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USE OF DATE SYRUP AS A SWEETENER IN NON ALCOHOLIC BEER: SENSORY AND RHEOLOGICAL ASSESSMENT

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ABSTRACT

Date is one of the important fruits in Middle East especially around the Persian Gulf. Iran is one of the highest producers of this fruit the world. In this study, the effect of using bleached date syrup as a substitutive of glucose syrup in the formulation of original beer (non-alcohol) the physical and sensory characteristics was investigated. Glucose in original beer (5 percent glucose) based on its dry mater substitution by 25:50:75 and 100 percent bleached date syrup. The results showed that by substitution 25 percent date syrup the viscosity of non alcoholic beer was minimum and the maximum viscosity obtain by replacing 50 percent date syrup. The best color was obtained in level 25 and 50 percent. Sensory Data analysis indicated that glucose replacement in 50 percent level has no significant effect on sensory acceptance the highest score obtained 75 percent glucose syrup replaced by date syrup.



Keywords: Non- alcoholic beer, date syrup, viscosity, color, glucose syrup, rheology

INTRODUCTION

Sucrose is the most common sweetener used in a variety of beverages. The white crystalline substance we know as sugar produced from sugar cane or sugar beets. Sucrose causes certain health problems such as hypertension, heart disease, tooth decaying, obesity, hormones imbalance, body damage to the adrenal glands and pancreas, increased anxiety and increased blood glucose levels and insulin, that are particularly harmful for diabetes. On the other hand, due to technological and economic problems ever-increasing researches and projects on replacing these kinds of sweeteners with other kinds have been conducted (Foulkes, 1977). Date is one of the important fruits in Middle East especially around the Persian Gulf. It is a unique fruit due to its special properties and compounds. Producing more than 800,000 tons dates per year, Iran is considered one of the largest producers of this product in the world. Unfortunately, more than 25 percent of this amount is wasted and feed to animals although could be potentially used in industry. According to the research, 60 kg date syrup is extracted from 100 kg dates. Considering the fact of being highly rich in nutritional values of one side and being low in cost from the other side, date could be used as an ingredient in food processing industries (Dowson, 1996 and Morton, 1978). Date contains natural sugars and dietary fibers and is a highly rich in carbohydrates (Shafiei et al., 2010). This fruit has a natural sweetness and distinctive pleasant flavor. In addition to having a very good taste, it is considered as an easily digestible and simple food (Abbès et al., 2011 and Dowson, 1962). The existing sugars in dates are majorly of fructose and glucose types. They have more advantages in comparison with sucrose on health, natural and high in sweetness (1.5 times more than common sugar). The sugar's naturalness helps sugars' absorption in the body of one side as well as being useful in reducing some health problems such as obesity, hypertension, diabetes and mellitus problems in the other side which are features of typical sugar (Arias-Jiménez, 2011; Barreveld, 1993). Generally due to the hydrophilic properties and suitable solubility, sugars make intense and highly solutions called osmual. Sugar joints with H₂O molecules through hydrogen bonds to make hydroxyl group and from the other hand sweeteners tend to absorb H₂O to increase viscosity. Sweeteners tendency to absorb water depends on their molecular size and weight. Lower the molecular weight of saccharides, cause the higher the tendency in water absorbing which leading to viscosity increase. Considering the molecular structure of sucrose, fructose and glucose, it seems that with an increase in active groups in date syrup to sucrose, Hydrogen bonds increase and which lead to viscosity increases (Fennema, 1962). Several studies have been done on the use of date syrup in food products. In a study of date syrup was used for ice cream and frozen fruit as a sweetener

and flavoring agent in various syrup concentrations. Results showed that the more syrup concentration of palm juice results more viscosity and over ran and it will lead to lesser melting time (Barreveld, 1993.; Hamad et al., 1983). Further studies have been done on the use of date syrup as a sweetener and flavor in dairy products. These studies showed that Low-fat water cow's milk prepared with palm syrup and fermented products prepared from milk, such as yogurt being flavored with date syrup, led to good outcomes (Moneib et al., 1974). The nutrient drink using fresh milk or milk powder and date juice to set pH for preventing clotting was prepared for a 3-month period in the common temperature of room. In a parallel research, a vanilla- chocolate drink made from milk and water mixed with mashed palm and sugar was prepared which proved to have a better rank than that of the control agent which was mixed just with sugar (Abbès et al., 2011., Hamad et al., 1983.; Mohammad et al., 2006). In recent year, regarding the increasing importance of health and due to the warnings made regarding the use of available beverages, the trend towards using natural beverages including fruit juice and non-alcoholic beer has been increased. Non-alcoholic beer contains many different components, including sucrose, glucose, maltose, vitamin C, vitamins B, organic acids, various amino acids, minerals, nucleic acid and aerated water (Brown and Aaron, 2005 and Charles, 2002). In this study, the bleached date syrup as a glucose syrup substituent in non-alcoholic beer was used and the effects of these drinks on the sensory and rheological characteristics were investigated as well.

MATERIAL AND METHODS

In this study, substitution of glucose syrup was done with bleached date syrup in non-alcoholic and flavorless beer produced in Sirang Koohrang Factory¹, under license of Bit burger², Germany in four level w/w 25, 50, 75 and 100 percent of glucose syrup.

Color test

The standard color of non-alcoholic beers should range from amber yellow to yellowish brown or falls something between these color spectrums. Because the color of non-alcoholic beer is one of the important factors in assessing quality therefore this parameter was targeted in this study. Uptake samples were read

¹ Sirang koohrang· Shalamzar, Shahre Kord, Iran

² Bit Burger, Germany

using a spectrophotometer³ and 1cm cell at a wavelength of 430 nm and then was reported using an equation based on EBC⁴ (Leitao, 2011).

Equation (1): $EBC=As *25$

Where:

As: Absorbance at 430 nm

The color of primary date syrup using ICUMSA method in the wavelength 420 nm using Equation 2 was measured and named ICUMSA Color 5(IU)

[18]. Equation 2: $ICUMSA\ color = \frac{10^6 * A_s}{B * RDS * \rho}$

Where:

As: Absorbance at 420 nm

RDS: Refract metric Dry substance (%)

ρ : Density (kg/m³)

B: cell length (cm)

Rheological test

One of the most important features of carbonated beverages is the ability to storage and exit of the carbon dioxide. Viscosity is one of the important factors in storing the carbon dioxide in beverages. So, considering the importance of viscosity in these products, rheological test seems very necessary. Viscosity was evaluated using Brookfield rotational viscometer (DVIII) equipped by ULA. Obtained data analyzed by rheocalc 3.2 software, to determine its rheological properties. The temperature of the test (25 ± 0.1°C) was kept circulating-refrigerating water bath TC502 made by Brookfield Company.

Sensory test performed by simple score method, obtained data analyzed by randomized complete block method "Friedman test" (Meilgaard et al., 1999) and results analyses by ANOVA with LSD test at 95 percent confidence level using SPSS ver17.

RESULTS AND DISCUSSION

The effects of glucose syrup substitute by date syrup on color

The original color of date syrup was measured to be 315 IU using Equation 2.

The results of the date syrup substitute of glucose syrup in the formulation of non-alcoholic beer on its color are shown in figure 1.

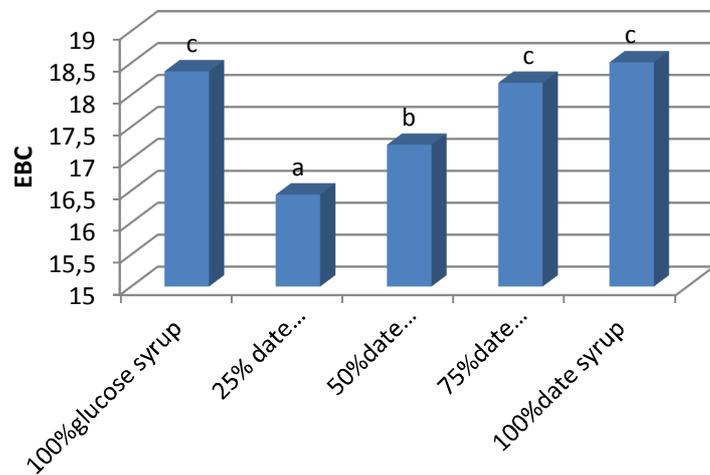


Figure 1 The obtained results of the replacement of glucose syrup than that of the date syrup in the formulation of non-alcoholic beer in wavelength of 430 nm.

As shown in figure1, the 50 percent substitution can produce best and lightest color and regarding sensory evaluation, its devoted highest score in taste, odor and color aspects and 50 percent substitution preferred by panelists between all samples.

The effect of glucose syrup replacement with date syrup on viscosity

Considering the importance of viscosity in carbonated beverages, the results of glucose syrup replacement with bleached palm syrup is shown in Figure 2. (Viscosity measured at Shear rate=150 S⁻¹)

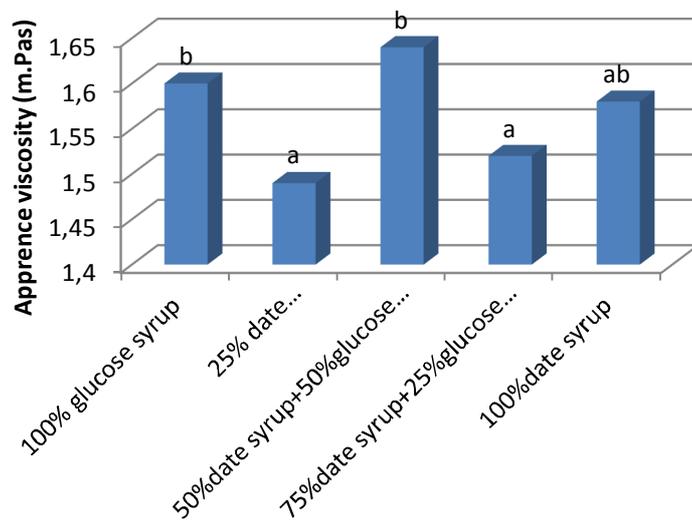


Figure 2 Results of the viscosity obtained from the replacement of the glucose syrup with bleached palm syrup at the temperature 25° C in the non-alcoholic beer formulation.

(Viscosity measured at Shear rate=150 S⁻¹)

As could be observed the minimum of viscosity was observed in the sample in which the glucose syrup was replaced with date syrup at 25 and 75 percent. Since reduction of the viscosity caused to more withdrawal of carbon dioxide from carbonated beverages (Indrawati et al., 2008) the use of date syrup at these levels is not suitable in soft drinks.

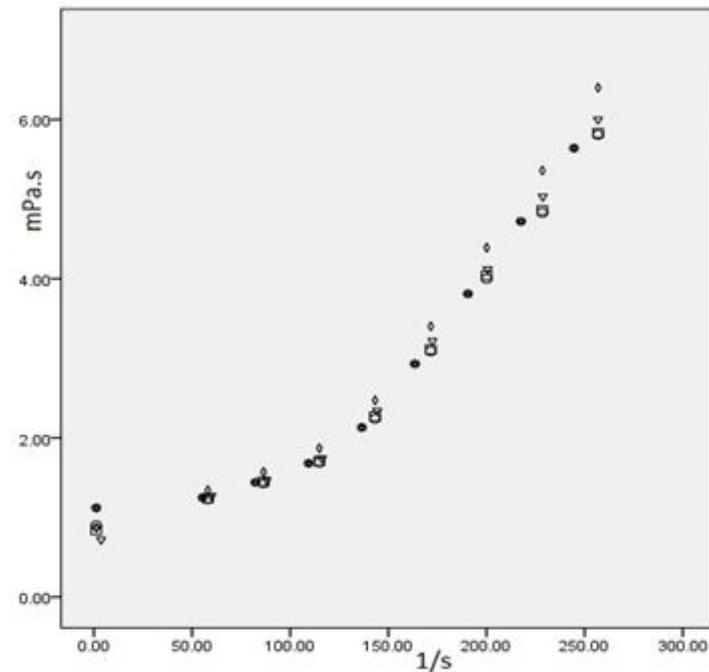


Figure 3 Shear stress-shear rate curve at temperature of 25° C, ○ 100% glucose syrup, □ 25% date syrup + 75% glucose syrup, 50% date syrup + 50% glucose syrup, 75% date syrup +25% glucose syrup, 100% date syrup

Considering the Rheological aspect, fluids are divided into two categories: 1 - Newtonian Fluid 2 - the non-Newtonian fluid. In non-Newtonian fluids shear stress is a linear function of shear rate. The coefficient of proportionality for this relationship is dynamic viscosity. In Non-Newtonian fluids the relationship between shear stress (shear stress-shear rate) is not linear and the viscosity is a function of shear stress which is called "Apparent Viscosity" (James, 1996).

As shown in Figure 3, the relationship between shear stress and share rate is not linear and it is indicated that the fluid is of the non-Newtonian fluid.

The other factor reflecting the customer satisfaction is sensory evaluation of the product. The results are shown in Table 1. (Tab 1)

³ Madison WI53711, USA

⁴ European Brewery Convention

⁵ ICUMSA UNIT

Table 1 The effect of glucose syrup replacement with date syrup on sensory characteristics

Sensory Evaluation		Effect
2 ±.16		total mean treatment
2 Sig*		
2.8 ^a	±.35	75% date syrup
2.13 ^{ab}	±.35	Blank
2.06 ^{ab}	±.35	50% date syrup
1.73 ^b	±.35	25% date syrup
1.26 ^b	±.35	%100date syrup
.36		Standard Error

Sig *: difference in the meaningful level of $p < 0.05$

Average different levels of treatment are determined with the same letters in terms of statistical probability level is $p < 0.05$ and they are not meaningful.

The results of sensory characteristics and overall acceptance of the study showed that there is no significant difference in replacing level 50 percent with the control sample. But there are significant differences in 25, 50 and 75 percent replacement levels of the control sample. Besides, the highest level of satisfaction is of replacing 75 percent and 50 percent and the lowest satisfaction in terms of sensory evaluation was 100 percent replacement of bleached juice date.

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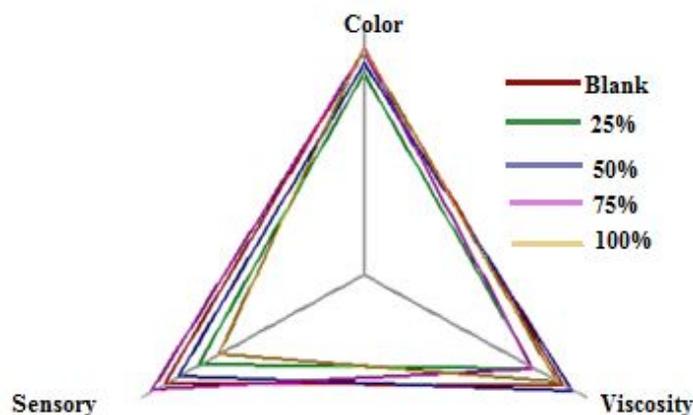


Figure 4 Relationship between Sensory, physical and colorimetric data

This figure signifies that 50 percent replacement level leads to the best color and the highest viscosity in the products. Also it met the people satisfaction based on sensory evaluation. Additionally, the 75 percent sample is technologically suitable but 100 percent has less acceptability but is more useful for health. Nevertheless from the health aspect, 100 percent replacement level of date syrup is considered to be the best.

CONCLUSION

It showed that the 100 percent glucose syrup substitute is good and useful for health but also proved to be bad based on technological aspects. Generally, regarding the results of physical and sensory experiments, the sample with 50 percent date syrup stands to be acceptable having maintained and or improved the physical characteristics. Its production possibility will increase the nutritional value of date compounds. Having used the low grade dates which are not suitable for fresh consumption, it will reduce agriculture waste.

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