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RESEARCH PAPER

Nutraceutical Potential of *Khakhra* Prepared by Chickweed (*Stellaria media*) Leaves

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ABSTRACT

Chickweed (*Stellaria media*) member of the family Caryophyllaceae. This plant is extensively cultivated globally and is inherent to Africa, Asia, China, Europe, and North America. Nutritional studies have revealed the presence of protein, especially 16 amino acids, and minerals such as calcium, iron, phosphorus, and zinc. The current study aimed to determine the nutritional composition (moisture, ash, fat, protein, carbohydrate, and crude fiber), mineral composition (iron, calcium, and zinc) of dry Chickweed leaves powder and develop nutrient-dense *khakhra* by incorporating leaves powder (2%, 4%, and 6%) respectively. Thereafter, assess the developed food product nutritional composition and sensory acceptability. For experiments, the nutritional composition was done according to the Association of Analytical Communities (AOAC) standard procedures. The mineral composition was determined by atomic absorption spectrophotometry. Triangle difference test was used for panel member selection that had better sensory attributes. Sensory acceptability was done with the help of a 9-point hedonic rating scale. All the results were expressed as mean ± standard deviation (SD) of triplicates. Leaves of Chickweed were recorded to have a protein (g) (29.5±0.34), crude fiber (g) (9.7±0.31), fat (g) (4.4±0.02), ash (g) (3.8±0.03), and carbohydrate (g) (39.0±0.02). The mineral composition of Chickweed leaves showed a higher amount of calcium (mg) (1780.4±0.07), iron (mg) (12.2±0.02), and zinc (mg) (1.3±0.04). Furthermore, the sensory acceptability test revealed that *khakhra* containing 6% of Chickweed powder received better scores as compared with control and other formulations for most of the sensorial attributes judged. Chickweed leaves powder can be used as a cheap natural source of nutrients for supplementing food products.

Keywords: Calcium, Chickweed, *Khakhra*, Leaves, *Stellaria media*

Stellaria media Linn., also known by the name of Chickweed, belongs to the family of Caryophyllaceae and contains 2630 species and 85 genera (Singh *et al*. 2022). It is also known to be Buch-bucha in Hindi, Chickweed, Mouse-ear, and Starweed in English. It is a perennial or annual herb that grows mainly in the cool season and moderate regions of Asia, Europe, and Northern America. In India, it grows in the Himalayas at a height of about 4300 m. Chickweed is widespread in open fields and areas of the world that require no cultivation (Ahmad *et al.* 2021). Chickweed leaves are rich in protein, fat, fiber, carbohydrates, and various dietary minerals. Chickweed is one of the nutrient-dense plants that contains 16 essential amino acids of the total free amino acids (27.27%), and total bound amino acids (48.05%) in their aerial part (Shan *et al*. 2013). That means the protein requirement from the chickweed is complete as compared to other green leafy vegetables (Melnyk *et al*. 2018). The leaves are also appraised to

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contain minerals such as calcium, iron, copper, zinc, magnesium, potassium, phosphorus, and sodium (Shinwari *et al*. 2015). Chickweed is largely cultivated due to its immense pharmacological potential such as antipyretic, antioxidant, anti-cancer, anti-bacterial, anti-fungal, anti-viral, anti-hepatitis, anti-inflammatory, and anti-obesity (Chak *et al*. 2021).

Khakhra is a very popular snack food that can be eaten from all walks of life, irrespective of age group. It is also included common snacks in Western India in Rajasthan and Gujarat. It is made up of wheat flour, mat bean, and oil. It is a fat-free and versatile breakfast. Due to the modern era, and the fast-changing lifestyle, people used to prefer instant food items like khakhra are very popular among the masses. Also, with the increasing awareness about health, people used to prefer to eat healthy nutritious snacks that had good taste. For the current study, *khakhra* was prepared by incorporating nutritionally rich processed millet, bean flour, seed, and Chickweed leaves powder. All the above-listed ingredients have low glycemic index which are beneficial in diabetes. Furthermore, they are also rich sources of fiber which helps to reduce cholesterol levels. The *khakhra* was made without the addition of visible fat thereby making the developed food product therapeutic.

Thus, the main objective of the study is to analyze the nutrient composition of Chickweed leaves powder and develop *khakhra* by incorporating chickweed leaves powder in different concentrations respectively. Furthermore, analyze the nutrient composition of *khakhra* and their sensory evaluation that can further direct research toward its applications for nutritious food product development in the market.

MATERIALS AND METHODS

Collection of plant material

The Chickweed fresh leaves were obtained from Patanjali Herbal Botanical Garden, Uttarakhand, India. Fresh leaves were cleaned under running tap water to take out all the dust, mud, and unwanted particles. The fresh leaves were dried under the shadow for the study. Dried leaves were stored in an air-tight container at room temperature for further analysis.

Nutrient analysis

Nutrient analysis was carried out according to the procedure given by the Association of Official Analytical Chemists (AOAC) (AOAC, 1990). For moisture content analysis, drying the samples in the hot air oven at 105 °C until a constant weight was obtained. Ash content was determined by using a muffle furnace for 12 h at 550 °C. The protein was estimated through micro Kjeldahl's distillation method (Buondonno *et al*. 2008). The crude fiber of the samples was determined by method (Pearson, 1976). Furthermore, macro and micro-elements calcium, iron and zinc were analyzed in *khakhra* incorporated by Chickweed leaves powder. The Atomic Absorption Spectroscopic standard method was used for determining the digested samples by using a BUCK Scientific 200A apparatus for calcium, iron and zinc (Murphy and Riley, 1962).

Statistical analysis

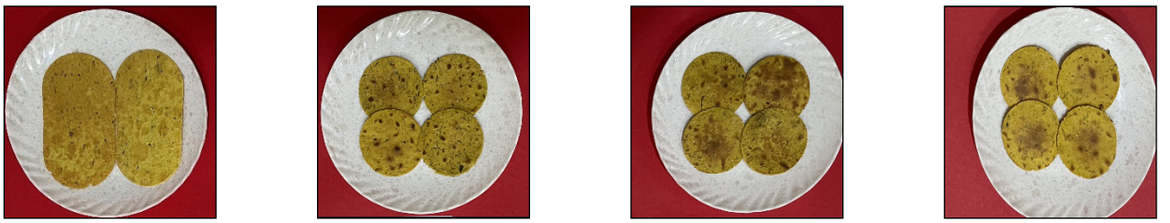
All the results were expressed as mean ± standard deviation. Statistical analysis was performed by using analysis of variance (ANOVA) GraphPad software (GraphPad Prism 8.0.2). Differences with ($P<0.05$) were considered significant as determined by the least significant difference (LSD).

RESULTS AND DISCUSSION

Table 1 exhibits the nutrient composition of dried leaves of Chickweed. The moisture, ash, fat, protein, carbohydrate, crude fiber, calcium, iron, and zinc were significantly affected by the drying methods. Dried leaves have an appreciable amount of different nutrients. This means that Chickweed is an excellent source of nutrients and have the capacity to combat various nutrient-related illness. The moisture content and ash content as (12.5±0.31) and (3.8±0.03) respectively. The obtained value of fat, protein, carbohydrate, crude fiber, calcium, iron, and zinc were (4.4±0.02), (29.5±0.34), (39.0±0.02), (9.7±0.31), (1780.4±0.07), (12.2±0.02), and (1.3±0.04) respectively.

(A) **(B)** **(C)**

Fig 1: Leaves of Chickweed **(A)** Fresh, **(B)** Dry, **(C)** Powder



Control **Variant A 2%** **Variant B 4%** **Variant C 6%**

Fig. 2: Image depicting the physical appearance of *Khakhra* incorporated by Chickweed leaves powder

Similar observations were recorded (Bisht *et al*. 2018; Civelek and Balkaya, 2013; Anwar *et al*. 2022).

Table 1: Nutrient composition of Chickweed leaves

Nutrients	Mean±SD
Moisture (g/100g)	12.5±0.31
Ash (g/100g)	3.8±0.03
Fat (g/100g)	4.4±0.02
Protein (g/100g)	29.5±0.34
Carbohydrate (g/100g)	39.0±0.02
Crude fiber (g/100g)	9.7±0.31
Calcium (mg/100g)	1780.4±0.07
Iron (mg/100g)	12.2±0.02
Zinc (mg/100g)	1.3±0.04

Values are means ± SD (n=3), ^{S} Significant, ^{NS} Non significant at the level of (p< 0.05).

The evaluation of moisture, ash, fat, protein, carbohydrate, crude fiber, calcium, iron, and zinc was done for khakhra made from Chickweed leaves powder. Table 2 shows the nutrient composition of *khakhra* with different concentrations. The variant C has the highest nutrient content in comparison with the control as well as other variants. The reason for the same is that Chickweed had a high amount of nutrient content as the concentration of chickweed powder was high in *khakhra* their nutrient content will be higher.

The mean sensory rating values for various attributes of 9-point hedonic scores for *khakhra* were presented in table 2. These were prepared by incorporating leaves powder 2, 4 and 6% respectively. In terms of overall acceptability variant C was highly acceptable and it was prepared by incorporating 6% leaves powder of Chickweed. It was followed by variants B, and A respectively. Although, the control was least accepted among all the developed products. In terms of various attributes, variant C was the most acceptable, and the control was the least accepted among all the developed products.

Table 2: Nutrient composition of *Khakhra* incorporated by Chickweed leaves powder

Nutrients	Control	Variant A (2%)	Variant B (4%)	Variant C (6%)
Moisture (g/100g)	4.3±1.52	5.8±2.00	6.1±1.00	7.0±1.00
Ash (g/100g)	6.0±0.06	3.6±0.15	4.2±0.15	4.5±0.17
Fat (g/100g)	5.1±2.00	8.3±0.06	8.4±0.05	9.0±0.06
Protein (g/100g)	10.8±0.20	14.4±0.32	15.4±0.36	16.3±0.06
Carbohydrate (g/100g)	38.0±0.05	32.9±0.18	28.7±0.05	24.9±0.08
Crude fiber (g/100g)	6.6±1.53	7.1±1.01	8.4±0.15	8.6±0.20
Calcium (mg/100g)	39.8±0.55	48.5±0.31	50.6±0.34	52.3±0.24
Iron (mg/100g)	1.5±0.10	3.5±0.15	3.7±0.08	3.7±0.15
Zinc (mg/100g)	0.3±0.10	0.4±0.04	0.5±0.13	0.5±0.04

Values are means ± SD (n=3), [S] Significant, [NS] Non significant at the level of (p< 0.05).

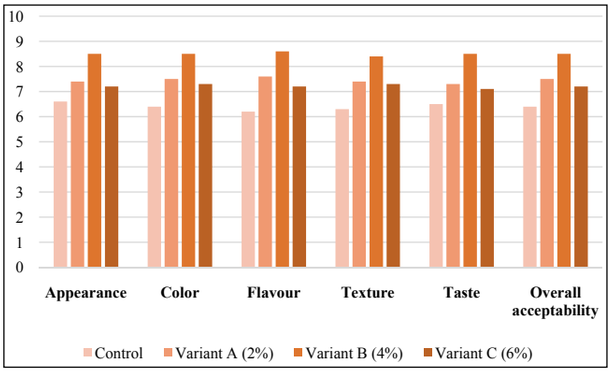


Fig. 3: Sensory evaluation of *Khakhra* incorporated by Chickweed leaves powder

CONCLUSION

This study enlarges and complements the literature knowledge on the nutrient composition of Chickweed leaves. Chickweed is well known medicinal plant with no side effects. This plant well grows in nature without any human effort and can be used as food as well as medicine. The current study aided the information about the nutrient composition of dried Chickweed leaves which might be the prime factor for their pharmacological effects. Furthermore, this research provides empirical evidence that the dried leaves yield more nutrients as compared with the fresh leaves. The findings of the current study showed that protein content was higher in Chickweed leaves. Additionally, calcium and iron were higher in leaves. This study confirms that Chickweed leaves are a good source of nutrition. It can be used in fresh forms where available naturally, and in dried forms to keep its nutrients intact to the maximum value. The significance of the drying process apart from this, it may lead to the development of novel nutrient-rich food products for the prevention of nutrient deficiency diseases.

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