

# Study the properties of a chickpea-based jelly product

*Elena Molchanova*<sup>1,\*</sup>, *Marya Shipareva*<sup>1</sup>, *Tatyana Evmeshkina*<sup>1</sup>, and *Ismoil Isabayev*<sup>2</sup>

<sup>1</sup>Moscow State University of Food Production (MSUFP), 125080 Volokolamskoe shosse 11, Moscow, Russia

<sup>2</sup>Bukhara Engineering-Technological Institute (BETI), 200117 K.Murtazaev street 15, Bukhara, Uzbekistan

**Abstract.** The consumption of food products with low consumer properties is the reason for a decrease in a life quality as well as for a number of diseases development among the population. Meanwhile, the annual volume of confectionery production and their consumption is increasing, which requires an expansion of the assortment in this group. A jelly product was developed, using the unusual raw materials - chickpeas (*Cicer arietinum*). During the formulation development the samples with high organoleptic characteristics were obtained. To determine the rheological properties, 1% agar solutions with sucrose content of 25% and with different contents of chickpea puree were examined. Additionally, the effect of the sucrose amount on agar jellies was studied. The samples were 1% agar solutions with different sucrose content. Thus, when developing a formulation with agar, for the desired result it is worth considering the amount of sucrose and chickpea puree, which affect the strength of the agar gel.

## 1 Introduction

The consumption of food products with low consumer properties is the reason for a decrease in a life quality as well as for a number of people diseases development, not least because of excessive saturated fats consumption, lack of protein, polyunsaturated fatty acids, and micronutrients and dietary fiber deficiency. Meanwhile, the annual volume of confectionery production and their consumption is increasing, which indicates a high demand for this group of products. Most of these products have a high energy value, contain a large amount of easily digestible carbohydrates and little protein. As for the market of jelly products, today all existing jellies have a low nutritional value, they are made of fruit and berry syrups basis with the addition of dyes and flavors, where the main component is sugar. Legumes are the promising components for the confectionery enrichment.

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\* Corresponding author: [molchanova@mgupp.ru](mailto:molchanova@mgupp.ru)

## **2 Literature review**

Legumes (chickpeas, mung bean, lentils, and various types of beans) are the sources of many useful components, primarily dietary fiber, protein and minerals. Chickpeas are rich in protein, they are a good source of lysine, leucine and, according to number of studies, the richest in calcium, phosphorus and sulfur, unlike with other legumes. The presence of resistant starch in chickpeas determines its low glycemic index [1, 2]. In addition, chickpeas have a relatively high antioxidant activity due to the presence of phenolic compounds [3,4].

Agar is a gelling agent that is widely used all over the world in many food and pharmaceutical products the manufacturing. In the production of confectionery products with a jelly-like structure, agar should be considered not as a food additive, but as the main ingredient that determines the structure of the finished product. The influence of different components on the agar jellies properties is being considered [5]

Earlier, we discussed the usage of legumes for the production of semi-finished flour confectionery products, their acceptable organoleptic characteristics were shown [6]. In general, chickpeas are widely used in the production of confectionery [7,8].

## **3 Materials and methods**

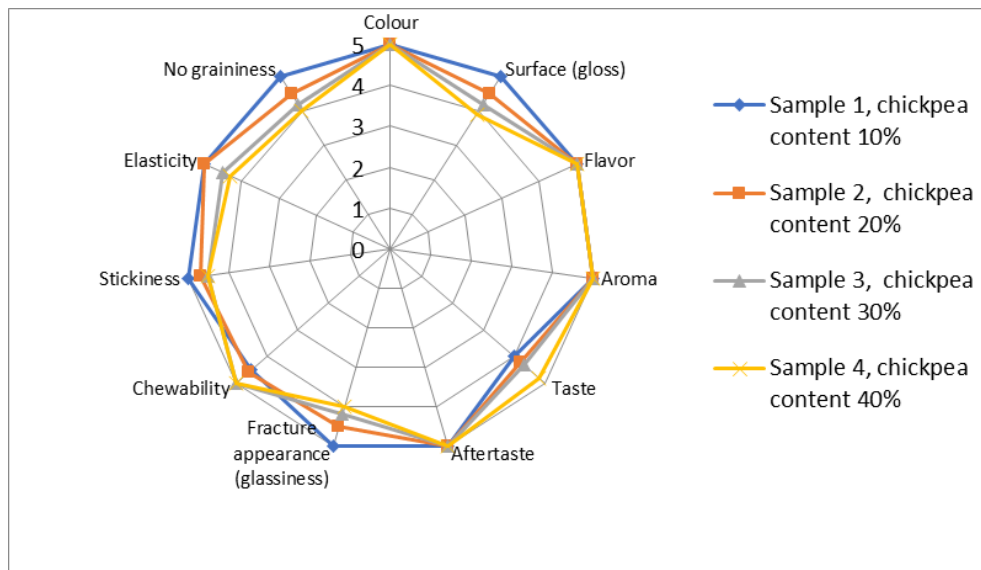
The objects of the study were chickpeas (*Cicer arietinum*) and agar, purchased in the retail store network. A jelly product was developed, which includes chickpea puree, agar, sugar, water. Chickpeas (*Cicer arietinum*) were soaked for 8 hours, the water was drained, boiled until done, and ground on a pulping machine until smooth, the agar was soaked in a cold water. Simultaneously, sugar, water and agar were added to the boiled chopped chickpeas, boiled down and poured into molds.

The organoleptic assessment was carried out by a commission of 5 people using a developed scale of descriptors, which, in addition to traditional indicators, included such indicators as surface gloss, aftertaste, fracture appearance (glassiness), chewiness, stickiness, lack of graininess, elasticity.

The study of samples rheological properties was carried out on the universal testing machine Shimadzu AGS-X. The deformation of the samples in all experiments was proceeding at a constant rate of 2 mm / min. Test process control and data processing were performed using TRAPEZIUM X software.

## **4 Results and discussion**

When developing the formulation, the influence of chickpea puree amount on the organoleptic and the jelly product mechanical properties was studied. Samples were prepared with chickpeas concentrations from 10% to 40%. The results of the experts sensory evaluation are shown in Figure 1.



**Fig. 1.** Diagram of samples quality organoleptic indicators

Different chickpea puree dosage in the composition of the jellied product did not affect the taste, flavor, aroma and aftertaste. The main changes were observed in the surface condition, chewability, glassiness at fracture and mechanical characteristics. With an increase in the chickpea content, the elasticity decreased slightly. In addition, the indicators of surface glossiness and glassiness at the fracture decreased. The chewability of the samples improved, and they became melted in the mouth.

The effect of different sucrose content on the structural and mechanical properties was assessed by the results of the ultimate stress of agar jellies destruction (table 1). The sugar concentration was selected taking into account the developed product with a jelly texture. The concentration of 60% had been studied as the most common in the production of sugary confectionery.

**Table 1.** Structural and mechanical properties of agar jellies

Sample №	Concentration of sucrose in the samples, %	Average ultimate fracture stress, (kN/m <sup>2</sup> )
1	0	88,53±3,30
2	10	150,03±1,03
3	15	150,21±0,84
4	20	149,88±0,56
5	25	149,74±0,07
6	30	139,86±7,18
7	60	40,37±1,59

The addition of a small amount of sucrose (10%) to the agar solution almost doubled the strength, which was evaluated in terms of the ultimate fracture stress. A further increase in sucrose concentration from 10% to 25% led to almost no changes. The addition of 30% sucrose to the solution slightly reduced the strength by 7%, and at a concentration of 60% it decreased almost 4 times. Earlier, the effect of sucrose solution on agar gels with additional 0.5% Tween 20 was studied by A.L. Ellis et al. [5]. In their work, the values of Young's modulus gradually increased up to a sucrose content of 50% and slightly decreased at a concentration of 60%.

To examine the rheological properties of agar jellies with a chickpea puree, 1% agar solutions were prepared with a sucrose content of 25%, and with a different content of chickpea puree (10%, 20%, 30%, and 40%). Compared to gels made of agar and sucrose, the values of the ultimate breaking stress were significantly lower, which indicates the lower strength of the jellies. Adding up to 30% chickpea puree slightly reduced the indicators. A sharp decrease in the strength of agar gel by 2 times occurred with an increase in the concentration of chickpea puree from 30% to 40% (Table 2).

**Table 2.** Structural and mechanical properties of agar jellies with a chickpea puree

Sample №	Sample (1% agar, 25% sucrose) and chickpea puree content	Average ultimate fracture stress, (kN/m <sup>2</sup> )
1	10% chickpea	15,152±1,403
2	20% chickpea	15,099±0,611
3	30% chickpea	13,268±0,859
4	40% chickpea	7,420±0,346

The presented studies have shown the possibility of using chickpeas in the production of jelly products. In general, all samples had high organoleptic characteristics. Changes in rheological characteristics were observed after the addition of 40% chickpea.

Thus, when developing a formulation with agar, for the desired result, it is worth take into consideration the amount of sucrose and chickpea puree, which affect the strength of the agar gel. The developed agar-based jelly products containing chickpea puree, although differing in texture, all had high organoleptic rates.

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