Quality evaluation of biscuits supplemented with *Rhododendron* flower powder

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ABSTRACT

In the present study, *Rhododendron* flowers were used for the preparation of biscuits to enhance the utility of this valuable flower. Dried *Rhododendron* petals powder was incorporated at different levels (0%, 5%, 10% and 15%) in biscuits and their sensory and physico-chemical properties were evaluated. The results revealed that, the length and thickness of biscuits decreased by increasing the proportion of *Rhododendron* powder in biscuits. Addition of *Rhododendron* powder to wheat flour significantly increased the content of moisture, ash (0.75 to 1.20%), protein (3.06 to 4.96 %), fibre (0.07 to 0.67 %) and iron (3.90 to 4.19 mg/100g). The sensory results showed a significant decrease (7.70 to 7.10) in the overall acceptability by the addition of *Rhododendron* powder to wheat flour but the product remained acceptable in terms of sensory acceptability up to the level 10 per cent. From the study it can be concluded that a maximum of 15% *Rhododendron* powder can be incorporated to prepare acceptable quality of biscuits.

Key words: Biscuits, Iron, Proximate composition, *Rhododendron arboreum*, Sensory acceptability.

INTRODUCTION

*Rhododendrons* are wildly grown flowers in Himachal Pradesh at high altitude. The genus *Rhododendron* belongs to the heather family, Ericaceae. It is commonly known as “burans”, is amongst highly valued wild edible flower growing between 1500 and 2400 m above mean sea level. The flower of *Rhododendron* exhibits many nutritional, medicinal and aromatic properties and has a number of uses in folk medicine.

Traditionally, the petals of the *Rhododendron arboreum* flowers are commonly used in the preparation of chutney by the hill people. Flowers contain anthocyanins and flavonols as the major pigments (Krishna *et al.* 2010) and the hot water extract of flowers can be used as natural food colouring agent. Flowers are sourish-sweet in taste eaten raw; in Himachal Pradesh it is used for making chutneys, cold drinks and squash; also form an important constituent of local wine, ‘sur’ (Kharwal and Rawat 2013) which helps in preventing high-altitude sickness. At home scale, small quantities of juice extracted from flower is used for preparing jelly and squash and syrup. The dried flowers are highly efficient in the treatment of diarrhea, blood dysentery (Laloo *et al.* 2006). Fragrant dried and powered flowers mixed with oil are used for massage over the entire body in post-delivery complications like fevers, cough and cold.

*Rhododendron* flowers are good source of energy, protein, iron, antioxidants and flavonoids. It has a special place in the cultural and economic life of the people of Himachal Pradesh. However, it has remained neglected and its nutritional qualities and value added products have hardly received any attention so far. Considering the nutritive value of *Rhododendron* flower the study was carried out with the objective to develop high quality biscuits by using *Rhododendron* powder for supplementing biscuits to enhance the utility of this valuable flower.

MATERIALS AND METHODS

The study was carried out in the Department of Food Science, Nutrition and Technology, College of Home Science, CSK Himachal Pradesh Agriculture University, Palampur.

Raw materials: *Rhododendron* flowers were procured from the local people of Palampur. The flowers were cleaned and graded according to size and color and after removing the calyx and stalk, the petals were washed under running tap water. Petals were sun dried. Dried petals were coarsely powdered in a blender, sieved through 250 μm sieve and stored in polythene bag.

Preparation of blends: Blends were prepared using mixture of wheat flour and *Rhododendron* powder in the ratios of 100/0, 95/5, 95/10 and 85/15w/w. The choice of these levels was made on the initial acceptability trials of the baked product.

Biscuits preparation: Biscuits were prepared from the blends containing different proportions (0%, 5%, 10% and 15%) of *Rhododendron* powder. Biscuits made from pure wheat flour were kept as control. All ingredients used in the biscuits formulation were commercially available (Table 1). For the preparation of biscuits all the ingredients were sieved together except sugar. Fat and sugar were mixed together.
Physical and nutritional analysis of prepared biscuits:

Physical Parameters: Biscuits were analyzed for the physical parameters i.e. Dough handling, Rolling ability, length, thickness and weight of set of five biscuits.

Proximate composition: The biscuits were analyzed for proximate composition based on the standard method available (AOAC, 1990). Samples were analyzed for moisture, crude fat (Soxhlet extraction method), protein (micro-Kjeldahl Method), crude fibre and ash contents.

Minerals: Minerals composition was analyzed by the method of Ranganna, 2007. The organic matter present in the sample (1g) was wet digested with 25 ml of diacid mixture (HNO₃: HClO₄ in 5:1) and kept overnight. Digestion was done next day by heating till clear white precipitates settled down at the bottom. The crystals were dissolved by diluting in double distilled water. The contents were filtered through Whatman No. 42 filter paper. The filtrate was made up to the volume of 25 ml. The digested samples were analyzed for the determination of calcium and iron by atomic absorption spectrophotometer.

Sensory characteristics: The organoleptic characteristics of biscuits were determined, using a taste panel, consisting of 10 judges. The panelists evaluated the products for colour, flavour, taste, texture/consistency and overall acceptability. The ratings were on a 9-point hedonic scale, ranging from 9 (like extremely) to 1 (dislike extremely), for each organoleptic characteristic (Austin and Ram, 1971). Results were subjected to analysis of variance.

Statistical analysis: The data obtained from various parameters were subjected to statistical analysis with the help of computer using CRD design. The data were analyzed using analysis of variance. The level of significance was deliberated at p≤0.05. (Gupta 2000).

RESULTS AND DISCUSSION

The results of physical parameters of biscuits are given in the Table 2. The dough was non-sticky in all the proportions on biscuits and rolling ability was also not affected by adding Rhododendron powder. The addition of Rhododendron powder had significant effect on the length and thickness of the biscuits. Consequent upon the increase in the proportion of Rhododendron in biscuits, the length and thickness of biscuits decreased. The length and thickness of controlled biscuits was recorded as 22.90 cm and 6.66 cm which decreased significantly (P≤0.05) to 20.90 cm and 5.96 cm respectively in biscuits prepared by incorporating Rhododendron powder 15 per cent proportion. The weight of biscuits varied non-significantly by adding of Rhododendron powder.

Proximate composition of RP and RP-5–15% are presented in Table 3. Rhododendron powder possessed good quantities of ash content 3.55 along with iron 6.01 mg/100 g. Increasing addition of Rhododendron powder (5–15%) has shown good enhancement in ash content, an indicator of mineral composition and chiefly iron in biscuits when compared to control biscuits (Table 3).

The moisture and protein content varied significantly (P≤0.05) when controlled biscuits were compared with its other counterparts. The incorporation of Rhododendron flower powder into biscuits showed an increasing trend in the moisture compared to control. With regard to the crude protein content, a significantly lower value of protein was observed in 5 per cent level (2.23%) and highest was observed in 15 per cent (4.96%).

Table 1: Biscuit formulation substituted with different percentages of Rhododendron powder (RP).

| Ingredients          | Control | 5% RP | 10% RP | 15% RP | 66 ml (8.9 g of glucose in 150 ml water) |
|----------------------|---------|-------|--------|--------|----------------------------------------|
| FLOUR                | 45 g    |       | 42.75  | 40.5   | 6.75                                   |
| Rhododendron powder  | -       | 2.25  | 4.5    | 6.75   |                                        |
| Glucose solution     | 6.6 ml  |       |        |        |                                        |

Table 2: Physical parameters of biscuits supplemented with Rhododendron powder.

| Parameters          | Control | 5% RP | 10% RP | 15% RP | CD (P≤0.05) |
|---------------------|---------|-------|--------|--------|-------------|
| Dough handling      | Non-sticky | Non-sticky | Non-sticky | Non-sticky |             |
| Rolling ability     | Easy    | Easy  | Easy   | Easy   |             |
| Length (cm)         | 22.90   | 22.50 | 21.90  | 20.90  | 0.68        |
| Thickness (cm)      | 6.66    | 6.06  | 6.16   | 5.96   | 0.16        |
| Weight of Five biscuits (g) | 60.75 | 61.58 | 60.53  | 60.34  | NS          |
Table 3: Proximate composition and iron content of biscuits supplemented with Rhododendron powder.

| Parameters          | Control | 5% RP | 10% RP | 15% RP | CD (P ≤ 0.05) |
|---------------------|---------|-------|--------|--------|---------------|
| Moisture (%)        | 8.91    | 1.05  | 1.45   | 2.05   | 3.43          | 0.12          |
| Ash (%)             | 3.55    | 0.75  | 1.12   | 1.11   | 1.20          | 0.04          |
| Crude Protein (%)   | 5.09    | 3.06  | 2.23   | 2.80   | 4.96          | 0.06          |
| Fat (%)             | 5.42    | 12.44 | 12.48  | 12.51  | 12.91         | NS            |
| Crude Fibre (%)     | 13.72   | 0.07  | 0.12   | 0.37   | 0.67          | 0.02          |
| Iron (mg/100g)      | 6.01    | 3.90  | 4.07   | 4.15   | 4.19          | 0.07          |

The ash content showed significant increase in the formulated biscuits compared to control and this increase in ash in biscuits can be attributed to the additional minerals that might have naturally existed in the Rhododendron flowers.

Regarding crude fat, all the samples showed non-significant increase when compared to control. Fat content in biscuits is a vital basic component, and if reduced can play a significant role in altering the flavour, appearance and texture (Rankin, 2000; Maache-Rezzoug et al. 1998). However, excessive amounts of fat might not be considered healthier. So also, excessive fat levels can lead to oxidation process in the biscuits, especially during extended storage. However, we envisage that rancidity problems can be minimized by addition of synthetic or natural antioxidant rich compounds such as that of Rhododendron flowers, which can be explored in future studies. A significant increase in the crude fibre content was observed. Iron content also increased significantly as the proportion of Rhododendron powder increased in the biscuits. A significantly higher amount of iron was observed in biscuits prepared by using 15 per cent Rhododendron powder (4.19 mg/100g) and the lower was observed in controlled biscuits (3.90 mg/100g).

**Sensory analysis:** Sensory parameters (Fig. 1) depicted that colour scores varied non-significantly in the Rhododendron supplemented biscuits. A significant decrease but acceptable (7.70 to 7.10) scores for taste was observed in all blends. Controlled biscuits differed significantly when compared with biscuits prepared by using Rhododendron in the level of 10 and 15 per cent but non-significant when compared with 5 per cent. Overall scores indicated highly acceptable for SB-5%, 10% and 15% and comparable to control (CB). Addition of spirulina powder, whole wheat and sorghum flours in biscuits increased its protein, fibre as well as antioxidant potential however, high levels of fortification (> 7% spirulina powder and > 30% sorghum flour) adversely affected the color, textural and sensory attributes of biscuits (Parul et al. 2015).

**CONCLUSION**

The study conclusively indicated that nutritional quality particularly iron, fibre and protein increased in Rhododendron supplemented biscuits as compared to the control biscuits. Since the Rhododendron flowers are available for a short duration, they can be processed into dried powder to utilize throughout the year to prepare Rhododendron based value added products, not only in the area of availability but also in other parts also.
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