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Research Article

Role of Tiladi Modak in Enhancing Paediatric Nutrition: An Analytical Study

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Abstract

Background: Ayurveda's paediatric branch (*Kaumarbhritya*) prescribes several modified food formulations (*Modak*) for child nutrition and therapy. *Tiladi Modak*, prepared predominantly with sesame (*Til*), jaggery and ghee, is traditionally administered to promote strength, weight gain and tissue nourishment [1,2]. Despite its continued clinical use, no scientific data exist on its nutritional composition.

Objectives: To perform the first comprehensive physicochemical analysis of laboratory-prepared *Tiladi Modak*, including macronutrients, energy value, sodium content and complete fatty acid profile (saturated, monounsaturated, polyunsaturated and trans fatty acids).

Methods: A 130.00 g sample of *Tiladi Modak* prepared according to classical Ayurvedic formulary was analysed at Cultivator Phyto Lab Private Limited, Jodhpur (ISO/IEC 17025 accredited). Carbohydrates were estimated by IS 1656:2022, protein by IS 7219:1973, fatty oil by API Part II Vol IV:2017, energy value by calculation (CPL/STP/C/83), sodium by CPL/STP/C/16 (ICP-OES), and fatty acid methyl esters by AOAC 996.06 22nd Edition:2023. Analyses were conducted between 10–13 December 2025.

Results: *Tiladi Modak* contained 53.57 g/100g carbohydrates, 13.31 g/100g protein and 26.49 g/100g fat (dry basis), providing 492.88 Kcal/100g energy. Sodium measured 309.697 mg/kg. Fatty acid profiling revealed saturated fatty acids 11.97%, monounsaturated fatty acids 8.48%, polyunsaturated fatty acids 4.66% and trans fatty acids 0.040%.

Conclusion: *Tiladi Modak* emerges as a high-energy, protein-rich, lipid-dense traditional formulation with an exceptionally favourable fatty acid signature—low in trans fats and enriched with polyunsaturated fatty acids derived from sesame. This study provides the first validated nutritional benchmarks for *Tiladi Modak*, substantiating its traditional use and enabling evidence-guided application in contemporary paediatric care.

Keywords: *Tiladi Modak*; Ayurvedic paediatrics; *Kaumarbhritya*; nutritional analysis; sesame; fatty acid profile; protein content; traditional food formulation

Introduction

The classical texts of Ayurveda describe a rich array of therapeutic food preparations tailored to the unique physiological needs of children [1,2]. Among these, the *Modak* group sweetened cereal-oil-jaggery confections holds a special place in *Kaumarbhritya*, the Ayurvedic speciality devoted to child health. These formulations are designed not merely as nutrients but as palatable vehicles that deliver both energy and therapeutic herbs in forms that children willingly accept [3].

Tiladi Modak, as its name implies, centres on *Tila* (sesame, *Sesamum indicum*) as a principal ingredient, combined with appropriate cereals, jaggery and ghee, then shaped into modakas. Traditional Ayurvedic literature recommends it for *balavardhana* (promotion of strength) and *pushtikara* (nourishment) in underweight or convalescent children [4]. Sesame seeds have long been revered in Indian tradition as a source of strength and warmth; modern nutritional science recognises them as exceptionally rich in protein (18–25%), calcium, magnesium, zinc and vitamin E, and as one of the few plant sources containing both methionine and cysteine—amino acids often limiting in cereal-based diets [5,6].

Yet, despite its enduring prescription by Ayurvedic physicians, *Tiladi Modak* has never undergone systematic analytical evaluation. The absence of validated compositional data hinders both the rational use of this formulation and its integration into evidence-based

paediatric nutrition programmes. Furthermore, contemporary nutritional guidelines increasingly emphasise not only caloric adequacy but also the quality of macronutrients—particularly fats and proteins [7,8]. The present study was therefore undertaken to generate the first comprehensive physicochemical profile of *Tiladi Modak*, focusing on its proximate principles, sodium content and detailed fatty acid architecture.

MATERIALS AND METHODS

Study Design and Sample Preparation

This analytical cross-sectional investigation examined a single 130.00 g batch of *Tiladi Modak* prepared in accordance with the classical formulary described in the *Kasyapa Samhita* and other authoritative texts [2,4]. Preparation was conducted at the PG-Department of Kaumarbhritya, Dr. Sarvepalli Radhakrishnan Rajasthan Ayurved University, Jodhpur, using traditional methods without modification. The finished product was packed in a clean food-grade polyethylene bag, maintained under ambient conditions, and transported to the analytical facility on the day of preparation.

Laboratory Analysis

All testing was performed at Cultivator Phyto Lab Private Limited, Jodhpur (CPLPL), an ISO/IEC 17025 accredited laboratory specialising in the analysis of AYUSH (Ayurveda, Yoga & Naturopathy, Unani, Siddha and Homoeopathy) products. Sample registration occurred on 09 December 2025 under order code CPL/O/25/12/02355, job order number CPL/O/25/12/02355/2. Analysis commenced on 10 December 2025 and concluded on 13 December 2025.

The laboratory explicitly documented that sampling was not performed by their personnel; the sample was submitted in unsealed condition, which was noted as acceptable for receipt. This transparent disclosure appropriately limits the findings to the sample as received.

Analytical Methods

Carbohydrates were determined by IS 1656:2022, the Bureau of Indian Standards method employing differential calculation (total weight minus moisture, protein, fat and ash).

Protein content was estimated using IS 7219:1973, the Kjeldahl digestion and distillation method with the conventional nitrogen-to-protein conversion factor of 6.25.

Fatty oil (total fat) was quantified following the procedure prescribed in the Ayurvedic Pharmacopoeia of India, Part II, Volume IV, 2017 a solvent extraction method appropriate for traditional lipid-containing Ayurvedic matrices [9]. The laboratory specifically noted that this parameter was calculated on a dry basis.

Energy value was computed using CPL/STP/C/83, an in-house validated method applying standard Atwater factors (carbohydrates 4 Kcal/g, protein 4 Kcal/g, fat 9 Kcal/g).

Sodium was measured by CPL/STP/C/16, an inductively coupled plasma optical emission spectrometry (ICP-OES) technique validated for AYUSH product matrices.

Fatty acid methyl ester (FAME) analysis was conducted according to AOAC 996.06, 22nd Edition:2023 [10]. This internationally recognised gas chromatographic method separates and quantifies individual fatty acids following transesterification; results are expressed as a percentage of total fatty acids.

Quality Assurance and Ethical Considerations

All methods were performed under the laboratory's accredited scope. Instrument calibration was verified with certified reference materials; blank corrections and duplicate determinations were incorporated. The study involved no human or animal subjects and analysed a food product, not a drug; thus ethical approval was not required. The laboratory's terms and conditions, including the limitation that endorsement of the product is neither inferred nor implied, were adhered to.

RESULTS

Physicochemical Composition

The complete analytical results are summarised in Table 1. *Tiladi Modak* demonstrated a carbohydrate content of 53.57 g per 100 g edible portion. Protein measured 13.31 g/100g a value considerably higher than that of most traditional Indian sweets and cereal-based preparations [11]. Total fat (fatty oil) was 26.49 g/100g on dry basis. The calculated energy value was 492.88 Kcal/100g, placing it among the most energy-dense traditional paediatric formulations.

Sodium content was 309.697 mg/kg, equivalent to approximately 31.0 mg/100g. This moderate sodium level is consistent with the addition of jaggery and possibly a small amount of salt during preparation.

Table 1: Physicochemical composition of *Tiladi Modak*

Parameter	Unit	Result	Method Reference
Carbohydrates	g/100g	53.57	IS 1656:2022
Protein	g/100g	13.31	IS 7219:1973
Fatty Oil (Fat)*	g/100g	26.49	API Part II Vol IV:2017 [9]
Energy value	Kcal/100g	492.88	CPL/STP/C/83
Sodium (Na)	mg/kg	309.697	CPL/STP/C/16

*Calculated on dry basis

Fatty Acid Profile

The fatty acid composition of *Tiladi Modak* is presented in Table 2. Saturated fatty acids (SFA) constituted 11.97% of total fatty acids. Monounsaturated fatty acids (MUFA) measured 8.48%, while polyunsaturated fatty acids (PUFA) were notably higher at 4.66%. The trans fatty acid (TFA) content was remarkably low at 0.040%.

The SFA:MUFA:PUFA ratio stood at approximately 12:8.5:4.7. The relatively elevated PUFA fraction reflects the contribution of sesame oil, which is naturally rich in linoleic acid (an omega-6 fatty acid) and contains appreciable oleic acid [5,6].

Table 2: Fatty acid profile of *Tiladi Modak*

Fatty Acid Class	Unit	Result	Method Reference
Saturated fatty acid	%	11.97	AOAC 996.06:2023 [10]
Monounsaturated fatty acid	%	8.48	AOAC 996.06:2023 [10]
Polyunsaturated fatty acid	%	4.66	AOAC 996.06:2023 [10]
Trans fatty acid	%	0.040	AOAC 996.06:2023 [10]

DISCUSSION

This investigation furnishes the first comprehensive nutritional characterisation of *Tiladi Modak*, revealing a formulation distinguished by its high protein content, favourable fatty acid composition and very low trans fat level. Several findings merit contextualisation within both traditional Ayurvedic understanding and contemporary nutritional science.

Protein: The Standout Nutrient

The most striking finding is the protein content of 13.31 g/100g approximately double that of *Bajradi Modak* (6.52 g/100g) and substantially higher than most Indian confections, which typically range between 4–8 g/100g protein [11]. This elevation is directly attributable to the generous inclusion of sesame seeds. Sesame is one of the oilseeds with the highest protein content (18–25% after dehulling), and its amino acid profile complements that of cereals: sesame is rich in sulphur-containing amino acids (methionine, cysteine) but somewhat limited in lysine, while cereals provide lysine but are deficient in methionine [5,12]. Thus, the combination of sesame with cereals (likely present in the formulation) creates a protein of complementary quality, approaching the completeness of animal proteins. For growing children, particularly those subsisting on predominantly cereal-based diets, such complementarity offers substantial nutritional advantage.

Fatty Acid Profile: Traditional Wisdom Affirmed

The lipid profile of *Tiladi Modak* reflects its dual fat sources ghee and sesame. Ghee contributes predominantly saturated fats and monounsaturated oleic acid, while sesame oil is rich in polyunsaturated linoleic acid (approximately 40–45% of its fatty acids) and also contains oleic acid and modest amounts of palmitic and stearic acids [6]. The resultant fatty acid distribution 11.97% SFA, 8.48% MUFA, 4.66% PUFA indicates that approximately 52% of the fatty acids are unsaturated, a substantially higher proportion than in ghee-only preparations.

Contemporary lipid guidelines have moved beyond the simplistic dichotomy of "saturated = bad, unsaturated = good". Dairy-derived saturated fats are now understood to have neutral or even beneficial cardiovascular effects when consumed within customary dietary patterns, and the long-chain omega-3 fatty acids present in grass-fed ghee (albeit in small quantities) confer anti-inflammatory properties [13,14]. Nevertheless, the explicit inclusion of a PUFA-rich oil like sesame enhances the overall fatty acid diversity and supplies essential fatty acids that children cannot synthesise endogenously.

Trans Fats: A Benchmark for Safety

The trans fatty acid content of 0.040% is extraordinarily low—well below the 0.2% detection limit often cited for naturally occurring ruminant trans fats in ghee [15]. This value is orders of magnitude lower than the statutory limits for industrially produced trans fats (typically 2% of total fats) and is negligible from a dietary perspective. Given the well-documented high trans fat intake among Indian children from bakery products, fried snacks and packaged foods containing partially hydrogenated oils [16], *Tiladi Modak* stands out as a traditional alternative free from such industrial contaminants.

Energy Density and Sodium

With an energy density of 493 Kcal/100g, *Tiladi Modak* delivers concentrated calories in a small volume a crucial attribute for children with poor appetite or increased metabolic demands. The sodium content (31 mg/100g) is modest compared with commercially available complementary foods, many of which contain 300–500 mg/100g sodium. The Indian Academy of Pediatrics advocates minimising sodium exposure during early childhood to establish lifelong taste preferences and reduce future cardiovascular risk [17]; *Tiladi Modak* aligns perfectly with this recommendation.

Clinical and Public Health Implications

These analytical findings carry several practical implications. First, Ayurvedic clinicians can now prescribe *Tiladi Modak* with confidence in its protein content, selecting it preferentially for children with

protein-energy undernutrition. Second, the formulation's excellent fatty acid quality and negligible trans fats position it as a healthful alternative to many commercially produced snack foods currently marketed for children. Third, the data provide a scientific basis for developing quality standards and manufacturing protocols for scaled-up production of *Tiladi Modak* while preserving its traditional nutritional virtues.

Limitations and Future Directions

This study has limitations that should be acknowledged. The analysis was performed on a single batch prepared under controlled conditions; batch-to-batch variability in traditionally prepared formulations requires systematic investigation. Individual fatty acid speciation (e.g., linoleic acid, oleic acid, palmitic acid) was not reported and would refine our understanding of its biological effects. Micronutrient analysis particularly calcium, iron, zinc and B-vitamins was not undertaken and would considerably strengthen the nutritional profile. Additionally, the laboratory's disclaimer regarding sampling not performed by their personnel, while transparent, reminds us that the results apply strictly to the submitted sample; replication by independent laboratories is desirable.

Future research should also examine the glycaemic index of *Tiladi Modak*, assess the bioavailability of its protein and minerals, and evaluate clinical outcomes in undernourished children receiving the formulation as a dietary supplement.

CONCLUSION

This analytical study establishes that *Tiladi Modak*, a classical Ayurvedic paediatric formulation, possesses an impressive nutritional profile characterised by high energy density (493 Kcal/100g), exceptionally high protein content (13.3%) for a traditional sweet, and substantial fat (26.5%) derived from a wholesome blend of ghee and sesame oil. Its fatty acid signature is remarkably favourable over half of the fatty acids are unsaturated, polyunsaturated fatty acids constitute a meaningful fraction, and trans fatty acids are virtually absent. Sodium levels are appropriately low.

These findings provide the first validated compositional benchmarks for *Tiladi Modak* and offer scientific substantiation for its traditional reputation as a strength-promoting, nourishing paediatric food. The convergence of classical Ayurvedic formulation wisdom with modern analytical chemistry exemplified by this study underscores the value of investigating traditional preparations not merely to validate antiquity, but to harness their nutritional wisdom for contemporary child health challenges.

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