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PRELIMINARY PHYSICO CHEMICAL, PHYTOCHEMICAL AND NUTRITIONAL ANALYSIS OF BALAVILWAMAJJADI MODAKA GRANULES

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Abstract

Balavilwa majjadi modaka is a herbal formulation mentioned in *Astangahrudaya Uttara stana*, in the chapter "*Balopacharaneeyam*". It is described as a complementary food for weaning and is *Deepana* (digestive) in action. A formulation in the form of granules was developed from *Balavilwa majjadi modaka* yoga as a weaning food for infants. Its primary pharmaceutical, physico chemical, phytochemical and nutritional studies were carried out. Modification of formulation in to granules made it more presentable, palatable and user friendly. From the nutritional study it was found the formulation *Balavilwamajjadi granule* provides reasonable number of calories as a complementary feeding formulation for infants. It contains some important micronutrient too.

Key words - Balavilwamajjadi modaka granule, complementary food, Infants,Nutritional analysis

Introduction

The research programs in *Bhaishajya Kalpana*- Ayurvedic Pharmaceutical Science include preparation of good quality medicines which are user friendly. Different combinations said in Ayurvedic classics have got great potential in the prevention and cure of diseases and is an unexplored area. The details about different complementary foods have been mentioned in the chapter of *Bālopacharaneeyam,* in Ashtanga Hrudaya Utharastana[1]. The formulation named *Balavilwa majjadi modaka* is described as a complementary food for weaning and is *deepana* (digestive) in action. Even though the formulation is classically mentioned and the ingredients of the formulation are easily available, it is not commonly used and its efficacy as a weaning food is not evaluated using present clinical parameters. Also, the organoleptic character of the formulation has got much importance as it affect the intake of complementary food by the growing child.as

an initial step, the primary pharmaceutical, physico chemical, phytochemical and nutritional analysis were conducted.

Materials and method

1.Preparation of *Balavilwa majjadi modaka granules.*

1.1. Ingredients.

1. *Phala majja of Bala* vilwa[2](Unripened fruit pulp of Vilwa-Aegle marmelos)
2. *Ela* (dried seed of Cardamom)
3. *Sarkara*(Sugar)
4. *Laja sakthu*(Puffed rice powder)

Even though the dosage form was *modaka*, it was prepared in granule form. It was because

1. To make the dosage form more presentable.
2. Since it is a food formulation, the shape and size of *gutika* like preparation is unsuitable and impractical because of the size or number required per dose
3. Easy for packing, storage and dispensing.

The quality of the raw materials were confirmed in the Drug Testing Lab of the Department of *Rasa Sastra and Bhaishajya Kalpana of Govt,Ayurveda College,Thiruvananthapuram.*

The pulp of *vilwa phala* was taken out. It was found that the pulp contains high amount of mucilage and gum. Seeds were removed and the pulp dried in sunlight. Dried pulp of *Vilwaphala, Laja* (puffed rice), were searched for impurities and cleaned thoroughly. *Laja, vilwamajja* and seeds of *Ela* were finely powdered and homogenously mixed. Sugar candy was taken instead of sugar as it has properties like *balya and brumhana*[3] and frequently used in pediatric formulations traditionally than the later.

Proportion of ingredients is not mentioned for the formulation in the classical reference. Laja, *Vilwa and Ela* were taken in the ratio 4:2:1. Four times of sugar candy was taken in relation to *churna* as the general rule. Sugar candy was completely dissolved in required quantity of water. It was filtered using a cloth to remove the impurities, if any. The filtrate was taken in clean vessel and heated over *mandhagni.* Continuously stirred while heating. After reaching the proper *paka,* (for getting the consistency of granules, *paka* should be just above the *leha paka*[4]) vessel was removed from fire. Powdered drugs were added in to this and mixed well. After attaining the consistency of dough, it was pressed down through a suitable sieve of number10 superimposed on number 22. The granules were dried by spreading and keeping them in hot air oven at a temperature not exceeding 60^{o} C.

1.2. Dose

No specific dose is mentioned in the text. Since it is a food formulation, it has to be taken according to the digestive power of the child.Digestive power is depend upon age of individuals.

1.3. Stability

Sample of *Balavilwamajjadi granule* was stored in clean airtight screw capped squat jar with wide opened mouth, away from moisture and direct sunlight. The physical stability of the samples was evaluated based on the changes in consistency, colour, odour and taste of the contents. The sample did not undergo any noticeable physical change even after 6 months. To know more about the maintenance of stability and therapeutic efficacy of the product, detailed studies incorporating modern technology are essential.

1.4. Analysis of Granules

Bulk density, Void porosity and Angle of repose (flow properties)[5]

Bulk density, Void porosity and Angle of repose (flow properties) of the granules were tested. Bulk density is defined as the mass of the granule /powder divided by the bulk volume. It is important in the case of packing of granules and powders. Container size for a dosage form depends on bulk density. Porosity is the total space present in a collection of powder/granules. Porosity influences the rate of disintegration and dissolution. The flow properties of powder/granule depend on the number of points of contact or the frictional force between the particles with regular and irregular sizes. If the frictional force is increased the granules does not flow easily and readily.

2.Analytical study of Raw and Bala vilwamajjadi granules *Samples*

After the preparation of the formulation, two samples were analyzed in the laboratory. The samples evaluated in this study were

Sample 1 (Raw) – Raw drugs without sugar

Sample 2 (B V Granules) – *Bala vilwamajjadi* granules

2.1. Organoleptic features

Organoleptic characters like Colour, Odour,Touch ,Taste and consistency of both sample 1 and 2 were noted

2.2Physico chemical analysis

Primary physico chemical analysis include P^H, Loss on drying, Total ash, Water soluble ash, Acid-insoluble ash, Cold water extractive and Alcohol soluble extractive.[6]

2.3. Thin layer chromatography

Thin layer chromatography is a versatile and specialized laboratory technique that was evolved in early Fifties, and since has become an indispensable means of separation for analysts and researchers around the globe.

2.4. Phytochemical analysis

Phytochemical analysis such as Alkaloids, Tannins &Phenolics and Flavonoids were carried out by standard procedures.[7]

3.Nutritional analysis

Assessment of nutritional value is important in the case of food formulations. Nutritional studies of the formulation were carried out at National Institute for Interdisciplinary Science and Technology, Council of Scientific & Industrial Research, Thiruvananthapuram. Total calorie, percentage of carbohydrate, protein, fat and presence of micro nutrients were evaluated.[8]

3.1. Estimation of protein

Estimation of protein was done by semi-micro kjeldahl method.

3.2. Estimation of Fat

Fat estimation was done by Soxhlet extraction method.

3.3. Estimation of carbohydrate

Carbohydrate is found by calculation method. Percentage of carbohydrate=100 – [Moisture + Ash + Protein + Fat + Crude Fiber]

3.4. Estimation of calcium, potassium and Sodium

Estimation of Calcium, Potassium and Sodium was done by Flame photometry (more accurately called flame atomic emission spectrometry). Flame photometry is suitable for qualitative and quantitative determination of several cations, especially for metals that are easily excited to higher energy levels at a

relatively low flame temperature (mainly Na, K, Rb, Cs, Ca, Ba, Cu). Flame photometers use optical filters to monitor for the selected emission wavelength produced by the analyte species. Comparison of emission intensities of unknowns to either that of standard solutions (plotting calibration curve), or to those of an internal standard (standard addition method), allows quantitative analysis of the analyte metal in the sample solution.

From the study it was found the formulation *bālavilwamajjadi granule* is providing reasonable number of calories as a formulation for infants. It contains some important micronutrient too. It was not able to find out all the nutrients present and further tests need to be conducted.

Results and Discussion

Preparation of *Balavilwamajjadi modaka* granules were done as per standard procedures. The value of void porosity denotes the granule has got a good disintegration and dissolution rate.

Table1.Angle of Repose of Balavilwamajjadi granule

Substance	Radius (cm)	Height (cm)			tanØ	Angle of Repose ($\tan^{-1}$ h/r)
		H1	H2	Mean		
Bālavilwa majjadi granules	3.3	1.9	2.1	2	0.606	31°.24

The granules show a good reasonable flow property.

Table 2-Organoleptic characters of samples

Character	**Raw**	**B V Granules**
Colour	Light yellowish	Creamy
Odour	Pleasant	Pleasant
Touch	Smooth	Hard
Taste	Bitter, pungent	Sweet
Consistency	Powdery	Granular

Table 3 Details of Physico chemical parameters

	Raw drugs without sugar	B V Granules
Ph	6.6	6.8
Loss on drying	10.6%	3.70%
Total ash	3.64%	0.65%
Water soluble ash	1.82 %	0.3%
Acid-insoluble ash	0.45%	0.1%(Negligible)
Cold water extractive	34.26%	84.6%
Alcohol soluble extractive	5.72%	5.18%.

P^H of sample 1 is 6.6 and that of sample 2 is 6.8. On comparing the p^H, both shows almost same with sample 1 slightly towards acidic p^H. Moisture content of sample 1 is10.6% and that of sample 2 is 3.70%. Sample 1 was air dried. Sample 2 was oven dried after the preparation and hence shows less moisture content. Total ash of raw drugs and finished product are 3.64% and0.65% respectively. Ash value normally designates the presence of inorganic salts found naturally in the drug, as well as inorganic matter derived from external sources. Both contain very small number of inorganic parts or external impurities. Sample 2 contains sugar as a major ingredient, four times of sample 1 and is burnt off during ignition. The values of both samples justify the percentage of ingredients in the samples. Water soluble ash of sample 1 and sample 2 are 1.82% and 0.3% respectively. Acid insoluble ash of sample 1 and sample 2 are 0.45% and 0.1% respectively. Both the values justify the percentage of ingredients in the samples.

Cold water extractive of raw drug is 34.26% and that of finished product is 84.6% which is very high because of high percentage of sugar. Alcohol soluble extractive of raw drug is 5.72% and that of finished product is 5.18%. Alcohol extractive was determined using absolute ethanol gave a value corresponding to the polarity of the solvent. But it could have been a higher value in case of sample 2 when the procedure is carried out using 95% ethanol.

The result obtained from TLC is given below.

Table 4. Rf values obtained in the solvent system -1

Solvent System (1)	Rf Values of The Samples – Detection In UV	
	Sample 1 **Aegle marmelos**	**Sample 2** **Balavilwamajjadi granules**
Acetone, chloroform and benzene (4:4:1)	0.82	0.82
	0.72	0.72
	0.37	0.37
	0.27	0.27
	–	0.16

The chemical constituents with Rf value 0.82, 0.72 and 0.37 and 0.27 are seen in both samples. The chemical constituents with Rf value 0.16 are seen in sample 2 only.

Table5. Rf values obtained in the solvent system- 2

Solvent System (2)	Rf values of the samples – detection in UV	
	Sample 1 Aegle marmelos	**Sample 2 Balavilwamajjadi granules**
Toluene and Ether saturated with 10% Acetic acid (1:1)	0.82	0.82
	0.72	0.72
	0.52	0.52

The TLC results indicate the presence of almost all the constituents of sample 1 in sample 2. Solvent system 1-Acetone, chloroform and benzene (4:4:1), showed more spots than solvent system 2 -Toluene and Ether saturated with 10% Acetic acid (1:1)

Table 6. Result of the qualitative test of the analytical samples

	Sample 1	**Sample 2**
Alkaloids	+	++
Tannins &Phenolics	+	++
Flavonoids	+++	+++

Qualitative analysis shows that the samples contain alkaloids, phenolics and flavanoids. Both samples contain high amount of flavanoids.Qualitative analysis of sample 2 for alkaloids showed more positive results denoting the presence of alkaloids in other ingredients

Percentage of protein present in 100 g of *Balavilwamajjadi* granule is 10.2% which gives energy of 40.8 calories. Percentage of fat present in 100 g of *Balavilwamajjadi* granule is 3.3% which gives energy of 29.7 Calories. Percentage of Carbohydrate present in 100 g of *Balavilwamajjadi* granule is 77.77 % which gives energy of 311.08 Calories. Total caloric value of the formulation is 381.58 cal/100g.Amount of micro nutrients Sodium, potassium and Calcium in the formulation is 0.11%, 0.31% and 0.08% respectively.

Conclusion

Infant feeding is the matter of great concern in the field of nutrition since malnutrition of early childhood has long term serious consequences as it impedes motor, sensory, cognitive, social and environmental development. Inadequate knowledge about proper weaning practices, non-availability of cost effective formulations, low nutrient density and poor quality of the foods, and low family income are some major factors that hinders proper and timely complementary feeding. From the study it was found the formulation *Balavilwamajjadi granule* is providing reasonable number of calories as a complementary formulation for infants. It contains some important micronutrient too. Modification of formulation in to granules made it more presentable, palatable and user friendly It was not able to find out all the nutrients present and further tests need to be conducted.

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