycerides, polar li-pids, peroxides, and hydroperoxides, which interact with structural components of flour. This improves the rheological properties of dough and the quality of baked goods [17].

During baking, fats participate in the formation of the leavening structure and texture of the goods. The composition and properties of fat affect the aeration level and rise of dough pieces during baking. For example, S.P. Cauvain [5] stresses the importance of adding fat or an emulsifier to dough to reach the desired porosity of baked products. It is noted that fat ensures a high gas retaining ability, affecting positively the size and stability of gas bubbles. It is stated that the stabilizing action on gas bubbles can be produced by the solid part of fat. The crystals of the solid part of fat align at the boundary of a gas bubble and the liquid phase of the dough and affect both the size and stability of gas bubbles. As dough temperature rises, some fat crystals melt and lose their ability to stabilize gas bubbles. Ultimately, all fat is melted, and the stability of the gas bubbles is maintained by other components, namely, gelatinized starch and gluten denatured protein.

Therefore, the role of fat at the initial stages of baking is retaining gas bubbles in dough and preventing their coalescence. As dough is heated in the oven, its structure cannot restrict the dilatation of gas bubbles, and individual bubbles increase, coalesce, and get destroyed. All this makes dough settle down. As the dough temperature in the oven grows, solid fat becomes liquid and air bubbles tend to emerge from the dough and to come to the top. The longer the bubbles are retained in the dough, the larger the volume of the products. The author concludes that fat should have a high melting point. However, to ensure the effectiveness of solid fats, it is important to ensure their uniform distribution in dough, which is difficult to attain if at least a part of the fat is not liquid.

Other works [9, 10, 15, 18, 20] also note that fats restrict gas diffusion through pore walls at the initial stage of baking at temperatures of 38–58°C, when the dough becomes softer before the stage of absorbing water by starch grains. The stabilization of pores leads to a more stable volume and a thinner texture of baked products. The necessity to use solid fats in dough is substantiated as follows: during baking, solid fat crystals are separated from the liquid phase and are covered with a protein membrane. This membrane allows a large amount of solid phase crystals of a fatty product to attach to air bubbles. In the course of baking, fat crystals melt, and the protein membrane unites with the surface of the bubbles as they extend, increasing extension resistance. It is assumed that the greater the number of fine crystals in fat, the higher is the efficiency of this process under baking. This mechanism can explain the formation of a dough texture containing a plasticized fat with hard crystals.

Fat also affects the size and stability of air bubbles in beaten pastry dough before baking and at initial baking stages [14, 15, 19]. The main function of fat in baking products from beaten dough is to aerate dough during kneading. Beaten dough is foam in which air bubbles are retained in the liquid phase and are separated from each other by a thin film of a stabilizing agent. This stabilization is especially important at initial baking stages, when the rise in temperature increases the tendency to the rise of air bubbles. Later, in the course of baking, as proteins denature, starch gelatinizes, and moisture evaporates, the walls of the bubbles gradually become stronger, the foam begins to harden, and the gas bubbles burst and come out of the cavities, forming a spongy structure, in which individual cells are interconnected, allowing gases and liquids to pass through it.

The moment when the liquid dough foam transforms into a "sponge" is largely determined by the recipe, while the stability of air bubbles under a temperature increase significantly affects the porosity and volume of the product. Protective films that are formed around the gas bubbles can be of different origin, including the participation of fat in their formation. To maintain the stability of air bubbles during baking, it is recommended, prior to the transformation of foam into a biscuit, adding emulsifiers in amounts sufficient for this. The mobility of fats in products depends on the content of the liquid fraction at a given temperature because, under the action of gravity, liquid fat can go down. The dripping of fat can also depend on the product's storage temperature. The higher the storage temperature, the larger the liquid phase in this fat is and, hence, the higher is the risk of fat dripping and oiling the packing.

In baking laminated dough products [5, 15, 19], dough layers are affected by forces that spread them, which considerably increases the volume of the products. Pressure is created by bubbles of steam or gas exhaling under the use of baking powder or yeast. When gas bubbles enlarge, fat acts as a barrier for their movement and the dough layers are spread. To obtain a maximal volume, it is important to preserve fatty layers as long as possible; hence, it is recommended cooling the fat to 12–13°C before lamination to increase the share of its solid phase. The rise of laminated dough products depends on the following characteristics of fat: the amount of fat added (the larger the amount, the higher the rise is), the content of solid fat (the higher the content, the higher the rise is), the solidity of fat (the higher the solidity, the higher the rise is), and the size of crystals (the smaller the size, the higher the rise is).

Despite the better rise of baked products under a high content of solid fats, their organoleptic properties can worsen because fats with a low melting temperature create the impression of "greasiness" and an unpleasant feeling of an envelope in the mouth. Hence, importantly, the content of solid fat should not be too high.

The importance of the uniform distribution of recipe components in pastes for improving the quality of semiprepared and prepared products is stressed in many works [3, 4, 18]. When using fat in the solid form, one can have problems associated with its uniform distribution in dough. For example, to improve the organoleptic properties of biscuits, it is recommended using melted fats heated up to transition to the liquid state. It is emphasized that adding solid fat is an option, but the volume and texture of products will be worse.

The aforementioned statements concerning the role, composition, and physical state of fat during dough preparation and dough piece baking are applicable only to some types of flour products. For example, the supposition that it is advisable to introduce fats in the plasticized fine-crystalline state is applicable to pastry dough with a high fat content. The opinion that it is recommended introducing fats in the melted form together with a well-dispersed emulsion is more applicable to plastic dough with a lower content of fat.

Hypotheses about the role of fat in the production of baked flour goods mainly come down to the following. Liquid fats, as a result of their better distribution and interaction with recipe components, favor the formation of the necessary structural–mechanical properties of dough and the texture of the organoleptic properties of products. Solid fats play the role of a stabilizing structure primarily at the initial stage of baking and during storage.

However, the above hypotheses cannot embrace the entire diversity of dough types and explain the role of fats in the formation of ready products' properties. For example, melted fats are used to knead dough for sugar and dry cookies, crackers, and gingerbreads. The temperature and duration of the stages preceding baking cannot create conditions for the crystallization of fats. Obviously, fat in a dough piece at the baking stage is liquid. Fat crystals can form only after cooling during storage, which makes the products harder.

Noteworthy is also the hypothesis about the role of unsaturated fatty acids in forming bread dough [2, 11, 16]. It is stressed that they can form complex compounds with proteins, which increases the ability of gluten films to spread without tearing under the pressure of the growing gas bubbles. The elasticity of gluten and the retaining ability of dough increase, the crumb structure improves, and the bread specific volume grows. Evidently, this action of fat is more expressed in bread and pastry dough with a low fat content.

Ultimately, the structural–mechanical properties of any dough are determined by the relation and properties of high-molecular hydrophilic polymers (proteins, starch, dietary fiber, and pectins) and low-molecular hydrophilic and hydrophobic compounds (sugars, fats, and amino acids). In other words, the structure of dough is determined by its chemical structure, the strength of contact interaction between its components, and process parameters. An optimum of these indicators should exist for each product, because both their decrease and increase will affect the ability of dough to form and the quality of baked products.

Note that many studies are dedicated to the elaboration of fatty products for flour goods. These developments are mainly aimed at creating specialized fats for baking (shortenings). Such fats are obtained by mixing fats with oils, flavorings, emulsifiers, stabilizers, and preservation agents with the subsequent cooling and packing. The necessary hardness is reached through a definite relation of solid and liquid fractions of fats. Many shortenings have specific properties that make them fit for individual products, for example, for baking cakes, cookies, or crackers.

The need for the use of specialized fatty products is determined by the fact that they make it possible to increase the production performance and ensure the stable quality of products. However, the problem of using fats is associated with their high cost, and their positive effect is often brought to naught due to an increase in price. In addition, little attention is paid to the nutritional and biological value of such fats.

In the mid-1990s, increasingly more palm oil began to appear in the Russian market. Tak-ing into account its low cost, many fabricators began to use it for kneading dough. However, the use of palm oil in the dough composition has elucidated a number of its drawbacks. Palm oil contains a large quantity of solid triglycerides and saturated fatty acids, which make cookies harder during storage as the oil is crystallized. During storage, on the surface of cookies with palm oil, fat bloom can appear as a result of the formation of large crystals under temperature fluctuation. In addition, since recently, palm oil prices have been growing, and fabricators have to look for and alternative [7].

A universally available type of fatty products is liquid vegetable oils. Owing to the pres-ence of a large amount of unsaturated fatty acids, including the essential polyunsaturated fatty acids of the ω-3 family, and the high content of tocopherols, phospholipids, and carotenoids, liquid vegetable oils have a high nutritional value, are characterized by a long shelf life and low cost, and are convenient in storage, dosing, and use [8, 12]. However, the use of liquid vegetable oils for the production of pastries is limited because they are badly retained by products and show up during production and storage. This is why it is necessary to develop technological solutions that could stabilize the structure of dough and products by binding and retaining liquid oil.

To stabilize nutritional systems with liquid vegetable oils, the food industry widely em-ploys stabilizing food additives based on high-molecular compounds, such as proteins and polysaccharides. At present, popular are food additives designed to ensure aggregate stability and/or to maintain a uniform consistency of two or more immiscible ingredients. They include thickeners, gelatinizing agents, bulking agents, and moisture retention agents [21].

Stabilizing food additives also affect the shelf life of foods because they bind water, which delays drying, hinders the development and reproduction of undesirable microorganisms, and slows down the oxidative spoilage of fats.

To form and stabilize the consistency, food technology often uses complex natural hydro-colloid polymer-based stabilizers with a wide range of functional–technological properties. The use of complex additives makes it possible to broaden the spectrum of their technological properties and favors the emergence of synergism. Each of the ingredients in stabilizing systems specifically affects the consistency, structure, outer appearance, taste perception, and stability of goods during production and storage.

The set of ingredients for mixtures of stabilizing additives changes depending on the composition, expected results, and cost. For example, the stabilizing function of polysaccharides is largely determined by interaction with the partner–protein. The protein–polysaccharide complex is present in many foods, and studying its properties and behavior in technological processes is one of the most important aspects of food science. Widely used for stabilizing the structure of foods are stabilizing systems based on natural high-molecular hydrocolloids, such as gums, modified starches, food fibers, and protein preparations. Natural stabilizers are also used in developing special and functional foods.

To increase the effectiveness of liquid vegetable oils and stabilizing food additives in pastry production, new technological solutions are necessary, making it possible to regulate the properties of semiprepared and prepared products for increasing stability, including the baking stage. This should be substantiated by the functional and technological properties of raw materials, by dosing, and by methods of introducing recipe components.

In developing a method of fabricating cookies, implying the replacement of solid-consistency fat by liquid vegetable oil to stabilize the structure of dough and the quality of products, we used a complex food additive based of xanthan and guar gums, dietary fiber preparations, and a soybean protein isolate. All the components are on the list of food components and additives that have no adverse effect on human health when using them for food fabrication.

These food additives were chosen proceeding from studies on their functional–technological properties [22]. Preparations based on xanthan and guar gums have a high water-retaining ability, fat-emulsifying ability, and stability of emulsions; wheat gluten has a high water- and fat-retaining ability; and the soybean protein isolate has a good fat-emulsifying ability and a high stability of emulsions. The presence of the above properties makes it possible to suggest reaching the necessary stabilizing action in introducing these food additives to the composition of dough with liquid vegetable oil.

It was established in the course of our studies that the production of cookies with liquid vegetable oil implies not only a change in the traditional set of recipe components but also an increase in the moisture content of dough. Changing solid fat for liquid vegetable oil and intro-ducing a stabilizing food additive make it possible to increase the dough moisture content by 1.5–2% and to decrease the share of fat in the recipe by 15–20% without changing the structural–mechanical properties of dough and the traditional consumer attributes of the cookies [23].

The studies have made it possible to propose an innovative method of preparing cookies with liquid vegetable oils and stabilizing natural high-molecular biopolymer-based food addi-tives [24]. The main technological stages are preparing the recipe mixture by mixing all components except for flour and the fat phase (see figure), obtaining the fat phase from liquid vegetable oil and the complex of stabilizing food additives, and preparing a fat–flour mixture from flour and the fat phase. Dough is kneaded from the recipe and fat–flour mixtures, after which it is formed, baked, and cooled.

Preparing the fat phase from the mixture of liquid vegetable oil and the complex stabiliz-ing additive creates conditions for a better distribution of the additive and a fuller interaction of its components with the oil. Mixing flour with the fat phase makes it possible to create condi-tions for a better interaction of hydrophobic groups of flour high-molecular compounds with oil and the absorption of oil by the surface of solid particles to increase the stability of dough and product properties and to decrease the migration of oil from goods during production and stor-age.

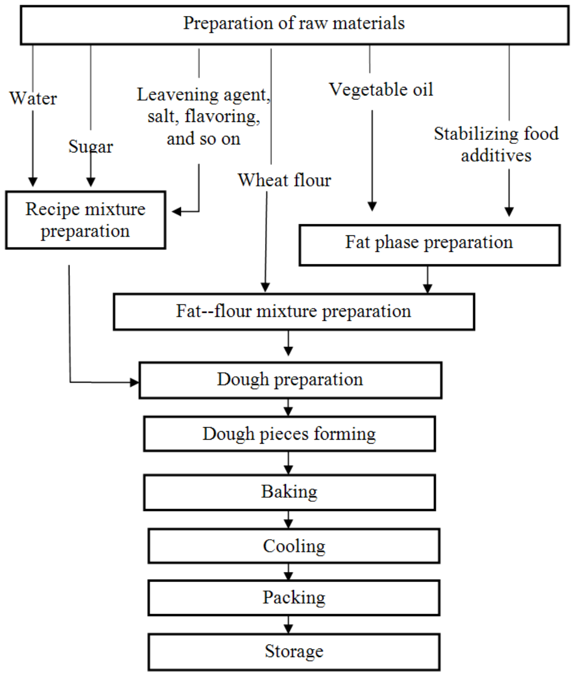

Figure Flow diagram of the production of cookies using liquid vegetable oils.

Our studies show that introducing liquid vegetable oils to pastry requires the use of stabi-lizing food additives and technological methods making it possible to effectively emulsify, bind, and retain liquid vegetable oil and, thus, to stabilize the structure of dough and the quality of products. The use of this technology of fabricating flour pastries with the use of raw materials containing physiologically functional ingredients makes it possible not only to obtain high-quality products but also to increase their nutritional value under the simultaneous decrease in food energy.

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