



Development and Quality Evaluation of Herbal Cookies fortified with Ashwagandha (*Withania somnifera*) Root Powder

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Abstract

Ashwagandha has been used as a medication in Ayurveda for millennia, but its use in commercial foods is a less researched field of food science. The roots and leaves of Ashwagandha (*Withania somnifera*), also known as Indian winter cherry, have been used in an Indian traditional system of medications for over 3000 years, Ayurveda and Unani, for a variety of disorders, particularly those connected to brain and nerve function. Medicinal plants serve an important role in maintaining population health. Each medicinal plant species has its own nutrient profile, as well as compounds with therapeutic potential. Ashwagandha exhibits a variety of health benefits with little or no associated toxicity when consumed within recommended limit. The bitter taste of this medicinal herb limits its usage in food industry. Considering the health benefits of ashwagandha as a valuable herb and along with the beneficial effects of use of other cereals like Wheat, Finger millets, Pearl millets and Corn this multi grain herbal cookie fortified with Ashwagandha was developed. The final composition was arrived based on trial and error method of optimization, sensory evaluation by a panel of 15 members. 4.5% of Ashwagandha fortified cookie was found to be the optimal treatment and detailed sensory, proximate, microbial and cost analysis were carried out.

Keywords: Ashwagandha powder, Ayurvedic, Medicinal plant, Cost analysis, Sensory Analysis, Herbal Cookies

Introduction

Ashwagandha (*Withania somnifera*) is a herb that is widely found in India and known for its medicinal value. Ayurveda has significantly acknowledged the properties of Ashwagandha several centuries ago and considers it a magical cure for many diseases. Literature studies and researches have found that Ashwagandha is considered safe for consumption from infants to adults. Withanolide present in ashwagandha consists of steroidal molecules which are said to combat numerous infections in human body. It acts as a muscle relaxer and nerve functioner in human

body. Ashwagandha is usually used in Indian conventional fitness care systems especially in Ayurvedic medicines. It carries constituents like cuseohygrine, anahygrine, tropine, and anaferine, glycosides, withenolide with starches and amino acids that combat infections. (Narendra singh, et al., 2011). Anti-stress, adaptogenic, aphrodisiac, antibacterial, antioxidant, sedative, diuretic, antispasmodic, germicidal, and anti-inflammatory are properties of Ashwagandha. In cases of alcoholism, it functions as a nervine tonic and hypnotic. It stimulates the thyroid and acts as a natural vitamin for sleeplessness. Hiccups, colds, diabetes, leprosy, sentinel dementia, Parkinson's disease, cough, ulcers, rheumatism, arthritis, intestinal infections, bronchitis, sedative, and senile debility are all treated with dried roots. Carbuncles, irritations, and swellings are treated with leaves. It also supports liver anti-peroxidation and disease resistance immunology. Because the majority of Indians are impoverished, their options for a balanced diet are limited due to a shortage of nutritious foods; nonetheless, this single product would cover all nutrient requirements. Considering these points, a convenience food product like cookies was developed with insights from Ayurveda and science. (Manvir Kaur Gill et al., 2019)

Literature Review

The chemical composition of low-cost nutritive wafer cookies composed of ayurvedic or herbal extracts such as shatavari and ashwagandha powder was examined for nutritional characteristics. Newly created wafer biscuits were shown to be high in carbohydrate (65%), calories, and fat in studies (24 percent fat). The findings show that freshly created biscuits were shockingly high in protein (8.20%) and dietary fibre (1.5%) and were widely welcomed by customers, owing to their low cost and health benefits in terms of sensory characteristics and nutritional values. It is useful for developing youngsters as well as in specific therapeutic situations where general malaise dominates the diseases, and such fortified meals can be commercialised as enterprise. (M. A. Haque et al., 2016)

An ashwagandha based cookie was developed and cost of a prepared value added Ashwagandha food product along with sensory was analysed. For each product, three treatments and one control (T1, T2, and T3) were made by combining Ashwagandha root powder with 100 percent refined wheat flour, and a control (T0) was made with 100 percent refined wheat flour. In terms of organoleptic properties of cookie sample T1 (2.5 percent ashwagandha+ 2.5 percent ginger+ 5 percent Shatavari + 90 percent refined wheat flour) was the most acceptable therapy. The cost of the 'Cookies' per 100 gm of raw ingredients was Rs.25.92. (Kumari Sangita, 2016)

Date fruit contains more than 70% sugar, primarily glucose and fructose, and is thus a high-energy food source making it an ideal sugar (sucrose) substitute in the cookies recipe, as well as providing significant nutritional benefits to diabetics and other metabolic health patients. Date fruit is high in fibre and antioxidant flavonoids such as beta-carotene, lutein, and zeaxanthin. As a result of the nutritional components of whole wheat flour and date

palm fruit as a sugar substitute, cookies baked with this combination will not only be an ideal snack/food for diabetics and other metabolic health-related patients, but will also become a good functional food with significant nutritional value. (Hamza et al., 2014)

The chemical composition of nutritive cost efficient wafer cookies composed of ayurvedic or herbal extracts such as shatavari and ashwagandha powder was examined for nutritional characteristics. Newly created wafer biscuits were shown to be high in carbohydrate (65%), calories, and fat in studies (24 percent fat). The findings show that freshly created biscuits were shockingly high in protein (8.20%) and dietary fibre (1.5%) and were widely welcomed by customers, owing to their low cost and health benefits in terms of sensory characteristics and nutritional values. It is useful for developing youngsters as well as in specific therapeutic situations where general malaise dominates the diseases, and such fortified meals can be commercialised as a social enterprise. (Kumari Sangita et al., 2016)

Wheat flour, ragi flour, milk, white butter/ghee, salt, baking soda, baking powder, sugar, vanilla essence, and Ashwagandha root powder were used to make wheat flour-based herbal biscuits. Six white butter biscuit samples were made with different amounts of Ashwagandha root powder and Ragi flour. The biscuit is accepted because of its flavour, which contains 2% Ashwagandha and 28% ragi. In addition, ghee was used instead of white butter to enhance the flavour of the biscuits. Both white butter and ghee samples were subjected to sensory and physical investigation. The results show that the biscuits made with ghee had a larger diameter and thickness, and scored significantly higher in all categories of sensory analysis. (Shreeya Baghel et al., 2020)

Materials and Methods

Procurement of raw materials:

Medicinal herb Ashwagandha (*Withania somnifera*) and other ingredients like pearl millet, sorghum, wheat, finger millet, butter, sugar, ghee, baking soda, milk powder were purchased from local market in Coimbatore.

Details of treatments for cookies:

T0 = Market sample Multigrain Biscuit

T1 = 98 % Multi grain Flour blends and other ingredients + 2 % Ashwagandha powder

T2 = 97.5 % Multi grain Flour blends and other ingredients + 2.5 % Ashwagandha powder

T3 = 97 % Multi grain Flour blends and other ingredients + 3 % Ashwagandha powder

T4 = 96.5 % Multi grain Flour blends and other ingredients + 3.5% Ashwagandha powder

T5 = 96 % Multi grain Flour blends and other ingredients + 4 % Ashwagandha powder

T6 = 95.5 % Multi grain Flour blends and other ingredients + 4.5 % Ashwagandha powder

T7 = 95 % Multi grain Flour blends and other ingredients + 5 % Ashwagandha powder

Dough Preparation

The cookies were prepared with the incorporation of Ashwagandha in 2gm, 2.5gm, 3gm, 3.5gm, 4gm, 4.5gm, 5 gm concentration trials with multigrain flours, sugar and fat amount constant and market sample cookies were considered as control. Unsalted butter was taken in a mixing bowl and icing sugar is added to the bowl. It is whisked by using an electric beater at medium speed until soft and creamy texture is formed then ghee, salt, milk powder, baking soda and other dry ingredients like pearl millet flour, finger millet flour, sorghum flour, wheat flour and ashwagandha powder were mixed and added. It is then mixed at medium speed using a dough mixer and kneaded well to form a dough.

Processing of Cookie

Oven was preheated at 180°C. The dough was taken and weighed, it was split into equal weights of dough and was sheeted to a thickness of 5 mm with help of rolling pin and an aluminum frame of standard height. It was cut into uniform shapes using cookie cutter and placed on the butter greased tray and finally, baked in the oven for 30 minutes until a baked brown colour was obtained. They were allowed to cool before being packed in polyethylene bag and stored in cold and dry place. It was then subjected to different analysis methods to determine its nutrition, taste and quality.



Fig 1: Treated cookies for analysis based on different composition of Ashwagandha



Process Flow Chart

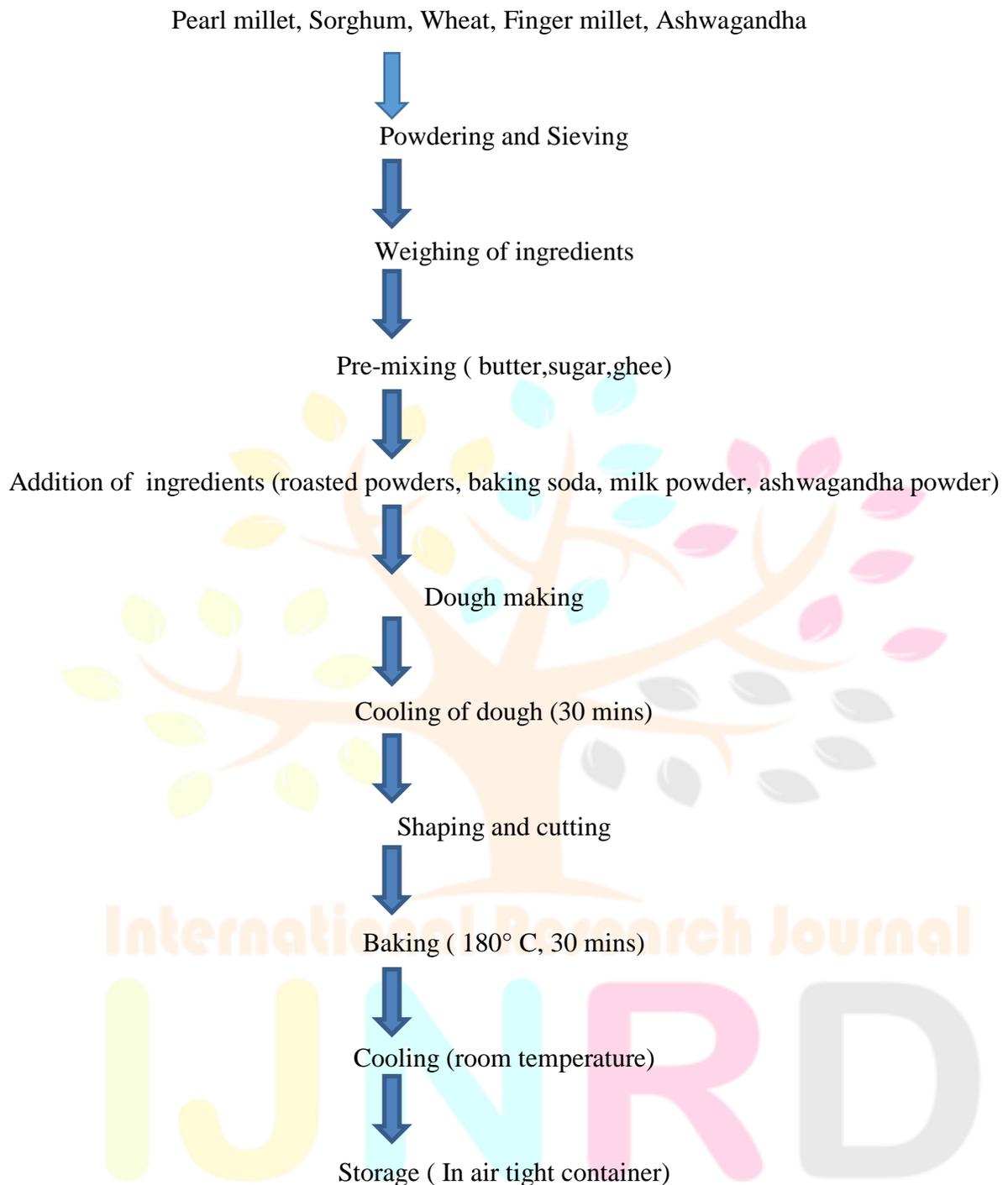




Fig 2: Cookies before baking



Fig 3 Cookies after Baking

Sensory Evaluation

Sensory evaluation of the food products for their acceptability was done by a panel of 15 judges on the basis of evaluation of attributes like Colour and Appearance, Body and Texture, Taste & Flavour and Overall Acceptability on a Hedonic scale based on 9 points.

Proximate Analysis

The proximate analysis like fat, carbohydrate, protein, ash, fibre were carried out following AOAC 1996 and 2000 procedures. Protein content was determined by Kjeldahl method, fat by Soxhlete method, Ash content was determined by Muffle furnace method, Fibre content by enzymatic-gravimetric method and Carbohydrate by Molisch's test. Formulas used:

Ash Test

Take a silica dish of 7-8 cm diameter. Weigh 5 – 10 gm cookie sample in the dish. Keep it in a muffle furnace at a temperature of 550°C for 4-6 hours till a white ash is obtained. Take the dish out carefully and allow it to cool in a dessicator. Weigh it and keep again in the muffle furnace for 1 hour. Repeat the same process of cooling and weighing. Note the lowest weight of all and calculate total ash with formula.

$$\% \text{ Total ash} = (W3 - W1) * 100 / (W2 - W1)$$

Where,

W1 = Weight of dish (empty), W2= Weight of dish (with sample), W3 =Weight of dish (with ash)

Unit all in gram. (Der-Jiun Ooi et al., 2012)

Moisture Content

$$\text{Moisture percent} = \frac{(W1 - W2) \times 100}{(W1 - W)}$$

Where,

W1 = Weight of the dish with the material before drying (gm)

W2 = Weight of the dish with the material after drying (gm)

W = Weight of the empty dish (gm)

Fat Test

First, clean all of the glass apparatus with petroleum ether and dry it in a 102°C oven before storing it in a desiccator. Place 5 g of powdered and dry material in the thimble and weigh it. In the soxhlet extractor, place the thimble. Clean a 150 mL round bottom flask and fill it with 90 mL petroleum ether. Allow the petroleum ether to boil by placing the entire setup on a heating mantle. Extraction should be continued for several hours, almost 6 hours. Allow the sample to cool before removing the condensing unit from the extraction unit. Finally, it eliminates all lipid. After distillation, collect practically all of the solvent. Place the sample in the oven and then in the desiccator when it has been removed. Calculate the sample's weight. As a result, we have a sample that has been defatted.

$$\text{Fat \%} = (w2 - w1) / p * 100$$

Where,

W2- Final weight of sample, W1 – Initial weight of sample

Crude Fiber Test

Determine the sample moisture individually by heating to constant weight in an oven at 105 °C. Place in a desiccator to cool. After preheating with the hot plate to shorten the time required for boiling, weigh accurately 1 g about of grinded sample (1 mm about) and add 1.25 percent sulfuric acid up to the 150 ml notch. As an antifoam agent, add 3-5 drops of n-octanol. Boil for 30 minutes from the time the water starts to boil. Drain sulfuric acid by connecting to the vacuum. Wash three times with 30 mL of hot deionized water (crucible filled to the top), each time attaching to compressed air to mix the contents of the crucible. Add 150 ml of heated potassium hydroxide (KOH) 1.25 percent and 3-5 drops of antifoam after draining the last wash. Heat for 30 minutes. Filter and wash. Finish with a final wash in cold deionized water to chill the crucibles, then wash three times the crucible contents with 25 mL acetone, stirring with compressed air each time. After drying in an oven at 105 °C for an hour

or up to constant weight, remove the crucibles and determine the dry weight. Place in a desiccator to chill. In comparison to W1, this weight (W2) shows the crude fibre plus ash content on comparison with the starting weight. (AOAC 1996)

Protein Test

Calculation of nitrogen content: $\% N = (1,4007 * ceq * (V - Vb)) / E$ (Ng, E.C et al,2008)

Where,

ceq - H⁺ Ion concentration of standard volumetric solution: hydrochloric acid

c = 0,1 mol/l alternativ: sulfuric acid ceq = 0,1 mol/l

V - Consumption volumetric standard solutions sample (ml)

Vb - Consumption volumetric standard solution blank (ml)

E - Weight (g)

Calculation of protein content: $\% Protein = \% N * PF$

Carbohydrate and Energy Test

Carbohydrate (g/100g) = 100 - (Moisture + Ash + Protein + Fat + Fibre)

Food energy values in both kilocalories (kcal) and kilojoules use the same factors.

Energy (kcal/100g) = (Carbohydrate * 4) + (Protein * 4) + (Fat * 9)

Microbial Analysis

Microbiological analysis was carried out by standard plate count method as explained in IS 5402(Part 1): 2021 and IS 5403:1999 for yeast and mold count.

Cost Analysis

The cost of the products was calculated for raw ingredients at price of rupees/kg, machineries and other expenses involved in production.

Results and Discussion

The result obtained from the analysis are presented and discussed below:

Table 1: Average sensory scores of control and treated samples of Ashwagandha cookies

Control & Treatments	Color	Appearance	Texture	Taste	Flavour	Size	Mouthfeel	Palatability	Smell	Overall Acceptability
T0	6.8	7.4	6.1	6.4	7.2	7.7	7.5	7.1	7.3	7.1
T1	7.4	7.6	7.4	7.3	7.5	7.1	7.2	7.4	7.1	7.3
T2	7.6	7.5	7.6	7.2	7.4	7.2	7.8	7.3	7.1	7.4
T3	7.6	7.4	7.7	7.2	7.2	7.1	7.3	7.2	7.4	7.3
T4	7.6	7.4	7.6	7.3	7.5	7.4	7.3	7.1	7.1	7.4
T5	7.4	7.8	7.2	7.9	8.1	8.1	7.1	7.4	7.6	7.6
T6	7.9	8.3	8.4	8.6	8.3	8.2	8.1	7.8	8.2	8.2
T7	7.3	7.1	6.2	6.3	6.1	7.2	6.2	6.8	6.7	6.7

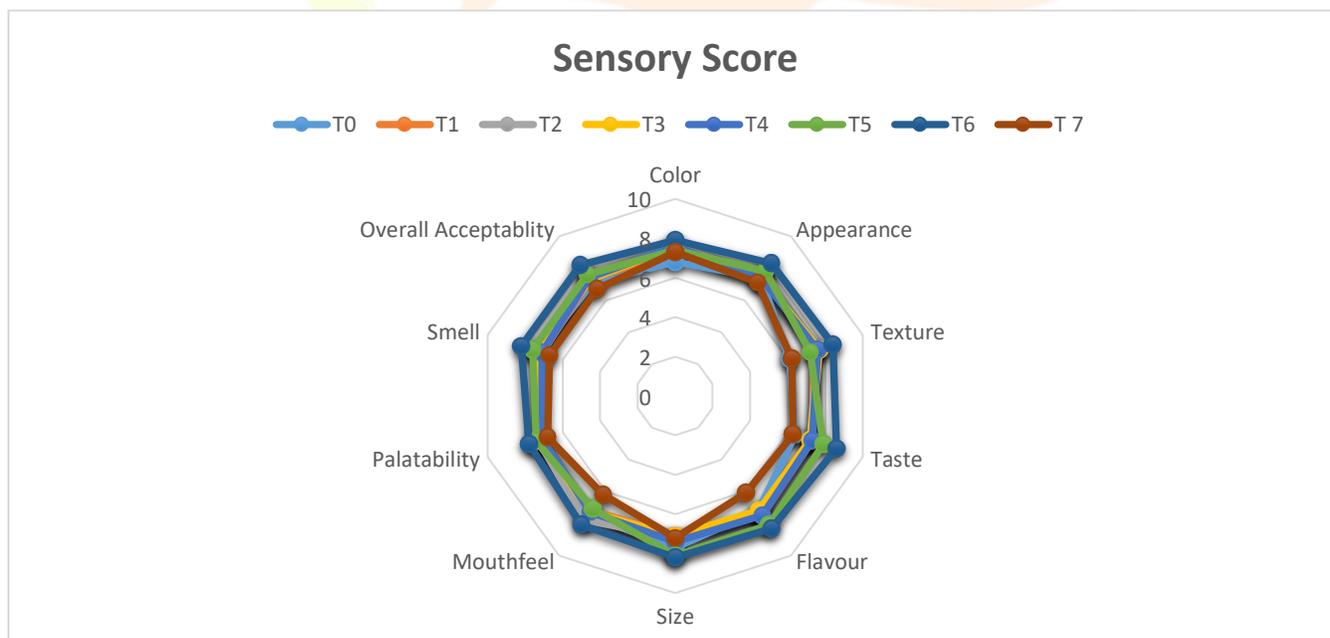
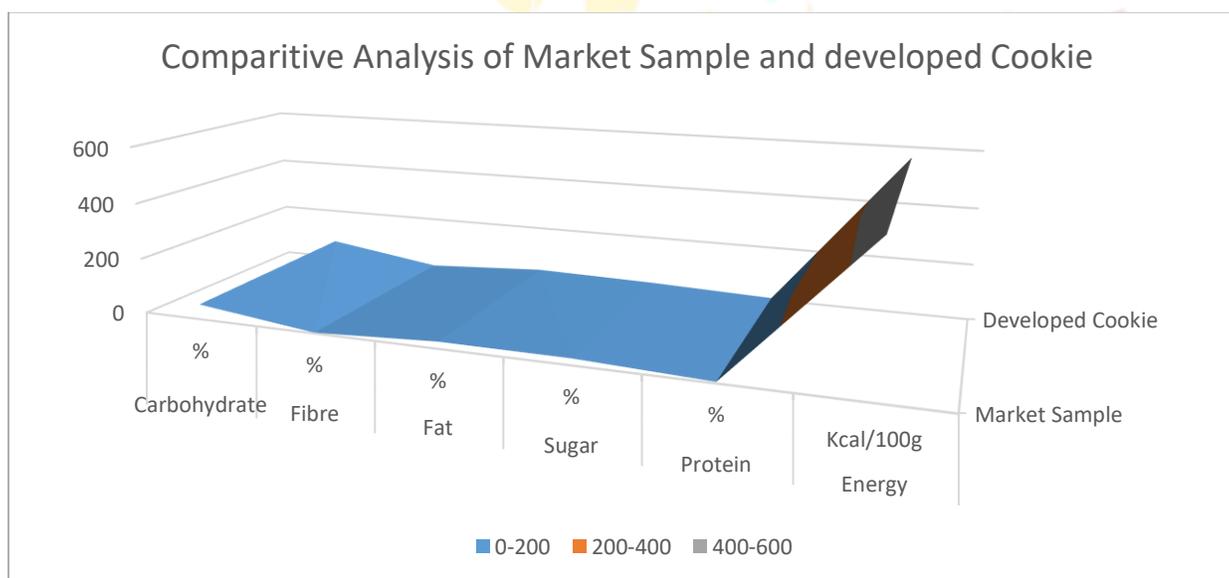


Fig 4: Radar chart representing sensory analysis score

The data in the above table and graph shows the average sensory scores of different parameters in control and treated cookies, clearly shows that T6 had the highest score in all parameters, indicating that cookies made with 4.5 percent ashwagandha root powder and blended flours improved all parameters and acceptability. Hence T6 was chosen as the final formulation of product.

Table 2: Proximate Analysis data of market cookie sample and developed cookie product

Parameters	Unit	Market Sample	Developed Cookie
Carbohydrate	%	54.61	68.21
Crude Fibre	%	2.50	4.59
Fat	%	24.6	29.40
Sugar	%	23.26	21.2
Protein	%	4.8	6.63
Energy	Kcal/100g	499.04	563.96



The data in the above table significantly shows the overall carbohydrate, energy and protein value higher on comparison with the present market multi grain cookie product. As aimed it aids the population to boost their overall energy and relieve from stressed conditions due to its high nutritional composition.

Table 3: Microbial Analysis Result

Parameters	Unit	Limit as per FSSAI	Result
Total Plate Count	CFU/gm	10^6	1200
Yeast and Mold	CFU/gm	10^4	150

The result obtained indicates that the developed cookies is contamination free as a limit upto 10^6 for Total Plate Count and a limit upto 10^4 for Yeast and Mold is considered safe for consumption according to FSSAI. Hence the developed cookies are fit for consumption in a healthy manner and was found to be safe for consumption upto 1 month of storage without use of preservatives at normal conditions.

Table 4: Cost involved in the purchase of ingredients for approx 1 kg cookie dough preparation

S.no	Ingredients	Cost/kg	Quantity needed(gm)	Cost for actual quantity(rupees)
1	Wheat powder	55	200	11
2	Finger millet powder	50	200	10
3	Pearl millet powder	25	150	3.75
4	Corn powder	25	150	3.75
5	Ashwagandha powder	650	4.5	2.9
6	Sugar	40	100	4
7	Butter	380	120	45.6
8	Ghee	600	30	18
9	Milk Powder	480	45.5	21.8
	Total		1000	120.8

Table 5: Cost involved in actual 100gram preparation of final cookie

S.no	Components	COST
1	100 gm product	12.4
2	Cost of packing one pack	3
3	Expected other expenses	2
Total		17.4

Conclusion

Bakery items have been increasingly popular in recent years among people of all ages and from all walks of life. Cookies are the most popular of these, and they can be utilised to provide health-promoting nutrients and/or nutraceutical components. Herbal powders, such as Ayurvedic powder of Ashwagandha, are a good source of macronutrients, micronutrients, and nutraceutical components in this regard. In Cookies the sensory scores of T6 (4.5% ashwagandha+ 95.5 % Multi grain Flour blends and other ingredients) was best regarding the overall acceptability and there was significant difference between the market sample taken for analysis and the developed cookie. Cost of the Cookies per 100 gm of raw ingredients as the prevailing cost of the raw materials was Rs.17.4 including all expenses involved in production. The current study aims to improve nutrition and nutraceutical components in herbal cookies supplemented with Ashwagandha by including traditional or unique ingredients, analysing nutrient composition, and determining consumer acceptability of the most popular value-added cookies.

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