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Development of low cost nutritive biscuits with Ayurvedic formulation

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ABSTRACT

Major rural population of India is malnourished and live below poverty line. The food intake by such people is of substandard with respect to nutritive value and often leads to some disorder. Common and easy to eat food for such people is biscuit. The advantages of certain ayurvedic herbs are well documented in literature. Low cost nutritive biscuits made of ayurvedic components shatavari, Ashawagandha and Yastimadhu powder was developed. It is rich in carbohydrate, energy, protein and fat which add to its medicinal importance for malnourished population. Newly formulated biscuits were investigated for its chemical and sensory characteristics by method reported in the literature**.** A brief microbiological studies were also planned evaluate shelf life of the product. Finally a survey was conducted to ascertain its over all acceptability amongst the population.

Introduction

Bakery products:

The concept of processed food has caught the imagination in recent years because of its enhanced convenience. Even the fast paced life changing the socio-economic conditions with less time for fresh food preparation has also created place for ready to eat food preparations. Biscuits are one of the most popular widely consumed processed food product in India. 80% of bakery products like bread and biscuits are consumed on regular basis by common people. The amount per capita consumption of biscuits is quite low as compared to in developed countries Biscuits are the properly baked products with variety of ingredients. Bakery products has great scope of changing its composition with nutritive supplements[1]. However, biscuit making is an art of turning a simple ingredient into wonderful delicious food with different aroma and crunchy taste. The common ingredients are varying proportion of refined wheat flour, vegetable shortening, butter, sugar, baking powder and flavoring agents. Biscuits are consumed by all age group consumer in particular health disorder people because of its instant energy release and various nutritive benefits. An idea of making biscuits with a ayurvedic herbs was an innovative steps in upgrading the nutritive value of the biscuits along with medicinal value. Biscuit can also be consumed as nutritive supplements for regular consumption due to its ready to eat advantages**.**

Importance of Ayurvedic herbs:

The various medical systems has been known for treating different types of health disorder. Ayurvedic medicine[2] is a system of traditional medicine native to the Indian subcontinent and is a form of alternative medicine. An ever increasing complaint about the health disorder, statistically show graph in upward direction. People suffer due to their life style with respect to food habits, lack of exercise, stress developing work style and polluted environment. Pollution leads to food-borne, water borne and airborne diseases. All these diseases are related to variations of microorganisms which may be classified as bacteria, pathogen, viruses and fungus. Health disorders can be controlled by killing microorganisms or at least by inhibiting their growth. This can be achieved by few active chemical components prepared either synthetically or by extracting from their natural occurrence.

Herb is a medicinal plant containing active component to inhibit the growth of microorganism whereby controlling the health complaints[3]. Ayurveda stresses the use of plant-based medicines and treatments. In

addition, fats are used both for consumption and for external use. Minerals, including sulfur, arsenic, lead, copper sulfate and gold are consumed as prescribed. This practice of adding minerals to herbal medicine is known as *Rosa Shastra*. Most Ayurvedic medicines are made up of a combination of herbs. Some herbal medicines may interact with treatments from doctors, including chemotherapy, radiotherapy, biological therapy or hormone therapy. Some are concerned about the toxicity of Ayurvedic medicines because ayurvedic remedies contained levels of heavy metals like mercury, lead and arsenic. Using Ayurvedic techniques often helps to reduce stress level which then lead to a better reception of the other treatments. Ayurvedic treatments like yoga and massage are usually safe and provide more benefit than harm.

Present study:

The study was aimed to formulate biscuits which are cost effective as well as functional with optimum nutritional and sensory attributes. In the present research few herbal plants are investigated for their medicinal and therapeutic use to cure health disorder. Very popular plants like Ashwagandha, Shatavari and Yastimadhu are selected for this purpose. Each plant is characterized by physical and chemical properties. The entire work was planned with following objectives.

- To formulate cost effective biscuits with added advantage of nutritive and medicinal benefits.
- To incorporate Ayurvedic powder of Shatavari, Ashwagandha and Yastimadhu in plain refined flour biscuits as a nutritive and medicinal supplement to all age group consumers. .
- To study the factors affecting the shelf life of newly formulated biscuits.
- To establish chemical and microbiological characteristics of newly formulated biscuits.
- To recommend low density polyethylene packaging material to match with the shelf-life the product.
- To investigate changes in organopleptic qualities during storage.
- To perform sensory evaluation and consumer survey of the biscuits

Methods and Materials:

The ayurvedic biscuits were formulated following ingredient and standard recipe was suggested for making the biscuits with incorporation of ayurvedic herbs Three different herbs shatavari, Ashwagandha and Yastimadhu were selected in powder form to enhance the medicinal importance of the biscuits. It is necessary to identify the parts of plants which contain maximum active components which is effective for the treatment of various health complaimnts[3]. The plant body like, roots, bark, leaves, flowers and fruits are selected based on their botanical importance and physical properties.

Each part of theses herbal plant is thoroughly washed and weighed after cleaning with water. Physical parameters like total ash, moisture, color, taste and odor and effect of heat has been determined and results are tabulated[4]. A simple chemical method[5] is used to isolate active component using Soxhalet extractor and extract is characterized by HPLC technique for its various active components. Ether is used as a solvent for extraction. Various sophisticated techniques are used to characterize the structure of active component and their medicinal benefits are discussed. Powdered forms of these natural herbs are used to formulate the biscuits.

The standard recipe was designed with following proportion of ingredients

Proportion of ingredients used to formulate the new ayurvedic biscuits.

Ingredients	**Amount (gm)**
Refinewd wheat flour	100
Powdered sugar	50
Butter	60
Dessicated coconut	15
Cocoa powder	8
Shatavari powder	**3**
Ashwagandha powder	**3**
Yastimadhu powder	**3**
Vanila essence	Few drops
Baking powder	¼ tsp
Water	15-35ml

The dough was made and in a proper shape it was baked in an oven at 150^0C for 20minute. The proximate analysis with respect to moisture, total ash content, protein, carbohydrate, fat and fiber value was performed on newly formulated biscuits by AOAC method. The levels of active component from herb ingredients were analyzed by HPTLC method. Aesthetic parameters were investigated by sensory evaluation of the product. The evaluation was carried out by the panel of judges on nine point Hedonic scale. The mean value of score was given to each parameter like color, texture, taste, flavor, mouth-feel and overall acceptblity.

For microbiological analysis was performed by standard plate count method as follows[6]. 1ml of aliquot of sample was taken in sterile Petri dish of both dilutions. Tryptone Glucose Beef extract was added in both the dishes. Rotate the plates to mix the sample with agar diluents properly. Incubate the dishes for 48hrs at 37^0C. Count the colonies and calculate the Total Viable Count (TVC) per gm.
In order to establish shelf life of the product, some parameters were evaluated for extend period over three weeks using standard procedure reported in the literature.

Results and discussion:

The results of experiments are tabulated in the table no.1. The result indicates that all the raw material was under standard limit prescribed by PFA and in tune with Ayurvedic pharamacopeia[2]. The moisture content of the Ashwagandha was maximum, while that of yastimadhu was minimum. In all moisture content was low and will not have significant effect on the shelf life of the food product[7]. Similarly, total ash content represents the inorganic residues of the raw materials used to make the biscuits. These residues will have higher thermal stability and can withstand at higher temperature of baking the food products. The ash contents were further classified as its water and alcoholic solubility. In particular Shatavari powder has maximum water soluble minerals while Ashwagandha had minimum. The alcoholic extract of these herbal powders has approximately similar composition. The butter used for the preparation of biscuits should have lower acidity value. The butter has only 0.015% titrable acidity in terms of lactic acid supports the quality of newly formulated biscuits.

Table No. 1 Analysis of Raw materials

Raw materials	% Moisture	% Total Ash	% Acid insoluble ash	% Water soluble ash	% Alcohol extract	Titrable acidity
Shatavari powder	5.55	3.35	-	49.0	21.0	-
Ashwagandha powder	7.35	4.45	-	15.5	18.2	-
Yastimadhu powder	3.80	4.60	-	22.9	27.4	-
Refined wheat flour	5.47	3.50	0.90	-	-	-
Cocoa powder	3.10	5.64	0.46	-	-	-
Desiccated coconut	1.96	2.50	0.10	-	-	-
Butter	9.00	1.76	0.81	-	-	0.015

The herbal ingredients have definite role to play and food products can be given status of Biscuit with therapeutic advantages. Each herb has definite health advantages due to active components present in it. .

Shatavari

Shatavari has active constituents such as galactose, arabinose, steroidal, glycosides and saponins. Shatavari contains phytoestrogens, a natural hormone precursor that rebalances oestrogen levels in women. Shatavari is considered to be the best general tonic for women in Ayurveda, Saponins and Asparagus are the two active components of Shatavari It is considered to be the women's tonic and is used as a natural regulator[8].. These hormones play an important role in a woman's long term health, preventing heart disease and osteoporosis. It helps to increase the milk secretion during lactation It is clinically proven herb to promote fertility, strengthen the uterus, regulate menstruation, promote the flow of breast milk, assist in recovery from childbirth and alleviate many symptoms of the menopause.. It helps to stimulate the immune system and helps the body to eliminate toxins. Shatavari is useful in Cancer, convalescence, cough, dehydration, diarrhoea, dysentery, fevers (chronic), Hematemesis, herpes, hyperacidity, impotence, Leucorrhea, lung abscess, sexual debility, stomach ulcers, rheumatism, protects from the effects of chemotherapy and soothes the dry, inflamed membranes of kidneys, lungs, sexual organs and stomach. Asparagus increases breast milk and semen, nurtures mucous membranes, acts as Immune system booster, Blood cleanser, supplies female hormones, Nourishes the ovum. Shatavari has active constituents such as galactose, arabinose, steroidal, glycosides and saponins[9-13].

Ashwagandha

Ashwagandha is a shrub that flourishes in India. The roots of the Ashwagandha plant have been employed for treatment. Ashwagandha has many beneficial elements, including flavonoids[14]. Ashwagandha contain different natural antioxidants: superoxide dismutase, catalaze and glutathione peroxidase which are responsible as a health promoters. It contents Whaferin A and Withanolide G. as an active component. The antioxidant has anti-stress, cognition-facilitating, anti-inflammatory and anti-aging effects[15]. It has been used to treat inflammation, fevers and to protect against infection or illness. It has been used to boost the immune system, improve memory and to promote overall wellness.. Ashwagandha is prescribed as a treatment for cerebral disorders in the elderly, including memory loss. The research showed that ashwagandha led to more acetylcholine receptor activity. The increase of activity in neurotransmitter could account for the increase in cognitive ability and memory that is attributed to ashwagandha. Withaferin A affects both T and B lympohocytes. It even protects against stress induced ulcers and works as mood stabilizer. This herb has been given GRAS status and can be used as food ingredient in cereals, candies chewgum and cookies.

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Yastimadhu

Yastimadhu has glycyrrhizinic as active component[16]. In ayurveda, yastimadhu is used as an anti-inflammatory agent. It is used in eye diseases, throat infection and antiarthriatic agent. Animal studies indicate its preventive action in cirrohosis of liver and triglyceride accumulation in liver However, liver glycogen level was increased significantly All the experimental findings are presented in tabular form and discussed logically and interpreted with scientific evidence.

Glycyrrhizinic acid

Biscuits were analysed for the presence of active component using chromatographic technique reported in the literature. The chromatogram confirms the presence of these active ingredients in the newly formulated biscuits indicates that active components like Saponin, Withanolides and Glycyrrhizinic acid are present even after baking. All the three active ingredients are shown in figure no. 1

Table no. 2 Chemical parameters of the newly formulated biscuits

% Parameters	Fresh	1st week	2nd week	3rd week
Moisture	0.74	1.10	1.47	1.85
Total ash	1.00	1.03	1.78	2.10
Acid Insoluble ash	0.08	0.10	1.20	1.46
Carbohydrate	60.08	-	-	-
Protein	7.00	-	-	-
Fat	25.62	-	-	-
Dietary Fiber	0.68	-	-	-

The analytical data for the biscuits are tabulated in table no.2. Major three parameters which are responsible for the shelf life of the biscuits are investigated. The study was design for the extended period of three week and at the end of every week moisture, total ash and insoluble ash was determined. Theses results are reproduced in bar diagram in figure no. 2 Graph of the result indicates that these parameters are increases steadily. The trend indicates that biscuits absorbs moisture requires good packaging material for the longer storage. The trend also indicates that strict microbiological control is essential for the product.

The nutritive status of biscuits can be established by its nutritive parameters. The major parameters carbohydrate, protein, fat and dietary fibre are determined. It also suggests that biscuits are rich in carbohydrates and protein. The 25% of fat from good quality butter is an advantage with respect to taste and mouthfeel. However detailed investigation is recommended for the determination of fatty acids. The dietary content of the biscuit is in favour of its medicinal importance. Higher value of fibre can improve the digestion and helpful in abdominal disorder.

The newly formulated biscuits were diagnosed for its microbiological status by pour plate technique using agar. Results are expressed as Total Viable Count (TVC), Yeast Mold Count and Total Coliform cfu/mL[17]. The results are summerized in table no.3

Table no. 3 Microbiological investigation

MPN expressed as [cfu/mL]	Fresh	1st week	2nd week	3rd week
Total Viable Count X 10^2 dilution	-	11	14	26
Yeat Mold count X 10^2 dilution	-	-	-	-
Total Coliform X 10^2 dilution	-	-	-	-

The result indicate that biscuit has small growth of microorganism in terms of TVC but yeast mold count as well as total coliform count does not show any growth. It is very clear that biscuits are safe to eat and does not prolifor any microorganism on its consumption.

The sensory evaluation was carried out for the new product for its acceptability by the common consumers. Subjects were selected randomly and test was carried by different sensory evaluation methods. Composite Scoring test was performed by giving the consumer the sample to taste with respect to certain organoleptic parameters. The mean value and statistical treatment to results for 100 subjects are reported in the following table no. 4

Table no.4 Mean and Standard deviation of composite Score

Parameters	Colour	Flavour	Texture	Taste	Crispness	Acceptability
Maximum Score	20	10	20	20	20	10
Mean	14.04	6.39	14.33	12.66	15.65	7.16
Std. deviation	6.60	2.08	6.80	9.20	16.30	14.60

Table No. 5 Effect of storage on various sensory parameters

Characteristics	Fresh	1st week	2nd week	3rd week
Color (20)	13.2	14.0	14.6	13.8
Flavor (10)	6.6	6.2	6.3	5.7
Texture (20)	14.3	14.2	13.9	13.7
Taste (20)	14.7	13.7	13.6	12.2
Crispness (20)	15.6	14.6	14.2	13.8
Acceptability (10)	6.7	6.0	5.6	5.2
Total (100)	**71.1**	**68.7**	**68.2**	**64.4**

The results of sensory evaluation clearly suggest the over acceptability of the newly formulated biscuits particularly with respect to its color and crispiness. The decrease in the acceptability over the period of three week is very marginal. However, better packaging material with attractive picture is essential to market the product.

CONCLUSIONS:

Following conclusions can be drawn in favour of objectives planned for the development of newly formulated ayurvedic biscuits.

- These biscuits are high in 65% carbohydrates, 25% fat, 7% protein and 0.68% of fibre.
- The results indicate that newly formulated biscuits were widely accepted by the consumers mainly due to its low cost and health benefits.
- Studies report that these herbal powders retain the active component without decomposition even after baking process.
- Due to higher nutritive value it is more effective for growing children as well as in certain therapeutic conditions when general malaise dominates the diseases.
- To overcome chronic malnutrition it's an cost effective supplement with approximate Rs 25.
- The attention should be given to the locally available raw ingredients material and its utilization wisely to combate malnutrition.
- Health of society can be entrusted by effective revival of ayurvedic with its full dignity.

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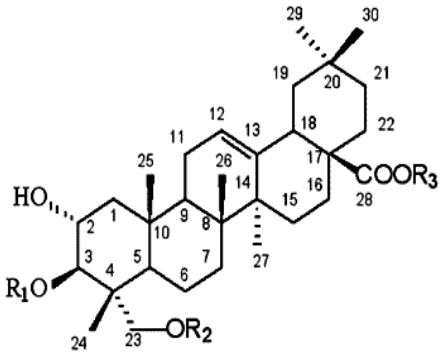
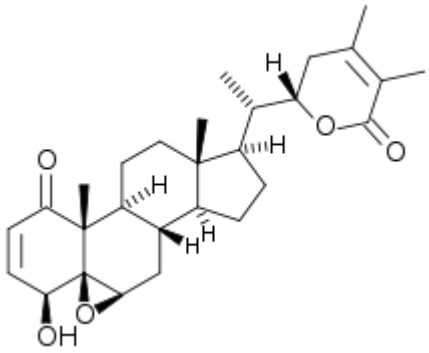


Saponin



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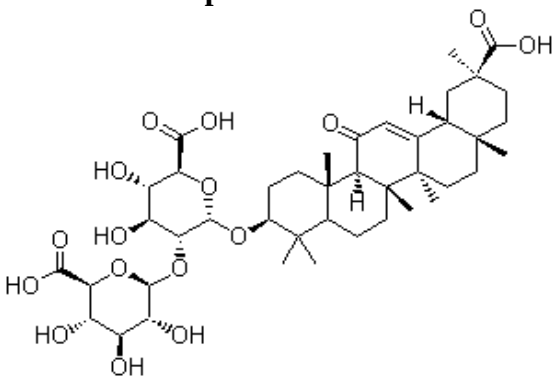

Glycyrrhizinic acid

Figure no. 1 Active ingredients from Avurvedic herbs

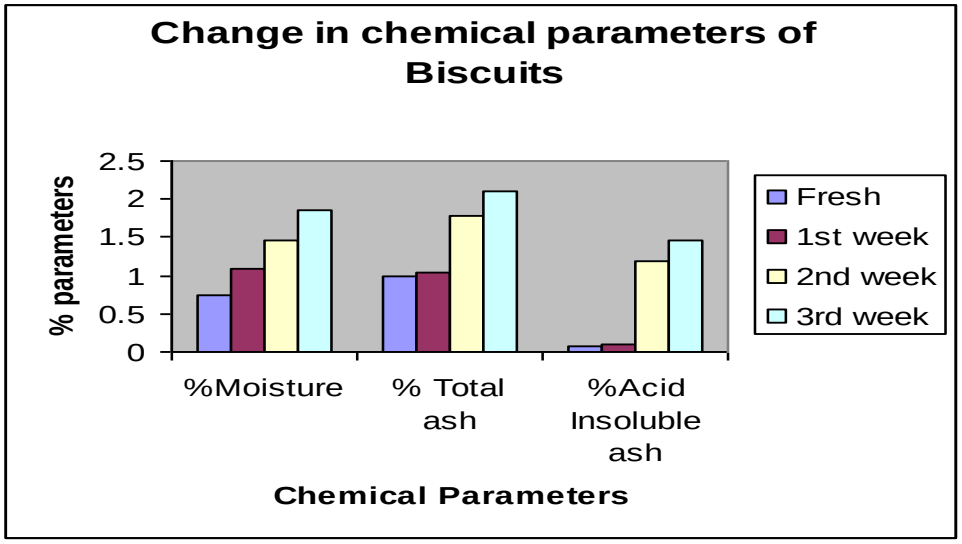

Figure No.2 Changes in chemical parameters of biscuits during storage

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