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## NUTRITIONAL EVALUATION AND STABILITY ASSESSMENT OF *MASHADI MODAKA*: AN AYURVEDIC FORMULATION AS A NUTRITIONAL SUPPLEMENT

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### ABSTRACT

**Background of the Study:** *Mashadi Modaka* is indicated as one of the drugs for management of *Karshya* (underweight) and aphrodisiac wellbeing. Standardization and assurance of quality of herbal compounds Evaluation and Stability Assessment is needed.

**Aim and Objectives:** To evaluate the Nutritional value and Stability of *Mashadi Modaka*.

**Material and methods:** Test drug sample was prepared with *Godhuma*, *Shali Tandula*, *Nistusha Masha (Urada)*, *Yava* etc. in the institutional pharmacy after that sample was analysed by using techniques like Spectrophotometry, Chromatography, and Titration methods. **Result:** Nutritional Analysis study showed that all the essential macronutrient and micronutrient available in *Mashadi Modaka*. **Discussion and Conclusion:** *Mashadi Modaka* provides 526.15 Kcal of energy per 100 grams, with 60.96 grams of carbohydrates, 10.39 grams of protein, and 26.75 grams of fat with appropriate shelf- life (Stability).

**Keywords:** Ayurvedic formulation, *Karshya*, *Mashadi Modaka*, Nutritional Analysis, Nutritional supplement, Shelf Life

**INTRODUCTION:** A healthy and long life is the primary goal of health systems, and in this context, Zero Hunger,” the second goal, of the Sustainable Development Goals (SDGs). Approximately 582 million people could be chronically undernourished by 2030.<sup>[1]</sup> Food is the life-force of all living beings.<sup>[2]</sup> Because every living being is made up of food and it is the mode by which every prerequisite of body is going to be full filled.<sup>[3]</sup>

Food with known nutrients is the key to understanding the application of food as supplements. Nutritional study is a dynamic process in which the food consumed is utilized to nourish the body and involving the assimilation of nutrients.<sup>[4]</sup> It includes studying how food is going to be processed within the body, encompassing digestion, absorption, transport, and disposal of products to provide energy, build and repair body tissues, and protect against microorganisms, heat, and other stressors.

Nutrition specifically addresses the food and nutritional requirements of individuals. Sufficient and well-balanced diet along with frequent physical activity constitute proper nutrition, which is the foundation of good health. Conversely, poor nutrition can lead to reduced immunity, increased susceptibility to disease, impaired physical and mental development, and decreased productivity.<sup>[5]</sup>

Ensuring food security with the proper amount and quality of food is a significant challenge for poor families. It is a myth that merely providing an adequate quantity and quality of food is sufficient for maintaining good nutritional status. Good nutrition allows for proper growth and overall health as influenced by the utilization of nutrients. Currently, overweight and obesity are major global issues affecting both developing and developed countries. Conversely, underweight and undernutrition among adults are significant problems in underdeveloped countries, reducing work efficiency and affecting national GDP, leading to lower economic development. Undernutrition includes both protein-energy malnutrition and micronutrient deficiencies. It occurs when, over an extended period, food intake in both quantity and quality is insufficient to meet dietary and nutritional needs. Even if food intake is adequate, issues with digestion, absorption, or nutrient metabolism can lead to undernutrition. It is typically measured using indicators such as underweight, stunting, and wasting.<sup>[6]</sup> Poverty and hunger, which encompass lack of adequate nutrition rather than just food, are leading causes of undernutrition. These

conditions result in low food intake, inefficient nutrient utilization, or nutrient loss from the body. Persistent underweight can lead to decreased appetite, gradual weight loss, reduced work efficiency, increased absenteeism, chronic gastrointestinal issues, and weakened immunity, raising the risk of infectious diseases.<sup>[7]</sup> Ultimately, these issues contribute to a greater burden on the country.

Multiple nutritional supplements marketed in the world and many supplements contain active ingredients that can have strong effects on the body and that may increase the kidney load.<sup>[8]</sup> *Mashadi Modaka*<sup>[9]</sup> is an Ayurvedic formulation that is indicated for *Pushti Karma* (nourishment therapy) under *Vajikarana Dravya* (Aphrodisiac substance) with the common ingredients like *Godhuma* (*Triticum sativum*), *Shali Tandula* (*Oryza sativa*), *Nistusha Masha* (*Dehusked blackgram*) (*Vigna Mungo*), *Yava* (*Hordeum vulgare*) etc. All ingredients except *Pippali* (*Piper longum*) are the part of regular food, *Pippali* in this *Modaka* increases the effect of all other ingredients with synergistic effect due to its *Agnivridhhi* property.

#### **MATERIAL AND METHODS:**

Ingredients of *Mashadi Modaka* like flour of *Godhuma*, *Nistusha Masha*, *Shali Tandula* and *Yava* procured from local market and authenticated in institutional pharmacy. Other materials like Ghee and *Sita* (sugar) taken from pharmacy. For nutritional analysis, Spectrophotometry and Chromatography laboratory methods were used. Microbiological Analysis has done in accelerated conditions.

**Materials and Authentication of Ingredients:** Ingredients (Figure:1 to Figure:8) of *Mashadi Modaka* contains all food ingredients like Wheat, Rice, Barley,

Black gram and *Pippali* in equal quantity and *Sita* (refined sugar) equal to all. Ghee only required for roasting of flour. All details are tabulated in the Table: 1

**Table:1 Ingredients of *Mashadi Modaka***

Sl.No.	Name of Ingredient	Latin Name	Family	Part used	Proportion of Ingredients
1	<i>Godhuma</i>	<i>Triticum sativum</i>	Poaceae	Seed	100gm
2	<i>Pippali</i>	<i>Piper longum</i>	Piperaceae	Fruit	100gm
3	<i>Masha</i>	<i>Vigna Mungo</i>	Fabaceae	Seed	100gm
4	<i>Shali Tandula</i>	<i>Oryza sativa</i>	Poaceae	Seed	100gm
5	<i>Yava</i>	<i>Hordeum vulgare</i>	Gramineae	-	100gm
6	<i>Sharkara</i>	Refined sugar	-	-	500gm
7	<i>Ghrita</i>	Refined butter	-	-	250gm
8	<i>Jala</i>	Water	-	-	-



**Figure:1 *Godhuma*(*Triticum sativum*)**



**Figure:2 *Pippali* (*Piper longum*)**



**Figure:3 *Masha*(*Vigna Mungo*)**



**Figure:4 *Shali Tandula* (*Oryza sativa*)**



**Figure:5 *Yava* (*Hordeum vulgare*)**



**Figure:6 *Sharkara* (Refined sugar)**



**Figure:7 Ghrita (Refined butter)**



**Figure:8 Jala (Water)**

*Mashadi Modaka* was prepared (Figure:09 to Figure:12) in the Pharmacy on 30.09.2023 and made 3 packets of 250gm each. <sup>[10]</sup> It contains flour of *Yava*, *Godhuma*, *Masha*, *Shali Dhanya* and *Pippali Churna* in equal quantity. All flours were roasted individually with refined butter on a low flame until the colour of the flour becomes golden brown. Sugar was added with water and converted into sugar syrup on a slow flame. After that, sugar syrup was mixed with all the roasted powders and manually made into *Modaka*. (sweet dumpling). The batch size was 1.250 kg and stored in an airtight container in an uncontrolled humidity environment at room temperature.



**Figure:9 Step-1:** Heating ghee in a pan and then add wheat flour

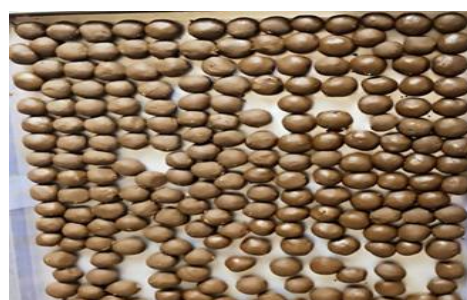


**Figure:10 Step-2** Keeping roasting on low flame till the colour of flour becomes golden brown.(All the flours have to be roasted in the same manner)



**Figure:11 Step-3** Make sugar syrup by adding sugar to water and heat till one-two string consistency (*Khandapak*). Mix the ghee fried all the flours.

**Institutional Ethical Approval:** The study was approved by the Institutional



**Figure:12 Step-4** Roll them between palms into *Modaka* weighing 20 grams each final product.

Ethics Committee ref no. PGT/7/-  
A/Ethics/2022-23/2218



## NUTRITIONAL ANALYSIS OF MASHADI MODAKA

**Laboratory Testing Methods:** The test drug sample was analysed by using

techniques like Spectrophotometry, Chromatography, and Titration methods. [11,12] Its nutritional value is listed in Table 2.

**Table No:2 Nutritional Analysis of Mashadi Modaka Per 100 gm**

Sl.No.	Parameters	Units	Methods	Results of Analysis as per 100gm	RDA Value
1	Energy	Kcal	SOP-CHM-29-00	526.15	2000
2	Carbohydrate	gm	SOP-CHM-28-00	60.96	-
3	Protein	gm	By FSSAI Manual for cereal & cereal product (8.7)2016	10.39	-
4	Total Fat	gm		26.75	67
5	Total sugar	gm		11.12	-
6	Added sugar	gm	By FSSAI Manual for cereal & cereal product (14.5)2016 By FSSAI Manual for cereal & cereal product (2.6)2016 By FSSAI Manual for cereal & cereal product (2.6)2016	9.08	50
7	Trans fat	gm	AOAC 996.06 20 <sup>th</sup> Ed.	BLQ*	2
8	Saturated Fat	gm	AOAC 996.06 20 <sup>th</sup> Ed.	19.332	22
9	Cholesterol	mg	AOAC 996.10 20 <sup>th</sup> Ed.	17.260	-
10	Sodium	mg	SOP-CHM-27-00	6.63	2000

\*BLQ: Below Limit of Quantification

**Stability Assessment (Microbiological, Chemical and Organoleptic Assessments) of Mashadi Modaka:** The shelf-life (stability) of a food product is the period during which it remains safe to consume and retains acceptable quality for consumers. Through shelf-life analysis, manufacturers can determine accurate expiration dates, ensuring that the product's safety and qualities are maintained when stored under recommended conditions. Trail drug was

stored for 0.3 month (9 days) in client location and then accelerated (38 °C & 90% RH) for 1.7 weeks (12 days) in conditions equivalent to 1.7 months (51days) in room conditions for duration. It is influenced by a combination of physical, microbiological, and chemical processes. Chemical changes, such as oxidation, colour loss, pH shifts, and enzymatic deterioration, can affect the product's quality. Physical tests, including assessments of moisture content, textural

changes, and the occurrence of breakage or clumping, are crucial in evaluating a product's stability. Additionally, microbial assessments ensure that pathogenic microorganisms are absent, adhering to regulatory standards for food safety.

Beyond these factors, sensory aspects like flavour, texture, and appearance are essential for consumer acceptability, as they significantly affect the overall perception and enjoyment of the food product.

**Table -3 Stability Assessment of Mashadi Modaka (Per 100 Gm)**

Test	Phase	Units	Methods	After 0.3 month (9 days) in room conditions and 0.7 week(5 days) in accelerated conditions (Phase A)	After 0.3 month(9 days)in room conditions and 0.7 week (5 days) in accelerated conditions (B Phase)	Specified limits
<b>Microbiological Analysis</b>						
	<b>Total viable count</b>	cfu/gm	IS 5402(I):2021	<10	<10	Max 10 <sup>4</sup>
	<b>Coliform</b>	cfu/gm	IS 5401(I):2012 Reaffirmed:2018	<10	<10	Max 10 <sup>2</sup>
	<b>E coli</b>	cfu/gm	IS 5887(I):1976 Reaffirmed:2018	Absent	Absent	Absent
	<b>Salmonella</b>	/gm	ISO 6579 (I)2017 (E)	Absent	Absent	Absent
	<b>Staphylococcus aureus</b>	/25gm	IS 5887 (II):1976 Reaffirmed:2018	Absent	Absent	Absent
	<b>Yeast</b>	cfu/gm	IS 5403:1999 Reaffirmed:2018	<10	<10	Max 10 <sup>2</sup>
	<b>Mold</b>	cfu/gm	IS 5403:1999 Reaffirmed:2018	<10	<10	Max 10 <sup>2</sup>
<b>Chemical Analysis</b>						
	<b>pH (5% aqueous solution)</b>	-	By FSSAI Manual -fruits &Vegetable products (2.3):2016	6.50	6.48	Not Specified
	<b>Acidity as</b>	gm/100gm	By FSSAI	0.76	0.78	Not

	<b>citric acid anhydrous</b>		Manual-Fruit & Vegetable Product (2.4):2016			Specified
	<b>Moisture</b>	gm/100gm	By FSSAI Manual-Cereal & Cereal Product 3(8:1)2016	0.81	0.80	Not Specified
	<b>Peroxide value</b>	meq/kg	By FSSAI Manual oil & fat (37.0)2016	0.46	0.50	Not Specified
	<b>Free Fatty acid as oleic acid</b>	gm/100	By FSSAI Manual oil & fat (11.0)2016	0.35	0.38	Not Specified
<b>Organoleptic Analysis</b>						
	<b>Appearance</b>	-	IS 6273 (II):1971	5	5	3 to 5
	<b>Odour</b>	-	IS 6273 (II):1971	5	5	3 to 5
	<b>Taste</b>	-	IS 6273 (II):1971	5	5	3 to 5
	<b>Texture / consistency</b>	-	IS 6273 (II):1971	4	4	3 to 5
	<b>Result</b>	-	-	Pass	Pass	-
	<b>Shelf life Obtained</b>	Months		1	2	

**Chemical Analysis** – Oxidation refers to the reaction of oxygen with food components, leading to spoilage and off-flavours, such as rancidity in fats. Colour change and loss involve alterations in a food's color, which can affect its visual appeal and signal potential deterioration. pH changes involve shifts in acidity or alkalinity that can impact food safety and quality, influencing factors like flavour and preservation. <sup>[13]</sup> Enzymatic deterioration results from enzymatic activity that degrades food, affecting its texture, flavour, and nutritional value, as

seen in processes like fruit ripening or meat spoilage.

**Microbiological Analysis**-Ensuring the absence of pathogenic microorganisms in the food product, in accordance with regulatory standards. Microbial analysis conducted in laboratory with outsource

**Organoleptic Analysis**- Sensory qualities such as flavour, texture, and appearance are crucial for consumer acceptability. These attributes significantly influence the product's shelf life and overall appeal to consumers.

The analysis of *Mashadi Modaka* confirms that it meets the recommended limits for the tested parameters like Microbiological, pH, moisture, free fatty acid chemical analysis and Organoleptic parameters like Appearance, Odour, Taste, Texture / consistency and it has a shelf life more than 2 months from the date of manufacture.

**RESULTS:** As per nutritional analysis product, *Mashadi Modaka*, provides 526.15 kcal of energy along with 60.96 grams of carbohydrates, 10.39 grams of protein, and 26.75 grams of fat per 100gm with appropriate shelf- life (stability). The results of stability test analysis of the *Modaka* sample confirm that the recommended limits of shelf life of the sample were more 2 months from date of manufacture. In terms of organoleptic parameters, sample was observed good texture in the A and B phase.

## DISCUSSION

**Nutritional Analysis of *Mashadi Modaka***  
Nutritional supplements <sup>[14]</sup> that intended to supplement the diet and contain one or more dietary ingredients like macronutrients (carbohydrates, proteins, fats and fibres) and micronutrients (minerals and vitamins) or their constituents. *Mashadi Modaka* contains mainly ingredients of staple food like *Godhuma* (*Triticum sativum*), *Masha* (*Vigna Mungo*), *Shali Tandula* (*Oryza sativa*), *Yava* (*Hordeum vulgare*) and *Pippali* (*Piper longum*) etc. that are the source of different nutrients.

According to nutritional analysis, Calorific Value of *Mashadi Modaka* is 526.15 Kcal/100gm (total energy content in a food item) noted. Total fat and sugar present is 26.75 gm/100 gm and 11.12

gm/100 gm respectively. Other nutrients like Carbohydrates 60.96gm/100 gm (including sugars, starches, and dietary fibre), Protein 10.39 gm/100 gm (Essential for growth, tissue repair and weight increase) and Cholesterol is 17.260mg/100 gm, Sodium 6.63mg/100gm Saturated Fat 19.332/100gm are present in test drug per 100 gm. For healthy adult's needs minimum 1900 to 2320 kcal/day energy, 50-60 gm protein, 20-30gm fat and less than 200mg cholesterol is permissible in diet. <sup>[15]</sup> *Mashadi Modaka* also supplements for dietary fibres due to the presence of cereals like wheat and barley. Intake of trans-fats less than 1% of total energy intake is recommended and Trans-fat is available but in less than limit.

As *Mashadi Modaka* also contains *Pippali* (*Pipiper longum*), that acts as bio-enhancer agent and enhances the absorption and assimilation of drug due to the presence of Piperine, <sup>[16][17]</sup> and also improves the immunity of the patients. *Karshya* (undernutrition) is not only energy imbalance between the input and output of energy, it occurs due to *Agni Mandya*. Undernutrition drives an increased risk of infection by reducing gut barrier function, modifying the intestinal microbiota, altering the regulation of inflammatory adipocytokines, and limiting the uptake of key micro and macronutrients. <sup>[18]</sup>

Proper levels of macronutrients and micronutrients are required to meet nutritional needs. However, symptoms such as loss of appetite, unintentional weight loss, and fatigue in undernourished individuals do not necessarily indicate that food is deficient in nutrients. Often, these



symptoms caused by a lack of supportive factors that aid in nutrient absorption.

Nutritional supplements like protein rich, vitamins like A, D and E and some herbal products increases the kidney load and liver toxicity <sup>[19]</sup> and other gastrointestinal disturbance like nausea, distension of abdomen, loss of appetite and other that create additional health compliances. Trial drug insides are acceptable for body and avoided the organ damage.

### **Stability Assessment of Mashadi Modaka**

Stability testing involves a series of microbiological, chemical, and sensory tests conducted on food products to determine when they are no longer safe to consume and when they lose their peak quality markers. The length of a product's stability depends on factors such as the quality of ingredients, the manufacturing process, the type of packaging, and storage conditions.

The Stability (shelf- life) of a product assures consumers that they can safely consume it within the specified period while maintaining acceptable quality. These tests are crucial for assessing food spoilage, indicated by the types and levels of microorganisms present. It evaluates the presence and quantity of pathogens in a product to determine its condition. Common pathogens that cause food poisoning include *Listeria monocytogenes*, *Staphylococcus aureus*, *Escherichia coli* O157:H7, *Escherichia coli*, *Salmonella*, *Bacillus cereus*, and *Campylobacter*. <sup>[20]</sup> Spoilage is identified by changes in specific product characteristics, such as standard plate count, yeast and mold levels, *Lactobacillus*, anaerobic plate count, and coliforms. In the

microbiological assessment *E. coli*, *Salmonella*, and *Staphylococcus aureus* not present, and other organisms like coliforms, yeast, and mold were within acceptable limits according to the guidelines in the trial drug.

Chemistry quality tests assess the chemical characteristics of food to determine its freshness and overall quality. These tests typically include evaluating moisture content, acidity levels, and pH.

Sensory and physical tests during a product's stability assess whether the food remains safe by evaluating its appearance, odour, texture, and flavour. The sample of *Mashadi Modaka* showed no changes in physical characteristics after 1 month and 2 months when tested by accelerated aging method. <sup>[21]</sup> *Mashadi Modaka* contain ghee and sugar that act as natural preservatives and have low moisture that also prevent the growth of organism during storage.

**CONCLUSION:** *Mashadi Modaka* provides 526.15 Kcal of energy with 60.96 grams of carbohydrates, 10.39 grams of protein, and 26.75 grams of fat per 100 grams with appropriate stability of more than 2 months without any alteration in quality of product. All essential macronutrient and micronutrient available in this formulation as partial supplements for the deficient *Karshya* (underweight) patients and by improving the digestion power and assimilation increase the bioavailability of nutrients.

**DECLARATION:** The authors declare that artificial intelligence (AI)-assisted technologies were used solely for language editing, grammar correction, and improving clarity of expression during manuscript preparation, while full responsibility for the originality, accuracy,

data interpretation, and scientific content rests with the authors.

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