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RESEARCH NOTE

Physio-chemical and Sensory Properties of Biscuits Fortified with Carrot Powder

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ABSTRACT

The aim of the present study was to determine the acceptance level of biscuits made with maida: wheat in the ratio of (100:0, 50:50, 0:100) incorporated with dried carrot powder through sensory and physio-chemical evaluation (weight, diameter, thickness, spread ratio, moisture, ash, carbohydrate, fat, proteins). The butter, egg and sugar mixture were mixed after which flours, baking powder were rubbed uniformly. The dough was then, shaped and baked on a greased tray at 160°C for 10 to 15 minutes. The biscuit produced were analysed for proximate composition using standard AOAC methods. Physical and chemical analysis of cookies was in accordance with sensory analysis. On consumption of 100g cookies with maida and wheat per day gives around 11% recommended daily allowance of Vitamin A. Fortifying food with vitamin A could help in meeting the RDA of vitamin A especially and thus, could serve as a supplement to kids.

Keywords: Fortified biscuits, carrot powder, sensory and physiochemical evaluation

Bakery products are consumed and enjoyed all people of various age groups. One of the earliest and oldest techniques in the food processing field is the baking technique (Kulkarni *et al.* 2010). Bakery products have a diverse group of cookie varieties ranging from high to low fat, high to low sugar and several other combinations. Nowadays, biscuits are the most popular amongst consumers as a better source of carbohydrates, proteins, dietary fiber along with quite good shelf-life and also serve as a ready-to-eat product (Bala *et al.* 2015). Mostly biscuits are made with maida, which lacks roughage or fibre. Consuming maida for a long time spikes up the sugar level and also bad cholesterol (LDL) resulting in many health issues like weight gain, high blood pressure, and mood swings.

Carrots are one of the best sources of β-carotene. The carotene content of carrots ranges from 60–120 mg/100 g, but some varieties can reach up to 300 mg/100 g (Velisek, 1999). Carotenes contain mainly β-carotene, i.e., about 80%. The pigments are bound by proteins. Carrots can give a lot of vitamin A; food matrices incredibly influence the bioavailability of the plant carotenoids or their productivity of change to vitamin A, or both (Tang *et al.* 2005). Some studies have indicated that β-carotene may be poorly absorbed from certain vegetables (Brown *et al.* 1989). Carotenoids are broadly known as provitamin A, while there is an expanding enthusiasm for their job as an antioxidant (Bohm *et al.* 2002). Anti-cancer activity and other health benefits provided by β-carotene include the protection against cardiovascular disease or cataract prevention (Dietmar and Bamedi, 2001). According to studies carried out by National Institute of Nutrition (2011), 84% of preschool children in India are not even meeting the 50% of RDA of Vitamin A. In India, more than 52,000 children go blind every year because of vitamin A deficiency (Saijudinsheikh

and Dilip, 2018). In rural areas of Andhra Pradesh, Tamil Nadu, Karnataka, West Bengal, and Bihar vitamin A deficiency is more prevalent. Lack of knowledge, low purchasing power, socio-cultural factors, inadequate maternal and childcare are some of the factors behind VAD (Vitamin A deficiency). Vitamin A is an essential nutrient needed in small amounts for the normal functioning of the visual system, and maintenance of cell function for growth, epithelial integrity, red blood cell production, immunity and reproduction. Essential nutrients cannot be synthesized by the body and therefore, must be provided through diet. When dietary intake is chronically low, there will be insufficient vitamin A to support the vision and cellular processes, leading to impaired tissue function. Low vitamin A intake during nutritionally demanding periods in life, such as infancy, childhood, pregnancy and lactation, greatly raises the risk of health consequences, or vitamin A deficiency disorders (VADD). Multiple approaches, including vitamin A supplementation, food fortification, dietary diversification, and public health measures, have been suggested to prevent and control VADD.

The objective of the present investigation was to estimate the acceptance level of biscuits fortified with dried carrot powder through sensory and physio-chemical evaluation.

MATERIALS AND METHODS

Ingredients

Maida, wheat flour, shortening, sugar, baking powder, vanilla essence, eggs were obtained from local market.

Carrot powder preparation

Fresh carrots after blanching, tray drying and grounding produced carrot powder; these were then incorporated during biscuit making.

Preparation of biscuits

Biscuits were prepared by using different blends of wheat and maida (Table 1). Other ingredients viz., sugar powder, shortening, vanilla essence and baking powder were used in biscuits recipe. Egg and sugar powder were mixed together until soft and spongy texture was formed. To this, melted butter along with vanilla essence was added and whisked. Flour was then added, to the mixture along with a pinch of baking powder. The dough was then, made into bean shapes and baking was done at 180°C for 15–17 min.

Table 1: Different combinations of Maida and wheat flour

Combinations	Maida (%)	Wheat (%)	Carrot powder (g)
TI	100	0	5
T2	50	50	5
T3	0	100	5

Physico-chemical analysis

Physical characteristics of cookies like weight, width, thickness and spread ratio were measured according to the methods described by Zarina Mushtaq *et al.* (2010).

Weight was determined using an electronic weighing balance. Diameter of cookies was measured by placing six cookies horizontally (edge to edge) and rotated at 90o angle for triplicate reading. Thickness (T): The thickness of cookies was measured by placing six cookies on one another and the duplicate readings were recorded. Spread Ratio (SR): The spread ratio is defined as a ratio of diameter and thickness and was calculated according to the formula:

$$SR = (Diameter/Thickness \times CF) \times 10$$

Where, CF = Correction factor at constant atmospheric pressure (1.0 in this case).

Proximate Chemical Analysis

For the determination of moisture content,the standard oven method was used (AOAC, 1990). Samples were taken in petri plates and dried in hot air oven at 105 °C for 5 hrs to get constant weight. Moisture content was determined by the difference in weight with sample weight as given below:

$$Moisture\% = (W2 – W3)/ (W2 – W1)$$

Combination 1 Combination 2 Combination 3

Fig. 1: Shapes of biscuits of different combinations

Where,

W1-Weight of the empty glass petri dish,

W2-Weight of empty glass petri dish+ sample (Before drying) and

W3-Weight of empty glass petri dish + sample (after drying)

1gm sample was taken in a crucible and kept in a muffle furnace and heated at 525 ˚C for 5 hours. After cooling it was weighed in a weighing balance

$$\text{Ash\%} = (W3 - W1)/(W2 - W1)$$

Where, W1-Weight of the crucible without sample,

W2-Weight of the crucible with sample before drying and

W3-Weight of the dish with sample after igniting

The protein contents of biscuits were determined by Micro-Kjeldhal method as reported earlier (Ranganna, 2007). Nitrogen content was estimated by the Kjeldahl method. It was then converted into per cent crude protein by multiplying with a factor of 6.25.

For the determination of fat, the Soxhlet method was used (Ranganna, 2007). The ether soluble material in foodis extracted for 6-8 hrs from moisture free sample using a Soxhlet extraction apparatus using the following formula,

$$\text{Fat\%} = \frac{\text{(Final weight of the flask-Empty weight of flask-Weight of the sample)}}{\text{Weight of the sample}} \times 100$$

The amounts of total carbohydrate present in the samples were calculated by the difference. It was obtained by subtracting the total content (%) of protein, fat, ash and moisture from 100

$$\text{\% carbohydrate} = 100 - (\text{\% protein} + \text{\% Fat} + \text{\% ash} + \text{\% moisture})$$

Total carotenoid (Provitamin A) was extracted from the food material using acetone-hexane solvents and the colour absorbance was measured at 450nm. It was expressed as β-carotene.

Total Energy

The energy was estimated from the carbohydrates, fats and protein content (Protein*4+carbohydrate*4+fat*9).

Sensory Evaluation

Cookies were subjected to sensory evaluation using 10 semi-trained panellists drawn within the University community. The cookies were evaluated for taste, texture, colour, and overall acceptability. The ratings were obtained on a 9-point hedonic scale ranging from 9 (like extremely) to 1 (dislike extremely). All panellists were the regular consumers of cookies.

RESULTS AND DISCUSSION

The physical analysis of cookies (weight, diameter, thickness, spread ratio) showed that as the ratio of wheat increases the weight and thickness of the cookies also increased (Table 2). Cookie spread ratio stands for a ratio of diameter to height. Cookies

having higher spread ratio are considered most desirable (Finney, *et al.* 1950 and Kissel and Prentice, 1979). Results of the present study showed that cookies with 100% maida had higher spread ratio than the other two. This could be because of the lower thickness it created in the cookies.

Table 2: Physical analysis of cookies

Combinations	Physical Characteristics			
	Weight (g)	Diameter (cm)*	Thickness (cm)*	Spread ratio
T1	0.218	2.358±0.035	0.6165 ± 0.023	38.24
T2	0.225	2.349 ± 0.023	0.79 ± 0.056	29.73
T3	0.322	2.299 ± 0.023	0.77 ± 0.028	29.85

**Each value is an average of three determinations.*

Chemical analysis of cookies is given in Table 3. The results showed that T2 had the highest moisture content, lower protein content, lowest fat, comparable carbohydrates, lowest energy but higher carotenoids.

Table 3: Chemical Analysis of cookies

Combinations	Chemical Parameters (%)						
	Moisture %	Ash %	Protein %	Carbohydrate %	Fat %	Energy (Kcal/g)	Beta-carotene (CFU/100g)
T1	8.71 ± 0.210	1.8 ± 0.197	12.211	66.8	10.48	410	53.33 ± 1.15
T2	9.316 ± 0.432	2.53 ± 0.461	12.07	67.6	8.57	396	56.66 ± 3.05
T3	7.816 ± 0.116	3.16 ± 0.040	12.07	66.7	10.17	406	56.66 ± 4.16

For details see the Material and methods; CFU= Colony Forming Units.

Sensory evaluation based on colour and appearance, texture, taste and overall acceptability was carried out. The sensory evaluation of the food preparations made by the incorporation dried carrot powders revealed that all the food products developed were organoleptically acceptable. Based on the results it was found that cookies with equal ratios of maida and wheat (T2) were more acceptable than others and the least accepted was with 100% wheat (Fig. 2).

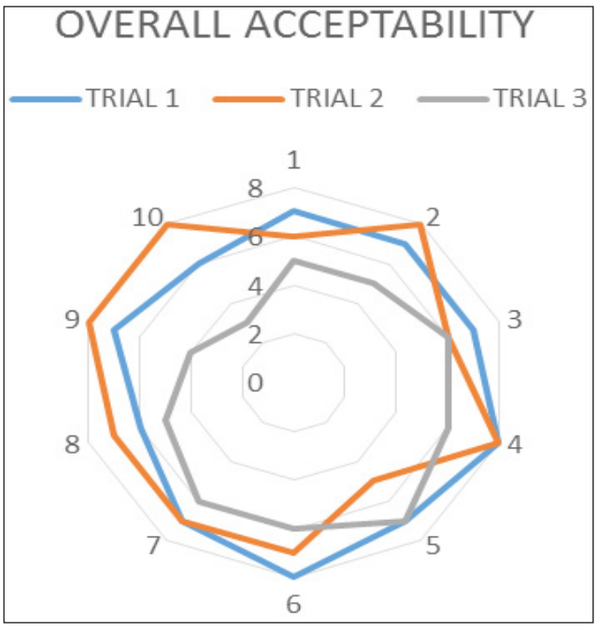

Fig. 2: Overall acceptability of fortified biscuits

The sensory analysis of cookies were in accordance with physico-chemical analysis discussed earlier. On consumption of 100g cookies with (50:50) of maida and wheat per day gives around 11% recommended daily allowance of Vitamin A. On consuming 100g cookies with (50:50) of Maida and wheat fortified with 5 g of carrot powder per day gives around 11% of recommended daily allowance of Vitamin A.Periodic, high-dose vitamin A supplementation is the WHO-recommended method to prevent VADD, since a single dose can compensate for reduced dietary intake or increased need over a period of several months. However, in India, only 34 per cent of targeted children currently receive the two doses per year, and new strategies are urgently needed. Multiple approaches, including vitamin A supplementation, food fortification, dietary diversification, and public health measures, have been suggested for prevention and control of VADD (Saijuddin Shaikh and Dilip Mahalanabis, 2018). Food fortification is the most reliable method among all as it can reach to a wide range of people, as like iodized salts.

REFERENCES

AOAC, 2000. Official Methods of Analysis, Association of Official Analytical Chemists, Washington.

Bala, A., Gul, K. and Riar, C. 2015. Functional and sensory properties of biscuits prepared from wheat flour supplemented with cassava and water chestnut flours. *Cogent Food Agric*., **1**: 01–07.

Bohm V., Putpitasari-Nienaber N.L., Ferruzzi M.G. and Schwartz, S.J. 2002: Trolox equivalent antioxidant capacity of different geometrical isomers of alfa-carotene, beta-carotene, lycopene and zeaxanthin. *Journal of Agricultural and Food Chemistry*, **50**: 221–226.

Brown E.D., Micozzi M.S., Craft N.E., Bieri J.G., Beecher G., Edwards B.K., Rose A., Taylor P.R. and Smith J.C. Jr. 1989. Plasma carotenoids in normal men after a single digestion of vegetables or purified β-carotene. *American Journal of Clinical Nutrition*, 49: 1258–1265.

Dietmar, E.B. and Bamedi, A. 2001. Carotenoid esters in vegetables and fruits: a screening with emphasis on β-cryptoxanthin esters. *Journal of Agricultural and Food Chemistry*, **49**: 2064–2067.

Finley, K.F., Morris, V.H. and Yamazaki, W.T. 1950. Micro versus macro cookie-baking procedures for evaluating the cookie quality of wheat varieties, *Cereal Chem*., **27**: 42.

Kissel, L. and Prentice, M. 1979. Protein and fibre enrichment of cookie flour with brewer's spent grains. *Cereal Chemistry*, **50**: 261–265.

Kulkarni, S., Sakhale, B., Pawar, V., Miniyar, U. and Patil, B. 2010. Studies on sensory quality of biscuits enriched with mushroom powder. *Food Sci. Res. J.*, **1**: 90–93.

Rangana S. 2007. *Handbook of analysis and quality control for fruit and vegetable products*. New Delhi, India: Tata McGraw Hill Company Ltd.

Saijuddin Shaikh and Dilip Mahalanabis, 2018. Prevalence of Vitamin A Deficiency is a Greater Concern in Children in India, *Nutrition and Food science International Journal*, **5**.

Tang G.W., Qin J., Dolnikowski G.G., Russell R.M. and Grusak M.A. 2005. Spinach or carrots can supply significant amounts of vitamin A as assesssed by feeding with intrinsically deuterated vegetables. *American Journal of Clinical Nutrition*, **82**: 821–828.

Velisek, J. 1999. Chemiepotravin (II). OSSIS, Tabor, www.wikipatents.com/6056962.html, Isolations and formulations of nutrient-rich carotenoids, United States Patent: 6056962.

Zarina Mushtaq, Salim-Ur-Rehmanand and Tahir Zahoor, 2010. Impact of xylitol replacement on physico-chemical, sensory and microbial quality of cookies, *Pakistan Journal of Nutrition*, **9**(6): 605-610.