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NUTRITIONAL EVALUATION OF COOKIES ENRICHED WITH VISHNUKRANTHI (Evolvulus alsinoides L.) POWDER

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Abstract

Medicinal plants play vital role in disease prevention due to presence of phytochemical constituents. The natural and unique medicinal plants are used for curing various diseases without causing any side effects. *Evolvulus alsinoides L.* is a forb species that is highly valued in traditional medicine for its memory - enhancing effects, and a range of other ethanomedicinal properties. It contains evolvulin, evolvulic acids and gave the highest content of total phenol, total flavonoid, total alkaloid and saponin. So it had the highest anti-oxidant, anti-hypertensive and anti-depression properties. The study was conducted to improve the nutritional qualities of cookies with incorporation of different levels of *Evolvulus alsinoides L* powder from 0, 5, 10, 15 and 20% and examined for its physical and chemical composition. The proximate composition of cookies enriched with *Evolvulus alsinoides L* powder from 5 to 20% indicated that crude fibre increased from 1.15% to 2.02% and ash content 1.21% to 2.16%. The incorporation of *Evolvulus alsinoides L* powder in cookies lowered the lightness and yellowness but increased browness of cookies. Sensory evaluation of cookies concluded that the cookies prepared with addition of 10% *Evolvulus alsinoides L* powder were more acceptable as compared to others.

Index Terms

Evolvulus alsinoides, Cookies, Nutitional evaluation, Sensory evaluation

I. INTRODUCTION

Foods with high nutritional value are in great demand for proper functioning of body systems and potential health benefits. With the developing technology, researchers have preferred to produce value added products. This is why the production and consumption of food products rich in bioactive components has increased. For these reasons, the bakery industry has started to develop a wide variety of bakery products enriched with bioactive components such as dietary fibers, antioxidants and phenolic compounds (Ozen Sokmen and Aycan Cinar, 2022).

Evolvulus alsinoides (L) of family convolvulaceae, is a perennial herb, small, hairy, procumbent, with a small woody and branched rootstock (Austin, 2008). Traditionally, this plant is being used for the treatment of fever, cough, cold, venereal diseases, bronchitis, biliousness, epilepsy, leucoderma, azoospermia, adenitis, dementia and used to promote hair growth, improves the complexion and appetite. It is well known for its memory enhancing property in traditional Indian system of medicine and extensively commercialized as nerve tonic in Asian countries. *Evolvulus alsinoides* extracts have exhibited anti-oxidant, anti-ulcer and immunomodulatory activities. Early phytochemical studies of this species resulted in the isolation and identification of chemical constituents such as triacontane, pentatriacontane, b-sitosterol and two alkaloids, betaine and shankpushpin.

In Sri Lanka, roots and stem extract of the plant are used to treat dysentery and depression. Leaves are recommended for asthma and mental disturbances (Rajaqkaruna N et al, 2002). It is used in insanity, epilepsy

and nervous debility. The plant is used in Ayurveda as a brain tonic in the treatment of neurodegenerative diseases, asthma and amnesia (Goyal PR et al, 2005). *E. alsinoides* has been proved to possess scientific potential in central nervous system depression, anxiolytic, tranquillizing, antidepressant, antistress, neurodegenerative, antiamnesic, antioxidant, hypolipidemic, immunomodulatory, analgesic, antifungal, antibacterial, antidiabetic, antiulcer, anticatatonic and cardiovascular activity (Sethiya NK, Nahata A et al, 2009). *E. alsinoides* is reported to contain several types of alkaloids, steroids, flavanoids and coumarins as active chemicals that bring about its biological effects (Sethiya NK, Thakore SG et al, 2009).

The whole plant is used in form of decoction in nervous debility and loss of memory. The plant is also useful as blood purifier and in bleeding piles. The fresh flowers with sugar are eaten as a brain tonic. The leaves are made into cigarettes and smoked in chronic bronchitis and asthma. It also improves complexion, voice and cures from intestinal worms. It promotes 'medha', the power of memory. As *E. alsinoides* powder has a valuable nutritious profile, it has been considered as one of the potential functional food sources. The utilization of *E. alsinoides* powder with wheat flour in bakery products has not been studied extensively. Therefore, this research revealed the innovative approach of increasing the consumption rate of *E. alsinoides* powder by the formulation of cookies and to evaluate the effect of substitution of wheat flour with the different levels of *E. alsinoides* powder on the physio-chemical and sensory properties of cookies.

II. MATERIALS AND METHODS

The present research work was carried out in the departments of Biochemistry and Home Science, V.V.Vanniaperumal College for Women, Virudhunagar during 2021- 2022.

2.1 Collection of Sample and other Ingredients

The fresh *Evolvulus alsinoides* plants were collected from Thenkasi district in the month of July, 2022 and authenticated (Reg No: XCH-40454) by Dr.S.Mutheeswaran, Scientist, Xavier Research Foundation, St.Xavier's College, Playamkottai, Tamil Nadu, India. The ingredients needed for cookies such as wheat flour, butter, jaggery, baking powder and salt were purchased from the local market in Virudhunagar and stored in good conditions.

2.2 Preparation of *Evolvulus alsinoides* Powder

The collected *Evolvulus alsinoides* plants were washed with distilled water. The whole plants were dried into cabinet drier. After drying, the plants were grinded well and sieved it. The prepared *Evolvulus alsinoides* powder was stored in air tight container for further uses.

Table 1: Ingredients used for the Development of Value Added Cookies

S.No	Ingredients	T_0	T_1	T_2	T_3	T_4
1	Wheat flour	100	95	90	85	80
2	*Evolvulus alsinoides* powder	-	05	10	15	20
3	Butter	60	60	60	60	60
4	Jaggery	40	40	40	40	40
5	Salt	To taste	To taste	To taste	To taste	To taste
6	Baking powder	A pinch	A pinch	A pinch	A pinch	A pinch

2.3 Development of Value Added Cookies

In this study, cookies were prepared by the incorporation of 5%, 10%, 15% and 20% of *Evolvulus alsinoides* powder respectively. Control was prepared as per the standard cookies recipe. Cream the butter, sieved the dry ingredients and mixed well with jiggery then made dough. After that, sheeting, cutting and baking at 150^0C for 15 mins.

2.4 Physical Characteristics

The physical characteristics of cookies such as diameter, thickness, spread ratio were measured as described in the A.A.C.C (2000) methods.

2.5 Texture measurement

Texture of cookies was evaluated by a universal texture analyser (Jacob and Leelavathi, 2007).

2.6 Colour measurement

Surface color of cookies was determined by measuring tristimolus L* (brightness), a* (redness),b* (yellowness) and Hue (H) values with a colorimeter (Nezhad and Butler, 2009).

2.7 Sensory Evaluation

The sensory characteristics of value added cookies prepared by incorporated *Evolvulus alsinoides* powder were assessed with the help of 20 panel members using 9 point Hedonic scales. The panelists were asked to give scores for colour, flavor, texture, taste and overall acceptability separately. The mean scores of all attributes helped to find the best out of the samples.

2.8 Nutrient Analysis

Moisture content of developed cookies were analysed by Hot air oven method. Carbohydrate of the sample was determined by using "Benedict's method. The protein content of the sample was determined by using "Lowry's Method". The ash content was determined for the selected value added cookies by Muffle furnance. Crude fiber is determined by sequential extraction of the sample with 1.25% of sulphuric acid and 1.25% of sodium hydroxide. (AOAC, 2000)

2.9 Statistical Analysis

All the results were statistically analyzed by using SPSS version 2.0.

III. RESULTS AND DISCUSSION

3.1 Physical characteristics of cookies

There were no significant differences in the diameter and thickness of the cookies among those containing up to 10% *Evolvulus alsinoides* powder and the control (Table 2). However, significant differences were found with higher levels of *E.alsinoides* powder. Larger diameter and lower thickness values were observed as the level of beetroot powder substitution increased. The incorporation of *E.alsinoides* powder affected cookie expansion by lowering gas retention compared to control. The spread ratio of cookies made with *E.alsinoides* powder was significantly lower than that of control. Muralidhar Ingle *et al.,* (2017) reported that cookies made with beetroot powder exhibited a reduction in size, thickness and spread ratio as the content of beetroot powder increased. Cho *et al*., (2006) also reported that the addition of sea tangle powder lowered the spread ratio of cookies. The cookies with larger spread or diameter were considered more desirable (Fimney *et al.,* 1950).

Table-2 Physical parameters of *Evolvulus alsinoides* powder incorporated cookies

Treatments*	Weight (g)	Diameter (mm)	Thickness (mm)	Spread ratio
T_0	8.48	44.36	10.49	4.51
T_1	8.58	45.22	10.58	4.26
T_2	8.67	45.38	10.60	4.23
T_3	8.72	45.71	10.79	4.29
T_4	8.74	45.85	10.82	4.28
SE	0.12	0.37	0.06	0.084
CD@5%	0.528	1.14	0.18	NS

* Indicates proportion of wheat flour : *Evolvulus alsinoides* powder;
T_0 (100:0), T_1 (95:5), T_2 (90:10), T_3 (85:15) and T_4 (80:20)

3.2 Texture analysis of cookies

It was revealed that the hardness of cookies was found to increase from 56.28 N to 70.15 N with addition of *Evolvulus alsinoides* powder (Table 3). The increased hardness may be attributed to dilution of wheat proteins with *Evolvulus alsinoides* proteins and fiber. There was positive correlation of fiber and protein contents with the hardness value of cookies (Piazza & Masi, 1997). The increase in cookies hardness was observed with increased fiber substitution (Arora & Camire, 1994). This was in consistent also with the result obtained as eggplant flour used in cookies as an important source of fiber (Jenkins *et al.,* 2003). Drisya *et al.,* (2015), reported that there was significant increase in the dough hardness with addition of DMKLP. Nandeesh *et al*., (2011) also reported increased biscuit dough hardness and decreased in cohesiveness, springiness and adhesiveness with addition of 30 % differently treated wheat brans. Therefore, high fiber content in *Evolvulus alsinoides* powder was evident to produce cookies with hard texture.

Table-3 Effect of different levels of *Evolvulus alsinoides* powder on textural characteristics of cookies

Treatments*	Force Max (N)	Break Force Sensitivity (N)	Max Displacement Force (N)
T_0	56.28	56.20	20.49
T_1	61.86	60.78	12.78
T_2	64.38	64.05	11.89
T_3	68.02	67.84	14.24
T_4	70.15	69.75	14.58
SE	0.187	0.052	0.081
CD@5%	0.532	0.154	0.245

* as suggested in Table 2.

3.3 Colour measurement

Colour is an important technical property of cookies and is mainly developed during the later stages of baking. (Culetu *et al*, 2021) The data presented in Table 4 illustrated that control cookies had significant difference in terms of L* (lightness), a* (redness), b* (yellowness), C (chroma) and h (hue) values compared to all other cookies made by substitution with *Evolvulus alsinoides* powder. The lightness value of control cookies was 65.782 and those of *Evolvulus alsinoides* powder cookies decreased from 56.775 to 55.289, indicating that lightness decreased with the reduction in the proportion of wheat flour because of the loss of white color of the flour. The redness value of control cookies was 4.877 and those of *Evolvulus alsinoides* powder cookies was increased from 5.674 to 5.948, showing more reddish color than control. The yellowness value of control cookies was 21.853 and cookies substituted with different levels of *Evolvulus alsinoides* powder decreased from 15.341 to 14.268. Hue refers to a term that describes the pure spectrum color without tint or shade. The increased level of substitution of *Evolvulus alsinoides* powder significantly reduced the hue value.

As Yang, Yin *et al.*, (2021) reported, higher a* values and lower L* values were indicators of Maillard browning. Compared to the control sample, the b* value and c* value of all black soybean cookies significantly decreased. Kumar and Sudha (2021) also had similar findings. They found the colour reduction by the incorporation of multigrain mix decreased the black soybean flour. Uthumporn *et al.*, (2015) observed decreased lightness value of cookies as the substitution level of fiber into formulation was elevated. Control cookies had significant difference in b* and C* values compared to other cookies. The differences in color could be due to uneven exposure of cookies' surface area to high baking temperature and colored compounds formed from chemical reactions such as caramelization and Maillard reaction (Purlis & Salvadori, 2007).

Table-4 Effect of different levels of *Evolvulus alsinoides* powder on color characteristics of cookies

Treatments*	L*	a*	b*	C*	H*
T_0	65.782	4.877	21.853	21.366	78.441
T_1	56.775	5.674	15.341	17.482	69.212
T_2	56.632	5.823	14.952	16.815	68.523
T_3	56.536	5.924	14.607	16.409	67.549
T_4	55.289	5.948	14.268	15.861	65.210
SE	0.502	0.065	0.053	0.142	0.056
CD@5%	1.486	0.187	0.162	0.416	0.187

* as suggested in Table 2.

3.4 Sensory evaluation

The treatment with 10 % replacement of wheat flour with *Evolvulus alsinoides* powder (T_2) obtained higher average score for color and appearance (8.25) with minimum score by treatment with 20 % replacement of wheat flour with *Evolvulus alsinoides* powder (T_4) (7.16). The treatment T_2 obtained highest score for texture (7.98), flavor (7.85), taste (8.35) and overall acceptability (8.45) as compared to control T_0 treatment (Table 5). Therefore, replacing up to 10% wheat flour with *Evolvulus alsinoides* powder resulted in good acceptability of cookies. The color and appearance of cookies is a function reducing sugars, as these reducing sugars during baking caramelized to produce brown color of cookies.

Table-5 Effect of different levels of *Evolvulus alsinoides* powder on color characteristics of cookies

Treatments*	Color and Appearance	Texture	Flavour	Taste	Overall acceptability
T_0	8.12	7.54	7.35	8.10	7.85
T_1	7.85	7.65	7.50	7.85	7.65
T_2	**8.25**	**7.98**	**7.85**	**8.35**	**8.45**
T_3	7.23	6.85	7.16	7.64	7.51

T_4	7.16	6.20	6.68	6.23	6.80
SE	0.168	0.046	0.082	0094	0.094
CD@5%	0.512	0.125	0.245	0.276	0.279

* as suggested in Table 2.

3.5 Proximate composition

Moisture content of control cookies was 2.67% and that of cookies containing *Evolvulus alsinoides* powder increased from 3.12 to 3.98 %. Crude protein content of control was 9.65 % and that of cookies containing incremental levels of *Evolvulus alsinoides* powder increased from 9.48 to 9.62 % (Table 6). Ash content of the cookies containing incremental levels of *Evolvulus alsinoides* powder was increased from 1.21 to 2.16 % which was significantly higher than that of control. Crude fiber content of cookies was significantly increased from 1.15 to 2.02 % with addition of *Evolvulus alsinoides* powder up to 20%. Crude fat and carbohydrates contents were decreased from 23.45 to 21.30 %, 63.12 to 62.42 respectively with addition of *Evolvulus alsinoides* powder. The difference in moisture content between samples might be due to the high fiber content in *Evolvulus alsinoides*. More hydroxyl groups of cellulose in fiber were able to bind with free water molecules through hydrogen bonding and thus resulting in greater water holding capacity (Rosell *et al.,* 2001). In conclusion nutritional analysis revealed that the increased substitution level of *E.alsinoides* powder up to 10 % increased the nutritional content (crude protein, crude fiber and minerals) when compared to control cookies. *Evolvulus alsinoides* powder also provided greater overall acceptability but increased the hardness value of cookies.

Table-6 Effect of different levels of *Evolvulus alsinoides* powder on color characteristics of cookies

Treatments*	Moisture (%)	Protein (%)	Fat (%)	Carbohydrates (%)	Ash (%)	Crude fiber (%)
T_0	2.67	9.65	24.65	63.98	0.75	0.95
T_1	3.12	9.48	23.45	63.12	1.21	1.15
T_2	**3.25**	**9.52**	**22.86**	**62.80**	**1.86**	**1.43**
T_3	3.56	9.56	22.15	62.65	2.32	1.85
T_4	3.98	9.62	21.30	62.42	2.16	2.02
SE	0.23	0.18	0.09	0.11	0.07	0.03
CD@5%	0.61	0.51	0.24	0.32	0.18	0.08

* as suggested in Table 2.

Table-7 Effect of different levels of *Evolvulus alsinoides* powder on micro-nutrient of cookies

Treatments*	Calcium mg/100g	Phosphorous mg/100g	Iron mg/100g	Calorific value (kcal)
T_0	28.12	178	1.12	506.76
T_1	29.23	265	1.23	502.18
T_2	**30.12**	**320**	**1.35**	**496.22**
T_3	30.48	352	1.41	493.05
T_4	30.65	371	1.46	491.43
SE	0.823	2.673	0.046	0.216
CD@5%	2.531	4.958	0.135	0.034

* as suggested in Table 2.

The results (Table 7) revealed that with increased level of *Evolvulus alsinoides* powder in cookies, there was increase in calcium, phosphorous and iron content of cookies with decrease in calorific value of cookies. The calcium content of cookies increased from 28.12 to 30.65, phosphorous content increased from 178 to 371, iron content was increased from 1.12 to 1.46 and calorific value decreased from 506.76 to 491.43 with increased level of *Evolvulus alsinoides* powder in cookies. Results showed that higher amount of *Evolvulus alsinoides* powder substituted into formulation resulted in increased minerals content in cookies in accordance with the findings of Uthumporn *et al.,* (2015), Hai-Jung Chung (2007) and Pinki and Awasthi (2014). Overall, it can be concluded that the substitution of wheat flour with *Evolvulus alsinoides* powder up to 10% into the fomulation of cookies enhanced the nutritional value of cookies.

IV. CONCLUSION

Evolvulus alsinoides is used in traditional medicine in East Asia, India, Africa and Philippines to cure fever, cough, cold, venereal diseases, adenitis and dementia. It has also reported in the treatment of neurodegenerative diseases, asthma and amnesia. It contain bioactive principles that may be of benefit in the treatment of various diseases. In this study, it was found out that *Evolvulus alsinoides* powder could potentially be used as ingredients in the production of some functional foods for human consumption through enhancing the

nutritional value of several food products. The results show that *Evolvulus alsinoides* powder are excellent sources of dietary fibre and it have many phytochemicals may therefore serve as important constituents of functional foods. It has the potential to reduce depression and useful for the treatment of hypertension. This value added cookies might increase the consumption rate of *Evolvulus alsinoides* plants among the people. This idea could also open new entrepreneurship business challenge in food processing field for small and medium enterprise.

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