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EDIBLE COATING AS FACTOR OF PRESERVING FRESHNESS AND INCREASING BIOLOGICAL VALUE OF GINGERBREAD CAKES

O. Shulga, PhD, Associate Professor*, *E-mail*: shulga83@voliacable.com

A. Chorna, Postgraduate student*, *E-mail*: Anastasia_Chernaya@ukr.net

L. Arsenieva, Doctor of technical sciences, Professor*, *E-mail*: ars-l@yandex.ua

*Department of Foodstuff Expertise

A. Hol, student, *E-mail*: goll.artem.95.ua@mail.ru

National University of Food Technologies, Volodymyrska str. 68, Kyiv, Ukraine, 01601

Annotation. The article presents experimental study on the feasibility of using edible films (in the coating) as a means of preventing staling and method of increasing the biological value of gingerbread products. Grounded components of edible coating. Based on the organoleptic and physico-chemical showers properties (moisture content, water absorptivity and friability) proved the feasibility and necessity of use last one edible coating, which also can increase the biological value of products, as part of the cover is linseed oil.

Keywords: edible coating, gingerbread products, biological value, shelf life.

ЇСТИВНЕ ПОКРИТТЯ ЯК ФАКТОР ЗБЕРЕЖЕННЯ СВІЖОСТІ ТА ЗАСІБ ПІДВИЩЕННЯ БІОЛОГІЧНОЇ ЦІННОСТІ ПРЯНИКОВИХ ВИРОБІВ

О.С. Шульга, кандидат технічних наук, доцент*, *E-mail*: shulga83@voliacable.com

А.І. Чорна, аспірант*, *E-mail*: Anastasia_Chernaya@ukr.net

Л.Ю. Арсеньєва, доктор технічних наук, професор*, *E-mail*: ars-l@yandex.ua

*кафедра експертизи харчових продуктів

А.О. Голь, студент, *E-mail*: goll.artem.95.ua@mail.ru

Національний університет харчових технологій, вул. Володимирська, 68, м. Київ, Україна, 01601

Анотація. У статті наведено експериментальні дослідження щодо доцільності використання їстівної плівки (покриття) як засобу запобігання черствіння та способу підвищення біологічної цінності пряникових виробів. Обґрунтовано склад компонентів їстівного покриття. На основі органолептичних та фізико-хімічних показників (масова частка вологи, намочуваність та крихкуватість) доведено доцільність і необхідність використання їстівного покриття, яке також дозволяє підвищувати біологічну цінність виробів, оскільки до складу покриття входить лляна олія.

Ключові слова: їстівне покриття, пряникові вироби, біологічна цінність, строк зберігання

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Introduction. Formulation of the problem

At present the problem of preserving freshness of confectionery products remains topical [1]. Nowadays the problem of preventing gingerbread cakes from staling remains unsolved, especially it is true for gummy gingerbreads. Adding moisture-retaining components, e.g. such polysaccharides as pectin [2], foods with high content of reducing substances such as glucose and fructose syrups [3] or malt [4,5], choux paste and the use of nontraditional raw materials, such as waxy wheat flour [6] or others solve this problem only partially.

Gingerbread cakes are foods with low biological value. Thermal processing (baking) in the production of gingerbread cakes makes it impossible to add most biologically active substances to these foods.

The use of edible coating will allow to stop the use of sugar syrup for gingerbreads coating and improve the biological value of foods due to the coating components.

The objective of the research was to determine the influence of edible coating with biologically active ingredients on the speed of staling of gingerbread products.

Bibliographic review

Attempts to coat confectionery products are made by A.M. Dorohovych and O.O. Gavva [7]: who suggested the coating made of modified starch, vegetable gum, flavoring and coloring agents. G.M. Lysyuk and others [8] developed a sprayed film-forming coating for bakery goods that consists of starch, glycerol and water. For confectionery packaging film used as corn and potato starch in combination with various food additives [9]. It is known [10] that the use of edible films which include pectin, prevents staling diet biscuit. This cake is better maintains freshness, especially on the fifth day of storage.

In these compositions are not using biologically active components, for example, omega-6 fatty acids

are also found in soybean, sunflower, mustard, canola and olive oils, they can also be used for making the film, but in sufficient amounts omega-3 fatty acids are found only in linseed oil. The content of omega-3 in linseed oil is 2 times higher than in fish oil [11].

The presence of hydrophobic component is justified by the need to «close» holes remaining after evaporation of the solvent (water), thereby creating a waterproof layer. Adding linseed oil in an amount of 5 – 10 % to the weight of the edible coating increases the amount of these acids from 1.09 to 2.2 g in 100 g of gingerbread (in respect to the amount of oil added), and that will allow to partially satisfy the daily needs in case of rational intake of 7 – 15.4 g (Regulations of the Ministry of Health of Ukraine approved by the Decree of the President of Ukraine on April 13, 2011 № 467).

The choice of film forming components is justified by technological aspects [17-19] and organoleptic properties of the film produced from them (neutral taste and odor, transparent, colorless, easy to chew). The gelatin coating retains moisture better than the starch one, because starch is liable to retrogradation [14]. That is, starch stops to hold water during transition to the crystalline state. The need of starch component in gelatin film is caused by the property of gelatin to form jelly while cooling that makes it impossible to apply such coating on confectionery products.

Gelatin also acts as emulsifier for linseed oil or paraffin. To form a uniform film structure, starch and gelatin should be mixed in a dry form, then water is added and it should be heat-stirring until gelatin is dissolved and starch is gelatinized. Then, plasticizer, urea, is added and stirred until it completely dissolves.

The mentioned plasticizer – urea [12], as an additive, does not have negative impact on the body when rationally consumed. In food industry urea (carbamide) is used for different purposes. It can act as an amplifier and modifier of taste and flavor, which is why urea is added in the chewing gum [13]. The mentioned plasticizer was selected as a source of nitrogen. With the help of infrared spectroscopy, it was also established that urea enters into chemical reaction with gelatin thereby strengthening the film [20].

Main part

Gummy gingerbreads were produced in the laboratory according to classical recipe [21].

The coating is composed of film forming components – corn starch or potato starch – 2 – 10 % and gelatin (E440) – 5 – 25 %, plasticizer – urea (E927b) – 1 – 5 %, hydrophobic component – paraffin (E905c) or linseed oil – 1 – 10 %, solvent – water. Innovative aspect of finding confirmed to award patent for the utility model on October 27, 2016 № u 201607676.

Coatings were made as follows: starch and gelatin mix in dry form and then added to the mixture required amount of water and stirring the mixture heated

to dissolve gelatin and is gelatinized. Then, plasticizer, urea, is added and stirred until it completely dissolves and aged for 5 – 10 min. After cooling the solution to a temperature less than 40 °C in a solution added linseed oil and whipped for 3 – 5 min. When using of thermostable hydrophobic component whipping can be carried out without cooling solution. The resulting emulsion is applied to the surface of the product by icing and stand 20 – 30 min to the formation of a film on the surface. Staling of gingerbreads can be determined by decreasing of moisture weight part and changing of water absorption, as natural polymers are prone to aging during storage period, which reduces their ability to retain moisture as a result of hardening [14]. These indicators are monitored by the Government State Standard (GSS) 15810-2014 «Confectionery. Gingerbreads. General specifications». Besides, aging of natural polymers increases friability of foods, though this indicator is not standardized according to GSS but is determined in order to study the dynamics of its change as an indirect indicator of gingerbreads staling during storage period [14].

Gummy gingerbreads storage period is one month according to the GSS 4187:2003 «Gingerbread confectionery». According to the GSS 15810-2014 «Confectionery. Gingerbread cakes. General specifications». The gingerbread products stored in conditions close to the conditions of commercial space: without hermetic packaging for ambient temperature, humidity of 75 %. We propose to apply edible coatings on gingerbreads after baking and cooling by the method of glazing.

Discussion of the study. The influence of coating on organoleptic properties is determined by the composite index of quality. GSS 15810-2014 «Confectionery. Gingerbread Products. General specifications» controls such organoleptic properties as taste and smell; structure; color; fracture form; surface; shape. It was found in the research that products with coatings are not worse in quality as compared to products coated with sugar syrup and they scored 1 (maximum number). Besides, the developed coating creates glossy surface on gingerbread cakes, which positively affects organoleptic properties. So, edible coating on the surface of gingerbreads positively affects organoleptic properties.

Research shows that it is advisable to value the change in physical and chemical properties firstly by determining the moisture content in gingerbreads during storage period as desorption processes are processes that lead to the release of moisture and cause gingerbreads staling [1].

Experimental data on the change of moisture content during storage period are shown in Table 1, where 0 day is the index, determined on the day of gingerbreads production after their cooling. The research lasted longer than the given storage period in order to determine how edible coating influences the prolongation of storage period.

Table 1 – Change of moisture content of gingerbreads during storage period

Time of storage, days	Gingerbreads in edible coating, %	Gingerbreads in synthetic material, %	Gingerbreads coated with sugar syrup, %
0	15,5±0,5	15,5±0,5	15,5±0,5
7	16,0±0,5	15,4±0,5	15,5±0,5
15	15,5±0,5	15,2±0,5	15,0±0,5
22	15,0±0,5	15,0±0,5	14,7±0,5
29	14,7±0,5	14,6±0,5	14,2±0,5
36	14,3±0,5	14,3±0,5	13,5±0,5
43	13,9±0,5	13,5±0,5	13,2±0,5

Gingerbreads with the suggested edible film, gingerbreads coated by sugar syrup and gingerbreads packed in synthetic polymer film were under study. According to the experimental data (Table 1), on the initial stage moisture fraction of gingerbreads with edible coating increased slightly (by 0.5 %) due to moisture absorption from the applied coating, but it did not exceed 16 % as determined by GSS 15810-2014 «Confectionery. Gingerbread Products. General specifications». Moisture content in gingerbreads with edible coating increases a little as moisture content of the solution of edible film that coats the surface of the of gingerbread constitutes 70 %. Thus, when it coats the surface of the film in the amount of about 1.5 g, a 30 g gingerbread gets about 1.05 g of moisture. Moisture content of gingerbread increases only by 0.5 %, although the calculations show that 5 % of moisture should be added from the film, but the main part of film moisture evaporates into the environment. Further

reduction of moisture during storage period for samples with edible coating occurs more slowly as compared with samples with sugar syrup and in synthetic packaging due to possible hygroscopic properties of edible coatings and creation of barrier layer that prevents moisture evaporation from gingerbread surface.

Thus, application of edible coating on the surface slows moisture evaporation from products and confirms functionality of its usage.

Water absorptivity is another indicator that shows the loss of freshness in gingerbreads during storage period. It is known [14] that natural polymers become «old» in time, their structure hardens, which reduces their ability to retain moisture and, consequently, the indicator of water absorptivity reduces. Experimental data are shown in the chart (Fig. 1). Water absorptivity is measured after the protective layer (edible film, synthetic film or layer of sugar syrup) is removed.

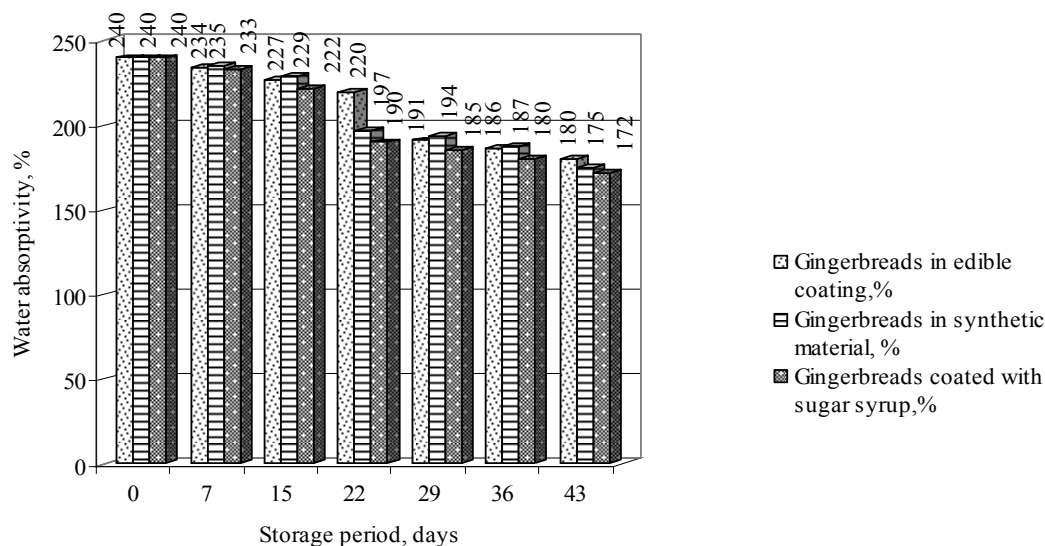


Fig. 1. Change of water absorptivity in gingerbreads during storage period

According to obtained experimental data (see Fig. 1), the indicator of water absorptivity of gingerbreads in edible film is more important during storage period, which shows less intensive staling of gingerbreads. Synthetic film also prevents moisture evaporation from the surface of gingerbreads, but if it is not applied hermetically, moisture can evaporate. According to experimental data, hygroscopicity of sugar syrup

is less important to preserve the moisture inside the product as compared with barrier layer of edible film or synthetic film. So, the indicator of water absorptivity also demonstrates functionality of applying of edible coating to preserve freshness of gingerbread cakes. The results of the experiment to determine friability changes during the storage period are shown in the graph (Fig. 2).

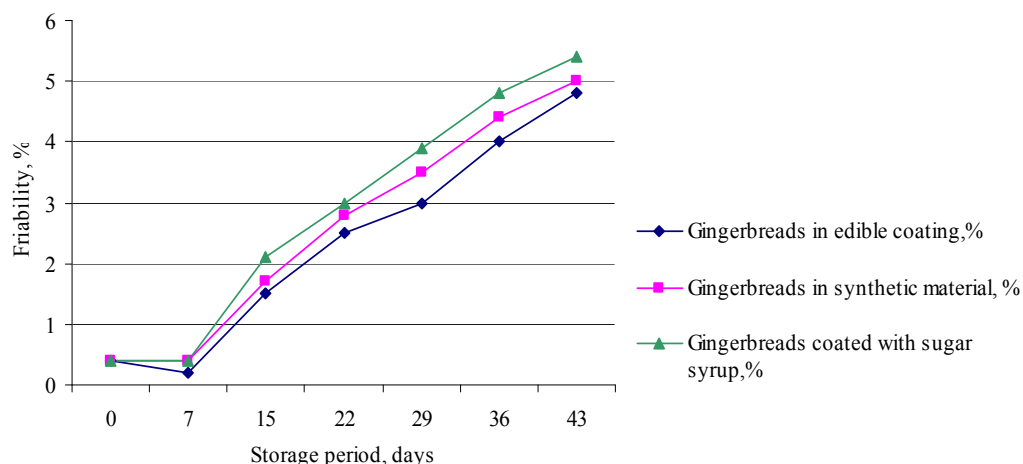


Fig. 2. Results of experimental studies of changes in friability during gingerbread storage period

Graph data (Fig. 2) show that edible film assists moisture retention in a gingerbread because friability of such a product is 0.6 % less as compared to coated gingerbreads at the end of storage period. 0.2 % decrease of friability at the end of week's storage period can be explained by a slight (0.5 %) increase in moisture content (see Table 1) of edible film. Moisture retention of gingerbreads packaged in polymeric film is almost at the same level as of gingerbreads in edible film (friability difference is only 0.2 %), but polymer film is not edible and therefore does not increase the biological value of products, which was mentioned above.

Conclusions

The experimental data of organoleptic, physical and chemical parameters verifies the hypothesis of functionality of using edible coating to preserve freshness of gingerbread cakes during storage period without deteriorating their organoleptic and studied physical and chemical parameters of quality. The proposed composition of edible coating can be used for other confectionery products, including fondant candy, jelly and marmalade products, i.e. products in which desorption process is the limiting factor of their storage period. Using edible coatings, it is also possible to expand the range of biologically active substances used to enrich confectionery products which is especially necessary and actual, as children are the most active consumers of these products.

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СЪЕДОБНОЕ ПОКРЫТИЕ КАК ФАКТОР СОХРАНЕНИЯ СВЕЖЕСТИ И СПОСОБ ПОВЫШЕНИЯ БИОЛОГИЧЕСКОЙ ЦЕННОСТИ ПРЯНИКОВЫХ ИЗДЕЛИЙ

О.С. Шульга, кандидат технических наук, доцент*, *E-mail*: shulga83@voliacable.com

А.И. Черная, аспирант*, *E-mail*: Anastasia_Chernaya@ukr.net

Л.Ю. Арсеньева, доктор технических наук, профессор*, *E-mail*: ars-l@yandex.ua
*кафедра экспертизы пищевых продуктов

А.О. Голь, студент, *E-mail*: goll.artem.95.ua@mail.ru

Национальный университет пищевых технологий, ул. Владимирская, 68, г. Киев, Украина, 01601

Аннотация. В статье приведены экспериментальные исследования по целесообразности использования съедобной пленки (покрытия) как средства предотвращения черствения и способа повышения биологической ценности пряничных изделий. Обоснованно состав компонентов съедобного покрытия. На основе органолептических и физико-химических показателей (влажность, намокаемость и крошковатость) доказана целесообразность и необходимость использования съедобного покрытия, которое также позволяет повышать биологическую ценность изделий, поскольку в состав покрытия входит льняное масло.

Ключевые слова: съедобное покрытие, пряничные изделия, биологическая ценность, срок хранения

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