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Available online at: www.jparonline.com**Formulation and evaluation of polyherbal cookies for diabetic patients**

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ABSTRACT: Background: Most of the people consume cookies during their breakfast, snacks and leisure time to regulate their hunger and get some energy, in market there are varieties of cookies which are available, and the main components are refined flour, sugar and butter. Hence, are generally avoided by obese and diabetic patients as they lead to high sugar level in blood. **Aim:** The present study was aimed to formulate and evaluate the polyherbal cookies for the diabetic patients. **Method:** The cookies were prepared by using oats, wheat flour and different Ayurveda herb. Diverse varieties were formulated using different plant to find out the best composition for cookies on the basis of palatability. The prepared cookies were evaluated for the physiochemical (total ash value, total moisture content, total water and alcoholic extraction) sensory (Color, odor, and taste), and their nutritional analysis. **Results:** On the basis of its nutritional value comparison, it was found that the protein content is higher in our formulation than the other marketed preparation. **Conclusion:** The herbal cookies have high amount of protein, controlled amount of fat and carbohydrate, thus it could be used in Diabetes patient.

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INTRODUCTION:

Diabetes- common, non-communicable metabolic disorder mostly occurring in young ones and are associated with other diseases like kidney disease, cardiovascular diseases etc. It occurs when pancreas does not produce insulin or is not properly consumed by body. According to the WHO survey report globally, it is estimated that 422 million adults were suffering in 2014 and rate of increment is about from 4.7 to 8.5 %. Diabetes mellitus, a chronic metabolic disease. Condition enounces by the elevated glucose level in blood (Hyperglycemia), hyperlipidemia, negative nitrogen balance, glycosuria and sometimes ketonemia.

Keywords: Diabetes mellitus, cookies, pharmacological activity, oats, *Tecoma stans*, *Withania somnifera*

Basically, it is grouped in three main types. Type 1 diabetes mellitus/ Insulin dependent diabetes mellitus/ Juvenile onset diabetes mellitus, which are mostly caused by the T-cell mediated autoimmune devastation of islets of insulin secretion Beta cells [1].

Polyherbal antidiabetic cookies are the combination of various herbs and cereals that have a great power to stimulate insulin secretion by countless mechanism of action. These cookies contain oats, *tecoma stans* leaves, Tulsi leaves, ashwagandha, honey, artificial sugar (sucralose) etc., which is tasty, healthy as well as beneficial for a diabetic patient of all age group and as the product contains herbs and cereals it has less adverse effect on one's body [2].

Tecoma stans a promising species in the trumpet vine family, *Bignoniaceae*. The common names are yellow elder, yellow trumpet bush, yellow bells and esperanza. It is a flowering perennial shrub or a small tree, 5 to 7.6 m in height. Antidiabetic effect of *Tecoma stans* was credited to alkaloids denominated tecomine and tecostanine. It has been reported that the sub chronic and acute administration of the alkaloid tecomine weakened plasmatic cholesterol and triglycerides levels without altering fasting glucose. *Tecoma stans* aqueous extract of the leaves exert its antidiabetic effects by exciting glucose uptake in both insulin-sensitive and insulin-resistant murine and the human adipocytes without any significant proadipogenic or antiadipogenic adverse effects [3].

Oats (*Avena sativa*) belongs to the family *Poaceae*. It has soluble fiber which is known as beta-glucan is a polysaccharide which contains glucose residue which binds with 1, 3 and 1, 4 bonds. Products that have beta-glucan been used since thousands of years for human health, but beta-glucan has been lately scrutinized as an active ingredient. Oat beta-glucan have been used for numerous clinical trials to reduce glucose level. Studies showed that oat beta-glucan have lowered postprandial glycemia. The outcome of beta-glucans to reduce blood glucose could be mediated possibly by postponing stomach emptying so that the dietary glucose is absorbed more progressively [4].

Ashwagandha (*Withania somnifera*) which belong to the family *Solanaceae*. The flavonoids and antioxidant which exists in the root of Ashwagandha for responsible for its antidiabetic property through improve the liver and kidney functioning and the balanced albumin and globulin ratio which plays a major role to treat diabetes [5].

MATERIALS AND METHODS:

Procurement of Raw Materials:

Freshed aerial parts of *Tecoma stans* (leaves), Ashwagandha (bark), and Tulsi (leaves) were collected from local areas of Chandrapur City. The collected plants were washed properly and sun dried. The dried plant was grinded into porous material and stored in sunlight container till future.

Oats, Milk, Flavoring agent (vanilla and cocoa), salt, baking powder, baking soda, butter, were purchased from local market of Chandrapur and artificial sugar (Diabliss sugar) was procured from its online store.

Method of Preparation of Polyherbal Cookies:

Different compositions (Table 1) of cookies were formulated using different ratios of Oats, wheat flour, roasted black-gram flour, *tecomastans* leaves powder, Ashwagandha powder, Tulsi powder, Milk, Flavoring agent (vanilla and cocoa), salt, baking powder, baking soda, butter, artificial sugar (Diabliss sugar), and based on the palatability and visual appealing. The final product was selected for sensory evaluation and nutritional value analysis.



Fig 1. Polyherbal cookies after baking.

Evaluations of Polyherbal cookies:

Moisture content:

Moisture content was determined by the method prescribed in the chemical Analysis of the food [10]. As stated in the procedure, sample of the cookies were weighed precisely in a moisture dish and were kept in hot air oven for about 2 h at 105 °C and then it was cooled in desiccators and again weighed. The process of heating was repeated for 30 min and then again cooled and weighed. The procedure was done until the variance between two successive weighing became less than that of 0.001 g.

Table 1. Preliminary batches of polyherbal cookies.

Contents	F1	F2	F3	F4	F5
<i>Tecoma stans</i> (g)	15	13	15	12	20
Ashwagandha (g)	10	8	12	10	5
Tulsi (g)	5	9	3	8	5
Oats (g)	40	40	40	40	40
Milk (ml)	10	10	10	10	10
Black gram flour (g)	40	40	40	40	40
Flavoring Agents (ml)	1	1	1	1	1
Butter (ml)	15	15	15	15	15
Salt (g)	1	1	1	1	1
Baking soda (g)	1	1	1	1	1
Baking powder (g)	1.5	1.5	1.5	1.5	1.5
Artificial sugar (g)	10	10	10	10	10
Wheat flour (g)	100	100	100	100	100

Evaluations of Ployherbal cookies:**Moisture content:**

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$$MC (\%) = [(W1-W2)/(W1-W)] \times 100 \dots(1)$$

Where, W1 = Weight of moisture dish with sample before drying; W2 = Weight of moisture dish with sample after drying; W = Weight of moisture dish.

Ash value:

Total ash content of the prepared cookies was determined by the following procedure [10]. According to the given procedure 1 gm of cookie sample was taken in a tarred crucible and it was burnt on the Bunsen burner until all the carbon was burnt. Then Sample was let to be cooled, weighed and then again, the procedure was repeated until the weight became constant. After that the total Ash value were calculated based on the equation given below;

$$\text{Ash value } (\%) = [(W1-W2)/(W1-W)] \times 100 \dots(2)$$

Where, W2 = Weigh of empty dish; W = Weigh of sample taken; W1 = Weigh of crucible with sample after complete burn.

Total alcoholic and water extractive values:

For the analysis of total alcohol/Water extractive value, 5 g of cookies powder sample were taken in 250 ml of volumetric flasks in which 90 % ethyl alcohol or Distilled water were added and was kept aside for 24 h. After the completion of 24 h, the samples were filtered and were taken in porcelain dishes. All the samples of alcoholic and water extracts were heated at the temperature of 100 °C for evaporation, following samples were cooled down and advance calculations were done by the following method.

About 5 g of sample gives 4x of alcohol extract.

$$\text{So, } 100 \text{ g of sample will gives } = 80 \times x/4 \dots(3)$$

Where, x = Sample after drying.

Nutritional analysis (Protein estimation):

Protein estimation was done by prescribed procedure in the given DGHS Manual. According to this method 200 to 300 mg of cookies powder were taken in 4 test tubes and then 3 g of catalyst ($K_2SO_4 + CuSO_4$) was added in it. About 10 ml of concentrated sulphuric acid was added to all tubes and then digested for 3 to 4 h. Later these samples were distilled with boric acid, potassium permanganate and 40 % of Sodium hydroxide and then were titrated with acid. This titrant was neutralized with ammonia and by this % of protein was calculated by using following equation.

$$PC = [(W/V)] \times 1000 \dots (4)$$

Where, PC = Protein concentration, W = Amount of sample in μg and V = Volume in μL .

Nutritional analysis (Fat content):

According to the given procedure, 2 g of the cookie sample was kept in Soxhlet apparatus with diethyl alcohol and petroleum ether in the ratio of 1:1 for 6 h then ether was removed by the process of distillation and were dried in hot air oven at $110 \pm 1^\circ\text{C}$ and later on was cooled in desiccator. Taken dried sample was weighed again. The left residue was washed with 2 to 3 ml of diethyl ether and the same process was repeated until the weight became constant.

$$\text{Fat content (\%)} = [(M1-M2)/W] \times 100 \dots (5)$$

Where, M1 = Weigh of Round bottom flask with fat; M2 = Weigh of the Round bottom flask; and W = Weight of the sample.

Nutritional analysis (Carbohydrate estimation):

Carbohydrate estimation was done by the procedure given in DGHS Manual. For estimation of carbohydrate 2 g of cookie sample powder was taken in a 200 ml of volumetric flask and then 50 ml of lead acetate was added. About 6 ml of 0.5 N HCl was added and heated on hot water bath. After heating, the sample was cooled and neutralized with 6 ml of 0.5 N NaOH, lastly the sample volume was made up to 200 ml using distilled water, Invert sugar was determined before inversion by Lane and Eynon method. According to this method 10 ml of mixed Fehling A and B solution was taken in the conical flask and titration was passed out with sample solution within 3 min without inversion by using 1 % aqueous Methylene Blue as an indicator.

$$RS (\%) = (F \times 10) / (C \times R) \dots (6)$$

Where, RS = reducing sugar % before inversion, C = concentration; R = Reading; F = Factor of Fehling solution Total invert sugar % after inversion.

Total Energy:

Total energy was valued on the basis of carbohydrates, proteins and fats content of cookie sample.

Sensory Analysis:

Sensory attributes such as flavor, aroma, taste, appearance and odour were evaluated by 9-point hedonic scale, total 64 people participated in this survey. Questionnaires and mouth rinsing water were conferred to taste panelist, through the session product was introduced and questions were explained to the volunteers.

RESULTS AND DISCUSSION:

Phytochemical Properties of Cookies:

The phytochemical properties of cookies are given in Table 2.

Table 2. Chemical and physiochemical parameter.

Sl. No.	Chemical And Physiochemical Parameters	Results
1	Ash content	7.10 %
2	Moisture content	6.91 %
3	Alkaloid	Present
4	Alcohol extraction	6.58 %
5	Water extraction	5.30 %
6	Fat content	14.04 %
7	Carbohydrate content	60.51%
8	Protein content	11.65 %
9	Total energy	414.9874 Kcal

By above mentioned Table 2 of results shown, those Cookies were spanning in nutritional values with controlled fat and carbohydrate and high rich in protein content which have made it acceptable among the health-conscious people, growing people and case of malnutrition. Comparative studies of different parameters of sensory evaluation exhibited that use of curry leaves as an active ingredient has given an appetizing and flavoring effect. Selected composition of cookies has made it acceptable around 90 to 96 % that will give us a hope to convert this formulation into large scale production. In terms of physiochemical properties, nutrition value, sensory evaluation and comparison with other marketed product were in acceptable range.

Sensory Evaluation:

Taste:

Taste is a promising parameter of sensory evaluation. The product might be fascinating and having an outstanding energy but sense of righteous taste it is likely to be unaccepted. Hence on the basis of this sensory evaluation it is found that due to use of *Tecoma stans* leaves its mean score was 92 to 95 % among the age group of 20 to 40. Graph of taste has been depicted below (Fig 2).

Flavour:

It is an essential part of taste as that plays a dynamic role in the acceptance of any food material. Used flavour of *Tecoma stans* leaves and vanilla essence was found to be highly considerable among all the volunteer of sensory evaluation because its smell act as a taster, because of it, it means score on excel was about 92 to 95 % (Fig 3).

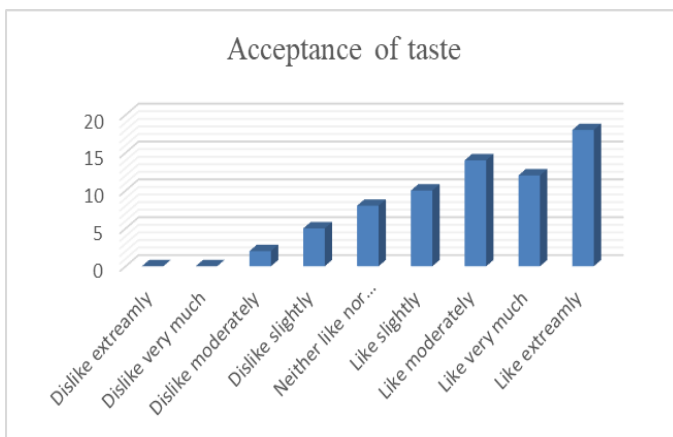


Fig 2. Acceptance of Taste.



Fig 3. Acceptance of flavour.

Aroma and Color:

Aroma or fragrance of foods are the imperceptible part of the acceptance and does play a crucial role in mouthful feel. Aroma is the first impression for the consumer to choose any food for consumption and even the color of food products. It is a sign of acceptance that have a boundless impact on the choice of product. Aroma and colour display an elegant effect on acceptance. The outcome of the results is showed that strong combined *tecoma stans*, Ashwagandha and vanilla aroma influenced the people greatly.

Overall Acceptance of Cookies:

Most important factor for food, snacks, and other drinks, after taking the bite or ship it must give a palatable and flavorful effect to the tongue so that it could be easily administrated. The result of this sensory evaluation is based on its taste, flavor, crispiness and aroma which was found to be appreciable with proper medicated effect.

CONCLUSION:

Based on statistical data it was found that herbal cookies have high amount of protein, controlled amount of fat

and carbohydrate in compared to other marketed product. Presence of *Tecoma stans* leaves and ashwagandha bark have given a new direction to convert home remedies into a marketed preparation which gives the highest acceptance in terms of flavor as well as the ingredients used in formulation has already proven significant role to control non-insulin dependent diabetes mellitus and other health issue. So, it could be serviceable in the manufacturing of highly nutritious cookies with low cost and high efficiency.

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