



## Preparation and characterization of sponge cake made with grape juice

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**Introduction:** Grape syrup is a natural sugar source that is obtained by concentration of fruit juice up to about 70% soluble dry matter concentration. Iran is ranked in seventh place in terms of grape production in the world, so there's good potential for converting grape waste to the valuable food products. Grapes with inappropriate appearance can be converted to grape syrup and used as an ingredient in formulation of many food products. Cake is one of the most popular products in bakery and confectionery industry. Cake composed of different components such as flour, oil, milk, baking powder and sugar. Sugar is the main ingredient for making cakes that besides the creating sweet taste, represents numerous functionalities in bakery products. Despite all the benefits of sucrose, because of the association with certain health problems like high blood pressure, cardiovascular disease, tooth decay, obesity and diabetes lots of research is underway to find a suitable replacement for sugar. The challenges ahead when replacing sugar with other sweeteners have forced the researchers to provide a sweetener with similar functional properties, taste and quality with sugar. The benefits of grape syrup compared with the sugar are having less crystallization problems, having higher water holding capacity properties and higher perceived sweetness in final product. Due to the mentioned challenges the present study aims to replace sugar with grape syrup in various amounts and to investigate the effects of the replacement on the physical properties of the resulting cakes.

**Materials and methods:** Grape juice with Brix 68-70 were obtained from local market. Cake flour was also purchased from the local market. In this research four different level of grape syrup (0, 20%, 40%, 60% replacing of sugar with grape juice) were used in cake formulations as a natural replacement for sugar. Preparation of cake batter was carried out using sugar dough method. Consistency and specific gravity of the batters and moisture content, volume, texture, color and sensory properties of the cakes were investigated according to the procedures described in standard methods.

**Results & Discussion:** The results showed that increasing grape syrup level caused an increase in batter consistency. The main component of the grape juice contains reducing sugars, monosaccharides such as glucose and fructose and there is a small amount of sucrose. Generally most sugars can cause highly concentrated solutions due to their highly water solubility and hydrophilic character. Sugars make hydrogen bonds with water molecules due to their hydroxyl groups, because of the molecular structure of the sugars like sucrose, fructose and glucose, it seems that increasing functional groups in grape sugars compared with sucrose, resulted in the formation of more hydrogen bonds, which caused the reduction in the mobility of free water and therefore make an increase in viscosity of the mixture. According to the results specific gravity of the cake batters increased as the grape syrup level increased. It can be concluded that the addition of the grape syrup to the cake formulation reduces gas storage capacity in the batter and therefore causes the increase in specific gravity of the system. Moisture content of cakes increased with grape syrup addition. Increasing the moisture content in the cake is probably due to competition between moisture- absorbing compounds in the formulation of cakes. The replacement of sugar with grape syrup in the cake formulations decreased the cake volumes. Cake volume is influenced by two main factors including consistency and the specific gravity of the batter. If the batter consistency be too low air bubbles and carbon dioxide that is produced by the decomposition of baking powder will leave the cake out quickly and cake volume will decrease. As mentioned before the saccharides with lower molecular weights tend to absorb more water and caused an increase in batter consistency of cakes prepared from grape syrup compared with the cakes prepared from sucrose. In addition specific gravity of the batter will increase with increasing grape syrup level, specific gravity represents the entry of air bubbles in the batter during

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mixing and the maintenance of the bubbles in the batter during storage and baking, lower specific gravity of cake batter reflects higher volume of the cakes. The results of texture analysis indicated that grape syrup-added cakes were softer than control sample, one reason for reducing the hardness is that when sucrose replace with grape syrup (that is mainly composed of glucose and fructose), the cake moisture content will increase and as a result caused the reduction of the cake hardness. Evaluation of color parameters showed that L values of cakes decreased and a value increased with addition of natural sweetener (Samples got darker). Sensory evaluation results showed that the cake formulation with 40% grape syrup obtained the highest score by panelists in terms of mouth-feel, wetness, and overall acceptability. It can be concluded that grape syrup could be used as a natural replacer for sugar in preparation of bakery products although further studies are necessary in order to gain appropriate formulation.

**Keywords.** Cake, Grape syrup, Natural sweetener, Sensory quality