

A Critical Appraisal of Nutritional Value of Mashadi Modaka in Ativyayama Janit Poshana Abhava (Relative Energy Deficiency) in Sports Persons

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Abstract

Background: Sports Medicine is defined as physical fitness, treatment and prevention of injury related to sports and exercise. As per Ayurvedic classical texts, in the concept of Dinacharya, Vyayama is defined as physical exercise and is advised to be performed at Ardhashakti (~half of one's capacity). Otherwise, Atiyoga Lakshana, such as Shrama (~excessive fatigue), Klama (~exhaustion), Kshaya (~depletion), etc., may be observed. Nowadays, it is observed that most sportspersons consume protein, carbohydrates, creatine, nitrates, and other supplements in the form of powders, jellies, bars, drinks, or granules. Some supplements have their own adverse effect on health which directly impact on their sports performance and without nutritional supplements sports person going to suffer from Relative Energy Deficiency in sports (RED-S). Considering this there is a need for nutritional enhancement and to improve the performance & physical fitness of sports person without any consequences as well as with full of nutritional values of the sports nutritional supplement. For this purpose, Mashadi Modaka are selected for sports nutritional supplement. **Aim & Objective:** To establish Nutritional Value of Mashadi Modaka in Ativyayama Janit Poshana Abhava (Relative Energy Deficiency in Sports) in Sports Persons **Materials & Methods:** Classical Ayurvedic textbooks, nutritional books, and databases, such as PubMed, Scopus, DHARA and Google Scholar etc. were reviewed. **Result and Discussion:** Balanced food support recovery and performance in condition of RED-S and here Mashadi Modaka fulfil the criteria of Sports nutritional supplement as given in this review article. **Conclusion:** By this critical review Mashadi Modaka can be used for nutritional enhancement as they give complete nutritional support and improves the performance in healthy sports persons.

Keywords: Deficiency, Mashadi Modaka, nutrition, RED-S, sports, supplement

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INTRODUCTION

Sports nutrition is the study and practice of nutrition and diet with regards to improving performance of sports person [1]. By the Ayurvedic concept, prevention of disease is important for maintenance of the health of healthy individuals which is also applicable for the sports person [2]. *Ayurveda* Science can play pivotal role in Sports Nutrition which is a fundamental requirement of Sports Science. Food is one of the important sub-pillars of life [3], i.e., Health and strength directly depend on food [4]. *Shrimad Bhagwat Geeta* categorises food in three categories like *Sattvika*, *Rajasika* and *Tamasika Ahara* [5]. Along with *Rajasika* and *Tamasika Ahara* sports persons have to take *Sattvika Ahara* more in quantity than other two. *Sattvika Ahara* like *Rasya* (~fresh, pleasant tasting food), *Snigdha* (~unctuous), *Sthira*

(~stability), *Hridya* (~pleasing to the heart) and other *Guna* of *Ahara* (~properties of food) mainly *Laghupaki* (~easily digestible), *Priya* (~agreeable), *Dhatupraposhaka* (~strengthening), *Manoabhilashi* (~acceptable to mind) food improves the *Rasa Dhatu*, removes the fatigue and tiredness immediately [6, 7].

As per study done among National Athletes in Malaysia 67.2% of sports persons having a medium/high RED-S risk [8]. India has made steady progress in the field of sports, as the India is the developing country, having traditional food habit, middle class family, therefore it's difficult to buy costly nutritional supplements to sports person. Considering this, *Mashadi Modaka* [9] is the best choice as a sports nutritional supplement.

AIM & OBJECTIVES

To establish Nutritional Value of *Mashadi Modaka* in *Ativyayama Janit Poshana Abhava* (Relative Energy Deficiency) in Sports Persons.

MATERIALS AND METHODS

Classical textbooks, such as *Brihatrayi*, *Laghutrayi* and other *Ayurvedic* texts were reviewed for *Vyayama* and *Ahara*. Different databases, such as PubMed, Scopus, DHARA, Google Scholar, J-Gate and Science Direct were also reviewed using the help of Boolean operators like “AND”, “OR” and “NOT”.

LITERATURE REVIEW

Review of *Vyayama*

Any strenuous physical activities should be performed as per the strength of the body, i.e., practice in moderation [4, 10]. *Acharya Dalhana* categorizes *Vyayama* as *Sharira* (~physical), *Vak* (~verbal), and *Manasa* (~mental) [11]. Classical Ayurvedic texts reference traditional physical practices, such as *Niyuddha* (~wrestling), *Adhwa* (~long-distance walking), *Shilanirghatan* (~stone throwing), and *Plavana* (~swimming), etc. which can be interpreted as early forms of structured physical exercise and competitive sports, analogous to modern athletic disciplines [12, 13].

Good Effects of *Vyayama* (Physical Activities) And *Balardha Vyayama Lakshana* (Features of Correct Exercise)

According to ancient classical *Ayurvedic* Texts, physical activity brings lightness to the body and mind, enhances working capacity, tolerance to misery, pacification of *Doshas* or elimination of impurities and increases in digestive fire, brings bodily stability and strength, physical development, lustre, compactness of body, tolerance to fatigue, exhaustion, thirst, heat, cold and provides optimum immunity when done *Ardhashakti* (~half of one's capacity) of individual which is denoted by sweating of axillae, temples, nose, joints coupled with dry mouth and dislodgement of *Vata* located in chest region to mouth (breathlessness) otherwise it harms.

Importance of Proper Nutrition in Sports Person

Food imparts nourishment, strength, formation of body tissues, enhances the life span, immunity, energy, memory, and improves digestive power, complexion, clarity, longevity, geniusness, happiness, health, satisfaction and intellect [14]. Strong persons, and those habituated to unctuous diet can daily practice *Vyayama* to half of their capacity [4]. In sports, the excessive physical exertion is involved during both training and competition is identified in Ayurveda as *Ativyayama* (~excessive exercise). Such exertion increases the body's demand to enhance the nutrition to support tissue repair, energy replenishment, and overall recovery.

Due to a lack of nutritional supplement, a sportsperson may experience symptoms, such as *Shrama* (~fatigue), *Klama* (~exhaustion), *Kshaya* (~wasting or depletion), and *Trishna* (~thirst) in the early stages, leading to Relative Energy Deficiency in Sport (RED-S). If this stage is ignored, the condition may worsen and result in more serious disorders, such as *Raktapitta* (bleeding disorders), *Pratamaka*

(~a type of dyspnoea), *Hikka* (~hiccups), *Shwasa* (~respiratory distress), *Kasa* (~cough), *Jwara* (~fever), *Chhardi* (~vomiting), *Pandu* (~anaemia), and *Vatavyadhi* (~neurological and musculoskeletal disorders), *Vatarakta* (~gout or arthritis), and *Mutrakrichra* (~dysuria), among others [15–23]. Selection of nutrient-rich food is important to reduce Relative Energy Deficiency in Sport (RED-S) which affects the health and performance of sports person [24]. Research indicates that high intake of protein powder as supplements, strain the kidneys and liver, and generate disorders like kidney damage, liver dysfunction, and metabolic disturbances [25].

***Ativyayama Lakshana* (~Excessive Exercise) and Relative Energy Deficiency in Sport Person (RED-S)**

Relative Energy Deficiency in Sport (RED-S) is defined as: Impaired physiological functioning caused by relative energy deficiency and includes but is not limited to impairments on metabolic rate, menstrual function, bone health, immunity, protein synthesis, and cardiovascular health [26]. RED-S is a syndrome of poor health and declining performance caused by not eating enough to meet the energy demands of training. It can affect athletes of any gender or level and often follows intense practices or competitions. Comparison of symptoms of RED-S and *Ativyayama* (~Excessive Exercise) is given in Table 1 [27–41].

Table 1. Comparison of symptoms of RED-S and *Ativyayama* (excessive exercise) [4, 10, 15, 23, 27–41].

S.N.	Symptoms of <i>Ativyayama</i> (Excessive Exercise)	Symptoms of RED-S
1	<i>Shrama</i>	Fatigue.
2	<i>Klama</i>	Decreased training response, improper functioning of sensory apparatus.
3	<i>Kshaya, Shosha</i>	Rapid weight loss.
4	<i>Yonikanda, Pandu</i>	Missed periods or delayed puberty (female athletes).
5	<i>Jwara, Rasa Dhatudushti</i>	Frequent illness, Hair loss.
6	<i>Vataj Hridroga, Siragranthi</i>	Low heart rate, long-term heart damage, atherosclerosis, Myocardial Infraction, Varicosity.
7	<i>Vatavyadhi, Kshataja Kasa, Vatarakta, Urakshata</i>	Increased risk of stress fractures and early onset osteoporosis, Increased injury risk.
8	<i>Agnidushti</i>	The body converts food into energy more slowly, low resting metabolic rate.
9	<i>Vataja Gulma, Chhardi</i>	Gastrointestinal problems, constipation.
10	<i>Karma Asamarthya</i>	Decreased muscle strength, Decreased endurance.
11	<i>Asthairya</i>	Decrease coordination, Decreased concentration.
12	<i>Vatika Atisara, Shula Roga</i>	Coeliac disease/inflammatory bowel disease.
13	<i>Ardhavabhedaka</i>	Headache.

Sports Nutrition

According to WHO sports is defined as any form of physical activity that contributes to physical fitness, mental well-being, and social interaction, including both casual and organized participation. Sports can be categorized in various ways based on environment, physical demands, and objectives. For example, indoor sports include activities like chess, snooker, and table tennis. In contrast, outdoor sports are played in open environments and include kabaddi, basketball, and cricket. Another classification is based on the energy systems used. Aerobic sports, such as long-distance running and swimming, emphasize cardiovascular endurance and sustained activity. “Anaerobic sports, such as weightlifting and sprinting primarily develop strength, speed, and power.” Sports Nutrition applies nutrition principles to sport with the intent of maximizing performance. The nutritional demands of an athlete during the main game are closely linked to the sport’s dominant physical component, such as endurance, strength, speed, flexibility and agility. These components determine which energy systems are primarily used, guiding whether carbohydrates, proteins, or fats should be emphasized in the diet.

Proper alignment of nutrition with these physical demands enhances performance, delays fatigue and supports recovery.

According to the National Institute of Nutrition, energy expenditure in sports is categorized into five groups based on the type of event, with values ranging from 3,000 to 6,000 kcal/day. For example, when energy expenditure is expressed relative to body weight, women hockey players require approximately 54.8 kcal/kg/day, men hockey players 48.7 kcal/kg/day, and women track athletes 46.1 kcal/kg/day, highlighting the variation in energy demands across different sports and genders. Recommended macronutrients guidelines for sports person is given in Table 2 [42].

Table 2. Requirement of macronutrients in sports.

S.N.	Constituent	Requirement
1	Carbohydrates	3–5 g + /kg/day for light activities to 8–12 g/kg/day for high level athletes training 4–5 hours daily.
2	Protein	1.2–2.0 g of protein/kg of body weight per day.
3	Fats	0.5 to 1.5 g/kg/day is required for long-term energy.

In addition, appropriate micronutrient intake is essential. For example, iron and vitamin B12 play critical roles in oxygen transport and energy metabolism, particularly in endurance sports. Adequate daily intake iron (8–18 mg) and vitamin B12 (2.4 µg) are necessary to prevent fatigue, support red blood cell production, and sustain athletic performance.

Heavy exercise sweat losses are about 1 to 2 L/h depending on intensity and duration, temperature, humidity etc. Athletes who are physically very active and exposed to hot environments have significantly increased fluid requirements, ranging from approximately 5 to 16 L/ day.; Requirement of salt is about 3gm/ day to 10gm/day depending on loss through urine, faces and sweat which further varies with climatic condition and form of physical activity.

DRUG REVIEW

Mashadi Modaka possesses *Balya* (~strengthening) and *Brihmaniya* (~nourishing) properties. In addition, cow milk, acting as an *Anupana* (~vehicle), is typically used alongside *Mashadi Modaka* to enhance its effectiveness. Further details about *Mashadi Modaka* are outlined in Tables 3 and 4 [43–45].

Table 3. Details of *Mashadi Modaka*.

S.N.	Name of Drug	English Name	Latin Name	Family	Part Used	Quantity
1	<i>Nistusha Masha (Urada)</i>	Black Gram	Vigna Mungo	Fabaceae	Flour	1 part
2	<i>Nistusha Godhuma</i>	Wheat	Triticum sativum	Poaceae	Flour	1 part
3	<i>Nistusha Yava</i>	Barley	Hordeum vulgare	Gramineae	Flour	1 part
4	<i>Shali Tandula</i>	Brown Rice	Oryza sativa	Poaceae	Flour	1 part
5	<i>Pippali</i>	Pippali	Piper longum	Piperaceae	Fruit	1 part
6	<i>Ghrita</i>	Refined Butter				5 parts
7	<i>Sita</i>	Sugar Crystal				5 parts
8	Water					10 parts

Nutritional Assessment of the Ingredient of *Mashadi Modaka* [46]

The proximate principles, dietary fibre, fat-soluble vitamins (as detailed in Table 5), water-soluble vitamins (as listed in Table 6), minerals, and trace elements (as shown in Table 7) are present in the ingredients of *Mashadi Modaka*, including Black Gram, Wheat, Barley, Brown Rice, and *Pippali*. Furthermore, certain ingredients contain carotenoids, amino acids, and minerals, such as Chromium, Aluminium, Molybdenum, Nickel, Lead, Lithium, Cadmium, Manganese, Selenium, and Cobalt, are present in some ingredients.

Table 4. Ayurvedic Properties of Ingredients of *Mashadi Modaka*.

S.N.	Ingredients	Properties
1	<i>Masha</i> (Black gram)	<i>Tarpana</i> (~nourishing), <i>Balya</i> (~promotes physical strength), <i>Ruchya</i> (~improves taste), <i>Snigdha</i> (~unctuous), <i>Brimhana</i> (~promotes bulk of tissue) properties. It also acts as <i>Vataghna</i> (~balances Vata Dosha).
2	<i>Godhuma</i> (Wheat)	<i>Vatapitta Shamaka</i> (~balances Vata and Pitta), <i>Madhura</i> (~sweet), <i>Guru</i> (~heavy to digest), <i>Snigdha</i> (~unctuous), <i>Hima</i> (~cooling), <i>Jeevana</i> (~enlivening), <i>Brimhana</i> (~promotes bulk), <i>Balya</i> (~improves strength), <i>Ruchiprada</i> (~improves taste), <i>Sthairyakara</i> (~improves stability), <i>Sandhanakrut</i> (~healing nature).
3	<i>Shali Tandul</i> (Brown rice)	<i>Rochana</i> (improves taste), <i>Swadu</i> (~sweet), <i>Hridya</i> (~pleasant to the heart), <i>Brimhana</i> (~promotes bulk), <i>Snigdha</i> (~unctuous) and <i>Balya</i> (~improves strength).
4	<i>Pippali</i>	<i>Kapha-Vataghna</i> (~balances Kapha and Vata Dosha), <i>Deepani</i> (~improves digestion), <i>Rasayana</i> (~rejuvenative), <i>Anushna</i> (~not very hot), <i>Snigdha</i> (~unctuous).
5	<i>Yava</i> (Barly)	<i>Sheeta</i> (cold in potency), <i>Guru</i> (~heavy to digest), <i>Lekhana</i> (~scraping), <i>Mridu</i> (~soft), <i>Ruksha</i> (~dry), <i>Sara</i> (~fluid), <i>Pichchila</i> (~slimy), <i>Agni Vardhaka</i> (~improves digestion), <i>Pathya</i> (~wholesome), <i>Medha Vardhaka</i> (~improves intelligence), <i>Swarya</i> (~improves voice), <i>Balakara</i> (~improves physical strength), <i>Varnya</i> (~improves skin complexion), <i>Sthairyakara</i> (~stabilizes the body), and <i>Vrishya</i> (~aphrodisiac).
6	<i>Gau Dugdha</i> (Cow Milk)	<i>Swadu</i> (~sweet), <i>Sheeta</i> (~cold), <i>Mridu</i> (~soft), <i>Snigdha</i> (~unctuous), <i>Bahala</i> (~nourishing), <i>Shlaksha</i> (~smooth), <i>Pichchila</i> (~slimy), <i>Guru</i> (~heavy), <i>Manda</i> (~slow), <i>Prasanna</i> (~pleasing), <i>Jeevaneeya</i> (~life-promoting), <i>Rasayana</i> (~rejuvenative), <i>Medhya</i> (~enhances intellect), <i>Balya</i> (~strengthening), <i>Sara</i> (~fluid), and <i>Stanya</i> (~promotes breast milk). It is indicated in conditions, such as <i>Kshataksheena</i> (~wasting), <i>Shrama</i> (~fatigue), <i>Bhrama</i> (~dizziness), <i>Mada</i> (~intoxication), <i>Alakshmi</i> (~misfortune), <i>Shwasa</i> (~asthma), <i>Kasa</i> (~cough), <i>Trut</i> (~thirst), <i>Kshudha</i> (~hunger), <i>Jeernajwara</i> (~chronic fever), <i>Mutrakrichha</i> (~dysuria), and <i>Raktapitta</i> (~blood disorders).
7	<i>Gau Ghrta</i> (Cow Ghee)	Ghee is known to enhance memory, intelligence, <i>Agni</i> (~digestive/ metabolic factor), <i>Shukra</i> (~semen), <i>Ojas</i> (~essence of all seven dhatu), and helps balance <i>Kapha</i> and <i>Meda</i> . It is considered effective in treating conditions related to <i>Vata</i> , <i>Pitta</i> , toxic states, insanity, consumption, inauspiciousness, and fever. <i>Ghee</i> is regarded as the most unctuous of edible substances, cold in potency, <i>Madhura</i> (~sweet) in taste and after digestion.

Table 5. Proximate principles, dietary fibre & fat-soluble vitamins, starch (All values are expressed per 100 g edible portion).

Food Name	Protein (gm)	Total Dietary Fibres (gm)	Carbohydrate (gm)	Energy (KJ)	Vit. D (µg)	Vit. E (mg)	Vit. K (µg)	Total Fat (gm)	Total Available CHO (gm)	Total Starch (gm)
Black Gram	23.06 ± 0.59	11.93 ± 0.26	51.00 ± 0.80	1356 ± 9	8.42 ± 0.19	01.38 ± 0.12	8.30 ± 1.51	1.69 ± 0.12	48.73 ± 1.91	47.89 ± 1.90
Wheat	10.57 ± 0.37	11.36 ± 0.29	64.17 ± 0.32	1340 ± 7	13.43 ± 1.77	0.33 ± 0.13	1.50 ± 0.47	1.53 ± 0.12	58.62 ± 2.68	56.82 ± 2.69
Barley	10.94 ± 0.51	15.64 ± 0.64	61.29 ± 0.77	1321 ± 19		0.01 ± 0.01	1.85 ± 0.79	1.30 ± 0.20	72.73 ± 2.93	72.67 ± 2.92
Brown Rice	9.16 ± 0.75	4.43 ± 0.54	74.80 ± 0.85	1480 ± 10		1.19 ± 0.72	2.00 ± 0.83	1.24 ± 0.08	72.00 ± 1.87	71.31 ± 1.91
<i>Pippali</i>	10.53 ± 0.45	34.14 ± 0.60	35.70 ± 0.45	906 ± 8	118 ± 1.6	0.27 ± 0.03	93.45 ± 1.89	2.27 ± 0.02	34.46 ± 0.61	31.72 ± 0.72

Table 6. Water soluble vitamins (all values are expressed per 100 g edible portion).

Food Name	Thiamine (B1) (mg)	Riboflavin (B2) (mg)	Niacin (B3) (mg)	Pantothenic acid (B5) (mg)	Total B6 (mg)	Biotin B7 (µg)	Total Foliates (B9) (µg)
Black Gram	0.21 ± 0.005	0.09 ± 0.003	1.76 ± 0.09	2.95 ± 0.26	0.22 ± 0.029	0.81 ± 0.13	88.75 ± 2.35
Wheat	0.42 ± 0.044	0.15 ± 0.010	2.37 ± 0.10	0.87 ± 0.04	0.25 ± 0.032	0.76 ± 0.12	29.22 ± 1.92
Barley	0.36 ± 0.059	0.18 ± 0.030	2.84 ± 0.08	0.14 ± 0.02	0.31 ± 0.026	2.38 ± 0.11	31.58 ± 3.79
Brown Rice	0.27 ± 0.023	0.06 ± 0.011	3.40 ± 0.12	0.61 ± 0.04	0.37 ± 0.035	1.38 ± 0.21	11.51 ± 1.69
<i>Pippali</i>	0.06 ± 0.011	0.14 ± 0.030	1.06 ± 0.11	0.23 ± 0.04	0.60 ± 0.051	2.34 ± 0.37	66.45 ± 15.02

Table 7. Minerals and trace elements (all values are expressed per 100g edible portion).

Food Name	Calcium (Ca) (mg)	Phosphorus (P) (mg)	Magnesium (Mg) (mg)	Sodium (Na) (mg)	Potassium (K) (mg)	Zinc (Zn) (mg)	Copper (Cu)(mg)	Iron (Fe)(mg)
Black Gram	55.67 ± 6.10	357 ± 43.7	173 ± 3.1	18.88 ± 2.27	1157 ± 38.0	3.00 ± 0.18	0.64 ± 0.08	4.67 ± 0.55
Wheat	30.94 ± 3.65	315 ± 41.4	125 ± 11.5	2.04 ± 0.31	311 ± 38.3	2.85 ± 0.32	0.48 ± 0.11	4.10 ± 0.67
Barley	28.64 ± 3.49	178 ± 26.8	48.97 ± 6.1	7.56 ± 1.52	268 ± 20.4	1.50 ± 0.27	0.43 ± 0.17	1.56 ± 0.15
Brown Rice	10.93 ± 1.79	267 ± 64.9	93.91 ± 9.11	3.64 ± 0.08	199 ± 40.9	1.68 ± 0.33	0.37 ± 0.4	1.02 ± 0.35
Pippali	414 ± 66.2	181 ± 6.9	189 ± 46.0	16.28 ± 2.00	1852 ± 425	1.52 ± 0.26	1.34 ± 0.40	7.99 ± 2.11

RESULT AND DISCUSSION

Vyayama in Ayurveda reflects structured physical activity analogous to modern sports training, promoting strength, metabolism and immunity when performed within individual capacity (~*Ardhashakti*). Over exercise, termed *Ativyayama*, results in physiological disturbances, such as *Shrama* (~fatigue), *Kshaya* (~tissue depletion), and *Vatavyadhi* (~neuromuscular disorders), closely paralleling the clinical features of Relative Energy Deficiency in Sport (RED-S). Ayurvedic emphasis on balanced food aligns with current recommendations to support recovery and performance while cautioning against excessive protein supplementation due to potential hepatic and renal impacts. Ayurvedic principles can enhance understanding of exercise tolerance and energy balance in sports persons by providing proper nutrition. Conversely, deficiencies in specific nutrients can directly affect athletic performance, highlighting the need for a well-rounded diet to optimize physical capabilities [47].

In sports, different sports nutrition supplements were used, in the same manner, *Mashadi Modaka* may also be used for nutritional enhancement in sports person. Because *Mashadi Modaka* have food-based ingredients and may provide complete nutritional values which is need of sports person. Macronutrients along with micronutrients are present in *Mashadi Modaka* which is need of sports person because due to lack of micro-nutritional deficiency can also causes decrease in performance of sports person. Approximate total nutrient values in the tables are as follows for 100 gm of *Mashadi Modaka*: Total Energy (6,403 KJ), Total Available CHO (358.81 gm), Carbohydrate (286.96 gm), Total Dietary Fibres (77.5 gm), Protein (64.26 gm), Vit. D (139.85 µg), Vit. E (3.18 gm), Vit. K (107.1 µg), Total fat (8.03 gm), Total starch (280.41 gm), Thiamine (63.69 mg), Riboflavin (0.6 mg), Niacin (11.43 mg), Pantothenic acid (4.8 mg), Total B6 (1.75 mg), Biotin (7.67 µg), Total Folates (227.51 µg), Calcium (540.18 mg), Phosphorus(1298 mg), Magnesium (659.88 mg), Sodium (48.4 mg), Potassium (3787 mg), Copper (3.26 mg), Iron (19.34 mg), Zinc (10.55 mg). *Sita* contains 399.6 calories and 98.2 carbs whereas in *Ghee* 71.02 ± 4.13% of total saturated fatty acids and 28.98 ± 2.44% of total unsaturated fatty acids are present. This means that if 20 grams of *Mashadi Modaka* are given to female athletes with deficiencies in iron, vitamin D, or calcium, it could provide an additional 4 mg of iron, 27.97 µg of vitamin D, and 108.04 mg of calcium to their normal daily diet. As a natural sports supplement or nutritional support, this single formulation can fulfil various dietary needs, reducing reliance on multiple artificial supplements. Moreover, the ingredients of *Mashadi Modaka* are commonly available, affordable, used in daily life, and economically making it a safe and practical option without adverse effects. According to the Ayurvedic concept of *Satmya*, which refers to substances or practices that are wholesome and beneficial to an individual even with continuous use, *Vyayama* (~exercise) should be adapted to suit individual suitability. In *Sharira Vyayama*, which corresponds to sports emphasizing health-related fitness components, such as muscular endurance in marathon running or basketball where physical strength and stamina are keys. In *Vak Vyayama*, where verbal communication and strategic interaction are crucial (e.g., football, hockey), effective verbal

coordination directly impacts performance. *Manasa Vyayama* involves mental agility, balance, and coordination, which are essential in both indoor games, like chess and outdoor combat sports, such as judo, karate, where focus, anticipation, and decision-making are vital. *Mashadi Modaka* plays an important supportive role across all three. Its ingredients possess properties, such as *Balya* (~promotes physical strength), *Tarpana* (~nourishing), *Jeevana* (~life-promoting), and *Brihana* (~promotes bulk of tissue) that support *Sharirika Vyayama*. For *Vak Vyayama*, it offers benefits through *Swarya* (~improves voice), *Rasayana* (~rejuvenating), *Ruchya* (~improves taste), and *Madhura* (~sweet) properties. In the case of *Manasa Vyayama*, *Mashadi Modaka* contributes through *Medhya* (~improves intelligence), *Sthairya* (~stability), and *Hridya Hridya* (~pleasant to the heart), making it a comprehensive supplement supporting physical, verbal, and mental aspects of *Vyayama* (~exercise).

Mashadi Modaka with cow milk as *Anupana* (~vehicle) possesses *Balya* (~strengthening) and *Brihmaniya* (~nourishing) properties, which are beneficial in meeting the nutritional needs of sports persons and helping to overcome RED-S. Maintaining proper fluid balance is crucial to prevent dehydration and its adverse effects on sports performance. In addition to plain water, nutrient-rich liquids are necessary that provide greater satiety are recommended to reduce the frequency of fluid intake. Cow's milk is a complete food composed of water around 87% and milk solids (13%). It holds various nutrients, which offers a nourishing effect on *Rasa Dhatu* by *Tarpana Guna* and may help prevent dehydration-related symptoms, ranging from thirst and loss of appetite to compromised renal function and, ultimately, mortality. These benefits align with current fluid replacement guidelines that emphasize both hydration and nutrient replenishment. As per properties of *Masha*, *Godhuma*, *Shali Tandula* and *Yava*, like *Balya* (~promotes physical strength), *Hridya* (~pleasant to the heart), *Brimhana* (~promotes bulk), *Pathya* (wholesome), etc., may provide positive effect on cardiorespiratory and muscular endurance, muscular strength affecting on metabolism and nutrition of sports person. Piperine present in the *Pippali* enhances the bioavailability of other ingredients present in *Mashadi Modaka* inducing stimulation of proteins associated with cytoskeletal function, resulting in an increase in the small intestine absorptive surface, thus assisting efficient permeation through the epithelial barrier [48].

CONCLUSIONS

This review supports the use of *Mashadi Modaka* as a potential Ayurvedic sports supplement to address energy deficiency and support performance of sportspersons. With nutrient-dense, food-based ingredients, the formulation offers a safe, affordable, and comprehensive nutritional profile. Its alignment with Ayurvedic principles of *Vyayama* and *Ahara* suggests potential benefits in enhancing physical fitness and preventing RED-S in sports persons.

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