Original Research Article

Formulation of nutrient-rich nachos using little millet (Panicum sumatrense) Flour

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ABSTRACT

Background: Nachos, originating from northern Mexico, are traditionally made using maize flour and commonly served as appetizers or snacks. Little millet, a nutritious alternative to maize, boosts high levels of iron, phosphorous, and protein, making it gluten-free and suitable for those with celiac disease.

Aim: This research was conducted to develop a value-based product with a lower gluten and carbohydrate content than standard nachos.

Objective: The study involved preparation of Nachos by replacing a portion of wheat flour with Little Millet flour in various ratios. The sensory quality of the developed Nachos was then assessed, and the proximate composition of both the modified version and traditionally prepared Nachos was estimated for comparison.

Materials and Methods: The product, formulated by substituting little millet flour for whole wheat flour in six variations, including a control group, was evaluated for its sensory attributes.

Conclusion: The developed product was a nutritionally superior and health-promoting product when compared to the standard Nachos.

Results: Among the variations, the 30% substitution of wheat flour with Little Millet flour was notably well-received by semi-trained sensory panelists. Proximate analysis of this chosen variation revealed lower carbohydrates but higher fiber and iron content. The iron levels evidently increased, while phosphorus levels showed no significant difference.

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1. Introduction

Nachos, a Mexican dish, are prepared from corn or wheat flour to form tortilla chips. Also known as tortilla chips, nachos are a crucial culinary delight in Mexico, America, and Colombia. These fried or baked chips come in various sizes and shapes, such as square, round, triangular, and rhombus. Nachos, a popular snack, can be served with or without sauces and spices based on individual preferences. With their rich composition of carbohydrates, protein, and fats, nachos exhibit excellent sensory and nutritional characteristics. In recent years, the rising demand for appetizing snacks like nachos has emphasized the need for mechanized production and standardized processes to meet market requirements.[1]

Millets are the oldest crops known, whose origin dates back to 4000 years ago.[2,3] They are ranked as the world's sixth most crucial crop and sustaining one-third of the global population, are renowned for their nutritional superiority over other major grains. Referred to as "Nutri-Cereals," millets, including little millet, offer an appealing alternative due to their elevated nutrient content compared to commonly consumed cereals.[4] Specifically, little millet (Panicum sumatrense) is cultivated in India, China, and

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regions like Madhya Pradesh, Chhattisgarh, and Andhra Pradesh, known locally as, Kutki Moraiyo, Shavan, or Sama. This nutritious grain stands out as a compelling substitute to wheat, boasting higher levels of protein, fiber, and minerals. Recognized by the Indian Council of Agricultural Research and the Indian Institute, millets, including little millet, hold the potential to address global challenges related to population growth, hunger, and food shortages.[5,6]

2. Objectives of the Study

1. Development of Nachos by substituting a portion of wheat flour with Little Millet flour in different proportions.
2. To analyse the sensory quality of the developed Nachos.
3. Estimation of proximate composition of the selected variation and traditionally prepared Nachos.

2.1. Procurement of raw materials

The research unfolded its insights in the Department of Food Science and Nutrition at Yuvaraja's College, an autonomous institution under the aegis of the University of Mysore in Mysuru. Essential ingredients, such as Wheat flour, Little Millet flour, chilli powder, turmeric powder, and oil, were sourced from the regional markets of Mysuru.

2.2. Method of preparation

Little Millet based Nachos were prepared by mixing all the dry ingredients, such as maize flour, Little Millet flour, Wheat flour, Besan flour, Red chilli powder, Oregano and salt excluding water hard dough was formed and allowed to rest for 30 minutes. Then it was divided into equal sized balls and flattened to uniform thickness. Triangle shapes were made using knife and baked in a preheated oven for 8 minutes at 180°C.[7]

2.3. Evaluation of organoleptic properties of Nachos

The developed product was subjected for the organoleptic properties using nine-point hedonic scale which ranges from (0-9) by semi-trained panelists. All six formulations including control were evaluated to consider for further analysis.[8]

### 2.4. Nutritional analysis of little millet nachos

The nutritional analysis involved triplicate assessments using established A.O.A.C. (2005) methods.[9,10] Crude fiber content was evaluated using a crude fiber analyzer. Carbohydrate content was computed by deducting the sum of moisture, protein, fat, and ash content from 100 per 100g of the sample. Moisture content was determined via a hot air oven at 98 to 100°C, protein content using the Micro-Kjeldhal method for total nitrogen, ash percentage through high-temperature incineration (600°C) in a muffle furnace, and fat content estimated using the Soxhlet apparatus.[11] Crude fiber content was evaluated using a crude fiber analyzer.[12] Carbohydrate content was computed by deducting the sum of moisture, protein, fat, and ash content from 100 per 100g of the sample.

Energy values were computed by the formula:

Energy value = Protein × 4 + Carbohydrate × 4+ Fat × 9.[13]

Furthermore, mineral analysis of iron, and phosphorus, employed Atomic Absorption Spectrometry (AAS) for its recognized accuracy and precision.[14]
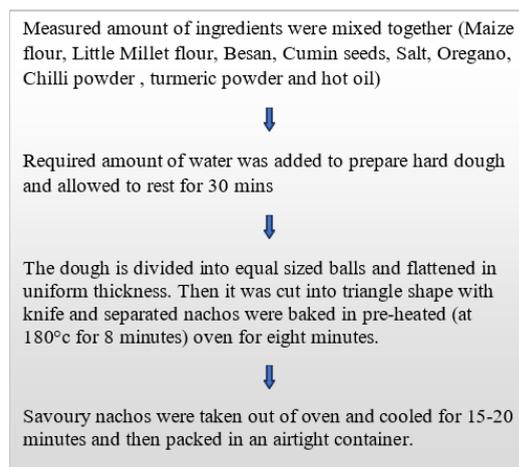
Figure 1: Flow chart of preparation of nachos from little millet flour
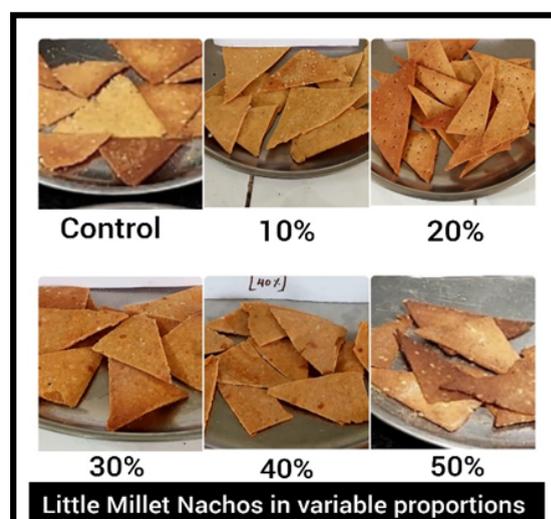
Figure 2: Nachos prepared from partial replacement of wheat flour with Little Millet flour in different proportions

Table 1: Formulation of product (ingredients g/100gm) for preparation of Little Millet Nachos

Ingredients	Control	LMT1	LMT2	LMT3	LMT4	LMT5
Maize Flour (g)	50	40	30	20	10	-
Little Millet (g)	-	10	20	30	40	50
Wheat Flour (g)	25	25	25	25	25	25
Besan Flour (g)	25	25	25	25	25	25

Table 2: Sensory scores of different variations of Nachos developed from little Millet Values are mean ± SD (n=40) *p value < 0.05 (Holm Sidak method)

Parameter	Standard Nachos	10% [LMN1]	20% [LMN2]	30% [LMN3]	40% [LMN4]	50%[LMN5]
Appearance	8.76±0.25	8.49±0.58	8.38±0.56	8.17±0.21	7.92±0.93	7.68±0.80
Colour	8.69±0.16	8.17±0.12	8.08±0.61	8.41±0.79	7.79±0.91	7.54±0.87
Texture	8.82±0.58	8.55±0.47	8.24±0.34	8.29±0.77	7.17±0.95*	6.52±0.79*
Flavour	8.64±0.21	8.25±0.51	8.01±0.78	8.00±0.88	7.61±0.86	6.95±0.31*
Taste	8.71±0.53	8.68±0.62	8.52±0.29	8.59±0.80	7.94±0.98	7.47±0.71
Overall acceptability	8.85±0.48	8.47±0.45	8.22±0.41	8.36±0.75	7.29±0.92*	7.03±0.23

Table 3: Proximate composition of Nachos (control and LMN3) developed from Little Millet. Values are mean ± SD (n=3) *p value < 0.05 (Holm Sidak method)

Nutrients	Standard	30% [LNM3]
Energy (kcal)	357.56±0.31	333.46±1.21
Protein (g)	11.68±0.41	8.56±0.16
Fat (g)	2.72±0.15	2.74± 0.83
Fibre (g)	2.74±0.23	5.91 ± 0.23*
Moisture (%)	9.03±1.12	11.86± 0.34
Ash (g)	2.24±0.20	2.26± 0.19
Carbohydrate (g)	71.59±1.04	67.87±1.32*
Phosphorus (mg)	255.75±1.36	257.07±1.01
Iron (mg)	2.29±0.91	7.96±0.14*

2.5. Data interpretation by statistical analysis

Each sample was subjected to extraction in triplicates, and the data presented reflects the average value along with the standard error derived from these triplicate determinations. The evaluation of statistical significance was conducted using the Holm Sidak method, with a predetermined significance level of p ≤ 0.05. This approach allowed for a rigorous analysis of the data to identify any meaningful findings or differences. [15]

2.6. Formulation of little millet nachosTable 1

3. Results and Discussion

3.1. Sensory evaluation of little millet nachos

Savoury nachos, incorporating varying levels of little millet (10% to 50%), showed an impact on the sensory characteristics, as outlined in Table 2. The standard Nachos received the highest rating for its exceptional organoleptic properties. LMN2, LMN3, and LMN4 achieved similar scores to the control across all sensory attributes. In contrast, LMN5 displayed lower scores and was less favoured compared to other variations. Notably, among all the variations, the 30% level (LMN3) was equally acceptable as the control in terms of sensory attributes. The parameters include standard nachos, along with variations at 10%, 20%, 30%, 40%, and 50%.

3.2. Nutritional analysis of nachos

A thorough analysis of the proximate composition of the selected nachos variant (LMN4) and the control was conducted, with detailed results presented in Table 3. It is noteworthy that the moisture content remained consistent across all LMN variations. Interestingly, LMN3 exhibited a higher protein content compared to the control, coupled with a decrease in carbohydrate content. Furthermore, LMN3 demonstrated enhanced levels of essential nutrients such as fiber, iron, and phosphorus.

4. Conclusion

The data interpretation revealed that incorporating 30% little millet flour in nachos was well-received by semi-trained panelists compared to standard nachos and other

variations. The chosen variant boosts higher fibre and lower carbohydrate levels than regular nachos, making it a promising option for diabetics and those with weight concerns. The fat content remains unchanged, making it suitable for health-conscious individuals. Additionally, the iron content triples, making it a healthy choice for women in the reproductive stage. Being gluten-free like other millets, it poses low-sensitivity issues compared to traditionally prepared nachos. Overall, this successful effort has resulted in as the best alternative for those seeking a delightful yet wholesome snack.

5. Source of Funding

None.

6. Conflict of Interest

None.

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