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INVESTIGATING THE POSSIBILITIES FOR USE OF GRAPE SEED POWDER IN THE PRODUCTION OF CALORIE REDUCED COCOA MUFFINS

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ABSTRACT

Scientific studies in recent years have clearly demonstrated the relationship between diets and diseases, and epidemiological studies indicate the effect of diet on the prevention of chronic diseases. The food industry develops day by day in order to offer more variety of products and to produce healthy foods. Emerging technology, intense participation in business life and urbanization, and people's preferences for food consumption are changing rapidly. Products such as muffins, biscuits, crackers and wafers (easy-to-carry, long shelf-life) are often confused as products consumed by individuals who have to devote less time to feeding. Muffin; have high nutritional value (due to the high carbohydrate, protein, and fat in them) but it is not rich enough in terms of vitamins, dietary fiber, and minerals necessary for body mechanics. In recent years, functional properties of products have been improved with the addition of dietary fiber additives as well as natural foodstuffs with antimicrobial and antioxidant properties. This study aimed to produce calorie reduced muffins by using grape seed powder which is a natural antioxidant and fiber source in cocoa muffin formulas. On the other hand, it is aimed to economically evaluate the wastes of the wine industry as well as to produce functional muffins with increased benefits on human health, in other words the aim of this study is to remove the oil, sugar and flour content of the muffin from the mixture at varying proportions and replace the removed part with grape seed powder. As a result of the study, it was observed that the grape seed powder supplementation did not affect the volume properties of the muffins, on the contrary, decreased the baking loss, and the products replaced with grape seeds powder have been opened in both interior and exterior colours. It can be said that the product group which is closest to the control in respect of the textural properties is the products produced with 2.5% substitution.

Keywords: Cacao Muffin, Calorie reduced, Grapeseed, Texture profile analysis

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Introduction

Scientific studies in recent years have clearly demonstrated the relationship between diets and diseases, and epidemiological studies indicate the effect of diet on the prevention of chronic diseases (Mete, 2008). Changing eating habits to more fruit, vegetables, and grains is an effective and practical approach to the prevention of chronic diseases (Bozhüyük et al., 2012). It is a known fact that more prevalent approaches to treatment are supposed to be superior. In recent years, it has been scientifically proven that some foods are prevented from taking some "natural" pathways into the body, or some diseases are treated partly, which has increased the importance of nutritional support in protecting our health. For this reason, functional foods and natural health products have become more consumed in daily diets (Coşkun, 2005). The food industry develops day by day in order to offer more variety of products and to produce healthy foods (Malek, 2013). Emerging technology, intense participation in business life and urbanization, and people's preferences for food consumption are changing rapidly. Products such as muffins, biscuits, crackers, and wafers (easy-to-carry, long shelf-life) are often confused as products consumed by individuals who have to devote less time to feeding (Seçen, 2016). Muffin is a bakery product which is produced almost everywhere in the world and which is highly preferred due to its soft texture and high quality, easy to produce and appeal to consumers (Dizlek, 2008; Martinez-Cervera, Salvador, & Sanz, 2014). Muffin products are an important part of the bakery industry (Martinez-Cervera, Salvador, & Sanz, 2015). Muffin; have high nutritional value (due to the high carbohydrate, protein, and fat in them) but it is not rich enough in terms of vitamins, dietary fiber, and minerals necessary for body mechanics (Malek, 2013). Grape (*Vitis vinifera* L.) is one of the most produced fruits of the world (Wang et al., 2017). Grape seeds are rich sources of monomeric phenolic compounds and procyanidins (Arvanitoyannis, Ladas, & Mavromatis, 2006; López-Miranda et al., 2016). It is known that these compounds act as antimutagenic and antiviral agents (Saito, Hosoyama, Ariga, Kataoka, & Yamaji, 1998). By using components that have functional characteristics in the production of baked goods, consumption of these foods and components that have beneficial effects on human health can be provided to participate in the human diet. By using components that have functional characteristics in the production of baked goods, consumption of these foods and components that have beneficial effects on human health can be provided to participate in the human diet. With dietary fiber additives, the functional properties of the products are increased and the intestinal system is regulated to provide health benefits (Ekici & Ercoskun, 2007). In recent years, functional properties of products have been improved with the addition of dietary fiber additives as well as natural foodstuffs with antimicrobial and antioxidant properties (Meral & Doğan, 2009). Grape seed, a by-product of the wine industry, has a significant level of antioxidant activity. This study aimed to produce calorie reduced cacao muffins by using grape seed powder which is a natural antioxidant and fiber source in cocoa muffin formulas. It is thought that the grape seed is transformed into a product which is the entry into the economy. Another goal is to reduce the calories of the products by making changes in the prescriptions of the cacao muffins.

Materials and Methods

Materials

The basic ingredients (wheat flour, sunflower oil, sugar, eggs, milk, baking soda, salt, and cocoa) used for making muffins were obtained from the local market. Grape seeds to be substituted for flour, sugar, and oil used in the production of cacao muffins were obtained from grapes (Dimrit) supplied from the farm in the year 2016 harvest.

Methods

Grape seeds were milled for 4 minutes at 400 rpm in ball mills and the particle size is reduced to less than 1 micron. In the experiment, grape seed powder has been substituted (2.5%, 5%, and 10%) for flour, oil, and sugar (total weight). Baking losses, specific volumes, volume, symmetry and uniformity index, cacao muffin crust and crumb colours were determined for products cooked in equal conditions. The products were stored for 1, 3 and 5 days and subjected to textural analyses in order to measure their structural properties.

Cacao Muffin Cooking Experiments

Baking times and formulations of cacao muffins were taken from one of the previous studies and revised (Karaoglu, Kotancilar, & Gercekaslan, 2008). The cacao muffin formulations are given in Table 1, the sequence and the timing given in Table 2 were used in the Laboratory of Food Engineering Department of Hacı Bektaş Veli University. Theoretical calorific values of the cacao muffins are also given in the calculated Table 1. Accordingly, Table 1, the decline of 2.5% in prescription led to a 0,98% decrease, the decline of 5% in prescription led to a 2,06% decrease, the decline of 10% in prescription led to a 4,12% decrease in the theoretical caloric value of cacao muffins. Cacao muffin dough was obtained in the mixer (Kenwood KM-242 Prospero) in accordance with the stated order and period. Cacao muffin mixture was poured 60 grams per gram of Teflon muffin molds (Kaiser Gourmet Muffin Pan-Germany) and cooked (Arçelik MF44) for 35 minutes at 175 ° C.

Analyses Made in Cacao Muffins

Specific volume, baking loss, volume, symmetry, uniformity (index of homogeneity), crust and crumb colour measurements were started 1 hour after the product was removed from the oven. In addition, texture profile analysis, and sensory analysis were performed on the produced cacao muffins.

Specific Volume, Baking Loss

The produced cacao muffins were weighed on an analytical scale (BEL, S1002-South Korea) with a weighing accuracy of 0.01 g and the volume was determined according to the method of displacement with rapeseed.

Volume, symmetry, uniformity (homogeneity) index

Volume, symmetry, uniformity index was determined in millimetres from the ruler (5cm) according to AACC 10-91 method (Committee, 1983). Although the volume index does not measure the actual volumes of the cacao muffins, it gives an idea of the volume of the cacao muffins and there is a correct relationship between volume index and volumes. In the cacao muffin industry, the symmetry index is used to determine the profile of the outlines of the cacao muffins, the increase in the symmetry index indicates the swelling, while the decrease indicates that the cacao muffin has a flat upper surface. The uniformity index represents the symmetry of the cacao muffin laterally, and it is desirable that this value is as close to zero as possible. It is stated that the negative or positive value of this index value is an undesirable condition in cacao muffins (Özer, 2004).

Cacao muffin crust and interior colour measurements

The crust and crumb of cacao muffins; lightness (L^*), redness (a^*), and yellowness (b^*) values of samples were measured by a CR-400 Minolta colorimeter (Konica Minolta Sensing Americas Inc., Ramsey, NJ). Calibration was performed prior to colour measurement using a white plate ($Y = 87.0$, $x = 0.3180$, and $y = 0.3355$) provided by the manufacturer. Each sample was evaluated at six locations on the cacao muffin crust and crumb surface (İ. Çelik, Kotancılar, H.G.,, 1995).

Textile profile analysis (TPA)

Texture Analyzer (TA-XT Plus Stable Micro Systems, UK) was used to determine the textural properties of the cacao muffins. Cylindrical probes (P / 36) with a diameter of 36 mm were used for TPA tests in the samples taken with 30 mm diameter and 30 mm height probes. The test parameters are set as follows; pre-test speed 1 mm / sec, test speed 2 mm / sec, post-test speed 1 mm / sec, waiting time 5 sec and trigger force 5 g. Hardness, adhesiveness, elasticity values were obtained from the obtained TPA curve and other parameters were derived from these values.

Table 1. Rate of Cacao Muffins Ingredients

Compounds	%	Control Group	2.5% Reduced	5% Reduced	10% Reduced	Theoretical Calorie Value kcal/g
Egg White (g)	11.4	114	114	114	114	17
Salt (g)	0.05	0.5	0.5	0.5	0.5	0
Sugar (g)	25.6	256	249.6	243.2	230.4	4
Whole Milk (g)	17	170	170	170	170	6.4
Sunflower Oil (g)	11.36	113.6	110.76	107.92	102.24	9
Egg Yolk (g)	2.3	23	23	23	23	55
Cocoa (g)	2.89	28.9	28.9	28.9	28.9	4.3
Grape Seed Powder (g)	0	0	16.46	32.93	65.86	0
Baking powder (g)	0.5	5	5	5	5	0.97
Flour (g)	28.9	289	281.78	274.55	260.1	3.64
Total Theoretical Calorie Value (kcal)	-	7518	7444	7363	7208	-
Percentage Decrease in Calorie (%)	-	-	0.98	2.06	4.12	-
Total	100%	1000 g	1000 g	1000 g	1000 g	-

Percentage based on the total weight of flour, sugar, and oil (2,5, 5 and 10%) from the cacao muffin components, instead of the reduced value added grape seed powder.

Table 2. Cacao muffins Production Flow Chart

Compounds	Mixing time (min)
Egg White + Salt	3
Sugar	1
Milk	2
Sunflower Oil +Egg Yolk	2
Flour + Cocoa + Baking Powder + Grape S. Powder	4

Sensory Analysis

The cacao muffins prepared with different formulations were evaluated by sensory analysis by panelists. Crust colour, crust thickness, crumb colour, porosity, elasticity, humidity, taste, odour, swallowability, mouth feel and overall acceptability were determined separately, the scoring form was prepared so that the panelists would understand best. The study was made with single-blind; the panelists did not know the content of the sensory analysis product. A score was created according to the hedonic scale, thus differences in taste between the products were determined (Altuğ & Elmacı, 2005). All panelists participating in the panel provided detailed information on the definition of scale forms. The desired textural and sensory structures of the cocoa muffins are described in detail in the panelists, the scores and the responses given in the sensory analysis are as follows; 0: absolutely unacceptable, 3: unacceptable, 5: neither acceptable nor unacceptable, 7: acceptable, 10: Absolutely acceptable. Sensory evaluations were made at different times and individually in a quiet and isolated environment. It is ensured that the panel area is a simple and airy space. In order for panelists to be able to make independent assessments, all conditions were met and water was provided in the panel area to neutralize the taste change between the products.

Statistical analyses

The research was carried out in 3 replicates according to the research plan based on the full chance of 2x4 factorial regeneration. the data obtained on the basis of the research were subjected to analysis of variance using the SPSS package program. The averages for the variation sources were compared using the Duncan Multiple Comparison Test. Experimental design: In the experiment, grape seed powder has been substituted (2.5%, 5%, and 10%) for flour, oil, and sugar (total weight), in this state, 4 groups of cacao muffins were produced.

Results and Discussion

Volume, symmetry, uniformity index and specific volume, baking loss results in the produced cacao muffins are given in Table 3. It is stated that the cacao muffin structure desired by the consumer is in a high volume, symmetrical and uniform structure. The volume index is a parameter that not only measures the actual volumes of cacao muffins but also gives an idea of volume. The symmetry index is used, in particular, to determine the profile lines of the cacao muffins in the muffin industry. The symmetry index increases when the muffin is swollen from the center and decreases when the muffin has a flat upper surface (Mercan, 2000). The uniformity index gives information about the lateral symmetry of the muffins (Bath, Shelke, & Hoseney, 1992).

When Table 3 is examined, it is seen that replacing flour, oil, and sugar used in cacao muffin production with grape seed powder does not affect the volume, symmetry, uniformity indexes. The control group was found to have the highest specific volume of cacao muffins. It has been found that the grape seed powder reduces the specific volume, in this respect it can be said that the changing rates significantly affect the specific volume statistically. It can be said that the control group of cacao muffins and 2.5% cacao muffins are statistically more than the others of cooked losses. The cooking loss is a criterion that must be determined from the point of attachment of the final product weight, which must be written on the packaging, especially in commercial productions and it is not desirable to consumers. Parallel to the increase in the cooking loss during the production of cacao muffins, the undesirable dimensional downsizing of the cacao muffin can also occur. In addition, depending on the loss of cooking, the product may also be dry. Many uncontrollable factors (oven temperature, ambient temperature, etc.) can affect cooking loss (Yıldız, 2010).

The most important factor affecting the taste of cacao muffins is the outer appearance of the cacao muffin and the crust colour, one of the most important criteria in cocoa muffins is the outer crust and the crumb colour of the cacao muffin (Karaoğlu, 1998). The ***L *, a *, b **** values of the produced cacao muffins were measured with a colorimeter and the results of these values are given in Table 4.

Table 3. Volume, symmetry, uniformity index and specific volume, baking loss results of cacao muffins produced with grape seed powder

	n	Volume Index (mm.)	Symmetry Index (mm.)	Uniformity Index (mm.)	Specific volume (cc/g)	Baking loss (%)
Mix Ratio						
Control	4	116.67±1.20[a]	25.33±0.33[a]	0.67±1.45[a]	2.21±0.31[a]	14.96±0.66[a]
2.5% Reduced	4	112.67±1.85[a]	26.00±0.00[a]	2.00±3.05[a]	2.04±0.01[b]	11.64±0.79[a]
5% Reduced	4	116.00±1.66[a]	22.00±1.52[a]	2.00±0.57[a]	1.97±0.01[b]	11.36±0.49[b]
10% Reduced	4	113.33±1.66[a]	25.67±2.02[a]	1.00±2.02[a]	1.98±0.03[b]	13.53±0.33[b]
P		-	-	-	**	**

Data were averages of three different samples ± standard deviation. Values followed by different letters in each column indicated significant differences ($p < 0.05$) among different treatments. Percentage based on the total weight of flour, sugar, and oil (2,5, 5 and 10%) from the cacao muffin components, instead of the reduced value added grape seed powder.

Table 4. Crust and interior ***L, (+) a*** and ***(+) b*** colour values of cacao muffins produced with grape seed powder

	n	Crust ***L**** value	Crust ***(+)a**** Value	Crust ***(+)b**** Value	Crumb ***L**** Value	Crumb ***(+)a**** Value	Crumb ***(+)b**** Value
Mix Ratio							
Control	4	29.99±0.12[d]	11.48±0.10[d]	12.74±0.12[d]	27.83±0.28[d]	11.88±0.12[ab]	15.42±0.12[d]
2.5% Reduced	4	32.56±0.56[c]	12.34±0.09[c]	14.96±0.15[c]	30.54±0.29[c]	12.07±0.06[a]	16.88±0.02[c]
5% Reduced	4	34.73±0.15[b]	13.08±0.19[b]	17.93±0.02[b]	35.61±0.17[b]	11.58±0.05[b]	17.99±0.15[b]
10% Reduced	4	37.08±0.56[a]	13.93±0.25[a]	21.40±0.34[a]	41.97±0.21[a]	10.80±0.14[c]	18.44±0.17[a]
P		**	**	**	**	**	**

Data were averages of three different samples ± standard deviation. Values followed by different letters in each column indicated significant differences ($p < 0.05$) among different treatments. Percentage based on the total weight of flour, sugar, and oil (2,5, 5 and 10%) from the cacao muffin components, instead of the reduced value added grape seed powder.

When Table 4 is examined, it was observed that adding grape seed powder to the cacao muffins had a very significant effect on the cacao muffin crust and crumb ***L, (+) a*** and ***(+) b*** colour values (p<0,01). As the grape seed powder substitution rate increases, the cacao muffin crust, and interiors colour are opened, reddish and yellowish. In addition, the outer profiles of the cacao muffins produced are photographed and given in figure 1. the crumb profiles of the cacao muffins produced are photographed and given in figure 2.

As can be seen from the photographs, the increase of the grape seed powders in the cacao muffin mix caused the product to open in colour.

It has been pointed out that the variation of basic ingredients in food production greatly affects the textural properties of the final product (Aguilera & Stanley, 1999). The resulting cacao muffins were subjected to textural profile analyses and the hardness, adhesiveness, resilience, cohesiveness, gumminess and chewiness values were obtained. The average values of these values are given in Table 5.

When Table 5 was examined, it was observed that control group cacao muffins became harder on day 1 storage, this has not changed in storage for 3 and 5 days. On the other hand, it has been determined that as the storage time increases, the hardness increases, the hardest cacao muffins are stored for 5 days. All baked goods have a series of physical and chemical changes called staling after the baking phase. The most important parameter related to staling is the gradual increase in the hardness of the product. It is known that the retrogradation of starch together with staling hardens the starch gel (Seyhun, 2004). The control group cacao muffins showed 3 and 5 days' storage result, chewiness and chewiness values higher than the other group cacao muffins. With the increase of storage period, the hardness and gumminess values of cacao muffins increased and cohesive and elasticity (resilience) values decreased. The retrogradation

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of amylose from the starch components is faster than amylopectin and the retrogradation is completed when the product is cooled after baking. However, since the amylopectin is retrograde at a lower rate, the product continues to retrograde after being cooled and is therefore considered to be the main effect of staling (BeMiller, Whistler, & Carbohydrates, 1996). Therefore, it is observed that the hardness value increases as the product become stale. Another parameter that affects cacao muffin hardness is the moisture loss of the cacao muffin along with storage. It is stated in the literature that hardness value increases with storage in cacao muffins (T. E. Çelik, 2012; Kaçar, 2010; Malek, 2013). The stickiness parameter was not statistically affected from either the groups nor from the storage period. It has been reported that the value of stickiness and hardness is related to the amount of starch and gelatinization of starch (Sozer, Dalgıc, & Kaya, 2007). It is known that there is a strong relationship between the textural properties and structure of food (Aguilera & Stanley, 1999).

The cacao muffins prepared with different formulations were evaluated by sensory analysis by panelists. The data on the sensory variability properties were determined separately. Sensory analysis data of crust colour, crust thickness, crumb colour, porosity, elasticity, humidity, taste, odour, swallowability, mouthfeel and overall acceptability of the products are given in Table 6.

Experienced panelists performing sensory analyses of the produced cacao muffins indicated that the control group and the 2.5% reduced products were acceptable, it has been seen that with the increase of the substitution ratio, the outer crust colour of caking has been removed from the acceptability, the similar situation for the crumb colour of cacao muffins. The mixing ratio affecting the taste of the crumb and outer colours of the cacao muffins did not affect the thickness and elasticity of the cacao muffins crust statistically. The panelists could not detect a statistical difference in the porosity of the products prepared with grape seed substitute, the photographs of the interior of the cacao muffin in Figure 2 already support this situation. As well as the increase in the substitution rate, the humidity, odour, mouth feel and overall acceptability of the cacao muffins has moved away from its acceptability, and even 10% substituted cacao muffins are the least admissible in the mouth. Substitution ratio did not statically effect of taste and swallowability in cacao muffins.

Figure 1. Outer profiles of cacao muffins

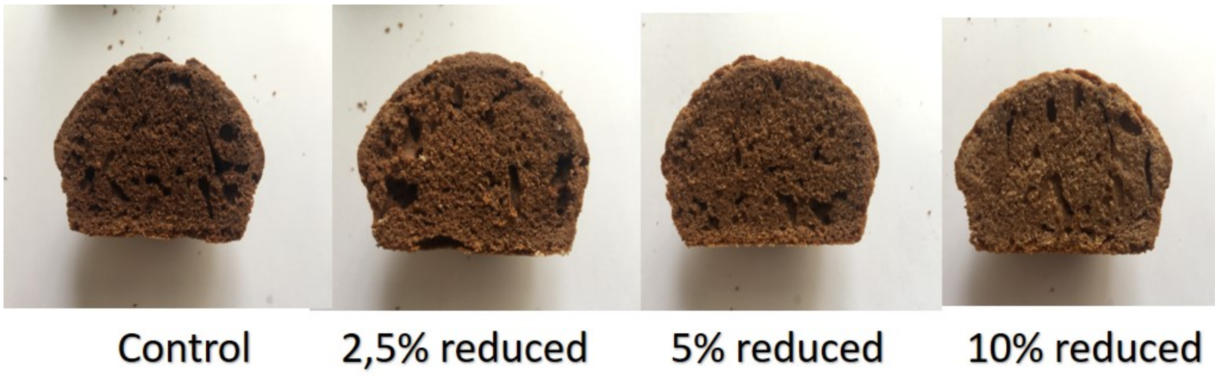

Figure 2. Crumb profiles of cacao muffins

Table 5. Hardness, adhesiveness, resilience, cohesiveness, gumminess and chewiness values of cacao muffins produced with grape seed powder

Days	Groups	n	Hardness (N)	Adhesive-ness	Resilience	Cohesiveness	Gumminess (N)	Chewiness (J)
1 day	Control	3	10.59±0.28^{abZ}	0.00±0.00^{aX}	0.92±0.00^{aX}	0.60±0.01^{aX}	6.43±0.15^{aZ}	5.97±0.19^{aX}
	2.5% Reduced	3	9.80±0.15^{bZ}	0.00±0.00^{aX}	0.92±0.00^{aX}	0.61±0.00^{aX}	6.01±0.07^{aZ}	5.54±0.09^{aZ}
	5% Reduced	3	10.22±0.32^{abZ}	0.00±0.00^{aX}	0.92±0.00^{aX}	0.58±0.00^{aX}	5.99±0.25^{aZ}	5.52±0.23^{aZ}
	10% Reduced	3	10.80±0.23^{aZ}	0.00±0.00^{aX}	0.91±0.00^{aX}	0.59±0.00^{aX}	6.39±0.21^{aZ}	5.88±0.20^{aY}
3 days	Control	3	19.16±0.94^{aY}	0.00±0.00^{aX}	0.89±0.00^{aY}	0.56±0.00^{aY}	10.86±0.54^{aY}	9.71±0.52^{aY}
	2.5% Reduced	3	15.48±0.43^{bY}	0.00±0.00^{aX}	0.89±0.00^{aY}	0.53±0.00^{abY}	8.35±0.19^{bY}	7.51±0.18^{bY}
	5% Reduced	3	14.82±0.42^{bY}	0.00±0.00^{aX}	0.89±0.00^{aY}	0.52±0.02^{bY}	7.82±0.51^{bY}	6.97±0.42^{bY}
	10% Reduced	3	15.76±0.53^{bY}	0.00±0.00^{aX}	0.88±0.00^{aY}	0.50±0.00^{bY}	7.93±0.40^{bY}	7.00±0.34^{bY}
5 days	Control	3	23.89±0.71^{aX}	0.00±0.00^{aX}	0.86±0.00^{aZ}	0.51±0.00^{aZ}	12.28±0.42^{aX}	10.64±0.40^{aY}
	2.5% Reduced	3	20.87±0.64^{bX}	0.00±0.00^{aX}	0.87±0.00^{aZ}	0.52±0.0^{0aY}	10.93±0.25^{abX}	9.52±0.18^{abX}
	5% Reduced	3	20.53±0.71^{bX}	0.00±0.00^{aX}	0.86±0.00^{aZ}	0.48±0.00^{bY}	9.94±0.46^{bX}	8.60±0.47^{abX}
	10% Reduced	3	22.32±0.67^{abX}	0.00±0.00^{aX}	0.86±0.00^{aY}	0.48±0.00^{bY}	10.86±0.49^{abX}	9.44±0.46^{bX}

Data were averages of three different samples ± standard deviation. Values followed by different letters in each column indicated significant differences ($p < 0.05$) among different treatments. Percentage based on the total weight of flour, sugar, and oil (2.5, 5 and 10%) from the cacao muffin components. instead of the reduced value added grape seed powder. The letters X. Y. Z show the difference between the days. a. b. letters indicate the difference between the groups.

Table 6a. Sensory analysis data of crust colour, crust thickness, crumb colour, porosity, elasticity, humidity, taste, odour, swallowability, mouth feel and overall acceptability of the products.

	n	Crust colour	Crust thickness	Crumb colour	Porosity	Elasticity
Mix Ratio						
Control	10	8.33±0.47^{a}	7.00±0.40^{a}	8.44±0.41^{a}	6.55±0.44^{a}	5.77±0.46^{a}
2.5% Reduced	10	7.33±0.28^{ab}	6.66±0.47^{a}	7.33±0.33^{a}	5.89±0.53^{a}	6.44±0.5^{3a}
5% Reduced	10	6.11±0.35^{b}	6.55±0.64^{a}	5.66±0.50^{b}	5.77±0.70^{a}	6.77±0.49^{a}
10% Reduced	10	4.33±0.60^{c}	6.33±0.74^{a}	3.88±0.65^{c}	5.00±0.97^{a}	6.44±0.47^{a}
P		**	-	**	-	-

Data were averages of three different samples ± standard deviation. Values followed by different letters in each column indicated significant differences ($p < 0.05$) among different treatments. Percentage based on the total weight of flour. sugar. and oil (2.5, 5 and 10%) from the cacao muffin components. instead of the reduced value added grape seed powder.

Table 6b. Sensory analysis data of crust colour, crust thickness, inner colour, porosity, elasticity, humidity, taste, odour, swallowability, mouth feel and overall acceptability of the products.

	n	Humidity	Taste	Odour	Swallowability	Mouthfeel	Overall acceptability
Mix Ratio							
Control	10	5.89±0.65[b]	6.55±0.72[a]	6.66±0.78[a]	5.66±0.62[a]	6.22±0.66[a]	7.00±0.68[a]
2.5% Reduced	10	6.22±0.59[b]	6.77±0.68[a]	6.33±0.70[a]	6.33±0.44[a]	6.22±0.61[a]	7.00±0.37[a]
5% Reduced	10	6.66±0.62[a]	6.66±0.28[a]	5.88±0.61[b]	6.66±0.50[a]	5.66±0.66[b]	6.33±0.44[b]
10% Reduced	10	6.88±0.53[a]	6.55±0.41[a]	5.77±0.64[b]	6.22±0.61[a]	4.77±0.77[c]	5.77±0.57[b]
P		-	-	-	-	-	-

Data were averages of three different samples ± standard deviation. Values followed by different letters in each column indicated significant differences ($p < 0.05$) among different treatments. Percentage based on the total weight of flour, sugar, and oil (2,5, 5 and 10%) from the cacao muffin components, instead of the reduced value added grape seed powder.

Conclusion

Cacao muffin is a bakery product widely produced and consumed by consumers all over the world. but thanks to the high sugar. fat. and flour it contains. it is in the class of high-calorie foods. The aim of this study is to remove the oil. sugar and flour content of the cacao muffin from the mixture at varying proportions and replace the removed part with grape seed powder. In some bakery products. it is not possible to completely remove oil. sugar and flour from the prescription due to the function of the oil. By using components that have functional characteristics in the production of baked goods. consumption of these foods and components that have beneficial effects on human health can be provided to participate in the human diet. As a result of the study. it was observed that the grape seed powder supplementation did not affect the volume properties of the cacao muffins. on the contrary. decreased the baking loss. and the products replaced with grape seeds powder have been opened in both interior and exterior colours. It can be said that the product group which is closest to the control in respect of the textural properties is the products produced with 2.5% substitution. Functionality has been added to the products produced at this site. and calories are reduced. in addition. grape seeds. which are the wine sector waste. are prevented from being economically lost in this way. On the other hand. the theoretical calorie reduction between 0.98% and 4.12% was achieved in cacao muffins.

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