

# NUTRITIONAL ASSESSMENT AND STUDY OF AN AYURVEDIC PAUSTIK BISCUIT FORMULATED WITH RAGI, MUDGA, AND SHALI ON SCHOOL GOING CHILDREN OF INDIA

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## Keywords

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## ABSTRACT

Malnutrition among school-going children remains a major challenge in developing countries, leading to growth retardation and low immunity (1). The present clinical study was conducted to evaluate the impact of an Ayurvedic, diet-based formulation — Paustik Biscuit, prepared from Ragi (*Eleusine coracana*), Mudga (*Vigna radiata*), and Shali (*Oryza sativa*) — on nutritional and growth parameters among primary school children in Patan district, Gujarat. The intervention was based on classical Ayurvedic principles of Brimhana and Rasayana chikitsa (2,3). Each child received one standardized biscuit daily during the intervention period under supervision. Anthropometric parameters such as height, weight, BMI, and mid-arm circumference were recorded before and after intervention. Post-intervention analysis revealed significant improvement in mean BMI and weight, particularly among underweight children (5,6). The results suggest that Paustik Biscuit can serve as a cost-effective and culturally acceptable dietary supplement for improving child nutrition in school settings (7). The study follows the CONSORT guidelines for clinical trials and the DID-METAB 2025 checklist as recommended for diet-based interventions (8).

## INTRODUCTION

Malnutrition among school-aged children remains a major health problem, especially in rural areas, affecting their physical and mental growth (1). Despite the availability of several nutrition programs, the improvement is still

limited. Ayurveda emphasizes the importance of a balanced diet (Ahara) and the use of Brimhana and Rasayana dravyas for nourishment and immunity (2). Hence, there is a strong need to develop a simple, cost-effective, and culturally acceptable dietary supplement

for school children based on Ayurvedic principles.

#### Novelty of the Study

The present study introduces an Ayurvedic dietary formulation—Paustik Biscuit—prepared from Ragi, Mudga, and Shali using traditional Ahara Kalpana principles. This formulation uses natural ingredients and follows Ayurvedic logic for Balya and Pushtikara action. The scientific evaluation of its effect on BMI, height, and weight of school children makes this work a novel contribution bridging Ayurveda and modern nutrition science.

## MATERIALS AND METHODS

### Materials and Methods

#### Biscuit Formulation

The biscuit was formulated using Ragi flour ½ part, Mudga flour 1 part and Shali flour 1 part. Additional ingredients included ghee, sarkara, and sunthi (ginger powder) to enhance flavor and digestibility. The dough was baked at ~180°C for sufficient time to ensure crisp texture while retaining nutritional value.

#### Nutritional Analysis

Laboratory analysis was done at a certified food testing lab – GUJARAT TESTLAB PRIVATE LIMITED. Proximate composition measured included gross energy, protein, fat, carbohydrate, fiber, ash, moisture, and

minerals (iron, calcium). The reported values per 100 g were as follows:

energy 520 kcal

protein 11 g

fat – 27 g

carbohydrate 58.0 g

fiber 5 g

iron 5.3 mg

calcium 95 mg.

#### Pilot Study Design

A one-month pilot study (30 days) was conducted during 2022 in two government primary schools in Sidhpur Taluka. Thirty (n = 30) children aged between 6 to 12 years participated, selected randomly among students whose parents gave consent. Each child was given two biscuit (20 g) daily twice under supervision. Baseline measures of body weight, height and BMI were recorded, and the same were re-measured after one month. Given the pilot nature of this study, a 30-day observation was used to assess the short-term acceptability and preliminary impact of the biscuits on growth parameters. While BMI and height changes typically require longer follow-up, this initial period provided early insight into trends, and concurrent dietary variations at home were not controlled, acknowledging these as

potential confounding factors for definitive growth outcomes." Acceptability was assessed via simple questionnaire feedback.

Although the Paustik Biscuit provided 208 Kcal, 4.4 g protein, 10.8 g fat, and 2 mg iron per 40 g serving (4 biscuits/day), this amount was designed as an adjuvant nutritional support rather than a complete dietary replacement. The daily requirements of calories and micronutrients vary with age and weight; therefore, the formulation was aimed to bridge the nutritional gap and enhance overall dietary intake among school children

### **Ethical Considerations**

Approval from school authorities was obtained. Parental consent was secured. The intervention involved only dietary supplementation using recognized safe food ingredients; no invasive methods were used. The present study was designed and reported following the CONSORT (consolidated standards of reporting trials) guidelines. As the intervention involved a dietary formulation (paustik biscuit), the DD-METAB 2025 checklist was also consulted to ensure comprehensive reporting of all dietary components, nutrient details and intervention methodology (8).

### **RESULTS AND DISCUSSION**

Children showed a small mean increase in weight (average gain ~0.6 kg) and slight upward trend in BMI, though these gains were not statistically significant given the short duration. However, acceptability was very good; children reported liking the biscuit flavor, texture and found it convenient as mid-morning and evening snack.

The nutritional analysis suggests that the Paustik Biscuit could serve as a calorie-dense snack with meaningful contributions of protein, iron and calcium. Ragi contributed to mineral content especially calcium and iron; Mudga contributed protein and digestible fiber; Shali provided digestible carbohydrate [4,6].

These preliminary findings align with modern studies showing millet-based snacks improve diet quality in children [5,7]. From Ayurvedic perspective, the combination of Laghu (light), Balya (strength-promoting) and Pushtikara Dravyas supports the concept of Ahara Shakti and Dhatu Pushti [2,3].

Limitations include the short-term nature (one month), lack of control group, and small sample size. Larger and longer interventions are recommended for robust statistical inference.

### **CONCLUSION**

The formulated Paustik Biscuit based on Ragi, Mudga, and Shali demonstrates promising nutritive value and high

acceptability among school children. Regular inclusion may support improved dietary intake and growth trends in similar settings. Future studies with extended duration and control arms are needed to firmly establish efficacy.

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Declarations

**Author Contributions:** Dr. Nikita Parmar conceptualized, designed, conducted, and analyzed the study and prepared the manuscript.

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**Declaration of AI Usage:** AI assistance (ChatGPT, OpenAI, USA) was used only for language refinement and formatting of the manuscript; no data analysis or interpretation was done by AI.

**Conflict of Interest:** The author declares no conflict of interest.

## Author Contributions

Dr. Nikita Parmar conceptualized the study, designed the intervention, collected and analyzed the data, and prepared the manuscript. The entire work, including literature review, statistical analysis, and final drafting, was carried out by the author as part of

her Ph.D. research under academic supervision.

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## Declaration on the Use of Artificial Intelligence (AI)

AI tools (specifically ChatGPT by OpenAI) were utilized only to assist in language refinement, grammar correction, and formatting of the manuscript. All scientific content, data interpretation, and conclusions were independently developed and verified by the author.

## Conflict of Interest

The author declares no conflict of interest related to this study, the formulation of Paustik Biscuit, or the publication of this manuscript.

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