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CHANGES IN BAKING AND SENSORY PROPERTIES OF WHEAT BREAD AND MUFFINS WITH THE ADDITION OF GRAPES

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ABSTRACT: Grape juice residue i.e. peel and seeds were dried in a cabinet drier at 60oC for 5 hours. Dried grape peel and seed powder were utilized in the bread and muffins, which were found to be rich in total phenolic compounds, anthocyanins and ascorbic acid. On addition of grape peel and seed powder to the bread at 2 per cent and 4 per cent in each there was increase in weight, volume, specific volume. The shelf life of bread with grape peel and seed powder was more than control. The appearance, colour, texture and taste of bread and muffins with grape peel and seed powder was more eye appealing than control with higher sensory scores.

Keywords: *Grape juice residue, total phenolics, anthocyanins, ascorbic acid, bakery products.*

Grape (*Vitis vinifera*), basically a sub- tropical crop, is cultivated in an area of 64.3 thousand ha with a total production 1,630.7 thousand tons and productivity of 25.4 tons/ha. Because of special arbour training systems provided for grape cultivation in India, productivity is highest among the grape growing countries of the world.

Grapes, the edible fruit of the grapevine, are a prime example of a true berry. A berry in botanical terms is a class of fleshy fruit lacking a stony layer, with the fruit wall being fleshy or pulpy (Robinson, 12). Grapes grow in bunches which vary in size and shape depending on the grape variety (Galet, 4) with varying colours from green to yellow, pink, crimson, dark blue, and black, with the majority of grapes being yellow or very dark purple (Robinson, 12).

The significant parts of the berry are the flesh, skin, and seeds (Robinson, 12). The flesh or pulp is the bulk of the berry. The pulp contains the juice in vacuoles of pericarp cells (Mullins *et al.,* 11). A central core of vascular strands connects to a mesh of veins that encircles the outer edge of the flesh like a "chicken-wire" cage. The grape skin is a tough enveloping layer around the grape that holds it together. The outside layer, or bloom, consists of waxy plates and cutin, which resist water, fungal spore growth and other biological infections. Below the bloom are the cell layers that form the skin and contained within these layers are concentrated carotenoids, xanthophylls and anthocyanins (Mullins *et al.,* 11). Tannins, along with a significant amount of the grapes flavor compounds, are also located in the skin. Seeds contain tannins, mostly pro-anthocyanidins, which if crushed, confer a bitter taste (Robinson, 12).

Disposal of grape pomace, the waste generated during wine making, has posed a major challenge for wineries. During wine production, wine grapes are harvested and pressed to extract juice for fermentation. As a result of pressing, the skins, stems, and seeds are left behind as waste. Removal of this pomace is costly and if the pomace is not treated effectively, it can initiate a number of environmental hazards, ranging from surface and ground water contamination to foul odours (Bonilla *et al.,* 2).

Winery waste can also have an environmental impact through the increase of the chemical oxygen demand (COD) and biochemical oxygen demand (BOD) within wastewater streams. The high COD and BOD levels of the grape pomace originate from their high pollution loads and high content of lipids and other organic substances such as sugars, tannins, polyphenols, poly alcohols and pectins (Schieber *et al.,* 14). Due to the environmental problems that these high COD and BOD cause, it is

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beneficial for wineries to find other applications for their grape pomace waste other than animal feeds or fertilizers (Inbar *et al.* 6). To help alleviate the issues associated with grape pomace, its use in alternative applications has been explored. Applications have included the production of value-added products such as dietary supplements for disease prevention (Shrikhande, 15), grappa (grape pomace alcohol) production (Hang and Woodams, 5), laccase (Moldes *et al.,* 10) and pullulan (Israilides *et al.,* 7) production. In addition to finding a productive use for a waste product, these products have been produced in response to a changing consumer demand for naturally processed, additive-free, and safe products. Consumers tend to prefer safe, traditional products, which are promoted as "natural" and without other additives (Bianco and Uccella, 1). Thus, the substitution of currently used synthetic food antioxidants by ones pereceived as "natural" by consumers interests the research community. The market demand for natural antioxidants rather than chemical antioxidants added to baked products has directly increased the demand for novel polyphenolic containing ingredients. As part of this trend, the formation of antioxidant rich flours milled from dried grape waste and the subsequent incorporation of these flours into baked foods is a promising option.

The baking market is an important segment within the food and beverage industry. The major products marketed within this industry include bread, morning goods, biscuits, cakes, and pastries (Gale, 3). Consumers are increasingly concerned about their health and are aware of the relationship between nutritious food and optimal health. Increasing consumer demand for healthy and convenient food has caused the baking industry to search for innovative yet functional ingredients, which will allow them to capitalize on the current market trends.

Various concerns have caused consumers to closely monitor their dietary requirements. The rising incidence of health conditions such as obesity, diabetes and cardiac problems, concerns over physical appearance and the increasing price of health care have all contributed to the demand for healthier bakery products (Lempert, 9). One way to create a healthier bakery product with an enhanced nutritional profile is through the addition of functional ingredients such as phytosterols, multigrain, prebiotics, multivitamins, and polyphenolics.

Grape seed flour has been shown to be rich in polyphenolic compounds and because of this profile, a growing demand exists for the inclusion of this flour into processed foods. Proantho-cyanidins are the major polyphenols found in red wine and grape seeds with grape seeds being rich sources of monomeric phenolic compounds such as (+)-catechin, (-)-epicatechin, (-)-epicatechin-3-o-gallate, and dimeric, trimeric, and oligomeric procyanidins (Saito *et al.,* 13). However, there is concern that food preparation processes such as baking cause a loss of some of the health benefits through phytochemical loss (Wang and Zhou, 17). Thus it is critical to consider the chemical changes which occur during food preparation.

The antioxidative properties of grape peel and seed, coupled with an increased interest by consumers in wheat-based products containing value-added ingredients, present a significant opportunity for research and development with the objectives- to develop bakery products by utilizing grape peel and seeds, and to study the shelf life of the products

MATERIALS AND METHODS

Raw materials-flour, sugar, salt, yeast and other ingredients for product preparation was procured from local market. Grapes (Punjab Purple) variety was procured from Department of Fruit Science, PAU, Ludhiana. Grape juice was extracted by using mechanical type of juice extractor. Bread was prepared after incorporation of grape peel and seed powder such at levels of 0-4 per cent and packed in different packaging materials (Low Density Polyethylene and Polypropylene)

which were stored under ambient (30±1ºC) conditions. Determination of physico-chemical characteristics of raw materials was done using standard procedures (AACC, 2000). Products-bread and muffins were prepared according to standard procedures (AACC, 2000) with slight modification. Product prepared was evaluated for sensory properties by panel of semi trained judges (Larmond, 8). For shelf life determination, breads were stored for 10 days at ambient and refrigerated temperatures and analyzed for shelf life study. Physico-chemical analysis, product quality, organoleptic quality and shelf life of raw material and product were observed and average data obtained were subjected to techniques of analysis of variance (Singh *et al.,* 16).

RESULTS AND DISCUSSION

Grape characteristics

Grapes had 50 per cent juice yield, 12.7 per cent peel, 6.3 per cent seed, 31 per cent wines, 69 per cent edible part and 19 per cent juice residue (Table 1). Punjab Purple grape juice had 19.67°B TSS, 18.2 per cent total solids, 0.5 per cent acidity, 8.13 mg/100g ascorbic acid, 5.47 mg/100g anthocyanins and 6.713 mg/100g tannins. The grape peel had 24.5°B TSS, 22 per cent total solids, 0.48 per cent acidity, 18.09 mg/100g ascorbic acid, 15.07 mg/100g anthocyanins and 34.68mg/g total phenols. Grape seed contains 37.5mg/g total phenols (Table 2). On an average, Red grapes contain 18.1° B TSS, 0.49 per cent acidity, 8.06 mg/100g ascorbic acid, 5.06 mg/100 anthocyanins and 3.92 pH (Gale *et al.,* 3). Similarly, the amount of total phenols from the different parts of the red grape berry were estimated to be ~33 per cent in the skins, ~62 per cent in the seeds, ~1 per cent in the pulp, and ~4 per cent in the juice. Grapes (blue variety) have 85±0.9 per cent moisture, 2.7±0.2 g/100g fiber and 23±9 mg/100g ascorbic acid. They also reported that grapes contain major minerals (mg/100g) like Ca (30±1.8), Mg (40±0.8), Na (4±0.8), P (20±1.8), K (249±15) and other trace minerals like Fe, Zn and Cu.

Table 1: Per cent recovery of various portions of grape variety 'Punjab Purple'.

Portions	Percentage
Juice Yield	50.0
Peel	12.7
seed	06.3
Wines	31.0
Edible part	69.0
Juice Residue	19.0

A grape seed contains mainly phenols such as proanthocyanidins (oligomeric proantho-cyanidins). Scientific studies have shown that the antioxidant power of proanthocyanidins is 20 times greater than vitamin E and 50 times greater than vitamin C. Researches suggest that grape seed oil helps to protect the body from sun damage, improve vision, improve flexibility in joints, improve blood circulation, and reduce LDL oxidation and the occurrence of coronary heart disease. The dietary consumption of grape and its products is associated with a lower incidence of degenerative diseases such as cardiovascular disease and certain types of cancers. Anthocyanins, flavanols, flavonols and resveratrol are the most important grape polyphenols because they possess many biological activities, such as antioxidant, cardioprotective, anticancer, anti-inflammation, antiaging and antimicrobial properties. They concluded that the polyphenols from grape could widely be employed to prevent and treat diseases in association with reactive oxygen species, such as atherosclerosis, coronary heart diseases and cancer.

Baking quality of bread

Significant variations were found in weight, height, volume and specific volume of bread prepared after incorporation of dried grape juice residue. Loaf weight increased with increasing level of dried grape juice residue. Similarly loaf height, volume, specific volume and shelf life of bread increased with increased level of dried grape juice residue as compared with control sample (Table 3).

Table 2: Physico-chemical characteristics of grape juice and peel.

Parameters	Grape juice	Grape peel	Grape seed
Total soluble solids(oB)	19.67	24.5	-
Total solids (per cent)	18.2	22.0	-
Acidity (per cent)	0.50	0.48	-
Ascorbicacid (mg/100g)	8.13	18.09	-
Anthocyanins (mg/100g)	5.47	15.07	-
Total phenols (mg/g)	-	34.68	37.5

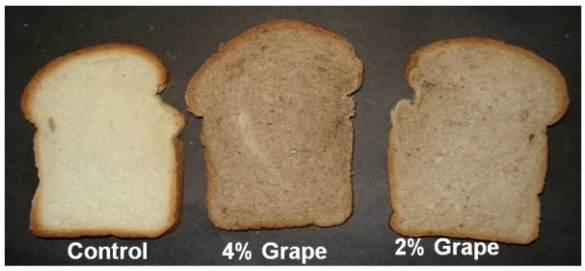

Fig. 1: Effect of grape peel and seed on the baking quality of bread.

Table 3: Effect of different concentrations of grape juice residue on the quality of bread.

Level (%)	Weight (g)	SD	Height (cm)	SD	Volume (cc)	SD	Specific Volume	SD	Room Temp. (days)	Refrige rator Temp. (days)
Control	132.98	2.364494	9.47	0.25	677.33	2.52	5.08	0.096	7	27
2	141.39	1.624856	9.67	0.25	701.66	7.64	4.95	0.087	8	30
4	137.27	2.927526	10.07	0.25	692.33	2.52	5.03	0.108	8	32

Table 4: Effect of different concentrations of grape juice residue on the sensory quality of Bread and Muffins.

	Bread						Muffins					
Samples	Appearance	Texture	Taste	Overall acceptability	Appearance	SD	Texture	SD	Taste	SD	Overall acceptability	SD
Control	7.75	7.50	7.63	7.63	8.75	0.83	8.50	0.91	8.63	0.97	8.25	0.33
2 per cent	7.63	7.63	7.88	7.88	8.25	0.56	8.00	0.22	8.32	0.67	8.00	0.55
4 per cent	8.50	8.33	8.33	8.33	8.50	0.72	8.25	0.51	8.88	0.45	8.50	0.31

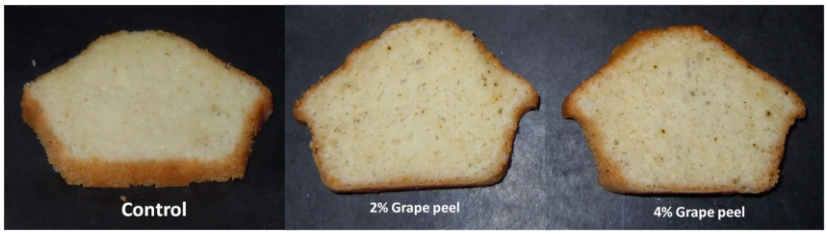

Fig. 2: Effect of grape peel and seed on the baking quality of muffins.

The earlier works reveal that bread with the addition of GSE had stronger antioxidant activity than that of blank bread, and increasing the level of GSE addition further enhanced the antioxidant capacity of the bread. However, thermal processing caused antioxidant activity of GSE added to bread to decrease by around 30–40 per cent. Also the effect of GSE on the formation of detrimental N-(carboxymethyl) lysine (CML), a famous advanced glycation end product in bread was studied. According to the results, GSE could reduce CML in bread and acted in a dose-dependent manner. Meanwhile, except for an acceptable colour change, adding GSE to bread had only little effect on the quality attributes of the bread. Altogether, findings indicated that GSE-fortified bread was promising to be developed as a functional food with relatively lower CML-related health risks, yet a high antioxidant activity.

Sensory evaluation of bread and muffins

Significant variations were found in overall acceptability of bread and muffins prepared after incorporation of dried grape juice residue at different level (Table 4). Overall acceptability was more at 4 per cent grape peel (8.33) as compared to control (7.63). Overall acceptability of muffins prepared after incorporation of dried grape juice residue was found more at 4 per cent as compared to control (Table 4).

CONCLUSION

On addition of grape peel and seed powder to the bread at 2 per cent and 4 per cent in each showed the increase in weight, volume, specific volume and shelf life. The shelf life of bread with grape peel and seed powder was more than control. The appearance, colour, texture and taste of bread with grape peel and seed powder was more eye appealing than control with higher sensory scores

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