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Study of the effects of taranjebin gum on the process of producing chewing gums and evaluation of its qualitative properties

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ABSTRACT

Sweeteners are one of the most important ingredients of confectionery products including chewing gums. Synthetic sweeteners have harmful effects on the human body and/or may cause problems with respect to the texture of chewing gums. Therefore, in this research we have studied the possibilty of using the herbal sweetener Taranjebin (at the rates of zero, four, or five grams) in the production of chewing gums (chewing gum weight=25grams). We have conducted qualitative and sensory tests on the chewing gums, including the determination of their moisture, ash, total gum, sticking on the teeth, the sweetening power and its stability, the softness, and the desirability of the flavor of the sweeteners.The Complete Randomized Block Design was used for the statistical analysis of the results, and Duncan's Multiple Range Test was employed for comparing the means. The results showed that the chewing gum containing three grams of Taranjebin had the highest quality and the chewing gum with five grams of Taranjebin had the lowest quality. Using Taranjebin as an herbal sweetener together with other sweeteners such as Sorbitol, Xylitol, etc., will reduce the quantities of the synthetic sweeteners used and, at the same time, can improve the characteristics of chewing gums.

Keywords*:* Chewing Gums, Sensory Tests, Qualitative Tests, Taranjebin

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INTRODUCTION

Shelf-Life refers to the time length a food product can be kept after being produced or packaged during which time its desirable sensory, chemical, physical, microbial, and nutritional characteristics which are stated on its label will be preserved under the specified conditions. In general, consumers of confectionery products prefer those that are sweetened by sugar replacements because these products allow the consumers to lower their calory intake and control their body weight and also due to the fact that these products play a role in controlling diseases such as diabetes and in reducing blood sugar. Therefore, in using sweeteners, caution must be exercised so as not to exceed the permissible limits recommended by the responsible authorities [3].

Camel`s thorn, with the scientific name of Alhagi maurorum, is a small shrub from half a meter to one meter tall that spreads on the ground, is thorny, and has sharp floccules. The pods are flocculent, somewhat thick, curved, and spongy; the ovary is covered with silk filaments. The fruits are segmented and have a regular appearance. The roots penetrate deep into the ground to reach water [3, 4]. The seeds are red and of the dimensions of those of millet. Alhagi maurorum is distributed in the cities of Ardakan, Yazd, Bafgh, Mehriz, and Marv, and contains Saccharose

[4] and secretes a sugary compound named Taranjebin. Although this plant is found throughout Iran, Taranjebin cannot be extracted from it everywhere it grows.Taranjebin is a laxative, expectorant, antiseptic, and antimicrobial compound. It also soothes the chest [14, 16, 18], excretes burnt bile and phlegm, is a tonic for the stomach and the intestines [10, 11], decreases body heat and relieves internal inflammation, is used in nerve tonics [22], and is employed as a sweetener in pharmaceutical products [8,20]. The general features of camel's thorn are that it remedies spasms, is an appetizer, helps in food digestion, and its sweetener is not harmful to the teeth (and actually prevents tooth decay and decomposition) [26]. Taranjebin, when employed as a laxative, is used at the rate of ten to seventy grams (depending on age). Camel's thorn, if eaten in samall amounts, is a laxative. However, if taken in large amounts, it will act as a purgative [12, 13].

Our purpose in this research was to use the herbal sweetener Taranjebin at the rates of zero, three, four, and five grams to improve the qualitative and sensory characteristics of chewing gums.

MATERIALS AND METHODS

The chewing gum base, which was produced in Turkey, was obtained from the Monoo Company, the Taranjebin gum from the sales centers of traditional medicines (in the province of Khoraan Razavi, Nishabur City) , and sorbitol , xylitol , mannitol , glycerine , and lecithin were obtained from the Sigma Company. Taranjebin was added to the base formulations at the four rates of zero, three, four, and five.

(Sample gum weight was twenty five grams)

Table 1: Chewing gum formulation

Raw materials	Percentage by weight
Base gum	25 – 30
Sweetener	54 – 68
Lecithin	0.5
Glycerine	0.5
Flavoring	1

1. Chewing Gum Production

First, the chewing gum base was placed in a laboratory mixer and kneaded for six minutes at forty five degrees centigrade to prepare a sticky and soft paste. The mixture of sweeteners, the Taranjebin, the softener, the emulsifier, and the flavoring was then gradually added and mixed with the paste. After that, the chewing gum paste was kneaded, flattened, and molded to take the shape of small circular pieces. The prepared chewing gum samples were packaged in plastic bags and coded randomly. Qualitative and sensory tests were then conducted [5, 19, 21, 25].

2. Qualitative Evaluation

In this research, the moisture, ash, and total gum contents in all four chewing gum types were studied. All tests were conducted according to the standard method number 759 of the ISIRI (the Institute of Standards and Industrial Research of Iran) concerning the production of chewing gums.

3. Sensory Evaluation

Sensory characteristics of the chewing gum samples, including their stickiness on the teeth, their sweetening power and the stability of this power, the softness of their texture, and the desirability of the flavor of the sweetener were tested. Eleven trained evaluators were asked to evaluate the chewing gum samples. They gave the samples the scores of one to five for the degree of their sticking on the teeth (1= very sticky , 2 = a little sticky , 3= average stickiness , 4 = slightly sticky , and 5 = not sticky) , for the stability of the sweetener (1 = very little , 2 = little , 3= average , 4 = good , 5 = excellent) , for the sweetening power (1 = very little , 2 = little , 3 = average , 4= good , 5 = very good) , for the texture (1= very hard , 2 = hard , 3 = average hardness , 4 = softn , 5= very soft) , and for the desirability of the flavor of the sweetener (1= not desirable , 2 = little desirability , 3 = average desirability , 4 = desirable , 5 = very desirable). The results obtained from sensory tests were investigated and, taking the scores given by the sensory evaluators into consideration, the Complete Randomized Block Design was used to analyze these results. Duncan's Multiple Range Test and the software Minitab 16 were also used to compare the means. The qualitative tests were evaluated at the one percent and the sensory tests at the five percent probability level.

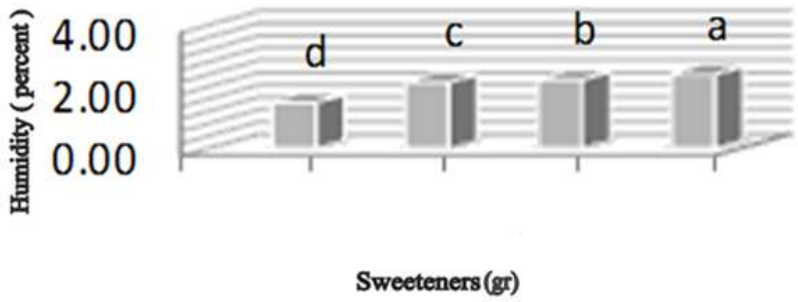
1. Qualitative Tests

A. Moisture

The moisture content of the chewing gums can be four at the maximum. As can be seen in Figure 1, there are significant differences between the chewing gum samples regarding moisture content. The more Taranjebin there is in the chewing gum, the greater the moisture content will be. In fact , the amount of moisture in Taranjebin will

change the moisture content of the chewing gums so that the more the Taranjebin content of the chewing gum is the more the moisture content of the chewing gum will be. Researchers have shown that glucose syrup can be added to food products to keep them fresh. This syrup has moisture-conserving properties and adding it to food products prevents them from drying during the period they are kept [17]. If more date liquid sugar is added to cakes as a replacement for other sweeteners, their moisture content will increase. This increase in moisture content is probably due to the competition among moisture absorbing constituents present in the formulation [1, 9, 23]. As more inulin is added, the moisture content will rise because of the presence of hydrophilic groups and due to the water absorption nature of inulin. Chewing gum samples with a high percentage of inulin had greater moisture contents [2].

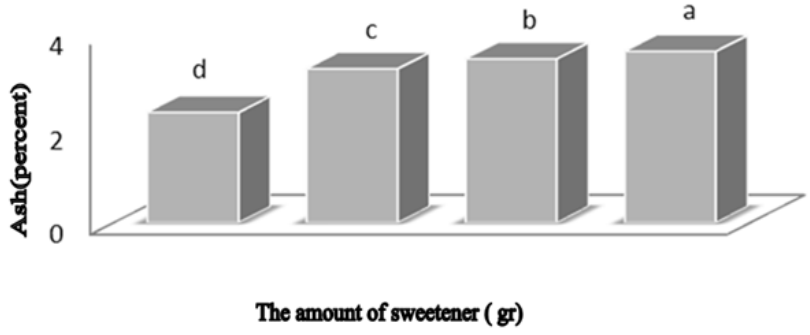
Figure 1: Changes in moisture content against the quantity of the Tatanjebin sweetener added to chewing gums produced



B. Ash

As is seen in Figure 2, there are significant statistical differences among the treatments concerning ash content. The more Taranjebin there is in a chewing gum, the more the ash content of the chewing gum will be. The ash content of Taranjebin is 5.7 percent; therefore, adding it to chewing gum formulations will increase the salt and mineral contents of chewing gums and, thereby, raises their ash content. Vahedi et al., in their research conducted in 2011, showed that when more permutite is added to chewing gum formulations their ash content increases. Generally, more ash is found in samples containing permutite because permutite is rich in mineral compounds [7].

Figure 2: Changes in ash content against the quantity of Taranjebin added to chewing gums



C. Total Gum

Figure 3 shows that there are statistically significant differences among the treatments with respect to total gum content. The total gum content of chewing gums rises when more Taranjebin is added to their formulations. In fact, Taranjebin is a gum secreted by the plant camel's thorn and hence, it can raise the total gum content of chewing gums.

Figure 3: Changes in total gum content against the quantity of Taranjebin added to chewing gums

RESULTS AND DISCUSSION

1. Sticking on the Teeth

As can be seen in Table 2, there are statistically significant differences among the treatments regarding the stickiness of the chewing gums on the teeth. With an increase in the Taranjebin content of chewing gums, the property of stickiness on the teeth poperty is intensified. This may be attributed to the greater moisture. The more the moisture content of the chewing gums is, the greater its property of stickiness on the teeth will be. The permutite content of chewing gums greatly affects this stickiness and, in general, this stickiness increases with a rise in the permutite content. There is a positive correlation between the permutite and the moisture contents in chewing gums so that when the permutite content is raised the stickiness increases [7].

Table 2: Study of the effects of different quantities of Taranjebin on the average stickiness of chewing gums

Quantity of the sweetener	S_1	S_2	S_3
Stickiness on the teeth	1.364^{c}	3^{b}	5^{a}

2. The Sweetening Power

It is observed that, with respect to the sweetening power, there are no statistically significant differences between the treatment in which four grams of Taranjebin is used and the treatments in which three and five grams of Taranjebin are added. However, there are statistically significant differences between the treatments of three and five grams of Taranjebin. Results obtained from the views expressed by the panelists (the 11 persons who evaluated the sensory qualities of the chewing gums) indicated that the sweetening power of Taranjebin is enhanced when more of it is added to chewing gums.

Table 3: Study of the effects of adding various quantities of Taranjebin on its average sweetening power in chewing gums

Quantity of the sweetener (grams)	S_1	S_2	S_3
Sweetening power	1.636^{b}	2.273^{ab}	2.545^{a}

3. Stability of the Sweetener after 30 Minutes of Chewing the Gum

In Table 4, no significant differences can be found between the treatments of using three or four grams of Taranjebin, but there are significant differences between the treatments in which five grams of Taranjebin are added to the chewing gums and those in which three or four grams of Taranjebin are used. Results obtained from the reports of the panelists also indicated that, in general, sweetening stability rises when more Taranjebin is used in chewing gums.

Table 4: Study of the effects of various quantities of Taranjebin on the average stability of the sweetener in chewing gums

Quantity of sweetener (grams)	S_1	S_2	S_3
Sweetener stability after 30 minutes	1.182^{b}	1.273^{b}	2.273^{a}

4. Softness of Texture

As can be seen in Table 5, there are significant differences between the treatments concerning texture softness. Results obtained from what the panelists reported showed that the chewing gums became softer when more Taranjebin was added to them. This can be mainly attributed to the moisture content as with a rise in moisture content the chewing gums become softer. In a research carried out by Ahmadi Gavlighi et al. (2010), it was observed that when more date liquid sugar was used in cakes their texture became softer [1]. Deverux et al. (2003) found that cake samples containing inulin were softer due to their higher moisture content [15].

Table 5: Study of the effects of various quantities of Taranjebin on the average softness of the texture of chewing gums

Quantity of sweetener(grams)	S_1	S_2	S_3
Softness of the textue	1.273^{c}	2.909^{b}	4.909^{a}

5. Desirability of the Flavor of Tarajebin

In Table 6, no significant differences can be observed between the treatments in which three and five grams of Taranjebin were used. However, the treatment in which four grams of Taranjebin were added to chewing gums was

significantly different from those in which three and five grams of Taranjebin were used. Results obtained from the reports of the panelists inidicate that the addition of four grams of Taranjebin to chewing gums is more acceptable than other treatments.

Table 6: Study of the effects of various quantities of Taranjebin on the average acceptability of its flavor

Quantity of sweetener (grams)	S_1	S_2	S_3
Desirability of the flavor of Taranjebin	1.818^b	2.364^a	2.273^b

CONCLUSION

A. The use of Taranjebin increases the moisture, ash, and total gum contents of chewing gums.
B. Taranjebin causes an increase in the degree of the stickiness of chewing gums on the teeth and in their softness and that is because it raises the moisture content of chewing gums.
C. The best treatments contained three and four four grams of Taranjebin.
D. It is possible to replace synthetic sweeteners by herbal ones in the mass production of chewing gums. Certain substances can be used to reduce the stickiness of chewing gums caused by the use of herbal sweeteners.
E. Herbal sweeteners may also be used together with synthetic ones to save on the consumption of synthetic sweeteners and even to improve the characteristics of chewing gums.

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