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Addition of pomace powder of Manjari Medika grapes *(Vitis vinifera)* improves nutraceutical and sensory properties of wheat bread

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ABSTRACT

The baking conditions were standardized to replace wheat flour by pomace powder of grapes *(Vitisvinifera)* of Manjari Medika as T_2, T_3, T_4 and T_5 and compared with control (T_1). Replacement of wheat flour by pomace powder tremendously improved nutritional and functional properties of breads compared with the control. The breads with pomace powered resulted in higher mineral contents. Available anthocyanins in pomace powder influenced colour intensity of breads. Evaluation of breads based on sensory properties, 5% replacement was found with maximum acceptance level followed by 10%. While 15 and 20% replacement were observed with lower score than the control. All levels of pomace powder scored better than the control for flavour. Thus, it is concluded that 10% replacement of wheat flour by pomace powder of Manjari Medika is well acceptable and can be adopted by bakery industries in bread-making.

Key Words: Wine, Juice, Baking, Functional properties, Natraceutical, Sensory

Grape *(Vitis vinifera)* is widely adopted globally. Grape pomace is the material that is discarded after juice or wine is extracted through pressing. This material consists of grape skins / pulp, seeds and either juice or wine depending on whether pressing occurred before or after fermentation. All those contain fairly good amount of flavanols, flavonoids, anthocyanins, and phenolic acids (Lafka *et al.*, 2007). Pomace of grapes have a good quantity of soluble dietary fiber (Llober and Canellas, 2007). To encourage and support the wine and juice industry in India, there is need to adopt practices for sustainable development and utilization of by-products generated during wine and juice making. It will help in opening of unlimited opportunities in this sector, same time support environment and consumers will get high valued products having foods with functional properties.

MATERIALS AND METHODS

The experiment was conducted at ICAR-NRC for Grapes, Pune, during 2018-19. Standard ingredients for bread making were collected and breads were prepared. To standardise baking conditions, a preliminary experiment was carried out with 10% white wheat flour replaced by pomace powder of Manjari Medika grapes. The dough was prepared by adding ingredients 900 g white wheat flour, 100 g pomace powder, 28 g sugar, 50g shortening, 30 g baking yeast, 20 g salt, 1 g calcium propionate, 5 g milk powder, 2 g bread improver and 2 g gluten. The straight dough method was opted with different temperature and time combinations of baking (160°C for 50, 45 and 40 min, at 170°C for 35, 30 and 25 min and at 180°C for 30, 25 and 20 min).

The suitable balking condition was identified based on organoleptic evaluation of breads by semi-trained panel using 9 point hedonic scale. Portion of white wheat flour was replaced by a linearly increasing quantity [5 (T_2), 10 (T_3), 15 (T_4) and 20% (T_5)] of pomace powder to finalize suitable combination.Prepared breads were analysed for nutraceutical and sensory properties compared with the controlsample(T_1) prepared without grape pomace powder. The straight dough method and baking parameters (170°C for 30 min) were finalized. The baked breads were cooled for 4 hr and sliced to give uniform shape and size to bread pieces.

Moisture content in bread was estimated by using hot air oven (Ranganna, 1995). The ash content was

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determined by ashing at 525±5°C for 6 hours (Ranganna, 1995). For fat, AOAC method (1995) was adopted. Two grams of samples were used. The protein content was estimated by method suggested by Lowry *et al.* (1951), carbohydrate content was determinedas method given by Hedge and Hofreiter (1962), phenol content against gallic acid (Slinkard and Singleton, 1977) and tannin content was measured by following method of Singleton *et al.* (1965). For anthocyanins content, method suggested by Picinelli *et al.* (1994) was adopted. Colour intensity was measured by the method of Sommers *et al.* (1997).

The mineral analysis samples were performed on ICP-MS (Agilent 7800). A semi-trained sensory panel of 20 members comprising 10 male and 10 females was involved in evaluation of sensory properties of breads. The sensory attributes, colour, texture and appearance, flavour, taste, mouth sensation and overall acceptability were considered. The products were sensory evaluated based on 9-point Hedonic scale. The data were collected from five biological replication of each treatment. The obtained data on different parameters were statistically analysed by using completely randomized design.

RESULTS AND DISCUSSION

Minimum score for sensory parameters was recorded when breads were baked at 160°C for 50 minutes, while bread prepared at 170°C for 30 minutes obtained maximum score, followed by baking at 170°C for 25 minutes. Besides, heat regulation and final moisture content are crucial in preparation of bakery products. Teshome *et al.* (2017) observed that quality of cookies affected by baking temperature and duration. Similar observations were noted by Saric *et al.* (2014). Baking temperature isbasic and most obvious factor, influence on heat transfer (convection, conduction, radiation). It affects various physical, chemical and biochemical changes during baking process (Mondal and Datta, 2008). Chul and Byung (2007) studied influence of baking time and temperature on quality characteristics of breads. Sharma *et al.* (2018) observed that dough matrices play an important role in optimizing baking conditions.

The data indicated that addition of pomace powder of Manjari Medika significantly improved quality of breads (Table 1). Moisture content was sharply decreased increased in T_2 compared to control *i.e.* T_1. But moisture contents again gradually increased by increasing pomace powder concentration. The ash, fat and protein content were increased by increasing pomace powder content, maximum content being in T_5 where 20% maida was replaced. Carbohydrate content increased by decreasing in all treatments except T_2 where 5% white wheat flour was replaced in comparison to T_1 and minimum carbohydrate (25.97%) was observed in T_5 and maximum (41.97%) was in T_2. Data on phenol, anthocyanins and tannin content in breads clearly indicate value-addition in breads in terms of functional properties.

Maximum levels of these parameters were recorded at maximum replacement of white wheat flour, 20% (T_5). Phenol and tannin content in the control was only 0.10 mg / 100 g, by replacement of white wheat flour, it increased and maximum content was observed in T_5 with values of 2.62 and 3.15 mg / 100 g, respectively. While NIL anthocyanins were estimated in the control (T_1) and increased upto level of 0.62 mg / 100 g in T_5. Anthocyanins contribute to colour confirmingthe present study. Colour intensity inwas zero in the

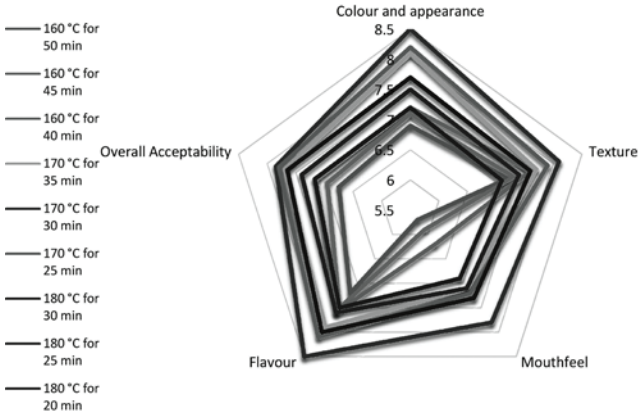

Fig. 1: Sensory qualities of breads with (Manjari Medika pomace powder) prepared under different baking conditions

Table 1. Physico-chemical properties of breads prepared by adding pomace powder

Pomace concentration	Moisture (%)	Ash (%)	Fat (%)	Protein (%)	Carbohydrate (%)	Phenol (mg/100 g)	Tannin (mg/100 g)	Anthocyanins mg/kg	Colour intensity %
Control	36.45	17.43	3.81	4.44	38.05	0.10	0.10	0.0	0.0
5%	30.22	18.47	3.81	5.60	41.97	0.70	0.85	0.05	0.25
10%	35.94	18.54	4.65	8.27	33.11	1.25	1.65	0.13	0.52
15%	35.98	19.70	5.07	9.35	33.03	1.45	2.35	0.399	1.03
20%	36.30	19.73	5.21	13.11	25.97	2..62	3.15	0.62	1.97
LSD (5%)	0.226	0.018	0.131	0.089	0.021	0.208	0.174	1.485	0.014

Table 2. Mineral profiling of breads enriched by adding Manjari Medika pomace powder

Pomace concentration	Zinc (ppm)	Copper (ppm)	Calcium (ppm)	Iron (ppm)
Control	9.82	5.32	322.8	44.0
5%	17.20	18.05	521.5	55.4
10%	18.87	16.20	547.6	64.0
15%	18.90	9.17	581.6	66.3
20%	22.22	9.27	750.4	72.7
LSD (5%)	2.104	0.8209	52.74	3.10

control. By replacing maida, colour intensity showed increasing trend. Maximum value, (1.97) was observed in T_5. Similar observation was observed in anthocyanins (Table 2). Addition of pomace powder resulted in increased content of Zn, Cu, Ca and Fe. Breads contained maximum Zn, Ca and Fe in T_5 where 20% white wheat flour was replaced by pomace powder and T_1 (control) was found with minimum values. While irregularity was observed in Cu content and maximum quantity (18.05 ppm) was estimated in T_2. By increasing quantity of pomace powder was resulted in decreeing trend.

Based on blended flour matrices, even when wheat flour is replaced by non-gluten forming type flours result in technologically viable and higher level of sensory acceptability of bakery products. The replacement of wheat flour improves nutritional properties in comparison to 100% wheat flour counterparts (Collar *et al.,* 2014). It is well documented by researchers, dough rheology, product texture, nutritional and functional properties of bakery products are affected by addition of grape by-products (Gaita *et al.,* 2018; Maner *et al.,* 2017; Iuga and Mironeasa, 2020). Tolve *et al.,* (2021) concluded that the addition of grape pomace powder changed the chemical composition of bread including colour parameters. The nutritional composition of breads showed incremental trend by increased white wheat flour replacement.

As pomace powder is obtained from red grapes and having anthocyanins, so the colour was imparted to breads also. Smith and Yu (2015) concluded that addition of grape powder is good source of dietary polyphenols and fiber. Utilization of grape pomace flour in bread making is able to add nutritional value of grape powder to bread.The pomace powder of Manjari Medika grapes is observed with higher contents of functional compounds (Sharma *et al.,* 2018) and same were transferred to breads. Same trend was reported in mineral composition of breads. The breads prepared by white wheat flourreplacement enriched in Cu, Fe, Zn and Cu content as pomace powder is rich source of these minerals. Ahmed *et al.,* (2020) recorded mineral content in pomace powders of different grape varieties.

Replacement of white wheat flour by pomace powder of Manjari Medika impacted on sensory properties of breads. As pomace added nutraceutical values to breads an increased trend was noted with increased level of pomace powder. Replacement of 5% scored maximum acceptance level followed by 10%. While 15 and 20% found with lower score than control. All levels of pomace powder scored better than the control for parameter flavour.Pomace powder of grape varieties added to breads influenced bread volume, firmness, crumb and crust colour, and odour and taste intensity (Sporin *et al.,* 2018).

Walker *et al.* (2014) reported that bread fortified with 10% of Pinot Noir grape pomace was acceptable by consumers. Almost same results were recorded in present investigation also. However, level of grape pomace in dough and varietal type of pomaces are also very important for producing bakery products having acceptable among consumers (Smith and Yu, 2015, Sharma *et al.,* 2018).

Thus it may be concluded that replacement of white wheat flour by pomace powder improved nutraceutical and sensory properties of breads. Addition of pomace powder can be easily accepted by consumers, sustaining grape-growing areas.

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