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Studies on development and organoleptic evaluation of noodles incorporated with broccoli (*Brassica oleracea* L.) powder

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Abstract

The study was conducted to develop noodles incorporated with broccoli (*Brassica oleracea* L.) powder. Broccoli powder was prepared by drying broccoli florets in cabinet dryer at 50 °C for 4-5 hr. Broccoli is rich source of protein, dietary fiber, calcium and iron. Noodles were prepared by using refined wheat flour, broccoli powder, eggs, salt etc. The broccoli powder was incorporated in noodles in different proportions with sample coding as control, BN1, BN2, BN3 and BN4 with 0, 5, 10, 15 and 20% respectively. Sensory evaluation revealed that sample BN2 was superior among all the samples. From the present investigation it was concluded that noodles prepared with incorporation of broccoli powder having good nutritional and sensory quality attributes. It was also concluded that sample BN2 got highest score for overall acceptability and it was taken for further analysis.

Keywords: Broccoli, *Brassica oleracea*, noodles, sensory properties.

Introduction

Broccoli scientifically known as "*Brassica oleracea* L.", a cruciferous green leaf cole vegetable; is one such promising underexploited plant. This plant is native of Italy, but can be successfully grown in our country. It is a source of valuable nutrients Vitamin A, C & riboflavin. It is also high in iron and calcium and is a non-fattening food and possesses various medicinal properties as well broccoli has large flower heads, usually green in color, arranged in a tree-like fashion on branches sprouting from a thick, edible stalk. The mass of flower heads is surrounded by leaves. Broccoli, most closely resembles cauliflower, which is a different cultivar of the same species (Mishra and Mukherjee, 2012) [5].

Broccoli also contains the compound "glucoraphanin", which can be processed into an anti-cancer compound "sulforaphane", though the benefits of broccoli are greatly reduced if the vegetable is boiled. Broccoli is also an excellent source of "indole-3-carbinol", a chemical which boosts DNA repair in cells and appears to block the growth of cancer cells. Broccoli has a chemical component called "indole-3-carbinol" that can combat breast cancer by converting a cancer-promoting estrogen into a more protective variety (Phillip, 2011) [10].

A cross-over clinical trial was undertaken to compare the bioavailability and tolerability of sulforaphane from two of broccoli sprout-derived beverages: one glucoraphanin-rich (GRR) and the other sulforaphane-rich (SFR). Bioavailability was substantially greater with the SFR (mean = 70%) than with GRR (mean = 5%) beverages. Glucoraphanin in broccoli is converted to sulforaphane either by plant myrosinases, or if the plant myrosinases have been denatured by cooking, by bacterial myrosinases in the human colon (Patricia *et al.*, 2011) [9].

In recent years, broccoli consumption has increased for their numerous beneficial effects in human health, such as the reduction of the risk of cancer (Talalay and Fahey, 2001) [11] and (Moreno *et al.*, 2006) [6]. As broccoli can be consumed both as fresh and processed food, it is regarded as a dual use vegetable. Typically, broccoli is processed as dried or frozen for retail sale, or canned for instant soup. By the booming number of health-conscious consumers, who prefer salad, side dish or a nutritious dietary supplement, broccoli offers great advantage and hence enhances its share of the market (Boriss and Brunke, 2005) [2].

Broccoli is one kind of perishable vegetable which is difficult to preserve as fresh for a long time because of its high level of moisture content. The moisture level of food materials is reduced by drying process in order to extend their shelf life. Therefore numerous drying methods have been invented and applied in food industry such as hot air drying, solar drying, freeze drying, fluidized bed drying, osmotic drying, far infrared drying, vacuum drying, *etc.* Noodles are mainly consumed by school children that need adequate protein for growth. Utilization of locally available inexpensive cereals like acha and soybean that can substitute a

part of wheat flour without adversely affecting the acceptability of the products will be a welcome development. (Omeire and Ohambele, 2010) [7].

Noodles are widely consumed throughout the world and their global consumption is second only to bread. Instant noodles are widely consumed throughout the world and it is a fast growing sector of the noodle industry (Owen, 2001) [8]. This is because instant noodles are convenient, easy to cook, low cost and have a relatively long shelf life. Wheat flour which is usually used to make instant noodles is not only low in fiber and protein contents but also poor in essential amino acid, lysine. Flour of hard wheat (*Triticum aestivum L.*) is the main primary ingredient and the addition of alkaline salts can help strengthens the structure and hence improve the firmness of the final product (Hou and Kruk, 1998) [3].

Materials and Methods

Materials

Fresh broccoli was obtained from vegetable scheme of Horticulture Department of V.N.M.K.V., Parbhani. The raw material such as refined wheat flour (*Triticum aestivum L.*), egg, salt, etc. were purchased from local market of Parbhani.

Methods:

Sensory evaluation of noodles

The sensory evaluation was carried out to assess the overall acceptability of the noodles incorporated with broccoli powder. The samples were cooked in boiling water for 8- 12 minutes and quality attributes (colour, flavor, taste and texture) of prepared noodles were evaluated against the control sample. Optimally cooked noodles were then analyzed for overall acceptability of the samples by 10 members using a nine-point hedonic scale.

Preparation of broccoli powder

Fresh broccoli florets were thoroughly washed to remove unwanted material and dirt, cut in small sizes, treated with 3% salt for colour retention and dried in cabinet dryer at 50 °C for 4-5 hr. The dried broccoli florets were then powdered.

Table 1: Formulation of noodles incorporated with broccoli powder

Sample	Refined wheat flour (gm)	Broccoli powder (gm)	Egg (gm)	Salt (gm)
Control	100	0	8	1.5
BN1	95	5	8	1.5
BN2	90	10	8	1.5
BN3	85	15	8	1.5
BN4	80	20	8	1.5

Control = 100% wheat flour noodles

BN1 = 5 g broccoli powder in 95g flour

BN2 = 10 g broccoli powder in 90g flour

BN3= 15g broccoli powder in 85g flour

BN4 = 20 g broccoli Powder in 80g flour

Preparation of noodles

The noodles were prepared with slight modification according to the method given by (Inglett *et al.*, 2003) [4]. Noodles were prepared in the laboratory. The basic ingredients used for making control dried noodle were 100.0 g refined wheat flour, 30.0 ml water, 8.0 g egg, 1.5 g salt. Four different formulations of dried noodle samples were prepared with addition of 5, 10, 15 and 20% broccoli powder. The different formulations were processed into noodles using an automatic extruder. In brief, broccoli powder was blended with refined wheat flour, salt was dissolved in the water and this solution was added to the flour in the extruder. After mixing of all

ingredients extrusion was occurred and strands of 2.0 mm thickness of noodles were obtained. The noodle strands were then cut to 15 cm in length and steaming was carried out over boiling water for 10 min. Subsequently, the steamed noodles were dried in a cabinet tray dryer at 60 °C for a total drying time of 2.5 hours.

Blending of refined wheat flour with broccoli powder

Mixing of ingredients in extruder with water

Mixing and kneading

Extrusion (Automatic single screw)

Steaming of noodles

Drying at 60 °C for 2.5 hr

Dried noodles

Packaging in HDPE

Flow sheet: Preparation of noodles

Organoleptic evaluation of noodles incorporated with broccoli powder

Organoleptic evaluation of noodles incorporated with broccoli powder for colour, flavor, taste, texture and overall acceptability was carried out by using standard method of (Amerine *et al.*, 1965) [1]. For these 10 semi-trained judges were used and 1 to 9-point hedonic scale was used for rating the quality of noodles incorporated with broccoli powder. The mean of ten judges was considered for evaluating the quality.

Results and Discussions

Table 2: Organoleptic evaluation of noodles incorporated with broccoli powder

Samples	Color	Flavor	Taste	Texture	Overall Acceptability
Control	7.50	7.0	7.50	7.75	7.6
BN1	8.5	7.50	8.5	8.25	8.5
BN2	9.0	8.0	9.0	8.50	8.7
BN3	8.5	7.25	7.75	8.0	7.8
BN4	8.5	7.25	7.75	8.0	7.75

Data pertaining to sensory evaluation of noodles incorporated with broccoli powder with respect to colour, flavour, taste, texture and overall acceptability were carried out. Accordingly, results obtained are depicted in table. 2.

Data indicated in table 2. Showed that the sample BN2 is the most acceptable product.

The average sensory attributes scores of prepared noodles (control) were analyzed for variance among the noodles prepared by different samples containing different levels of broccoli powder. BN2 sample got the highest score (8.7) and control sample lowest score (7.6).

In case of colour noodles prepared from sample BN2 is the best than other samples. Sample BN2 got the highest score (9.0) and sample control got the lowest score (7.5).

In case of flavor BN1 and BN2 samples got the highest score

(7.5 and 8.0) respectively. Sample BN3 and BN4 got the lowest score (7.25).

In case of taste sample BN2 got highest score (9.0) and control sample got lowest score (7.50).

In terms of texture BN1 and BN2 sample got the highest score (8.25 and 8.50). Sample and BN3 and BN4 got the same score (8.0) and sample control got the lowest score (7.75).

In terms of overall acceptability sample BN1 and BN2 sample had high score (8.5 and 8.7) respectively. Sample BN3 and BN4 got 7.8 and 7.75. Control sample got the least score (7.6) respectively.

From the above discussion we can conclude that sample BN3 showed near about same score as that of sample BN4. Sample BN2 got highest score as compare to sample BN1, BN3 and BN4. So, sample BN2 was selected for further studies.

Conclusion

Broccoli is rich source of protein, vitamins like vit. A, vit C, minerals like calcium, phosphorous, iron and dietary fiber. It is one kind of perishable vegetable which is difficult to preserve as fresh for a long time because of its high level of moisture content. So in order to have its health benefits broccoli powder can be added in noodles, it will increase its nutritional value as well as sensory attributes. Noodles incorporated with 10% broccoli powder got highest score in overall acceptability and it was taken for further analysis.

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