

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

Ajay Kumar Sharma^{1*}, R G Somkuwar¹, R A Dgadhair² and A K Upadhyay¹

<https://doi.org/10.5958/2455-7560.2023.00005.5>

¹ICAR-National Research Centre for Grapes, Pune 412 307, India

²ICAR-Directorate of Onion and Garlic Research, Pune 412 307, India

Received: 15 May 2020; Accepted: 17 August 2021

ABSTRACT

The baking conditions were standardized to replace wheat flour by pomace powder of grapes (*Vitis vinifera*) of Manjari Medika as T₂, T₃, T₄ and T₅ and compared with control (T₁). Replacement of wheat flour by pomace powder tremendously improved nutritional and functional properties of breads compared with the control. The breads with pomace powder 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, Nutraceutical, 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 baking 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 (T₂), 10 (T₃), 15 (T₄) and 20% (T₅)] of pomace powder to finalize suitable combination. Prepared breads were analysed for nutraceutical and sensory properties compared with the control sample (T₁) 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

*Corresponding author : ajay.sharma1@icar.gov.in

determined by ashing at $525 \pm 5^\circ\text{C}$ 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 determined as 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 is basic 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 confirming the present study. Colour intensity in was zero in the

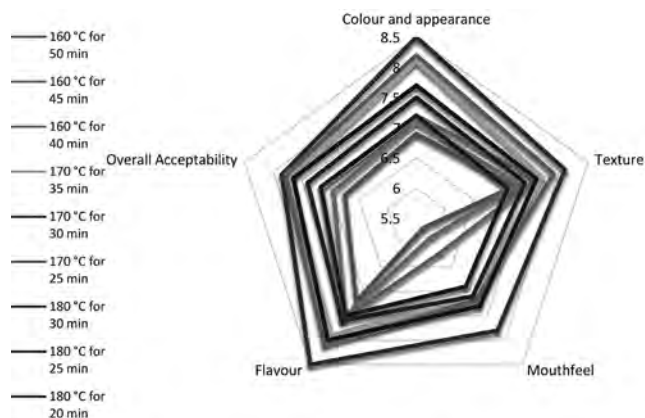


Fig. 1: Sensory qualities of breads with (Manjari Medika pomace powder) prepared under different baking conditions

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 T₅. 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 T₅ where 20% white wheat flour was replaced by pomace powder and T₁ (control) was found with minimum values. While irregularity was observed in Cu content and maximum quantity (18.05 ppm) was estimated in T₂. 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 flour replacement 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.

REFERENCES

- Ahmed I A M, Ozcan M A, Juhaimi F Y A, Babiker E E, Ghafoor K, Banjanin T, Osman M, Gassem M A and Alqah H. 2020. Chemical composition, bioactive compounds, mineral contents, and fatty acid composition of pomace powder of different grape varieties. *Journal of Food Processing and Preservation* **44**(4), e14539. DOI: 10.1111/jfpp.14539
- AOAC, Washington DC. 1995. 16th edition. Official Methods of Analysis Association of Official Analytical Chemists.
- Chul S P and Byung K B. 2007. Influence of baking and thawing conditions on quality of par-baked French bread. *Cereal Chemistry* **84**: 38-43.
- Collar C, Jiménez T, Conte P and Fadda C. 2014. Impact of ancient cereals, pseudocereals and legumes on starch hydrolysis and antiradical activity of technologically viable blended breads. *Carbohydrate Polymers* **113**: 149-58.
- Gaita C, Alexa E, Moigradean D and Poiana M A. 2018. Designing of high value - added pasta formulas by incorporation of grape pomace skins. *Romanian*

- Biotechnological Letters*. https://www.rombio.eu/docs/Gaita_etnonbreakingspaceal.pdf
- Hedge J E and Hofreiter B T. 1962. *Determination of Total Carbohydrate by Anthrone Method*. *Carbohydrate Chemistry*. Whistler R L and Be M (Eds), Academic Press, New York.
- Luga M and Mironeasa S. 2020. Potential of grape by products as functional ingredients in baked goods and pasta. *Compr. Rev. Food Sci. Food Saf.* **19**(5): 2473-505. <https://doi.org/10.1111/1541-4337.12597>.
- Lafka T I, Sinanoglou V and Lazos E. S. 2007. On the extraction and antioxidant activity of phenolic compounds from winery waste. *Food Chem.* **104**: 1206-1214. doi:10.1016/j.foodchem.2007.01.068
- Lowry O H, Rosebrough N J, Farr A L and Randall R J. 1951. Protein measurement with the Folin phenol reagent. *Journal of Biological Chemistry* **193**: 265-27.
- Maner S, Sharma A K and Banerjee K. 2017. Wheat flour replacement by wine grape pomace powder positively affects physical, functional and sensory properties of cookies. *Proceedings of National Academy of Science India Sect B: Biological Science* **87**(1): 109-113. DOI 10.1007/s40011-015-0570-5.
- Mondal A and Datta A K. 2008. Bread baking - A review. *Journal of Food Engineering* **86**: 465-74.
- Picinelli A, Bakkar J and Bridle P. 1994. Model wine solutions: effect of sulphur dioxide on colour and composition during ageing. *Vitis* **33**: 31-35.
- Ranganna S. 1995. *Hand book of Analysis and Quality Control for Fruits and Vegetable Products* (2nd edn). New Delhi: McGraw Hill publishing Co. Ltd.
- Saric B M, Nedeljković N M, Šimurina O D, Pestorić M V, Kos J J, Mandić A I, Sakać M B, Šarić L C, Psodorov D B and Mišan A C. 2014. The influence of baking time and temperature on characteristics of gluten free biscuits enriched with blueberry pomace. *Food and Feed Research* **41**: 39-46.
- Sharma A K, Dagadkhair R A and Somkuwar R G. 2018. Evaluation of grape pomace and quality of enriched cookies after standardizing baking conditions. *Journal of Agri. Search* **5**(1): 50-55.
- Singleton V L and Rossi A. 1965. Colorimetry of total phenolics with phosphomolybdic-phosphotungstic acid reagents. *American Journal of Enology and Viticulture* **16**:144-158.
- Slinkard K and Singleton V L. 1977. Total phenol analyses: automation and comparison with manual methods. *American Journal of Enology and Viticulture* **28**: 49-55.
- Smith I N and Yu J. 2015. Nutritional and Sensory Quality of Bread Containing Different Quantities of Grape Pomace from Different Grape Cultivars" *EC Nutrition* **2**(1): 291-301.
- Sommers T C and Evans M E. 1977. Spectral evolution of young red wines: anthocyanin equilibria, total phenols, and free and molecular SO₂. *Journal of the Science of Food and Agriculture* **28**: 279-87.
- Sporin M, Avbelj M, Kovač B and Močina S S. 2018. Quality characteristics of wheat flour dough and bread containing grape pomace flour. *Food Science and Technology International*. doi:10.1177/1082013217745398. **24**(3): 251-263.
- Teshome E, Tola Y B and Mohammed A. 2017. Optimization of Baking Temperature, Time and Thickness for Production of Gluten Free Biscuits from KeyetenaTeff (*Eragrostis tef*) Variety. *Journal of Food Processing and Technology* **8**: 675. doi: 10.4172/2157-7110.1000675.
- Tolve R, Simonato B, Raineo G, Bianchai F, Rizzi C, Cervini M and Giuberti G. 2021. Wheat Bread Fortification by Grape Pomace Powder: Nutritional, Technological, Antioxidant, and Sensory Properties. *Foods* **10**: 75. <https://doi.org/10.3390/foods10010075>
- Walker R, Tseng A, Cavender G, Ross A and Zhao Y. 2014. Physicochemical, Nutritional, and Sensory Qualities of Wine Grape Pomace Fortified Baked Goods. *J. Food Sci.* **7**: S1811-22.