Study of the Influence of Grape pomace Powder on the quality and staling of cakes

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Abstract

The purpose of this reasrh was to assess the chemical composition of grape pomace and its potential use as a partial replacement for wheat flour in cake recipes at percentages of 1.5%, 3%, and 7%. Higher levels of fiber, moisture, ash, protein, and carbohydrate were found in grape pomace flour (20±.57735%, 8.14±.48244%, 5.68 ±.28869%,5.77±.22169 %, and 58.52±.69312%), respectively. Using stable DPPH radicals, the antioxidant activity of the grape pomace was evaluated. Total flavonoids were10.66 mg RE/g ,± 2.18581 , total phenolic compounds were 49mg GAE/g±.57735, the DPPH was16.66±1.85592% . The cake's sensory and physical properties were assessed. The results also demonstrated that the specific volume of cake increased much more with the GPP substitution than with the control sample. The findings indicated that the cake sample with 3% GPP had the most palatable sensory qualities. The findings demonstrated that the GPP substitution reduced the cake samples' staling rate relative to the control sample. The above findings imply that GPP, a source of fiber and polyphenols with possible health benefits, would be a desirable additive to employ in fortified cakes.

Keywords: grapes pomace, physical properties, cake, staling.

Introduction

It is customary to discard a sizable portion of the by-product during the preparation of fruits and vegetables. Simultaneously, enormous amounts of byproducts from food processing are produced and never used, which, if improperly disposed of, might seriously pollute the environment. Reducing pollution and adding value would result from using these by-products as a source of dietary fiber [21]. Numerous studies have shown that fruits and vegetables are rich in dietary fiber (DF), which supports human physiological functions by lowering cholesterol, lowering hypertension and hyperlipidemia, and preserving gastrointestinal health[12]. Due to their recovery and the value they subsequently bring, agricultural by-products like grape pomace have the potential to be renewable, and their utilization could result in significant economic benefits [23]. Grape pomace has a number of active ingredients, including high levels of dietary fiber and antioxidants such as phenolics. [23] revealed that the product had a DF level exceeding 60%. A sizable market for fiber-rich components and goods, like muffins or other cakes that resemble them and are usually eaten for breakfast, has emerged as a result of consumers' interest in high-fiber diets [10]. People, particularly youngsters, around the world frequently use cakes as a substitute

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for their main meal due to their favorable sensory qualities, affordability, and ease of availability. Cake staining and moisture loss are significant issues that shorten the shelf life of cake products and pose a challenge to cake manufacturers [8]..The quality and shelf life of baked cakes can be affected by adding ingredients that affect formulae, air exposure of cake batters, and fluid batter stability [13].

The purpose of the study was to examine the effects of grape pomace powder, a by-product of juice production, on the nutritional qualities and physical attributes of cakes made using1.5%, 3%, and 7% grape pomace powder instead of wheat flour.

Material and Methods

Methods of analysis

The grapes) Vitis vinifera) harvested in the lraq in 2024 were used to make grape pomace powder (GPP). Following the extraction of juice, the grape pomace was dried in an oven for 48 hours at 60 °C. It was then crushed into a powder using a grinder and kept at 4 °C until it was analyzed or cakes were prepared. The remaining ingredients, such as wheat flour, baking powder, sugar, eggs, milk, shortening, and venill, came from neighborhood stores in Basrah, Iraq [15[

Approximative evaluation .

Grapes' protein, ash, moisture, fat, and crude fiber were assessed using the techniques outlined in [2]. By contrast, the carbohydrate was identified.

Calculating the total flavonoid and phenolic content

[14] used the Folin-Ciocalteu method to estimate the quantity of total phenols and used spectrophotometry to assess the amount of total flavonoids.

antioxidant activity

Using the [14] approach, the antioxidant activity of grape pomace extracts was assessed using the DPPH radical scavenging technique.

Preparation cakes

Cake samples were made using a version of [5] approach.The studies employed a cake batter mix that contained 100% wheat flour(72% extraction), 60% sugar, 50% shortening, 85% whole fresh egg, 3% dry milk powder, 4% baking powder, and 0.6% vanillin. For three minutes, shortening and sugar were blended to produce the control cake. Add the whole eggs and stir for two minutes. After adding the dry milk, baking powder, and sifted flour, the dough was stirred for four minutes. A minute was added to the batter mixing process once the bowl was scraped clean. In order to make the replacement cake batters, 1.5%, 3%, and 7% of GPP were used in place of flour. In an alternative modality. The mixing procedure was carried out in the same order as for the control. After pouring cake batter into each pan, the oven was set to 180°C for 30 minutes. Following baking, cakes were taken out of the pans and cooled to room temperature and then placed inside plastic bags. and kept for 7 days

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at room temperature. After being removed from the pans, samples were collected for analysis within an hour and frequently within a week.

Cake's physical attributes

the measurement of cake's physical attributes after one hour of baking, the volume was determined by displacement of rapeseed, [5] .The specific volume was also determined by calculating the volume-to-weight ratio.

Sensory analysis of cakes. Evaluation

A panel of ten employees from the Food Science Department of the university's basrah was asked to rate the qualitative characteristics of each cake sample. [1] used a 10-point rating system to assess crumb texture , crust color, crumb color, taste, odor, appearance, and overall acceptability.

Staling rate

Assessing the staling of cake samples. Alkaline water holding capacity was used to measure the staling. of baked cake containing powdered grapes pomac , as reported by [5[

Statistical analysis

A one-way analysis of variance (ANOVA) with three replications in a randomized block design was used to statistically examine the data. The statistical analysis was performed using the SPSS (2019.(

Results and Discussion

Chemical composition of GPP

Table 1 shows the chemical composition of the GPP. It has an 8.14± .48244% moisture content. This ratio agrees with the findings of [17] who found that grape pomace has a moisture content of 6.61%.. The grape pomace powder exhibited higher levels of ash, protein, and carbohydrate (5.68±.28869% ,5.77±.22169 %, and 58.52±.69312 %), respectively

Table 1 : chemical composition of grape pomace powder

properties	values(%)
Moisture	8.14± .48244
Protein	5.77±.22169
fat	1.87±.18771
ash	5.68±.28869
fiber	20±.57735
Carbohydrate	58.52±.69312

According to data in Table 1. However, the pomace powder from grapes contained more crud fiber (20±.57735%). The amount of raw fiber in the grape pomace powder. This means that some bakery products have more fiber since they use grape pomace powder. It was 20±.57735 % in terms of the total amount of dietary fiber. This outcome concurs with that of)Sousa et al. ,2014), who discovered that it is 46.17%. [6] discovered that the overall percentage of dietary fiber was 31.66%. Researchers have linked GP fibers to antioxidant-active polyphenols. Thus, GPP fibers differ structurally from those in other fruits and cereals.

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Calculating the total flavonoid, phenolic content, and antioxidant activity

The overall phenolic component , total flavonoid and the DPPH concentration in GPP was 49 mg GAE/g±.57735, were10.66 mg RE/g,± 2.18581and 16.66±1.85592% as shown in Table 2. This is consistent with findings from[18], who measured that the range of the total phenolic level in four distinct GPP variet als was 33 to 75 mg GAE/g.. However, [9]discovered that GPP has 480 mg GAE/g of TP concentration. The phenolic composition of GPP is determined by a number of parameters, including the grapevine variety, berry size, maturity degree, and environment [17 [

Table2: Total flavonoids, DPPH, and phenolic compounds in GPP

constituent	values
phenolic	49mg GAE/g±.57735
flavonoid	10.66 mg RE/g,± 2.18581
DPPH%	16.66±1.85592

These outcomes are consistent with those of[11]. However, [24]found that phenolic in GPP was high than four times higher than the current outcome. The kind of extraction technique used could be the cause of the discrepancy

Cake sample weight, volume, and specific volume

Table:3 lists the Physical characteristics of cake made with substitute wheat flour and varying amounts of powdered grape pomace. cake's physical attributes were impacted by the GPP state. with the exception of the specific volume of 7% GPP, which was raised, all samples' cake volume and specific volume increased overall when compared to the control (220.00 ±5.77350 cm3, 256.66 ±3.33333 cm3, 276.66±3.33333 cm3 and1.0567±.03180 cm3/g, 1.2600±01528 cm3/g and 1.2833±.01667 cm3/g, respectively,.compared with control 203.33±3.33333 cm3 and 1.0167±.01667 cm3/g.

The addition of grape pomace powder to cake increased their weight relative to the control group; however, the weight of the cake control was lower199.43±.26034g. The volume of the baked cakes was seen to be increased to surpass that of the control at all investigated levels upon the addition of grape pomace powder to the cake mix, particularly at the 5% GPP level

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Table 3: Physical characteristics of cake made with wheat flour substituted with varying quantities of grape pomace powder

Sample	Weight g	volume cm^3	specific volume cm^3/g
0%	199.43±.26034a	203.33±3.33333a	1.0167±.01667a
1.5%	207.00±.57735b	220.00±5.77350b	1.0567±.03180a
3%	203.20±.05774c	256.66±3.33333c	1.2600±01528b
7%	214.80±.05774d	276.66±3.33333d	1.2833±.01667b

Similar results were seen with[16]. the decreased gluten level of the flaxseed bread may be the cause of the decrease in specific volume. Lower specific volume values of bread made with non-glutinous flour added or partially substituted for wheat flour may be caused by the additives' lower gluten content, which results in less gas trapping and an active gluten network. This may be closely linked to the greater bread hardness described in the preceding division on bread.

Sensory assessment of cake samples

Table 4 shows the results of the sensory analysis of the control and grape pomace cake samples. The cake sample enriched with 1.5% GPP was shown to have the greatest sensory scores in taste 8.5760±.16799 . As a result, the addition of GPP improved the majority of the cake's sensory qualities and was tolerated up to a 1.5 % level. The addition of GPP had a considerable impact on the cake's flavor as well. specifically, the inclusion of GPP increased the cake's overall flavor and acidity 7.9230±.26732 and 6.6680±.42545 at level 3% and 7% while increasing its sweet taste. GPP fortification had a major impact on the crust color and crumb color were 8.4000±.24832, 7.6600±.20667 and 8.1360±.39582, 6.6360±.15703 ,respectively . The higher concentration of colors from the grape pomace can account for this outcome. The cake produced with GPP showed the largest color shift, which was explained by the dessert's deep purple hue. because of the maillarnd reactions that took place during baking, all of the cake crusts were darker. The lowest color value was found in the cake control.

Ultimately, there was a discernible effect of the GPP addition on the product's overall acceptance. In fact, the GPP cake's acceptability score was9.1210±.16694, 8.1180±.17653 and6.8850±.13569 , compared to the control 8.1200±.24409. [7] reported a similar outcome. This implies that customers will accept muffins

Enhanced with 5% and 10% grape pomace. Additionally, according to[20], given that GPP significantly affects the fortified bread's antioxidant activity, polyphenol content, and overall dietary fiber content while obtaining an acceptance score that is comparable to that of regular bread, it is a good ingredient for use in bakeries

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Table 4: Sensory analysis of cakes made with wheat flour substituted with varying quantities of grape pomace powder

levels	Appearance	Crust color	Crumb color	Taste	Aroma	Over all acceptability
0%	8.4130±.32617a	9.2480±.17650a	8.5660±.14976a	7.6640±.44992a	8.5320±.24000a	8.1200±.24409a
1.5%	8.0140±.15808a	8.1480±.36215b	7.6910±.15798b	8.5760±.16799b	8.0510±.23252b	9.1210±.16694b
3%	6.6140±.20431b	8.4000±.24832a	8.1360±.39582a	7.0240±.31413c	7.9230±.26732c	8.1180±.17653a
7%	5.7110±.28265ab	7.6600±.20667c	6.6360±.15703c	7.1290±.26624d	6.6680±.42545d	6.8850±.13569c

[5]

different letters denote statistical changes ($p < 0.05$). In the same column

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7% 3% 1.5% 0%

Fig 1. Sensory characteristics of cakes supplemented with varying quantities of grape pomace

Influence of the addition of grape pomace powder on the staling of the cake.

Staling is a multifaceted issue. It refers to every alteration that happens to a cake after baking. A straight forward test called alkaline water retention capacity is used to monitor the staling of bakery goods[3]. The information in Table 5. demonstrated how adding grape pomace powder affected the freshness of cake that was kept for 0, 3, 5, and 7 days at room temperature. under the same circumstances, grape pomace powder cake was predicted to be fresher than cake control

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Table 5 : Staling of cake made with wheat flour substituted with varying amounts of grape pomace powder and kept for seven days at room temperature.

levels	0	1.5	3	7
Storage days	Freshness%			
0	344.66±.88192a	413.44±3.27972a	436.66±8.81917a	460.00±5.77350a
3	362.66±31.466a	397.66±.88192b	462.33±7.88106b	463.33±8.81917b
5	250.15±.09644b	342.66±1.20185c	391.00±2.51661c	420.00±5.77350c
7	233.33±28.48001b	299.00±.57735d	318.12±.01528d	403.00±3.51188d

different letters denote statistical changes ($p < 0.05$). In the same column

As a result, later, the staling rate was raised. Accordingly, cake made with wheat flour is more staling quickly than cake made with grape pomace powder. This can be because the former has less moisture content than the latter. These results corroborated those of [4]who discovered that starch gelatinized at a rate that increased when there was an excess of water present. The process of gelatinization begins when water is absorbed by starch granules, which then swell and finally break down to release their amylose content. cakes were kept at room temperature in airtight plastic bags. It is evident that as the storage duration increased, the AWRC values gradually released, indicating that the GPP cake was fresher than the wheat cake control. At 7 day, the freshness reduction was 233.33±28.48001%,299.00 ±.57735 %, 318.12±.01528%, and 403.00±3.51188% at level 0,1.5 ,5 and 7%GPP. Throughout storage, the staling values of several cake samples significantly increased. The cake with replaced flour and varying quantities of grape pomace powder produced a smaller drop in these parameters (high freshness) compared to the control cake .cake samples made from GPP showed a lesser loss in staling value (excellent freshness). The cake made from wheat flour only had the greatest staling values had low freshness (344.66±.88192, 362.66±31.46603 , 250.15±.09644 and233.33±28.48001at 0 ,3 , 5 and 7 days, respective

Conclusion

Using powdered grape pomace, a creative and successful cake recipe was created. Dietary fiber and phenolic chemicals can be found in abundance in powdered grape pomace. The inclusion of 1.5, 3, and 7% GPP affected the appearance, essentially the color, It rose in crust color and cumber color as the addition amounts increased.

The antioxidant activity of powdered grape pomace helped extend the cake's shelf life. It is advised to add 1.5% to wheat flour as a substitute to make a cake that is edible. In conclusion, it is recommended that the food industry support the use of powdered grape

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pomace as an affordable method of utilizing locally obtained ingredients for cakes. As a result, the cakes will be able to contain ingredients with greater functionality and antioxidant activity.

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