

Nutrient composition of cauliflower (*Brassica oleracea* var. Botrytis) leaf powder and its acceptability in fast food snacks

R. MOGRA, J. BANGA AND PREETI RATHI

Cauliflower leaf powder was developed by drying cauliflower leaves. The process of drying of leaves in mechanical dryer was standardized after taking trials for different temperature and time period. On the basis of organoleptic characteristics of powder, the leaves dried at 40°C temperature for 22hrs were finalized. CLP was then analyzed for their nutritional and anti-nutritional composition. On dry weight basis CLP contained 12.55g moisture, 17.67g protein, 1.76g fat, 8.20g fiber, 15.32g ash per 100g. Energy was found to be 256 Kcal. Calcium, phosphorus, iron was 3600mg, 368mg and 36mg, respectively. Regarding anti nutrients it had tannins 40µg, oxalates 0.201g and phytates 11.3g. The results revealed that CLP developed from cauliflower leaves serve as a source of micronutrients. Thus, CLP need to be popularized which will be helpful in overcoming micronutrient deficiency diseases. In addition, optimum utilization of this uncommon leaves will help in widening food basket.

Key Words : Nutrient composition, Cauliflower leaf powder, Blanching

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INTRODUCTION

India is the second largest producer of vegetables in the world and accounts for about 15 per cent of the world's production of vegetables. The current production level is over 71 million tones and covers about 3 per cent of the total area under cultivation in the country. Among vegetables India occupies first position in the production of cauliflower. Cauliflower is usually known by local name as phoolgobhi and a popular vegetable of *Cruciferae* family. It is a major cole crop grown throughout the country for its white tender curd which is commonly used as vegetable.

Cauliflower is originated over 2000 years ago in the gardens of Asia Minor and the Mediterranean. The word cauliflower comes from latin word caulis means stalk and floris means flower. The botanical name of cauliflower is *Brassica oleracea* var. Botrytis. Cauliflower is nutritious, the versatility

of this plant is reflected by the fact that not only the curd but also leaves are used as a vegetable.

Cauliflower leaves are by-product of cauliflower cultivation. Cauliflower leaves which are normally wasted can be cooked like any other green leafy vegetable and can be used as a valuable source of micronutrients as they are rich in calcium, iron and phosphorus and also source of natural antioxidants the use of which may help in preventing degenerative diseases.

Adolescence is the age where the food behaviour is such that they skip meals and eat more junk foods and fast foods and suffer more from micronutrients deficiencies. The adolescence is considered especially vulnerable nutritionally because there is an increased demand for nutrient related to the dramatic increase in physical growth and development.

Fast food snacks have attained considerable popularity among adolescents in recent times. In fact these fast foods have become a part and parcel of their daily meal. Adolescence is a critical period of human development demanding increased intake of almost all the nutrients. Therefore, an attempt has been made to formulate commonly consumed fast food snacks by incorporating them with micronutrient rich available greens of cauliflower. so that their use as vegetable and in other food preparations can be promoted to overcome the micronutrient deficiency among population.

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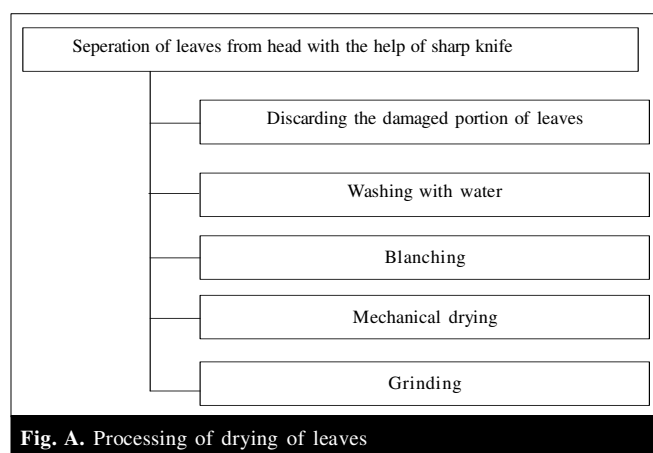
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METHODOLOGY

Cauliflower leaves were procured from the Department of Horticulture, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur in a single lot to avoid varietal differences. The damaged portion of leaves were discarded and the undamaged portions of leaves were subjected to further treatments. The leaves were washed thoroughly under tap water for 2-3 times to remove adhered dust and dirt. The leaves were then blanched in boiling distilled water for 10-15 seconds. Mechanical drying was done in view of speedy drying and to avoid the effect of climatic conditions. The dried sample thus obtained was powdered in an electric grinder (Fig. A).



The nutrient content was determined Proximate (Raghuramulu, 1983), iron (Bishnoi and Brar, 1988), calcium (Cheng and Bray, 1950), phosphorus, phytates, tannins and oxalates (Jain and Mogra, 2006). Various fast foods were prepared from dried cauliflower leaf powder such as tikki, chowmein, khaman, burger and sandwich. The preparation of products are given below:

Tikki a mouth watering popular snack made by preparing a mixture of boiled potato (40g), bread (1pc), clp (10g), green chillies (2g), coriander (2g), and onion (20g). Mixture was rolled into round tikki and then fried in oil (1tsp) till golden brown. Serve it with stirred curd (40g) tamarind chutney (2tsp) and tomato sauce (1tsp).

Chowmein it is a chinese fast food snack capsicum (25g), carrot (40g), cabbage (30g), onion (30g) and clp (10g) were fried in oil (20g) and at last added boiled noodles (30g), soya sauce and tomato sauce.

Khaman a steamed item made by preparing a batter with gramflour (40g), suji (30g), curd (30g), clp (10g) and eno (1tsp). batter was poured into a greased pan and steamed till done. A mixture of lemon juice (1) and sugar (5g) was poured into khaman. Prepared seasoning of oil (15ml), mustard seeds and curry leaves was also poured into khaman.

Burger is most popular style fast food snack. A mixture of potato (30g), onion (27g), coriander (2g), green chilli (2g) and clp (10g) was rolled and shape into tikki and then fried till golden brown. Heat the butter (20g) and toast the buns. Keep one tomato, onion, cucumber slice and one cutlet in between two slices of buns.

Sandwich a sandwich is simply two slices of bread with a filling in the middle. A stuffing of potato (30g), onion (10g), coriander (2g), green chilli (2g) and clp (10g) was rolled and placed between bread and then put in sandwich toaster until the bread turns crispy and brown.

Statistical analysis of data :

The information collected from the respondents was expressed in percentage and mean for the sensory characteristics of the food preparation.

OBSERVATIONS AND ASSESSMENT

Table 1 shows the scores of various organoleptic characteristics for acceptability of CLP in fast food snacks. All the snacks with different proportion of CLP were acceptable but snacks with CLP at 10 per cent incorporation had higher scores as compared to other two levels. Thus snacks with 10 per cent level of CLP were analyzed for nutrients. Kumar *et al.* (2004) reported that *mathri* and *chilla* prepared with different levels of amaranthus leaf powder and onion stalk (5,10 and 15%) were accepted by all panelists. On the basis of remarks of judges it was concluded that incorporation of CLP at 10 per cent level was highly acceptable and it will contribute more nutrients to the final product, hence the use of CLP at 10 per cent level is recommended.

Nutrient composition of CLP:

Table 2 presents the amount of nutrients and anti nutrients present in CLP. The moisture and protein content of CLP was 12.55 per cent and 17.67 per cent, respectively. The fat content of CLP was found to be 1.76 per cent. This lower fat in CLP was due to the fact that leafy vegetable contain negligible amount of fat in them. The ash content was 15.32 per cent. The fiber content of CLP was 8.2 per cent. The energy was 256 kcal per 100g on dry wt. basis. Ca, P, Fe content of the CLP 3600 mg, 368 mg and 36 mg/100g, respectively. The per cent bioavailability of iron was 7.8 mg in CLP. According to Kowsalya and Vidhya (2004) dehydration of vegetable results in concentration of macro and micro nutrients, Singh *et al.* (2006) reported that beta carotene was retained better in cabinet drier as compared to solar and low temperature drier. Data regarding the anti-nutritional composition clearly depict that it contained 40µg tannins, 11.3 phytate and 0.201g oxalates. Gopalan *et al.* (1997) reported that leafy vegetable are rich in oxalate content. The content lies between (600-800 mg/g). The value of tannin (1.6

Table 1. Mean sensory scores obtained by different fast food snacks using varying proportions of CLP

Fast foods	Amount of CLP	Colour	Texture	Flavour	Appearance	Taste	Overall acceptability
Tikki	5%	7.6	7.7	7.7	7.9	7.6	7.8
	7%	7.7	7.8	7.8	8.0	7.8	7.9
	10%	7.9	7.9	8.0	8.1	7.9	8.0
Chowmein	5%	7.3	7.3	7.5	7.5	7.5	7.6
	7%	7.5	7.4	7.7	7.5	7.7	7.7
	10%	7.6	7.6	8.0	7.7	8.0	7.9
Khaman	5%	7.6	7.7	7.5	7.6	7.7	7.7
	7%	7.7	7.8	7.7	7.8	7.8	7.8
	10%	7.9	7.9	8.0	7.9	7.9	8.0
Burger	5%	8	7.7	7.5	7.9	7.6	7.5
	7%	8	7.8	7.7	7.9	7.8	7.7
	10%	8.1	8.0	7.8	8.0	8.1	8.0
Sandwich	5%	7.3	7.1	7.1	7.3	7.2	7.3
	7%	7.3	7.2	7.3	7.4	7.3	7.5
	10%	7.4	7.4	7.5	7.6	7.5	7.7

mg/100 g) is lower than those reported by Kowsalya and Vidhya (2004).

Table 2. Per cent nutrient composition of CLP

Nutrients	Amount (per 100g)
Proximate	
Moisture (g)	12.55
Protein (g)	17.67
Fat (g)	1.76
Fiber (g)	8.2
Ash (g)	15.32
Energy (Kcal)	256
Minerals	
Calcium (mg)	3600
Phosphorus (mg)	368
Iron (mg)	36
Anti nutrients	
Tannins (μ g)	40
Oxalates (g)	0.201
Phytates (g)	11.3

Nutrient composition of CLP incorporated fast food snacks: Sandwich:

Data regarding proximate composition of sandwich has been presented in Table 3 which clearly depict that it contained moisture 61.53g and protein 3.93g. Regarding fat content of sandwich it was 1.66g. Ash and fiber content was found to be 1.81g and 0.86g, respectively. The energy content was 64 kcal. Further the Table 3 indicates it contained calcium 1686mg, phosphorus 89.28mg, iron 6.82mg with 1.80 per cent bioavailable

iron. Anti nutritional factors *viz.*, phytates, tannins and oxalates were found to be 1.42g, 2.10 μ g and 0.087g, respectively.

Khaman:

Table 3 further reveals the nutrients provided by khaman. It was containing moisture 63.76g, protein 13.2g, fat 13.8g, ash 7.03g and fiber 1.40g. The energy content was 652kcal. Regarding minerals it contained calcium 1390mg, phosphorus 284.4mg, iron 15.8mg and 4.74mg bioavailable iron. Phytates, tannins, oxalates were found to be 1.78g, 6.36 μ g and 0.180g, respectively.

Burger:

It is evident from the Table 3 that burger contained 65.24g moisture, 21.18g fat, 2.39g fiber and 7.18g ash. The energy content was found to be 885 kcal. Calcium, phosphorus, iron and bioavailable iron were found to be 4560mg, 250.8mg, 19mg and 5.5 mg. Further, phytates, tannins and oxalates contents were 2.87g, 10.92 μ g and 0.407g, respectively

Chowmein:

The nutrient composition of chowmein has been presented in Table 3 showed that it contained 56.26g moisture, 10.28g protein, 20.17g fat, 2.53g fiber, 2.89g ash and 605kcal energy. Minerals *viz.*, calcium, phosphorus, iron were 3016mg, 166.4mg, 15.6mg with 3.9mg bioavailable iron, respectively. Anti-nutritional factors *i.e.* phytate, tannin and oxalates were found to be 2.27g, 8.97 μ g and 0.104g, respectively.

Tikki:

A perusal of Table 3 indicates that tikki contained 60.74g moisture, 3.99g protein, 3.55g fat, 1.71g fiber, 3.25g

Table 3. Nutrient composition of fast food snacks (one serving) incorporated with CLP

Nutrients	Sandwich	Khaman	Burger	Chowmein	Tikki
Cooked wt. (g)	78	218	269	187	82
Dried wt. (g)	31	79	95	65	30
Proximate					
Moisture(g)	61.53	63.76	65.24	56.26	60.74
Protein(g)	3.93	13.2	11.93	10.28	3.99
Fat(g)	1.66	13.8	21.18	20.17	3.55
Fiber(g)	0.86	1.40	2.39	2.53	1.71
Ash(g)	1.81	7.03	7.18	2.89	3.25
Energy(kcal)	64	652	885	605	84
Minerals					
Calcium(mg)	1686	1390	4560	3016	1320
Phosphorus(mg)	89.28	284.4	250.8	166.4	109.8
Iron(mg)	6.82	15.8	19	15.6	4.8
Bioavailavility of iron(mg)	1.80	4.74	5.51	3.9	2.7
Anti nutrients					
Phytates(g)	1.42	1.78	2.87	2.27	1.43
Tannins(μ g)	2.10	6.63	10.92	8.97	4.26
Oxalates(g)	0.087	0.180	0.407	0.104	0.153

ash and 84kcal. Regarding mineral content of tikki it was found to be 1320mg calcium, 109.8mg phosphorus, 4.8mg iron and 2.7mg bioavailable iron. Further the table clearly depict that it contained 1.43g phytate, 4.26 μ g tannins and 0.153g oxalates.

Table 3 shows the proximate composition of fast food snacks on dry wt basis (one serving), where moisture content of burger (65.24g) and khaman (63.76g) was found to be high in comparison to other three fast food snacks *viz.*, sandwich, tikki and chowmein (61.53, 60.74 and 56.26), respectively. It is evident that protein content of khaman was found to be higher (13.20g) as compared to other products. Regarding the ash content of CLP incorporated fast food snacks sandwich shows least value (1.81) among all. Out of five fast foods burger contained relatively higher amount of energy. Like wise fiber content of sandwich, khaman, burger, chowmein and tikki was 0.86g, 1.40g, 2.39g, 2.53g, 1.71g, respectively. These values were more or less similar with each other. Data on fat content reveals that burger and chowmein contained high amount of fat 21.18g and 20.17g while fat content of khaman and tikki was 13.80g and 3.55g. Sandwich was found to be least fat value *i.e.* 1.66g. According to Punia *et al.* (2004) products prepared by incorporation of green leafy vegetable are good sources of Protein (27.8g), Fiber (8.0g), Carbohydrate (42.0g) and energy (310kcal/100g).

Data regarding the mineral content of CLP incorporated fast food snacks revealed that burger contained higher amount of calcium (4560mg) as compared other four products.

Phosphorus was found to be highest in khaman (284.40 mg) and lowest in sandwich (89.28 mg). Likewise iron content was higher in burger and lowest in sandwich. Bioavailable iron of sandwich, khaman, burger, chowmein and tikki was 1.80, 4.74, 5.51, 3.9 and 2.7, respectively. Punia *et al.* (2004) also reported that after dehydration green leafy vegetables contains 3350.0 mg/ca, 4.10 mg/Fe, 60.6mg. ascorbic acid and 10557 μ g/100g beta carotene.

It is evident from Table 3 that tannin content of burger and chowmein (10.92 μ g and 8.97 μ g) was found to be higher as compared to khaman, sandwich and tikki (6.63 μ g, 2.10 μ g and 4.26 μ g), respectively. Phytate and oxalate content were higher in burger (2.87g and 0.407g) and lowest in sandwich (1.42g and 0.087g), respectively.

Conclusions:

From the findings of present investigation, it may be concluded that cauliflower leaves which are normally wasted can be used as a valuable source of micronutrients. The result of the study shows that micronutrient deficiencies can be prevented if cauliflower leaves are used in dietaries.

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