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Replacing Sugar by Date Syrup in Gaz and Investigation of Texture Properties

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Abstract - Date Syrup is a natural sweetener that is suitable replacement for sugar in food stuffs formulation. In this Research Amounts of 25-100 percent of sugar in Gaz formulation were replaced with date syrup and to study effect of its use in product formulation, characteristics of texture, colour and sensory analyse of treatments were investigated. Statistical analyse of data was also done by SPSS software and Duncan test. The results of this research showed that amount of used date syrup in formulation had a significant effect on colour parameters (L^*, a^*, b^*), texture characteristics and sensory analyse of samples. By increase of date syrup in Gaz formulation, samples texture became softer than control sample and yellowness and redness index of samples were increased.

Key words -sugar, date syrup, Gaz

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I. INTRODUCTION

Due to the increasing rate of cardiovascular and cancer diseases and the complications and problems in using some of the foods containing sugar in the formulation, the intention to new foods which are modified by replacing their ingredients have been increased. Since sugar can cause diabetes (1) and plays a role in the improvement of heart disease, arteriosclerosis, mental illness, depression, aging and hypertension (2) and interferes with absorption of calcium and magnesium and protein (3). Also sugar is considered as the factor increasing obesity and decreasing enzyme function (4). Thus, using natural sweeteners instead of sugar in food formulations can be a good method. Date Syrup that produces from date is one of the suitable replacements that can be used for this purpose. Dates (*Phoenix dactylifera* L.) are significant product in hot desert regions of world and are marketed as high-value fruit (5) Iran which produces 18 percent of global date production, is a major date producing country (6). Dates are served as a

source of calories with about 78% carbohydrates 2-3% proteins and 1% fat (7). Date consumption is an important source of supplying vitamin and mineral in a balanced nutrition regime (8). Date has anti tumour activity, antioxidant and anti-mutagenic properties (9). Some studies have been carried out to use low quality dates to develop new products. The low quality date is a rich source of carbohydrates composed mainly of sugars and dietary fibres or used a date of good quality to product some products such a bakery, drink, jam and the confection (10). Research showed that when dates are eaten alone or mixed meals with plain yoghurt have low glycemic indexes (9). Larger parts of the carbohydrates in dates are in the form of fructose and glucose (11). Polysaccharide isolated from dates has an antitumor activity (12). High fructose syrup and liquid sugar can be produced from date syrup (11). Date syrup is a product obtained from matured which about 67-72% solid concentration consist to 95% reducing sugar (12, 13). Date syrup is a high energy food rich in carbohydrate, a good

source of minerals; but it is also contains a very complex mixture of other saccharides, amino and organic acids, polyphenols and carotenoids (9). The ingredients of date syrup depend on the type of date, but generally date syrup contains fructose, glucose, moisture and small amount of sucrose, protein, pectin, and calcium (12). Date syrup being used in the preparation of some traditional and industrial foods (13, 14). The Date syrup is directly consumed or used as an ingredient in some food formulation such as ice cream products, drink, confectionery, bakery products, bakery products, sesame paste/date syrup blends, jam and butter (15). One of the popular traditional confections of Iran is Gaz. it is made from egg white, rosewater, sugar, pistachios or almonds. It is a delicious sweet and many Iranian peoples enjoy eating it. The purpose of this study is the use of date syrup as a suitable replacement of sugar to reduce the harmful effect of sugar and improve the sensory characteristic of Gaz and investigation of effect of using date syrup to production a Gaz.

II. MATERIALS AND METHODS

2.1 Raw material

In this research, to produce Gaz, sugar 35%, glucose 46%, honey 4%, honey 3%, rosewater 5% and egg-white 7% were used and date syrup of formulation was supplied from Brojen Sybasan Company. To provide research treatments, amounts of 25-100 percent of sugar existing in Gaz were replaced by date syrup.

2.2 The physical, chemical characteristics of date syrup

Parameters evaluated for date syrup were pH, performed on a digital pH meter. Special gravity, was measured using a pycnometer, turbidity, were evaluated by turbid meter. Dry matter was determined by the AOAC method 934.01(16). Ash was determined by igniting a weighed sample in a muffle furnace at 550° c to constant weight, and extract was measured by the method of AOAC (17).

2.3 Study of texture characteristics

In this research, texture profile analysis (TPA), cutting and punch tests was used to study texture characteristics of product and to consider effect of adding date syrup to Gaz formulation. Also, to study difference between samples, their hardness, gaminess and chewiness factors were specified by Texture Analyzer CT3 model.

2.4 Study of sample colour

An EOS Canon digital camera was used to record the digital images, the images were saved as JPEG images and then Adobe Photoshop used for analysis colour parameters (L^* , a^* , b^*).

2.5 Sensory evolution

Samples of Gaz were assayed for sensory preference test in a hedonic scale of 9 points, where 1 (one) was for disliked very much and 9 (nine) for like very much according to stone and sidle The evaluators were asked to drink water after eating any of the previous samples to

omit the effect of their previous evaluations on new evaluations. The samples were presented to each assessor separately so that their evaluations do not affect each other's opinions (18).

2.6 Statistical analysis

Statistical analyses were conducted using SPSS VERSION 18.0. One-way analysis of variance (ANOVA) was conducted and Duncan test was used to determine the differences between treatment means ($p < 0.05$).

III. RESULTS AND DISCUSSION

3.1 Characteristics of date syrup

The date syrup physical and chemical characteristics were studied. Results are shown in Table1. According to this table the major part of date syrup sugar is reducing sugar and the amount of sucrose of date syrup is low. The major sugars of date syrup are fructose and glucose. These sugars have more advantages in comparison with sucrose on health, natural and high in sweetness (19).

Table 1. physical and chemical characteristics of date syrup

Dry matter (%)	72.1
Ash (%)	1.69
Specific gravity	1.36
pH	4.20
Turbidity	76.3
Total sugar	70.27
Reducing sugar	67.97
Sucrose	2.18

Rheological analysis of date syrup indicates the shear thinning behaviour and the flow index is less than one. Rheological properties of date syrup were investigated at various temperature, concentration and shear rate by Gabis, 2013. A shear thinning behaviour was observed for all concentration ($n < 1$). Flow curved were well described by the power law model and the power law model was suitable for describing the flow behaviour of date syrup since coefficients of determination were high (20).

Table2. Measurement of the rheological behaviour of date syrup according to power law model

	K	n	R^2
date liquid	23.93	0.99	0.99
syrup			

3.2 Effect of adding date syrup on treatments colour of Gaz

Study on colorants of date syrup showed that Melanoidin is the major part of colorant of date juice originating from maillard reactions between amino acids and reducing sugars. Another study indicated that alkaline degradation products of hexoses and iron-polyphenol complexes are the other colourants (13). Thus using date syrup in formulation of Gaz can change the colour of samples. Samples were evaluated to study effect of using date syrup on (L^* , a^* , b^*) color parameters. Related results

are presented in table 3. The results indicates that a*, b* factors increased and L* factor decreased because of adding date syrup in formulation. Since they are factor of a*, b* indicator of samples redness and yellowness index of samples containing date syrup is more than control samples and by increase of date syrup amount in formulation, L*parameter of samples has decreased, too. The Study of colour index parameters that are presented in table 3, indicates that there is a significant difference between various treatments in terms of said factors.

Table 3 Colour measurement of samples

	L	a	b
date syrup	51.37	21.89	22.98
Control sample	84.1 ^a .01	12.94 ^a .05	6.25 ^a 0.0
Sample %25	82.3 ^b 0.57	12.98 ^b .01	9.81 ^b 0.0
date syrup			
Sample %50	78.5 ^c 0	13.74 ^c .00	13.37 ^c 0.01
date syrup			
Sample %75	77.8 ^d 0.04	14.44 ^d 0.0	16.18 ^d 0.0
date syrup			
Sample %100	76.7 ^e .01	14.72 ^e .01	16.87 ^e 0.01
date syrup			

3.3 Texture characteristic of Gaz

3.3.1 Texture profile analyse test

One of the evaluation tests of samples texture characteristics is texture profile analyse test. In this test, hardness, gaminess and chewiness have been surveyed. Hardness factor in texture profile analyse test was studied between various treatments. Hardness indicates necessary force to press sample against molar teeth and represents essential force to achieve a certain transformation (21). Figure 1 show that is a significant difference between various treatments in terms of hardness. Maximum hardness in between said samples is related to control sample.

Another factor studied in this research is gaminess of samples. Gaminess is product of hardness in continuity and is related to gummy-sensory character and plasticity (22). Gaminess indicates essential energy rate for crush half-solid food stuff as long as prepared to ingest (21). Results obtained from comparison of samples gaminess in figure 2 shows that use of date syrup in Gaz formulation has been caused to decrease gaminess of Gaz samples. However, samples don't show any significant difference in terms of this.

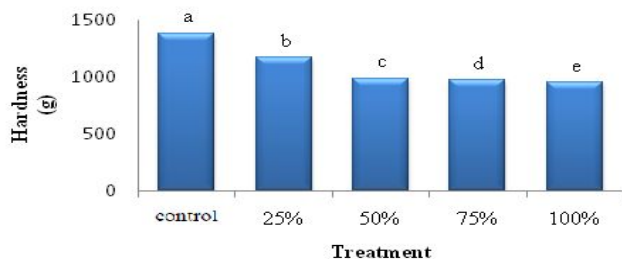


Figure1. Hardness of samples in texture profile analysis test

Chewiness is one of the studied factors in this test that means product of gaminess in elasticity and indicates necessary energy for palatal digestion and chewing of

solid food stuffs or the number of essential chewing to ingest certain amount of food stuff (21, 22) By increase of date syrup in formulation, chewiness of samples was decreased and from this view, samples showed a significant difference.

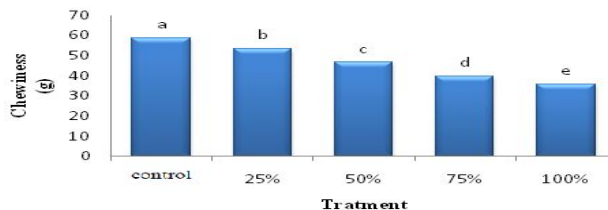


Figure3. Study of chewiness in texture profile analyze test of Gaz samples.

3.3.2 Punch test

Another test used for study of samples texture is punch test. Obtained results of this test that presented in Figure 4 indicate that by increase of date syrup in Gaz formulation, its hardness is decreased and Gaz samples become softer by increase of date syrup amount. With the view of hardness, there is a significant difference between various samples. Maximum hardness was related to control sample and Minimum hardness was observed in a sample containing 100% date syrup.

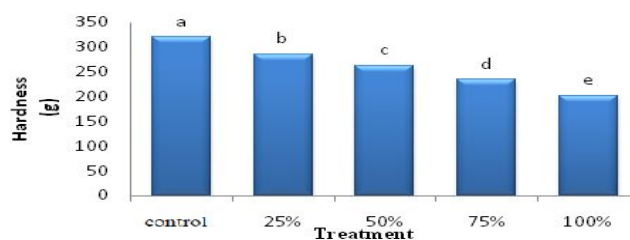


Figure4. Study of hardness in penetration test of Gaz sample containing date syrup

3.3.3 Cutting test

Study of cutting test among treatments containing date syrup indicated that hardness of samples has been increased by increasing date syrup in treatments so that minimum hardness was observed in a sample with 100% date syrup and maximum hardness was related to texture of check sample. In term of hardness, there is a significant difference between various samples.

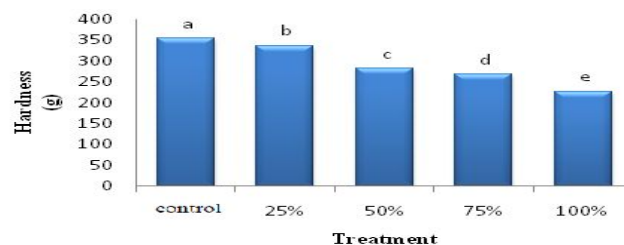


Figure 5. Study of hardness in cutting test of Gaz samples containing date syrup.

3.4 Sensory evaluation of Gaz

To study adding of date syrup in regard to acceptance and agreement of consumers, sensory characteristics of Gaz treatments were evaluated. Results showed that among related treatments there is a significant difference

in terms of sensory characteristics of Gaz. Between mentioned treatments, maximum score was related to sample with 50% date syrup that this sample had a large difference with a sample containing 75% date syrup and control sample and sample with 25% date syrup didn't show any significant difference, either.

Table4.Sensory evaluation of Gaz samples

Gaz sample	Score
Control sample	3.32 ^a ±1.01
Sample included %25 date syrup	3.34 ^a ±1.05
Sample included %50 date syrup	3.42 ^b ±1.01
Sample included %75 date syrup	3.40 ^b ±1.01
Sample included %100 date syrup	3.24 ^c ±1.04

Various letters indicate presence of significant difference in 95% level. (p<0.05).

IV. CONCLUSION

Obtained results from study of samples characteristics demonstrate that replacing sugar by date syrup in Gaz samples causes formation of softer texture of samples and measurement of hardness in tests related to texture confirmed this subject. Also, chewiness measurement of samples indicates that this factor (chewiness) is indicative of necessary energy for palatal digestion and chewing of solid food stuffs that in regard to become softer of samples, has been decreased. The study of samples colour shows that a sample of date syrup has fewer L* index than control sample that was caused to decrease the brightness of sample by increase of date syrup in formulation. a* and b* parameter of samples have also increased with regard to be higher of these factors in date syrup than control sample treatments. Study of sensory characteristics of samples also indicate that samples with 50, 25 and 75% date syrup had more acceptability than control sample in terms of general acceptance.

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