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Scientific Research

Production of functional pastille based on Citrus aurantium and investigation its physicochemical and sensory properties

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ABSTRACT

Vegetable, fruit and medicinal plant based snacks, have more acceptance and attractiveness than other ones. Citrus aurantium due to its Functional and nutritional factors, demand to consume it product. The aimed of this study was the production of Citrus aurantium based product which we named it Citrus aurantium *Mill* pastille. For this purpose, gelatin-pectin Mix Ratio (%5/5,7/3,9/1 and 10)and suger and isomalt was used as sweetner..The results showed by increasing the level of pectin, moisture was decreased, acidity and brix were increased. The results also suggest that texture characteristics with increasing pectin Hardness, Cohesiveness, Springiness and Chewiness increased. According to the results obtained from samples containing isomalt with ratio gelatin 9 pectin 1 a better ability to replace sugar And due to the appropriate nutritional characteristics,The pastilles known as functional food.

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1. Introduction

The change in the eating habits of consumers, including the desire to consume ready meals and snacks, is one of the reasons for the growth and development of new products. The development of agricultural transformation industries requires the creation of new attractions for consumers, which is possible with the production and supply of new products. New vegetarian snacks can be produced in small quantities, with the ability to eat quickly and have a beautiful appearance. The development of their consumption can be a positive cultural movement towards greater health[1].

Nowadays, with the attention and awareness of the benefits of consuming plants and their miraculous effect on the health of the body, more and more attention has been paid to this type of agricultural products. Among the crises in this field is the lack of proper processing and storage equipment and also the lack of sufficient knowledge in the field of process technology, which indicates the need to pay attention and importance to the sector of plant transformation and processing industries. One of the common snacks nowadays are the common pastilles in the market, which contain gelatin, acid, color and essence and other additives and are completely artificial in nature, in addition to having no nutritional value and having adverse effects on the health of consumers. . If a product based on plants and natural additives can be produced and introduced into the market. It will be a great help in increasing the nutritional value and producing a product with a new taste and aroma, and if it enters the consumer markets, it will be a new step in the direction of the health of most people in the society, especially children [2]. It is provided through main meals and snacks. Snacks can play an important role in providing daily energy and nutrients. This role can depend on many factors such as age, economic background, culture, physical condition of the body, gender, etc. [3]. The role of physical and sensory characteristics in the production of products is a very important issue that should be considered. manufacturers to be placed. In general, gums have a significant effect on the textural characteristics and mouthfeel of food products, while they are also important in creating water connections in confectionery products. In addition, the use of hydrocolloids in the formulation of fruit snacks to create textures new and increasing their stability due to their bulking property, water retention, texture improvement, effect on the release of flavoring substances and other structural and sensory characteristics in the desired product can be used [4]..*Citrus oranges*It is a tree with a height of 4 to 5 meters with shiny and fragrant leaves and a bitter taste, and it has fragrant flowers full of essence. Orange flowers are known as Bahar Naranj in Iran, which is the most important part of it. In the middle of spring, orange flowers bloom and fall quickly. These flowers are used to prepare orange juice and jam. Orange spring and its sweat are traditionally used as sedatives and diuretics [5].

The sweat made from orange blossoms is called orange spring sweat, which is hot and dry in nature. This sweat is invigorating, strengthens the brain, unclogs the nasal passages, eliminates secretions from the sinuses and the respiratory system. It is useful in eliminating some types of heart palpitations. In addition, it is useful in relieving the pain caused by wind in the large intestine [6].

Bahar Naranj pastille production is a newly emerging natural product in which a gelling agent (agar, gelatin, carboxymethyl cellulose) is added to a sugar syrup. The desired (hard and soft tissue) are selected and they are melted and molded into different shapes. And finally, the product is affected by the drying process. The final product has an elastic, springy and interconnected texture. Hydrocolloids are usually used with the purpose of improving the properties, creating texture and considering the desired functional characteristics in the new food product, and by using small amounts, they have an important effect on the texture and organoleptic characteristics of food [7].

Azimi et al. (2013) investigated the effect of guar hydrocolloids at the levels of (0, 0.5, 1) percent and gelatin at the levels of (0, 1, 2) percent on the color parameters of white mulberry pastille. The statistical results of data analysis showed that different concentrations of guar and gelatin had a significant effect on color parameters (b, a, L) ($P<0.05$) [8].

In a research, Rezaei et al. (2009) analyzed the tissue profile of pastille plum by sensory method and investigated the effect of introduced hydrocolloids on the overall acceptance of the tissue. The results of this

research showed that there is a strong and positive correlation between acceptance of the texture and taste of the samples and overall acceptance. Also, the models obtained from the central composite design showed that the stiffness of the tissue has an inverse relationship with the percentage of starch introduction and a direct relationship with the percentage of gelatin, and gelatin has a positive effect on the cohesion of the tissue. The highest tissue acceptance was related to a sample with 5.7% starch and 6.5% gelatin [9].

Bland et al. (2004) investigated the effect of gelatin and pectin on the flavor of strawberry paste. The results of the investigations showed that pectin gel had a higher dispersion coefficient of air in the gel than gelatin gel, but it increased the flavor more. Also, the strength of the samples was strongly affected by both types of hydrocolloid [7].

Dimars et al. (2000) investigated the texture and structure of pastilles based on gelatin and pectin. The results showed that the addition of pectin reduced the brittleness of gelatin gel. Also, by increasing the concentration of pectin, the viscosity and the amount of gel tissue formation increase [10].

The purpose of this research was to investigate the possibility of producing new products based on orange juice that can replace common snacks, especially pastilles consisting of gelatin, artificial colors and flavors, which despite their low nutritional value and causing various side effects, are highly liked by different sections of the society, especially children. And they are teenagers. Therefore, in this study, while producing the useful pastille of Bahar Naranj, the effect of using two hydrocolloids, agar and CMC, on the acceptance of the texture of the manufactured product was investigated, and with the help of the descriptive sensory analysis method, the texture characteristics of the product were quantitatively and qualitatively described.

2- Materials and methods

2-1- Materials

The raw materials included sugar, citric acid, pectin, gelatin. Baharnaranj was obtained from a reputable perfumer in Mashhad and sugar was obtained from one of the stores in Mashhad.

The chemicals used were citric acid from Merck, Germany, solvent gelatin and high methoxyl pectin from Azma Sazeh. Consumable sugar (sucrose) was purchased from a local supermarket. Liquid dextrose and glucose were obtained from Simorgh Halwa Sugar Factory. Citric acid (Merck) was prepared with distilled water as a 50% solution. The water used in the preparation of the product was laboratory distilled water. Lemon color, spring orange essential oil and corn starch powder were obtained from a confectionery store. Laboratory equipment includes laboratory scale with accuracy of 0.001 gram made by KERN company in Germany, laboratory oven (20-180 degrees Celsius) made by Fan Azma Gostar company, shaker machine tab-2100HF model made by Tehzih Azmaye Poya Iran company, texture profile analysis machine model TE Plus made in England, refrigerator for storing samples and laboratory glassware such as Beshr, Erlenmeyer, round and flat bottom balloon, Mazur, funnel, glass plate, pipette.

2-2-Methods

2-2-1- Extraction

The extraction of the extract was carried out by the method of Lopezcardaba et al. (2006), with some changes, in several steps by Benmari and using distilled water as a solvent. In such a way that the powder of orange flower was mixed with distilled water in a ratio of w/v (1:10) and was subjected to magnetic stirring for 60 minutes. Then the resulting mixture was placed in a bain-marie bath with a temperature of 80°C for 4 minutes. After collecting the extract, the obtained aqueous solution was filtered in a centrifuge at 6000 rpm for 5 minutes in several stages with Whatman No. 1 filter paper, and the filtered extract was kept in a dark container in a refrigerator at a temperature of 4.

2-2-2- Pastille production

The pastille formulation specifies the amounts in terms of the percentage of orange spring extract, sweetener and hydrocolloids. Due to the lack of background research regarding the production and formulation of pastilles based on Orange Spring, in order to determine the optimal conditions of production and some cases such as the best production method, the type and the appropriate amount of formulation ingredients, the experiments of this research in two stages of pre-treatment And the original was done. , the amount of orange juice consumed, the type and amount

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of sweetener and the progress and delay of the stages were among the most important issues in the production process, which by performing pre-treatments and using the results, determine the best production conditions while maintaining the chemical and sensory characteristics of the product. It became possible. Two suitable hydrocolloids for the production of jelly lozenges, gelatin and pectin, were used in the formulation with different percentages, and the most suitable hydrocolloids and the range of use were determined based on their appearance (shape and moldability) and taste and texture characteristics. became In order to choose the most suitable sweetener, different percentages of liquid glucose, sucrose and dextrose were used in the formulation. According to the sensory evaluation of the taste and texture of the produced samples, the type and amount of sweetener consumption was determined.

After weighing, the required gelatin was dissolved in distilled water (at least twice the weight of gelatin). A magnetic stirrer was used for better mixing. Then the resulting mixture was placed in a hot water bath (70 degrees Celsius) in order to remove air bubbles and make it clear. Then pectin was gradually and uniformly added to the gelatin solution according to the desired formulation. Then, 3 cc of the 20% weight-weight solution decoction of orange spring was added to the sample. In the next step, to prepare the sugar solution, liquid glucose, liquid dextrose and sugar (isomalt) in amounts of 15, 15 and 35 grams respectively (to prepare 100 grams of pastilles and in all formulations) are added to about 5 to 8 grams of distilled water and this mixture It was heated on a magnetic stirrer until the temperature reached 125 degrees Celsius to prepare a clear and thick sugar solution with a Brix of about 80. If heating continues, the sugar solution will caramelize and will not be usable. Then the gelatin solution (containing pectin and spring orange) was added to the sugar solution (temperature below 100 degrees Celsius) and the resulting mixture was again placed in a hot water bath with a temperature of 60 to 70 degrees Celsius until the air bubbles are removed and the mixture is completely be uniform After the complete mixing of the gelatin and sugar solution, to reach a pH of 35.3±0.05, the amount of 1.5 grams of citric acid (50 percent by weight solution), 0.05 grams of lemon color and 0.06 grams of spring orange essential oil (to per 100 grams of pastilles and to all formulations) were added and mixed slowly to prevent the formation of air bubbles. Starch molds were used to shape pastilles, and to prepare it, starch was created by applying pressure in the desired molds and the prepared pastille solution was poured into the molds. Then the desired molds were placed in the oven (37 degrees Celsius) for 24 hours. After that, the pastille was taken out of the mold by hand and the remnants of starch particles were completely removed from them using a brush. Then the lozenges were coded and kept at room temperature for 24 hours. Finally, due to the lack of access to polishing oil to clarify and improve the appearance of the lozenges, the samples were coated with a very small amount of liquid edible oil.

2-3- Test methods

2-3-1- Chemical tests

Chemical tests included humidity, brix and acidity.

2-3-1-1- Brakes

Control and measurement of Brix mixture was done by digital refractometer.

2-3-1-2- Humidity

First, 2 grams of pastille was weighed inside a clean plate that was dried in the oven and weighed. Then it was placed in the oven with a temperature of 105 degrees Celsius and kept at this temperature until a constant weight was reached. After this period, the dried pastilles were weighed and compared with the weight before baking, and the amount of moisture in the pastille was calculated [11].

Wm = sample weight before oven

wov = sample weight after oven

= humidity Wm- Wov / Wm

2-3-1-3-measurement of acidity

Acidity was carried out according to the Iranian national standard method No. 2682 using 0.1 normal interest[11].

2-3-2 - Textural parameters

In this research, a tissue analyzer was used for tissue profile analysis (TPA) in order to measure the tissue characteristics of production samples. In order to measure the textural characteristics of pastille samples, the load of the device was set to 5 kg (50 newtons). Then, each of the samples was compressed to the percentage of the initial height by a cylindrical probe with a diameter of 5 mm and a movement speed of 60 mm/min

in two round-trip cycles and then decompressed [12].

2 repetitions were considered for each formula. The examined texture characteristics obtained from the force-deformation curve are:

Hardness: the maximum force required to compress the samples (equivalent to the height of the peak force in the first stage of compression).

Continuity: the ability to expand and increase the length of the sample before the tissue breaks, which is equivalent to the ratio (the area of the positive compression force in the second cycle to the first cycle) in the curve.

Phenrite (elasticity): the ability of the sample to return to its original shape after removal of the deforming force, which is in the curve equivalent to the distance that the food material recovers its original height over time.

Chewability: the work required to chew and knead the sample for swallowing [13].

2-3-3-sensory analysis

The evaluated sensory characteristics included color, taste, smell, mouthfeel and acceptability.

2-4- Statistical analysis

Chemical and sensory tests of treated samples were performed in 3 repetitions on 3 different days. The results obtained were statistically analyzed by SPSS software.

3. Results and Discussion

3-1- Brix test

Figure 1 shows the comparison of the average test treatments on the Brix level of pastille samples examined in this research. As can be seen, with the increase in the level of pectin in the formulation prepared from pastille, the amount of brix of each sample has increased significantly at $P<0.05$. The results obtained from the statistical analysis show that the highest amount of Brix (14.62) corresponds to the sample containing sugar with a ratio of 5 gelatin to 5 pectin, and the lowest amount of Brix (11.04) corresponds to the sample The sample contains isomalt with a gelatin ratio of 10.

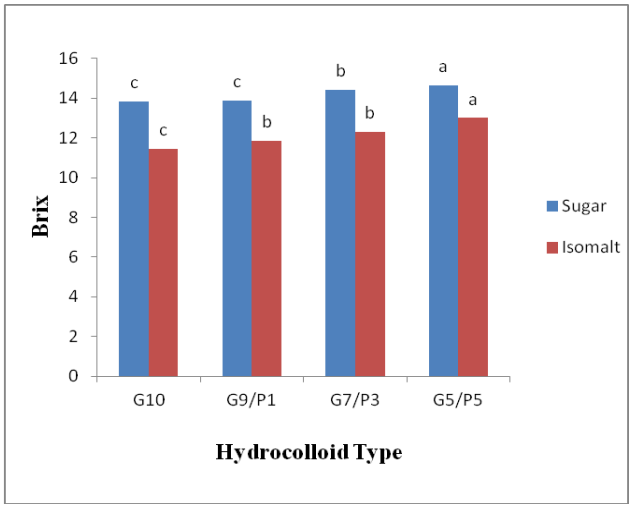

Fig 1 The effect of Type and ratio of Hydrocollooid on Brix Content

The results of comparing the average effects of the experimental treatments on the Brix content of the samples tested by Duncan's method showed that the sample containing isomalt with a ratio of 9 gelatin and 1 pectin had a significant difference with the sample containing sugar in the same ratio and were better samples. While there was no significant difference between the other experimental treatments in terms of the studied trait. As in Figure 1-4, it can be seen that the amount of brix of samples containing sugar was higher than that of samples containing isomalt. On the other hand, pectin can increase the viscosity, stability and consistency, as well as improve the suspension of substances in food systems, and it can be used specifically for the production of gel [14]. Koshki et al. (2009) during a study reached the conclusion that the amount of pectin in the formulation and the concentration temperature have an effect on the Brix level of the final product (tomato concentrate)[15]. In addition, Mohammadi et al. (2008) stated that by increasing the level of pectin in the formulation of green pistachio skin marmalade, the Brix of the final product increases. These researchers pointed out that the excessive increase of pectin and pistachio green skin in the marmalade formulation causes an excessive increase in the brix and hardness of the product, and it goes out of the acceptable range for acceptance by the consumer and reduces its marketability. 16].

2-3-humidity test

Figure 2 shows the comparison of the average test treatments on the moisture content of pastille samples examined in this research. As

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can be seen, with the increase of pectin level in the formulation prepared from pastille, the moisture content of each sample decreased significantly at the level of 5%. In such a way that the results obtained from the statistical analysis revealed that the highest amount of moisture (2.16) corresponds to the sample containing isomalt with a gelatin ratio of 10 and the lowest amount of this parameter (**83/0**) was related to the sample containing sugar with a ratio of 5 gelatin to 5 pectin.

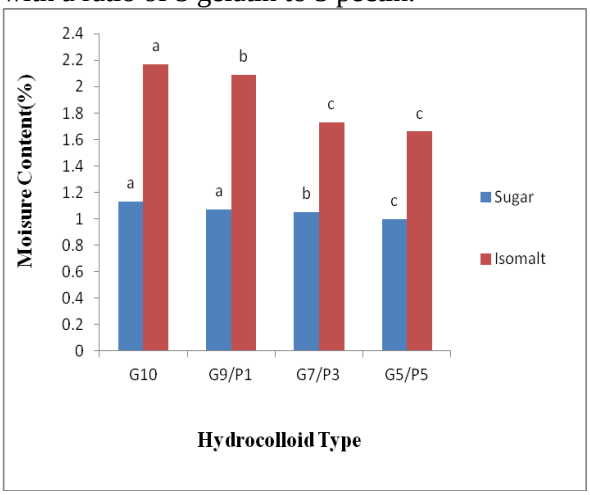

Fig 2 The effect of Type and ratio of Hydrocollooid on Moisture Content.

The results of the comparison of the average effects of the test treatments on the moisture level of the samples tested by Duncan's method showed that the sample containing isomalt with a ratio of gelatin 9 to pectin 1 and also the sample containing isomalt with a ratio of gelatin 7 to 3 also have a significant difference from the sample containing sugar. It was in the same ratio. While there was no significant difference between the other test treatments in terms of the examined trait. As in Figure 2-4, it can be seen that the moisture content of the samples containing isomalt was higher than the samples containing sugar, the reason for this can be attributed to the presence of sugar alcohol isomalt. in pastille formulations because sugar alcohols tend to hold water in their structure due to their hydroxyl groups [17]. The results of the experiments showed that the best amount of sugar replacement with the best moisture content is the use of samples containing isomalt with a ratio of 9 gelatin to 1 pectin, and these results were similar to the findings of Renda et al. and Faridah's group (2012). Other researchers, including Khalilian et al. (2013) and Shahidi et al. (2014) stated in their research works that increasing the concentration of hydrocolloids increases the binding intensity of water molecules and ultimately decreases the water activity of the samples [18 and 19].].. Pectin gel consists of a three-dimensional network that holds water, sugar and other soluble substances. The available connections are of hydrogen and hydrophobic type [20]. On the other hand, in the formation of pectin gel network, hydrophobic interactions between methyl groups are very important (pectins with a high degree of esterification) and because more than half of the hydrophilic carboxylic groups have been changed to hydrophobic ester groups, contact with Polar water molecules are reduced, which can be a factor in reducing water content with increasing pectin concentration [21].

3-3- acidity test

Figure 3 shows the comparison of the average test treatments on the acidity of pastille samples examined in this research. As can be seen, with the increase in the level of pectin in the formulation prepared from pastille, the acidity of each sample has increased significantly at $P<0.05$. The results obtained from the statistical analysis show that the highest level of acidity (33.87) corresponds to the sample containing isomalt with a ratio of 5 gelatin to 5 pectin and the lowest level of this parameter (26.04). , is related to the sample containing sugar with a gelatin ratio of 10.

The results of comparing the average effects of the test treatments on the acidity of the samples tested by Duncan's method showed that the sample containing isomalt with a ratio of 9 gelatin and 1 pectin was significantly different from the sample containing sugar in the same ratio. While there was no significant difference between the other experimental treatments in terms of the examined traits. As can be seen in Figure 3-4, the acidity of the samples containing isomalt was higher than the samples containing sugar. Parand, in a research, Mazaheri Tehrani and colleagues (2005) used lime waste, which has been debittered and is a rich source of pectin, to prepare marmalade and a kind of drink. These researchers came to the conclusion that the use of pectin can increase the acidity of production samples. Of course, it is important to mention that the highest increase in acidity of the samples produced by these researchers was

related to the presence of acid in the pulps used in the waste [22].

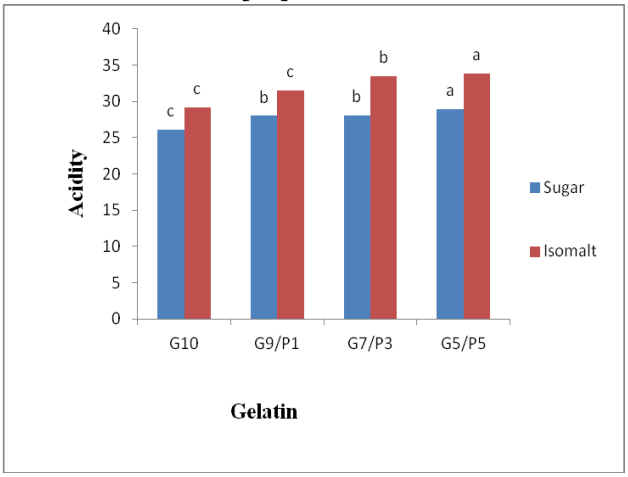

Fig 3 The effect of Type and ratio of Hydrocollooid on Acidity

3-4- Difficulty test

Figure 4 shows the comparison of the average test treatments on the hardness of pastille samples examined in this research. As can be seen, with the increase in the level of pectin in the formulation prepared from pastille, the hardness of each sample increased significantly at the level of 5%. In such a way that the results obtained from the statistical analysis revealed that the highest level of difficulty (**66/4**(corresponds to the sample containing sugar with the ratio of gelatin 5 along with pectin 5 and the lowest amount of this parameter)**45/2**) was related to the isomalt sample with 10 gelatin ratio.

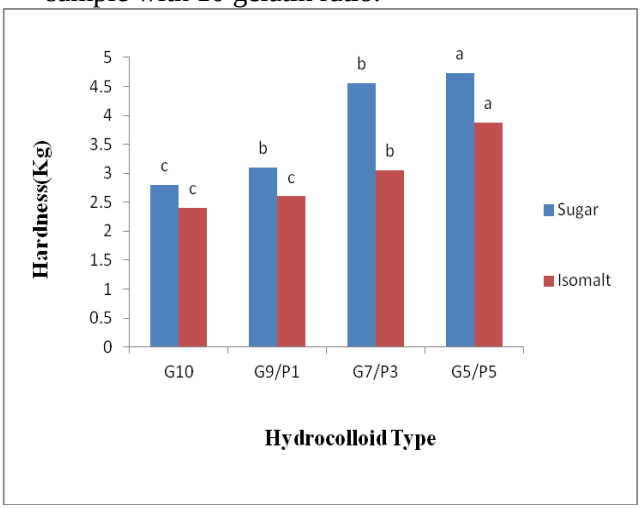

Fig 4 The effect of Type and ratio of Hydrocollooid on Hardness

The results of comparing the average effects of the test treatments on the hardness of the samples tested by Duncan's method showed that the sample containing isomalt with a ratio of 9 gelatin and 1 pectin was significantly different from the sample containing sugar in the same ratio and were better. While there was no significant difference between the other experimental treatments in terms of the studied traits. As can be seen in Figure 4-4, the hardness of samples containing sugar is higher than that of isomalt. Isomalt sugar alcohol has high solubility in water and more moisture retention properties at high temperatures than sugar, as a result, it has a greater tendency to bond with water. This property reduces the number of bonds between the gluten network and water molecules and creates a softer texture [23]. Logfran et al. (2006), with the research they conducted on the microstructures and kinetics of the rheological behavior of pectin gels, stated that one of the characteristics of pectin gel is the creation of a continuous and dense network structure [24]. Also, Tolstokhzov (1991), the reason for creating a continuous and dense phase of pectin gels was their strong tendency to create many interactions with water molecules[25]. Bland et al. (2006) investigated the rate of strawberry odor release and flavor emergence in gelatin and pectin gels, and pectin gels showed more power in odor release and flavor emergence. An increase in the concentration of pectin and gelatin led to an increase in the firmness of the gel, which reduced the rate of flavor release, and finally, the perception of the smell and taste of strawberry and sweetness decreased [26]. Demars and Ziegler (2001) investigated the texture and structure of gelatin-pectin mixed gel composition under the title of confectionery gums and produced different soft, hard, brittle and rubbery gel compositions. In this study, gels mixed with pectin and gelatin showed fruity, sweet and spicy flavors compared to gelatin gels. The results of this research showed that the addition of pectin causes fragility, reduced chewiness and greater smoothness of the gelatin gel structure [27].

3-5-Continuity test

In Figure 5, the comparison of the average test treatments on the consistency of pastille samples examined in this research is shown, as can be seen, with the increase in the level of pectin in the formulation prepared from pastille, the degree of consistency of each of the samples to It increased significantly at the

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level of 5%. In such a way that the results obtained from the statistical analysis revealed that the highest degree of consistency (1.39) is related to the sample containing sugar with a ratio of 5 gelatin to 5 pectin and the lowest amount of this parameter (**002/1**) was related to the sample containing isomalt with a gelatin ratio of 10.

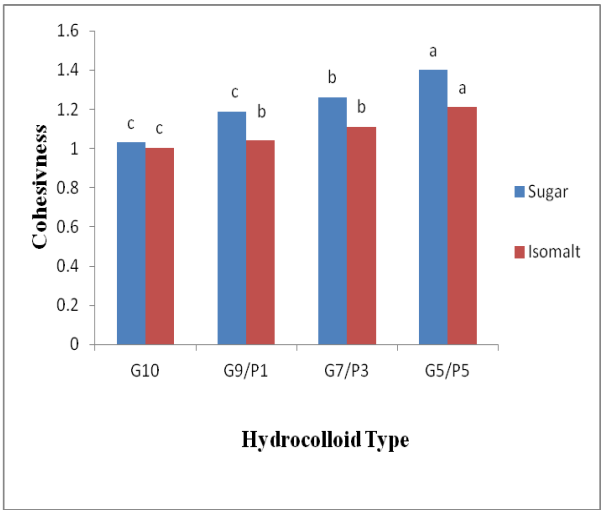

Fig 5 The effect of Type and ratio of Hydrocollooid on Cohesivness

The results of comparing the average effects of the test treatments on the consistency of the samples tested by Duncan's method showed that the sample containing isomalt with a ratio of 9 gelatin and 1 pectin had a significant difference with the sample containing sugar in the same ratio and were better. While there was no significant difference between the other experimental treatments in terms of the studied traits. As in Figure 5-4, it can be seen that the consistency of samples containing sugar is higher than that of isomalt. Continuity is the internal resistance of the food structure and its extent depends on the extent of intramolecular interactions of the formulation components. Due to the increase in brix of the samples containing sugar, the strength of the final gel increased, therefore the hardness and cohesion of the texture of the sugar samples increased, and finally the components of the formulation come into contact with each other more strongly. Hernandez et al. (1999) pointed out that the change in tissue consistency in gels made from strawberry pulp and gelatin depends on the concentration of hydrocolloid used and fruit pulp. In the research of these researchers, the increase of fruit pulp or the decrease of hydrocolloid concentration had a negative effect on the consistency of the final tissue of the gel [28].

3-6-chewing ability

Figure 6 shows the comparison of the average test treatments on the chewability of pastille samples examined in this research. As can be seen, by increasing the level of pectin in the formulation prepared from pastille, the amount of chewability of each sample increased significantly at the level of 5%. In such a way that the results obtained from the statistical analysis revealed that the highest amount of chewability (19861/895) is related to the sample containing 5 gelatin and 5 pectin with sugar and the lowest amount of this parameter (9232/655) , was related to the sample containing gelatin with isomalt ratio of 10.

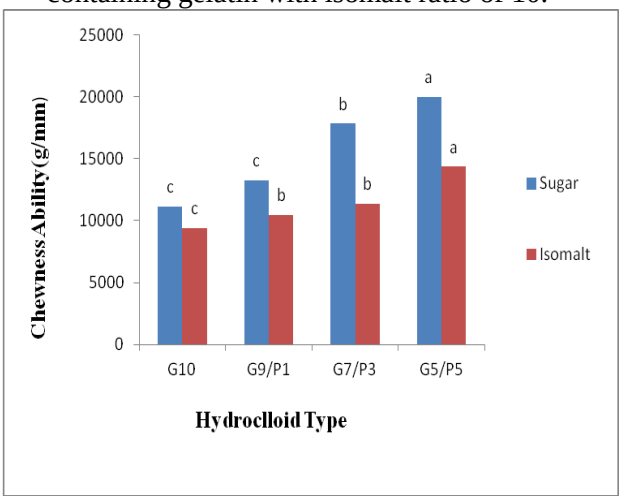

Fig 6 The effect of Type and ratio of Hydrocollooid on Chewiness

The results of comparing the average effects of the test treatments on the chewability of the samples tested by Duncan's method showed that the sample containing isomalt with a ratio of 9 gelatin and 1 pectin was significantly different from the sample containing sugar in the same ratio and was a better sample. While there was no significant difference between the other experimental treatments in terms of the examined traits. In Figure 6-4, the amount of chewability of samples containing sugar is higher than that of isomalt, which leads to an increase in the hardness of the texture, which leads to an increase in chewability. As mentioned in the tissue stiffness discussion, pectin seems to play a major role in tissue stiffness. Boland et al. (2006), stated that the time to chew the gel before swallowing significantly increased with the hardness of the gel, and harder gels were chewed for a longer time. Therefore, as mentioned before, in

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production samplesWithIncreasing the amount of pectin, the chewing ability of the tissue has increased [26]. Khalilian et al. (1389), also mentioned the same thing and directly and significantly evaluated the effect of pectin amount on the chewability of cantaloupe pastille tissue. They stated that the textural parameters of cantaloupe pastille are not only affected by the nature of the components and the interaction in the formulation, but other characteristics, especially the moisture level of the samples, can affect these parameters [29]. By examining the moisture changes in the samples, it was found that with the increase in the level of pectin, the moisture of the samples decreased and with the increase of the amount of xanthan, the moisture of the samples increased, it can be said that the effect of pectin and xanthan in addition to the effect of zinc on molecular interaction Formulation components can also affect the moisture content of samples.

3-7- Phenrite (elasticity)

Figure 7 shows the comparison of the average test treatments on the amount of fenrite of pastille samples examined in this research. As can be seen, with the increase in the level of pectin in the formulation prepared from pastille, the amount of fenrite of each sample has increased significantly at P<0.05. so that the results obtained from the statistical analysis show that the highest amount of Fenrite (**17/9**), corresponds to the sample containing sugar with a gelatin ratio of 10, and the lowest amount of this parameter (**30/6**), is related to the sample containing isomalt with a ratio of 5 gelatin to 5 pectin.

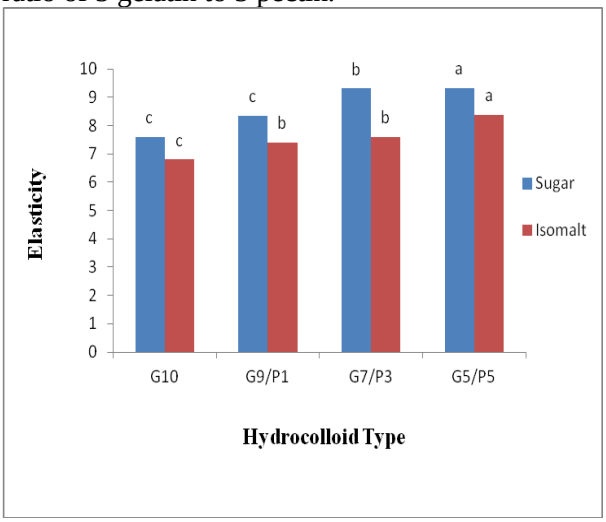

Fig 7 The effect of Type and ratio of Hydrocollooid on Springness

The results of the comparison of the average effects of the test treatments on the amount of fenrite of the samples tested by Duncan's method showed that the sample containing isomalt with a ratio of 9 gelatin and 1 pectin was significantly different from the sample containing sugar in the same ratio and was a better sample. While there was no significant difference between the other experimental treatments in terms of the examined traits. As in Figure 7, it can be seen that the amount of fenrite in samples containing sugar is higher than that of isomalt. The results of this research indicate that the characteristics of firmness, consistency, chewability and springiness have a close relationship with each other. Application of mixed hydrocolloids, usually non-gelling and viscosifying agents are used with gelling agents to increase viscosity or create better properties such as greater elasticity in gels [30]. Setser reported in 2013 that the greater the reactivity between the polymer components, the reduced solubility generally leads to the formation of spring-like, rubbery gels. Lazarid et al. (2007) reported the highest elasticity of gluten-free bread dough in samples containing 1 and 2% carboxymethyl cellulose [31]. The use of CMC in meat products increased the elastic modulus [32].

3-8-Color

Figure 8 shows the comparison of the average test treatments on the amount of color of pastel samples examined in this research. As can be seen, with the increase in the level of pectin in the formulation prepared from pastille, the amount of color of each sample has increased significantly at P<0.05. The results obtained from the statistical analysis show that the highest color score (5) corresponds to the sample containing 10% gelatin and the lowest value of this parameter (2) corresponds to the sample containing a mixture of 5% gelatin and 5% pectin. In both cases, it is sugar and isomalt.

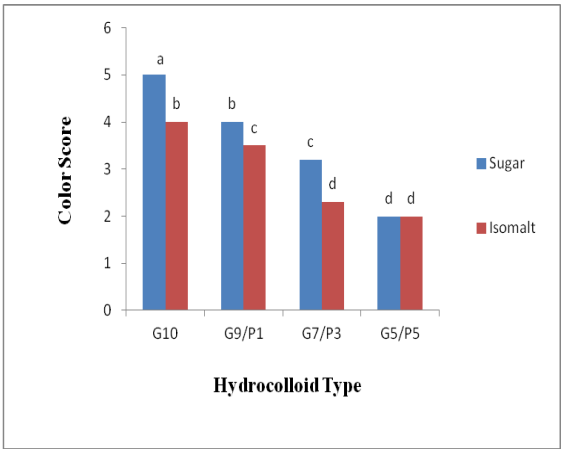

Fig 8 The effect of Type and ratio of Hydrocollooid on Color Score

The results of the comparison of the average effects of the test treatments on the color of the tested samples by Duncan's method showed that sugar and isomalt samples with equal concentrations of gelatin and pectin did not differ significantly from each other ($p>0.05$) (color is the first thing that customers notice It is attracted to it and it is one of the most important quality factors of food, and this observation often creates a background for other quality factors such as taste or smell.

9-3-taste

Figure 9 shows the comparison of the average test treatments on the taste of pastille samples examined in this research. As can be seen, by reducing the level of pectin in the formulation prepared from pastille, the taste score of each sample has increased significantly at $P<0.05$. The results obtained from the statistical analysis show that the highest amount of taste (5) corresponds to a sample without pectin and the lowest amount of this parameter (2) corresponds to the sample containing 5% pectin along with 5% gelatin. . The results of the comparison of the average effects of the test treatments on the taste of the tested samples using Duncan's method showed that sugar and isomalt samples were not significantly different from each other in all concentrations of hydrocolloids ($p>0.05$).

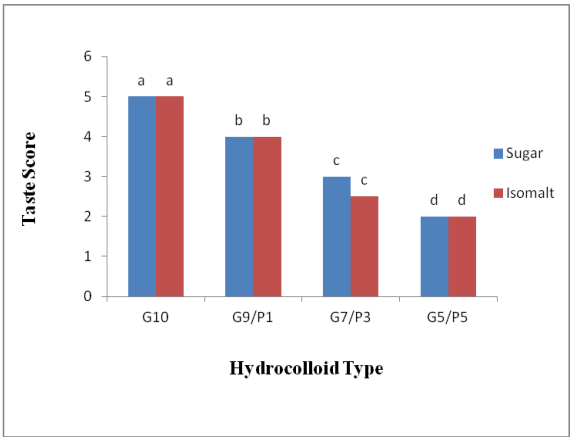

Fig 9 The effect of Type and ratio of Hydrocollooid on Taste Score

Perception of taste in the brain is a combination of two senses of smell and taste, so taste depends on two main compounds, volatile (aroma) compounds that are sensed by the taste buds on the tongue. In food, various factors may affect the release of volatile components in addition to taste. Many studies to investigate Taylor et al. (2001) showed that the release time of most flavor substances is different in textures with different degrees of hardness. The higher the hardness of the texture, the longer is the release time of flavoring agents. Taste perception in gel systems depends on the texture and the type of gelling agent. For example, in different gel textures with similar hardness, different perception of sweetness intensity has been reported [33].

Holwood (2002), reported that the perception of texture firmness affects the perception of taste. In other words, when the evaluator understands the firmness of the texture, he neglects the feeling and perception of sweetness and fruity aroma [34].

Reynard (2006) also stated in relation to the relationship between the gel structure, its texture and taste perception that the intensity of the perceived taste increases with the decrease in gel hardness. In other words, in jellied foods, gelling agents react with aromatic substances and create an obstacle for the diffusion and penetration of aromatic substances in the vapor phase [35]. Softer jellies have the ability to release larger amounts of aromatic compounds than have harder jellies [26]. Studies by researchers show that aroma release is not an effective factor in taste perception and taste has a greater effect on taste perception [26].

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Examining the results of sensory evaluation showed that the effect of variables on aroma was not significant, but the data showed that the lowest amount of aroma was related to the sample containing the highest amount of hydrocolloid, which is consistent with the mentioned contents.

3-10- was

Figure 10 shows the comparison of the average test treatments on the odor of pastille samples examined in this research. As it can be seen, with the reduction of pectin level in the formulation prepared from pastille, the amount of smell of each of the samples has increased significantly at P<0.05. The results obtained from the statistical analysis show that the highest amount of odor (5) corresponds to the sample containing 10% gelatin and the lowest amount of this parameter (2) corresponds to the sample containing 5% pectin along with gelatin. 5% is both sugar and iso malt.

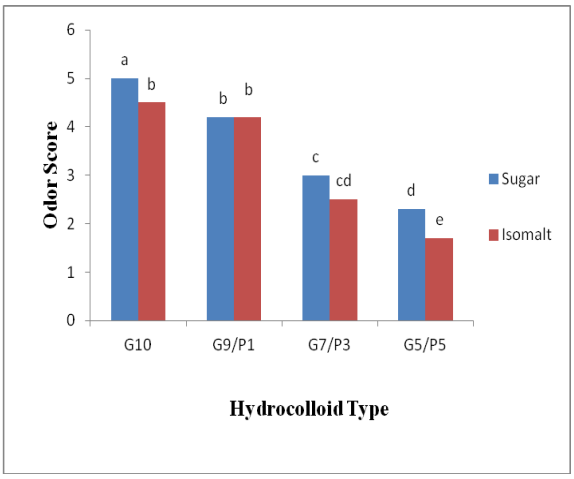

Fig 10 The effect of Type and ratio of Hydrocollooid on Odor Score

The results of comparing the average effects of the test treatments on the odor of the samples tested by Duncan's method showed that the sample containing 10% gelatin with sugar has the highest odor score, while the sample containing a mixture of 5% gelatin and 5% pectin prepared with isomalt has the lowest odor score. They gave.

3-11-oral sensation

Figure 11 shows the comparison of the average test treatments on the mouth feel of pastille samples examined in this research. As can be seen, with the increase in the level of pectin in the formulation prepared from pastille, the amount of mouthfeel of each of the samples has decreased significantly at P<0.05. The results obtained from the statistical analysis show that the highest mouthfeel (5) is related to the sample containing 10% gelatin with both sugar and isomalt compounds.

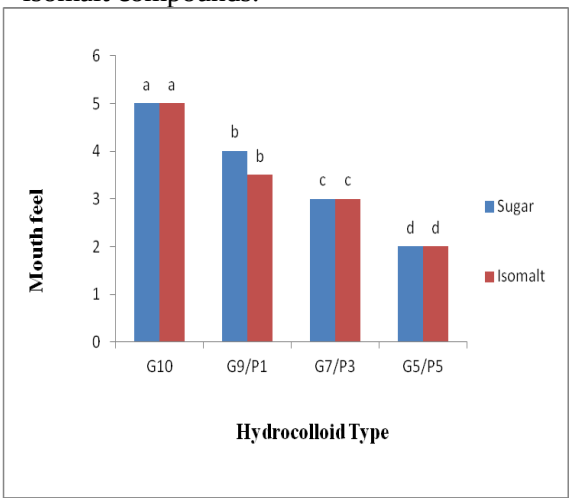

Fig 11 The effect of Type and ratio of Hydrocollooid on Mouth Feel

3-12-General acceptance

Figure 12 shows the comparison of the average test treatments on the overall acceptance rate of pastille samples examined in this research. As can be seen, with the increase in the level of pectin in the formulation prepared from pastille, the overall acceptance rate of each sample has increased significantly at P<0.05. In such a way that the results obtained from the statistical analysis show that the highest overall acceptance rate (5) is the sample containing 10% gelatin with sugar.The results of the comparison of the average effects of the test treatments on the overall acceptance rate of the samples tested by Duncan's method showed that the sample contained 10% gelatin with sugar. While there was a significant difference between the other experimental treatments in terms of the studied trait.

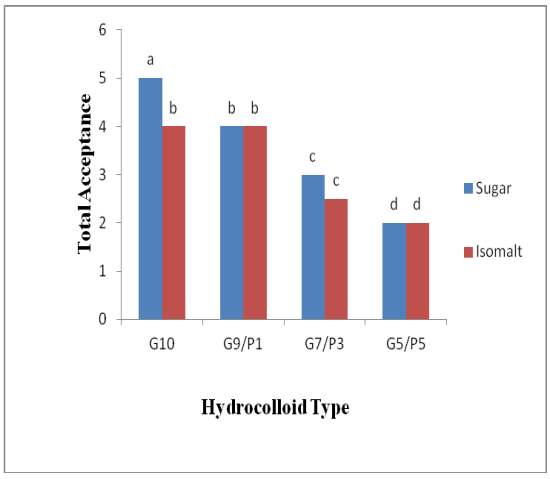

Fig 12 The effect of Type and ratio of Hydrocollooid on Total acceptance

Based on this research, it was determined that the results related to the examination of the tissue sample by the sensory evaluation method and the tissue profile analysis by the device method in relation to the effects of gelatin and pectin on all tissue attributes showed a similar trend, and this indicates that the results by the device method Goodness refers to the textural characteristics of production samples. In most of the researches, a good correlation of sensory device data obtained from tissue evaluation has been observed [36 and 37].

4 - Conclusion

Snacks based on fruits and vegetables are products that are highly accepted by consumers due to their small volume, high nutritional value, and good appearance. In this research, the effect of adding different concentrations of gelatin and pectin was investigated in order to prepare the useful spring orange pastille. Also, the examination of the physicochemical results (brix, acidity, moisture) and textural properties (hardness, cohesiveness, phenrite, chewability) of pastille shows that the samples containing isomalt with a ratio of gelatin 9 and pectin 1 were introduced as the best samples because of this. which had no negative effect on the textural properties and physicochemical properties of pastilles. According to the results of this study, it is possible to recommend the combination of isomalt and orange juice as a suitable substitute for sugar in pastille formulation to produce a useful product.

5- Resources

[1] Maghalli Kia, H., A witness,F., Khalilian,S., Mohammad Sani,A.2013. Effect of Arabic gum and emulsifier on moisture content, water activity and color parameters of soy milk pastilles.21st National Congress of Food Science and Technology of Iran .

[2] Maghsoudi,S. 2009. Candy and chocolate making technology. Agriculture Science Publication .258.

[3] Mahmodi, P., Tavakoli Poor, H., 2015.Evaluation of the effect of gelatin and guar hydrocolloids and date juice as a natural sweetener on the textural, color and sensory parameters of fruit pastilles based on kiwi puree. 21st National Congress of Food Science and Technology of Iran.

[4] Batu, A. and Kirmac, B. 2009. Production of Turkish delight (lokum). Food Research International. 42: 1-7.

[5].Muzaffarian, W.A. 1998.Dictionary of Iranian plant names: Latin, English, Persian Contemporary Culture.

[6] A safe, H., Yazdani, D., Shahnazi, S.2006. Planting, Holding and Harvesting Medicinal Plants: A Practical Guide to Growing 40 Important Medicinal Plants in Iran. Jihad Daneshgahi (Shahid Beheshti University) .

[7] Boland,A., Delahunty, M,and Van, R.2004. Influence of the texture of gelatin gels and pectin gels on strawberry flavour release and perception, Food Chemistry, 96 :452–460.

[8] Azimi, N., Mortazavi, S.A., Basiri, S.2009.Effect of different concentrations of guar and gelatin on moisture content and.activity of fruit berry juice based on white berries.22st National Congress of Food Science and Technology of Iran .

[9].Rezaei, R., Shahidi, F., Elahi, M., Mohebbi, M. Nasiri Mahallati, M. 2012. Analysis of plum pastel tissue profile by sensory and instrumental methods and optimization of its formulation. Iranian Food Science and Technology Research.8(1):30-39.

[10].Demars, L., and Ziegler, G. 2000.Texture and structure of gelatin- pectin based gummy confections. Food Hydrocolloid.

[11] AACC. 2000. Approved Methods of the American Association of Cereal Chemists, 10th Ed.,Vol. 2. American Association of Cereal Chemists, St. Paul, MN.

[DOR: 20.1001.1.20088787.1401.19.132.1.4]
[DOI: 10.22034/FSCT.19.132.1]

[12] Rahimi Dogahi, P., Shahidi, F. 2.15.Investigation of the effect of different levels of agar and CMC on the textural characteristics of tomato pastilles. twenty-first National Congress of Food Science and Technology .

[13] Sadeghi, F., Shahidi, F.2013.Evaluation of different formulas of almond pastilles based on sensory features and image processing techniques.21st National Congress of Food Science and Technology of Iran.

[14] Hashemi,M.2004. Food Industry Culture.J amee Publication.

[15] Kooshki,M., Azizi, M.H., Hejazi, M.A. 2010.Production and sensory characteristics of tomato juice concentrate Iranian Journal of Food Science and Technology .7(26):99-108.

[16] Mohammadi Moghadam, T., Razavi, M.A., Malekzadegan, F., Shaker, a.2009. Investigation of Physico-chemical and sensory properties of pistachio green hull`s marmalade. . Iranian Food Science and Technology . 6(4): 1-10.

[17] Bakal, A. I. (1983). Functionally of combined sweeteners in several food applications. J of Chemistry and Industry, 18, 700-704.

[18] Khalilian, S., Shahidi, F., Mohebbi, M.Fathi, M. 2011 Apple Pastel Formulation and Evaluation of Different Formulas Based on Sensory Properties and Water Activity. Iranian Food Science and Technology Research .2(7):129-136.

[19] Khalilian,S., A witness,F., Elahi,M., Mohebbi,M., Sarmad,M.,Roshannejad, M.2011. Effect of different concentrations of pectin and xanthan on sensory properties and activity of fruit lozenges based on cantaloupe puree. Iranian Food Science and Technology Research , 7(3): 200-209.

[20] Chinachoti, P., 1995, Carbohydrates: functionality in food, American Journal of Clinical Nutrition, 61: 922-929

[21] Piotr P., 2004, Water as the determinant of food engineering properties. A review. Journal of Food Engineering, 61, 483–495.

[22] Mazaheri Tehrani ,M., salary ,A., Heidar, A. 2007. Detoxification of lemon processing waste for marmalade and beverage preparation.Iranian Food Science and Technology Research , Volume 2(2): 60-53).

[23] Tavakolipour , M., Mahmoudi P, .2015.Evaluation of the effect of date juice substitution and gelatin and guar hydrocolloids on physical, chemical and organoleptic properties of kiwi pastilles . 23st National Congress of Food Science and Technology of Iran.

[24] Lo¨ fgren, C. Guillotin, S. & Hermansson, A.-M. 2006. Microstructure and kinetic rheological behavior of amidated and non-amidated LM pectin gels. Biomacromolecules.7: 114–121.

[25] Farhanaki ,A., Nearby ,M., Mesbahi, G.R.2013. Characteristics and applications of hydrocolloids in food and medicine (gelatin, tragacanth, gum arabic, starch, modified starch and pectin). Iranian Agricultural Science

[26] Demars, L., and Ziegler, G. 2001. Texture and structure of gelatin- pectin based gummy confections. Food Hydrocolloid. 15, 643-653.

[27]Hernández, M. J., Durán, L., & Costell, E., 1999, Influence of composition on mechanical properties of strawberry gels.Compression test and texture profile analysis. Food Science and Technology International, 5(1), 79-87.

[28] Boland, A., Delahunty, M. & Van Ruth, M., 2006, Influence of the texture of gelatin gels and pectin gels on strawberry flavour release and perception. Food Chemistry, 96, 452–460.

[29] Khalilian, S., Shahidi, F., Elahi, M., Mohebbi, M. 2013. Investigation of tissue properties and acceptance of fruit pastilles based on cantaloupe puree and the relationships between them using response level methods and principal component analysis. Journal of Innovation in Food Science and Technology.18(2):85-195.

[30] Williams, P,A, and Phillips,G,O,2000,Handbook of hydrocolloid,Introduction to food hydrocolloids,Woodhead Publishing Limited and CRC Press LLC.

[31] Lazaridou, A. Duta, D. Pagageorgious, M. Belc, N. and Biliaderis, CG. 2007. Effects of hydrocolloids on dough rheology and bread quality parameters in gluten –free formulations. Journal of food engineering. 79: 1033-1047.

[32] Frans, H. M.2005. Use of CMC in processed products. US Patent: 490998.

[33]Taylor, A. J. Besnard, S. Puaud, M. & Linforth, R. S. T. 2001. In vivo measurement

[DOR: 20.1001.1.20088787.1401.19.132.1.4]

[DOI: 10.22034/FSCT.19.132.1]

of flavour release from mixed phase gels. Biomolecular Engineering. 17: 143–150.
[34] Hollowood, T. A. Linforth, R. S. T. Taylor, A. J. 2002. The effect of viscosity on the perception of flover. Chemical Senses. 27: 583- 591.
[35] Renard, D. Van De Velde, F.Vischers , R. W. 2006. The gap between food gel structure, texture and perception.Food Hydrocolloids.20:423-431.
[36] Boland, K. B., Persephoni G., Saskia, M. van, R. 2003.Influence of gelatin, starch, pectin and artificial saliva on the release of 11 flavour compounds from model gel systems, Department of Food and Nutritional Sciences, University College Cork, Western Road, Cork, Ireland.
[37] Barangou L. M., Drake M., Daubert C. R. and Foegeding E. A. 2006. Textural properties of agarose gels. Relation between rheological properties and sensory texture. Food Hydrocolloids, (20): 196-203.
[38] DiMonaco, R. Cavellam, S. Masi, P. 2008. Predicting sensory cohesiveness, hardness and springiness of solid foods from instrumental measuremens. Journal Of Texture Studies. 39: 129-149.

[DOR: 20.1001.1.20088787.1401.19.132.1.4]
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مقاله علمی_پژوهشی

تولید پاستیل فراسودمند بهار نارنج و بررسی خصوصیات فیزیکوشیمیایی و حسی آن

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چکیده

اسنک های بر پایه میوه و سبزی وگیاهان دارویی نسبت به سایر اسنک ها پـذیرش و جـذابیت بیشتری دارند. بهارنارنج، به دلیل وجود ترکیبات فراسودمند و تغذیـه ای شـرایط تولیـد ایـن محصول ارزشمند را فراهم نموده است. هدف از این پژوهش تولید فرآورده نوظهوری بر پایـه بهارنارنج، تحت عنوان پاستیل بهارنارنج، بود. بدین منظـور از مخلـوط ژلاتـین و پکتـین در نسبت های ۵/۵، ۹/۷،۱/۳ و ۱۰ درصد و ایزومالت و شکر به عنوان شیرین کننده استفاده شد. نتایج نشان داد که با افزایش میزان پکتین در فرمولاسیون، میزان رطوبت هریـک از نمونـه هـا کاهش و میزان اسیدیته و بریکس آن ها افزایش یافت. همچنین بررسی نتایج ویژگی های بافتی بیانگر آن است با افزایش میزان پکتین میزان سفتی، پیوستگی، فنریت و قابلیت جویدن افزایش یافت. با توجه به نتایج به دست آمده نمونه حاوی ایزومالت با نسبت ژلاتین ۹ به همراه پکتین ۱ قابلیت بهتری برای جایگزینی شکر برخوردار بود و بـا توجـه بـه خصوصـیات تغذیـه ای مناسب، این پاستیل به عنوان به ماده غذایی عملگر شناخته می شود.