Comparative Physico-chemical and Nutritional analysis of 1 year old and new *Mudga* [*Vigna radiata* (L.) R. Wilczek]

Research Article

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Abstract

In Ayurveda classics it is quoted that grains must be used between 1 - 2 years after its production while consumption of new grains should be avoided as its long term intake causes harmful effect on body as it is said to be *Guru* i.e. difficult to digest and *Abhishyandi* i.e. increases secretions of internal organs. It is said to be one of the cause for manifestation of *Prameha* which is being correlated with Diabetes mellitus on the basis of symptoms. Grains are major part of Indian diet. Present study aims at comparison between 1 year old and new *Mudga* [*Vigna radiata* (L.) R. Wilczek] on the basis of physico-chemical and nutritional analysis. *Mudga* has been selected as it is most commonly used and have great therapeutic efficacy.

Keywords: *Mudga*, *Vigna radiata*, *Ahara*

Introduction

The International Diabetes Federation (IDF) estimates the total number of diabetic subjects to be around 40.9 million in India and this is further set to rise to 69.9 million by the year 2025 (1). Analysis of the causes which are responsible for its manifestation are faulty diet and Lifestyle (2). Among them diet is an important part.

Grains are major part of Indian diet. It is major source of Carbohydrates and Proteins. In Ayurveda it is quoted that use of 1 year old grains is beneficial while consumption of new grains for long time leads to harmful effects on body (3). Old grains are considered between 1-2 years of its production while within one year of production it is considered as new (4). So, according to Ayurveda grains must be used after one year of its production.

In Ayurveda, new grains are quoted as guru i.e. not easily digestible and have more *Kleda* (liquid matrix) (5) which is described as cause for many diseases like *Prameha* which can be correlated with Diabetes mellitus on the basis of symptoms (6). Old grains are said to be *Ruksha* dry (3), *Laghu* (7) i.e. easily digestible (8). Therefore old grains are considered as wholesome for daily intake. Among variety of grains *Mudga* [*Vigna radiata* (L.) R. Wilczek] was selected for present study as it most common in Indian diet and its highly beneficial

effects and therapeutic efficacy described in Ayurveda classics. Loss on drying, Ash value and Fat contents were taken as parameters to assess *Rukshsta* while water soluble extracts was taken as parameter to assess *Laghuta*.

Aims and Objective

Comparison between 1 year old and new *Mudga* on the basis of physico-chemical and nutritional analysis.

Materials and methods
Collection:

Mudga [Vigna radiata (L.) R. Wilczek] was collected from periphery of Jamnagar (Gujarat) and stored in dry and hygienic condition for 1 year.

Physico-chemical analysis:

Following parameters were analyzed for different physico-chemical parameters by today's routine methods at the pharmaceutical chemistry lab, GAU, Jamnagar. Parameters were selected on the basis of common parameters mentioned for powder in Ayurvedic Pharmacopoeia of India and CCRAS guidelines (9).

Physico-chemical Parameters (10):

1. Loss on Drying:

The loss on drying of the samples was determined by taking 2 g accurately weighed sample in a watch glass, previously weighed and drying in an oven at 110°C till constant weight. The weight after drying was noted and the loss on drying was calculated. The percentage was calculated on the basis of air dried samples.

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2. Ash Value:

The ash value of the samples was determined according to IP'85. About 2.028 g of the drug was accurately weight and taken in a silica crucible incinerated in a muffle furnace at a temperature not exceeding 450°C for about 4 hours, cooled and weighed.

3. Water Soluble extract:

About 5 g, accurately weighed, powder samples were taken in a conical flask. 100 ml of distilled water was added to it, shaken well and kept overnight. Next day it was filtered. 20 ml of the filtrate was taken in a previously weighed, dried porcelain evaporating dish and evaporated on a hot water bath. It was dried to constant weight in an oven and weighed. From the weight of the residue the water-soluble extractive percentage was calculated on the basis of air-dried sample.

4. Alcohol Soluble extract:

Methanol is having intermediate polarity. The methanol soluble extractive of the samples was determined in the similar way like water soluble extractive but by using methanol instead of water. The percentage of methanol soluble extractive was calculated.

5. pH:

Powder of 1 year old and new *Mudga* were dissolved in 50 ml of water and pH was identified by separate litmus paper.

High performance Thin Layer Chromatography study (HPTLC) (11):

Methanol extract of 1 year old and new *Mudga* was spotted on pre coated silica gel GF 254 aluminium plate as 5mm bands, 5 mm apart and 1 cm from the edge of the plates, by means of a Camag Linomate Vsample applicator fitted with a 100 µL Hamilton syringe. Ethyl acetate: water: Acetic acid (8:1:1) were used as the mobile phase. After development, Densitometric scanning was performed with a Camag TLC scanner III in reflectance absorbance mode at 254nm and 366 nm under control of win CATS software. The slit dimensions were 6 mm×0.45 mm and the scanning speed was 20 mm per second. All HPTLC plates were scanned with filter fraction Savitsy-goloy 7, minimum slope 5, minimum height 10 AU, minimum area 50 AU, and maximum height 990 AU with absorption unit.

Nutritional analysis:

Nutritional analysis of the two samples was performed at Radiant research laboratory, Bangalore.

Estimation of energy value

The sample calorific value was estimated (in Kcal) by multiplying the percentage crude protein, crude lipid and carbohydrate by the recommended factor used in analysis. The caloric value was determined based on the Atwater factor (12)

Carbohydrate determination:

50 mL of alkaline cupric tartrate was added to TS into a 400-mL beaker, along with 48 mL of water. It was mixed and pipet into a mixture of 5 grams of sample that had been diluted quantitatively with water to a 5.0% concentration. The solution was heated in a watch glass, regulating the heat so that boiling began after 4 minutes and continued boiling for another 2 minutes. The hot solution was filtered at once through a tared porcelain filtering crucible. The precipitate was washed with water maintained at 60°, then with 10 mL of alcohol. It was dried at 105° to constant weight. A blank determination was performed and necessary corrections were performed. The corrected weight of the precipitate was compared with dextrose of known concentration (13).

Estimation of crude fat:

Fat is estimated as crude ether extract of dry material. The dry sample is weighed accurately into a thimble and plugged with cotton. The thimble is the placed in a Soxhlet apparatus and extracted with anhydrous ether for about 16h. The ether extract is filtered into a weighed conical flask. The flask containing the ether extract is washed 4 to 5 times with small quantity of ether and the washings are also transferred. The ether is then removed by evaporation and the flask with residue dries in an oven at 80-100 ^{0}C, cooled in desiccators and weighed (14).

Determination of crude protein:

The crude protein was determined by the Kjeldahl method with slight modification. 0.5 g of the powder form of the sample was digested with 5 ml of concentrated sulphuric acid in the presence of Kjeldahl catalyst. The nitrogen from the protein in the sample was converted to ammonium sulphate that reacted with 2.5 ml of 2.5 % Brucine reagent, 5 ml of 98 % sulphuric acid to give a coloured derivative and the absorbance read at 470 nm. The percentage nitrogen was calculated and multiplied by 6.25 to obtain the value of the crude protein (15).

Antioxidant DPPH analysis:

The DPPH free radical is reduced to a corresponding hydrazine when it reacts with hydrogen donors. The DPPH radical is purple in color and upon reaction with hydrogen donor changes to yellow color. It is a discoloration assay, which is evaluated by the addition of the antioxidant to a DPPH solution in ethanol or methanol and the decrease in absorbance was measured at 490nm.

Reagents:

2, 2-Diphenyl 1-picryl hydrazyl solution (DPPH, 100 mM): 22 mg of DPPH was accurately weighed and dissolved in 100 ml of methanol. From this stock solution, 18 ml was taken and diluted to 100 ml using methanol to obtain 100 mM DPPH solution.

Preparation of test solutions:

21 mg each of the test substance was dissolved in distilled DMSO separately to obtain solutions of 21 mg/ml concentrations. Each of these solutions was

serially diluted separately to obtain lower concentrations.

Preparation of standard solutions: 10 mg each of quercitin was weighed separately and dissolved in 0.95 ml of Dimethyl sulfoxide (DMSO) to get 10.5 mg/ml concentrations. These solutions were serially diluted with DMSO to get lower concentrations.

Procedure: The assay was carried out in a 96 well microtitre plate. To 200 ml of DPPH solution, 10 ml of each of the test sample or the standard solution was added separately in wells of the microtitre plate. The final concentration of the test and standard solutions used were 1000, 500, 250, 125, 62.5, 31.25 and 15.625, 7.812 mg/ml. The plates were incubated at 37°C for 30 min and the absorbance of each solution was measured at 490 nm, using a microplate reader.

Observations and Results
Physico-chemical analysis:
Physico-Chemical parameters are given in Table 1. Results of HPTLC study is shown in Table 2. Densitogram of 1 year old and new Mudga is shown in Plates 1, 2, 3, 4.

Nutritional analysis:
Results of nutritional evaluation of 1 year old and new *Mudga* are given in Table 3.

Discussion
In the texts of Ayurveda, it is quoted that grains must be consumed after one year and within two years of their production. Properties of both have been mentioned separately. One year old grains are quoted as *Ruksha* dry (3), *Laghu* (7) i.e. easily digestible (8). While new grains are quoted as *Guru* (7) i.e. difficult to digest (8) and *Abhishyandi* i.e. increase the secretions of internal organs (7). The food articles which have *Abhishyandi* properties are said to increase *Kleda* (5) in body due to its more moisture contents which is quoted as cause for diseases like *Prameha* etc. (5).

Among the physico-chemical and nutritional parameters Loss on drying, Ash value and Fat contents were taken as parameters to assess *Rukshsta* while water soluble extracts was taken as parameter to assess *Laghuta*. In physico-chemical analysis, water soluble extract of 1 year old *Mudga* was more as compared to that of new *Mudga*. It shows that old *Mudga* has more bio-availability and easy digestibility than new *Mudga* because bio-availability of the drug depends on its water solubility (16). Loss on drying and Ash value was found more in new *Mudga*. It refers to the presence of more moisture contents in new *Mudga* as compared to old. pH value does not show major difference.

In nutritional analysis, Carbohydrates, Proteins and Energy content show almost similar value. Fat content of 1 year old *Mudga* is much low as compared to new *Mudga*. High fat diet have been proved to increase the risk of cardiovascular diseases (17). Therefore nowdays low-fat diets are being promoted for the prevention of heart disease. Antioxidant contents of 1 year old *Mudga* is higher than old *Mudga* which shows that intake of 1 year old *Mudga* is more beneficial for health.

Conclusion
In Ayurveda classics it is quoted that 1 year old grains are beneficial for health while new grains should be avoided due to its harmful effects on body. One year old grains are quoted as *Ruksha* (dry), *Laghu* i.e. easily digestible. While new grains are quoted as *Guru* i.e. difficult to digest and *Abhishyandi* i.e. increase the secretions of internal organs. In present study, loss on drying, Ash value and Fat contents were taken as parameters to assess *Rukshsta* while water soluble extracts was taken as parameter to assess *Laghuta*. Loss on drying and Ash value was found more in new *Mudga*. It refers to the presence of more moisture contents in new *Mudga* as compared to old. Water soluble extract of 1 year old *Mudga* was more as compared to that of new *Mudga*. It shows that old *Mudga* has more bio-availability and easy digestibility. It should be clinically correlated.

Table.1- Physico-chemical analysis of 1 year old and new *Mudga*

Name of Test	*Mudga* New	*Mudga* Old
Water soluble extract (%)	10.5	13.9
Loss on drying (%)	11.05	7.6
Ash value (%)	3.95	11.25
pH	4.5	4
Alcohol soluble extracts	6.2	5.96

Table 2: showing consolidated data of HPTLC profile of 1 year old and new *Mudga*

Solvent System: Ethyl acetate : water : Acetic acid (8 : 1: 1)

Condition	No. of spots		Max. Rf		Area	
	New *Mudga*	Old *Mudga*	New *Mudga*	Old *Mudga*	New *Mudga*	Old *Mudga*
Short UV (254 nm)	5	6	0.01, 0.56, 0.75, 0.84, 0.93	0.05, 0.19, 0.55, 0.69, 0.83, 0.93	4058.3, 1946.0, 2081.0, 1967.4, 727.8	493.9, 292.7, 841.0, 1645.5, 872.4, 399.4
Long UV (366 nm)	5	1	0.01, 0.56, 0.59, 0.84, 0.93	0.59	2942.4, 880.7, 645.2, 454.7, 298.9	747.8

Table.3- Nutritional analysis of 1 year old and new *Mudga*

	Mudga New	*Mudga* Old
Total Antioxidant	683.95	922.98
Protein (g/100g)	24.48	25.45
Fat (g/100g)	0.97	0.38
Carbohydrate (g/100g)	62.04	63.09
Energy (K Cals/100g)	354.81	357.58

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