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Effect of sun drying on Phytochemical and Anti-nutritional properties of Herbs and incorporated in the extruded ready to consume Food product

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Abstract

Background: Food is necessary for every human to lead a healthy life. The medicinal herbs are used in the present study. *Cardiospermum Halicacabum Linn.(Sapindaceae), Hydrocotyle vulgaris, Genus menta* all the three herbs were sun dried and then powdered to incorporate in convenient food products. The herb powders were dried under sun and then powdered. Nutrient analysis, toxicity and self-life assessment were done in that sun dried herb. Sun dried herb was incorporated in convenient food product and sensory analysis done by 30 semi trained panel members. In that best product were chosen for aluminium paper packaging. The sun-dried herb: nutrient, toxicity and self-life assessment were done. The sun-dried herb powder incorporated in convenient foods like **extruded food**-Sevai, noodles, **bakery food**- rusk, bread, **ready to eat/cook food**- vegetable soup mix, idly powder. All these prepared products were sensory evaluated and then variation 2 (10g) was chosen as best product by panel members**. conclusion:** The present study shows that sun dried herbs content nutrient is high and it is cost effective too in India.

Key words : herbs, convenient food, extruded food, bakery food, ready to eat/cook food.

Food is a human necessity. The health and wellbeing of a nation depends on the ready availability of quality of food at affordable price.The medicinal plant or a part of plant used for cooking and medicinal use on account of its flavour or therapeutic properties. [4]Herbs

are used for both medicinal and culinary purposes in the traditional way. In many delicious cuisines, dietary herbs are used to increase the taste, flavour of the food.[8] Recent years have seen dramatic growth in the consumption of natural foods and dietary supplements, 85 per cent of traditional medicinal products are derived from plants due to growing dissatisfaction with modern medicines and increased consumer interest in healthy living.[7] Three herbs were used *Cardio-spermum halicacabum* Linn. *(Sapindaceae),* Balloon Vine is an annual or Sometimes Perennial Climber, Commonly Found as an weed throughout India.[1] *Cardiospermum halicacabum* Linn. The phytotoxic analysis of leaf material indicated that the presence of phenolic compounds has an antimicrobial effect on plant materials.[12] *Hydrocotyle vulgaris* commonly known as marsh pennywort is a creeping mat forming plant of wet areas such as fens and bogs. Several species under genus Hydrocotyle possess mild diuretic, anti-rheumatic, dermatological, peripheral vasodilator and vulnerary properties.[11] *Genus menta* belonging to the family of lamiaceae, whose plants are among the most aromatic and spread in diverse environments worldwide, having simple, characteristic leaves with pleasant scent. It will grow 10- 120cm tall and can spread over an in determined sized area.[9] Herbs were sun dried and drying is the most common method of storing medicinal and aromatic plants and protecting their biochemical compounds. Drying the food product under natural sunny conditions is called as sun drying. No energy is required for then drying process. To practice sun drying of foods, hot days are desirable with minimum temperatures of 35°C with low humidity.[3] The leaves and stems from these plants have been used in Tamil cuisine (India) for preparing curries, lentil crepes, decoctions, sauces, herbs purees and vegetable soups as part of a healthy diet.[5] The Tender Young Shoots/ are used as a Vegetable, Fodder, Diuretic, Stomachic and Rubefacient.[15] In the current situations, innovation in form, texture, colour and content of extruded products has taken place due to growing demand for raw materials with functional features which is driven by evolving lifestyles and preferences.[13]Food extrusion is one of the emerging technologies in food industries to process and market a large number of products with varying size, shape, texture, and taste.[10] As convenient alternative ready to eat/ cook products have recently captured a sizable portion in food industry.[2] Evaluation of the safety of a food may involve tests for the pathogens or toxins of concern. Microbial testing of food involves the quality and safety analysis of the food samples. Microbiological criteria to monitor the potential shelf life of perishable foods. Quality of food as perceived by the consumer can be described as a value related ton flavour, colour and texture.[14] packaging is a science and technology of enclosing or protecting products from distribution and also refers to the process of designing, evaluating and producing packages.[6]

Objective :

- Infusion of underutilized green leaves in bakery, extruded and conventional food products.
- Formulation of products by substituting the major ingredients with the greens powder.
- To estimate the nutrient content and self-life of prepared various recipes.

In ancient civilization plants are used to treat common ailments and even life-threatening diseases. Natural plant -based remedies are used for the both acute and chronic health problems. Plant medicine is used as most widely because due to less or no side effects.[16]

Based on research sun drying and hot air oven drying methodsare selected. The herbs (Balloon Vine (*Cardiospermum halicacabum*), Neer Vallarai (*Hydrocotyle vulgaris* L), Mint (*Mentha spicata*) are dehydrated by sun, hot air oven and then powdered.

Nutrient analysis done such as calcium, crude fibre, phosphorus, vitamin C, moisture content and one of the anti-nutritional property nitrates were analysed. Toxicity of the herb powder was done to find out the consumption level of the herbs powder. The analysis did to find out the presence of lead, nickel, copper and zinc toxicity were assessed. Self- life of the herb powder was analysed. Microbial count was assessed to find out stability of sun dried herb powders.

The powdered herbs are incorporated in convenient products (vegetable soup mix, idly powder, bread, rusk, Sevai noodles). In all products herb powder were incorporated as 5g, 10g, 15g.

All prepared product were assessed in sense by 30 semi trained panel members.

The fresh raw herbs were selected and collected in home garden and then cleaned in fresh water than dehydrated by using three methods sun dried to a residual moisture content below 10 percent.

Samples	Drying Days
Balloon Vine (*Cardiospermum halicacabum)*	2
Neer Vallarai *(Hydrocotyle vulgaris* L.*)*	3
Mint *(Mentha spicata)*	1

Nutrient content :

Balloon Vine (*Cardiospermum halicacabum),* Neer Vallarai *(Hydro-cotyle vulgaris* L.*),* Mint *(Mentha spicata)* was sun dried and hot air oven dried evenly and then all the herbs were grounded finely and then sieved, 35g taken in each herb than mixed together and nutritive value was assessed for 100g. the nutrient content of the sun-dried herbs on net basis per 100g given in a table.

Nutritive Value of Herbs

Sno	Parameters	Test Method	Unit	Sun Dried
1.	Moisture	Fssai/ Aoac/ Is	g/100g	10.83
2.	Crude fiber		g/100g	1.1
3.	Vitamin C		mg/100g	337
4.	Calcium		mg/100g	1595
5.	Phosphorous		mg/100g	6.75
6.	Nitrate		mg/100g	54.19

The nutrient content in prepared Sun-dried herbs (100g) moisture content is 10.83g, crude fibre 1.1g, vitamin C 337mg, Calcium 1595mg, phosphorous 6.75mg, nitrate 54.19mg respectively.

Toxicity and Self Life Assessment of Sun-Dried Herbs :

All Sun dried; three herbs powder evenly taken and mixed together and toxicity and total plate count were assessed on net basis 100g given in the table below.

Toxicity And Self Life Assessment of Herbs

Sno	Parameters	Test Method	Unit	Sun Drying
1.	Lead	Fssai/ Aoac/ Is	mg/100g	3.71
2.	Nickel		mg/100g	2.21
3.	Copper		mg/100g	2.57
4.	Zinc		mg/100g	4.49
Microbial Analysis				
5.	Total plate count	IS5402:2012	Cfu/g	39

The toxicity and self-life of the prepared sun-dried herbs (100g) lead 3.71mg, nickel 2.21mg, copper 2.57mg, zinc 4.49mg and total plate count is 39cfu/g below 40cfg/g consider as good quality respectively.

Ethical aspects :

The Institutional Human Ethical Committee (IHEC) at Avinashilingam Institute reviews and approves research involving human participants. The IHEC ensures that research proposals involving humans adhere to ethical standards, including obtaining informed consent.

Sensory scores :

The sun-dried herbs powder was

Analysis Variance of Sun-Dried Herb Powders

Sun Dried	Grams	Mean Value	Sd	F Value	Sig	Rem
Idly Powder	5g	7.9	0.84	122.71	0.00	Significant
	10g	7.7	0.70			
	15g	5.63	0.85			
Veg Soup Mix	5g	7.5	0.73	149.21	0.00	Significant
	10g	8.1	0.59			
	15g	5.8	0.73			
Bread	5g	8.166	0.79	60.64	0.00	Significant
	10g	8.56	0.50			
	15g	7.06	0.69			
Rusk	5g	8.16	0.79	165.79	0.00	Significant
	10g	8.56	0.50			
	15g	5.86	0.73			
Noodles	5g	8.13	0.86	54.75	0.00	Significant
	10g	8.53	0.50			
	15g	7.1	0.66			
Sevai	5g	8.16	0.87	61.91	0.00	Significant
	10g	8.43	0.50			
	15g	6.4	1.19			

SD- standard deviation* F – calculating value* SIG- significance value*

chosen for the formulation of convenient products. The formulated products were subjected to sensory evaluation for this acceptability. The mean score obtained for the standard 5g, 10g, 15g herbs powder incorporated in convenient products were assessed. Using 9 point hedonic scale the variations were subjected to sensory evaluation and the best product was selected.

The overall mean score of idly powder incorporated sun-dried herb powder 5g was 7.9 ± 0.8, 10 g was 7.7 ± 0.7, 15g was 5.63 ± 0.8.

When calculated the mean score for vegetable soup mix incorporated with 5g, 10g, 15g of sun-dried herb powder; mean score was 7.5± 0.7, 8.1±0.5, 5.8±0.7.

When considering the mean score of bread incorporated with sun dried herb powder, it was revealed that the mean score was 8.1±0.5, 8.5±0.5, 7.0±0.6 at 5g, 10g, 15g of incorporation.

On incorporation of sun-dried herb powder in rusk; the mean sensory score of 5g, 10g, 15g was 8.1±0.7,8.5±0.5,5.86±0.7.

Sun dried herb powder incorporated in noodles; the mean score was 8.1±0.8 of 5g, 8.5±0.5 of 10, 7.1±0.6 of 15g.

On incorporation of 5g, 10g, 15g of sun-dried herb powder the mean sensory score for Sevai was 8.1±0.8, 8.43±0.5, 6.4 ±1.19.

It was found that there is a significant level within and between the group by using ANOVA technique in aspects of convenient food items. To find out which group significance from other post HOC test is applied to find out which is still more accepted and it was noted that 10g level of incorporation is most accepted proportion in all the convenient food product.

Table
Post Hoc Test Of Sun-Dried Herb Powders

Sun Dried	Grams	Grams	Hsd	Significance	Remark
Idly Powder	5g	S2=9.00 S1=7.90	1.10	0.00	Significant
	10g	S2=9.00 S3=5.63	3.37	0.00	
	15g	S1=7.90 S3=5.63	2.27	0.00	
Veg Soup Mix	5g	S1=7.50 S2=8.17	0.67	0.00	Significant
	10g	S1= 7.50 S3=5.87	1.63	0.00	
	15g	S2=8.17 S3=5.87	2.30	0.00	
Bread	5g	S1=8.17 S2=8.57	0.40	0.04	Significant

	10g	S1=8.17 S3=7.07	1.10	0.00	
	15g	S2=8.57 S3=7.07	1.50	0.00	
Rusk	5g	S1=8.17 S2=8.57	0.40	0.05	Significant
	10g	S1=8.17 S3=5.87	2.30	0.00	
	15g	S2=8.57 S3=5.87	2.70	0.00	
Noodles	5g	S1=8.13 S2=8.53	0.40	0.05	Significant
	10g	S1=8.13 S3=7.10	1.03	0.00	
	15g	S2=8.53 S3=7.10	1.43	0.00	
Sevai	5g	S1=8.17 S2=9.00	0.83	0.00	Significant
	10g	S1=8.17 S3=6.40	1.77	0.00	
	15g	S2=9.00 S3=6.47	2.60	0.00	

***S1-5g, S2-10g, S3-15g, Hsd- Honesty Significant Difference**

While comparing 5g, 10g, 15g of sun-dried herb powder idly powder, vegetable soup mix, bread, rusk, noodles, Sevai in that 10 g of sun-dried herb powder idly powder, vegetable soup mix, bread, rusk, noodles, Sevai was overall acceptable by the 30 semi trained panel members.

The present study shows that sun dried herbs content nutrient as high and it is cost effective too in India. The mean overall acceptability of sensory score in evaluation of sun-dried herbs powder of idly powder, vegetable soup mix, bread, Rusk, noodles, Sevai was subject to ANOVA and POST HOG TEST to interpret the significant difference between sensory scores of convenient foods and also between different level of incorporations. Variation 2, 10 percent of sun-dried herbs powder incorporated in idly powder, vegetable soup mix, bread, Rusk, noodles, Sevai was highly acceptable when compared with other variations in all the convenient food.

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