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Development and sensory evaluation of drumstick leaves powder (*Moringa oleifera* L.)

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Drumstick leaves (*Moringa oleifera*) was studied to develop technology for its powder to study the sensory evaluation of developed powder. Washed leaves were dried separately in mechanical tray drier, solar tray drier, open sun light and shade drying. The organoleptic evaluation of drumstick leaves powder samples revealed shade dried was best acceptable, hence was selected for further investigation.

Key Words : Drumstick, Drying, Leaves, *Moringa oleifera*

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INTRODUCTION

Green leafy vegetables offer a cheap but rich source of a number of micronutrients and other phytochemicals having antioxidant properties. Green vegetables are one of most important and vital ingredient that we need to include in our diet. The most popular ones being spinach, drumstick leaves, amaranth, gogu, fenugreek, mint etc. (Singh *et al.*, 2001). *Moringa oleifera* leaves have been used successfully in its dried state or powdered form to augment and make delicious meals and porridge diets for pregnant expectant mothers, nursing mothers, infants and young children as well as adults of all age groups (Duke, 1982). Therefore, it is necessary to increase the utilization of *Moringa* leaves consumption by the different communities. It should be consumed either fresh or dry (Mishra *et al.*, 2012).

Presently in India drumstick is being cultivated in area of 38000 ha. with annual vegetable pod production of 1.10-1.30 million tonnes. Andhra Pradesh (15665 ha) leads in area and production followed by Karnataka (10258ha) and Tamil Nadu (7408 ha) (Savitha *et al.*, 2014). Joshi and Mehta (2010) concludeda study with the objective to assess the effect of different methods of drying (sun, shade and oven drying) on the nutritive value of the selected leaf with its fresh counterparts. The results showed significant increase in all the nutrients in the dried samples of the leaves making them a concentrated source of nutrients. Shade dried samples had highest nutrient retention followed by sun dried and oven dried samples but the difference was not statistically significant.

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METHODOLOGY

Procurement of drumstick leaves :

Selection of drumstick leaves :

Drumstick leaves were procured from orchard of Swami Keshwanand Rajasthan Agricultural University, Bikaner for present investigation.

Cleaning and sorting of drumstick leaves :

The damage leaves were discarded. Drumstick leaves were washed with tap water to remove dust, dirt

and other adhering impurities.

Dehydration of leaves :

Standardization of drying method for drumstick leaves were carried out using standard methods of drying (CFTRI, 1996).

Method used for drying :

Drumstick leaves were dried by using different methods *i.e.* sun drying, shade drying, solar tray drying and oven drying. Method of drying conditions was standardized before conducting the experiment.

Drying was carried out in following manner.

Sun drying :

Washed leaves were spread singly on a clean and dry muslin cloth placed on clean cemented floor under sun shine. Drying process was continued till the weight of sample remained constant. The minimum and maximum day temperature ranged from 22- 30º C during month January. The leaves were completely dried in 14-16 hours (Fig. A).

Shade drying :

Washed leaves were dried under the shade on a clean and dry muslin cloth placed on the cemented floor till the weight of the samples remained constant. The temperature of the drying ranged from 18-20º C. The leaves were completely dried in 24-28 hours.

Solar tray drying :

Washed drumstick leaves were loaded uniformly in a tray and kept for dehydration in the drier. The tray had to be changed in relation from lower shelf to the upper one in order to ensure uniform drying of the entire mass and to avoid burning of the lower one due to excessive heat. The temperature of the solar drying is 5-7ºC higher than normal day temperature. The leaves were completely dried in 10-12 hours.

Oven drying :

Drumstick leaves were spread on the trays and kept for dehydration in the oven. The tray had to be changed in relation for lower shelf to upper one in order to ensure uniform drying of the entire mass and to avoid burning of the lower one due to excessive heat. The temperature of the drying ranged from 50-55º C. The leaves were completely dried in 5-6 hours.

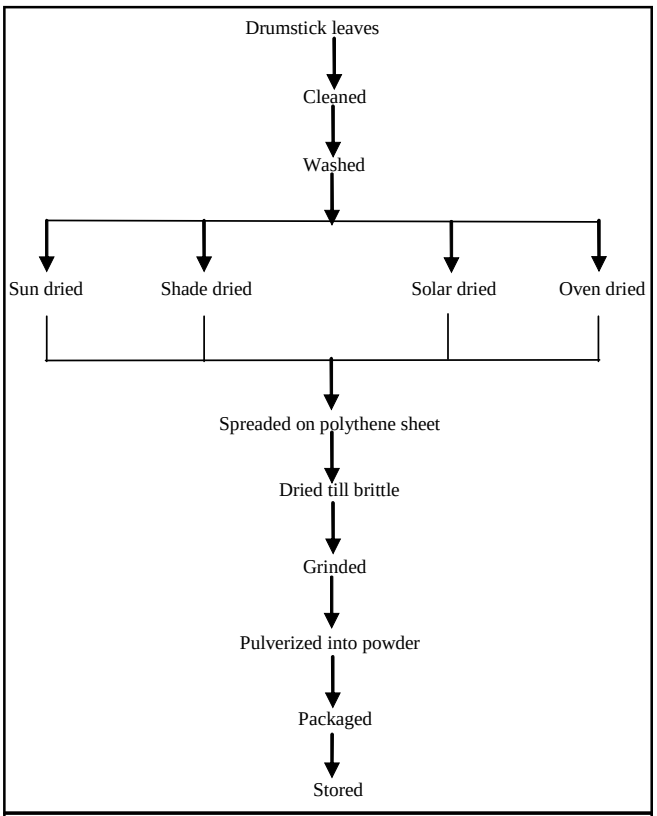

Fig. A : Flow diagrame of preparation of drumstick leaves powder

Organoleptic evaluation of developed raw material powders :

Standardization of the developed powders (Sun, Shade, Solar and Oven) was carried out thorough organoleptic evaluation. The developed powders evaluated for their sensory characteristics like colour, aroma, texture and overall acceptability by selected panel of ten semi trained panel members.

Selection of panel members :

Threshold test was used for selection of the panel member (Potter, 1987). Convenience, experience, knowledge, willingness, interest and sincerity were the criteria for consideration of panel members. Ten members were enlisted in the panel comprised of staff members of the College of Home Science, SKRAU, Bikaner.

Preparation of score card :

Score card was developed for assessing acceptability

of powders on the basis of certain qualities looked for in food preparation such as appearance, colour, aroma, texture and overall acceptability. Six- point hedonic ranking scale was provided to the judges for scoring as suggested by Ranganna (1986).

Organoleptic evaluation of developed powders :

The developed powder was served to the panellist separately in similar container with different codes for their sensory evaluation. Care was taken to conduct the evaluation in an undisturbed environment because it may distract or influence the judgement of panel members.

Statistical analysis :

The data of the organoleptic acceptability, nutritional assessment and shelf-life study was statistically analyzed to find out significance of the results (Chandel, 1997).

The results are expressed as mean ± SD. The obtained data statistically analyzed by using SPSS statistics (Ver. 20) software.

OBSERVATIONS AND ASSESSMENT

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Organoleptic evaluation of developed drumstick leaves powder :

Selected drumstick leaves were dried using sun drying, shade drying, solar drying and oven drying. The developed powders were evaluated for sensory characteristics by a panel of 10 semi-trained judges using six- point hedonic ranking scale. Score awarded to the individual sensory attributes by panellists are presented in Table 1.

Colour :

Mean scores for colour of shade dried powder was found superior (5.2) when compared to sun dried (4.8), oven dried (5.1) and solar dried (4.9) powders (Table 1). Scores obtained by colour of powder prepared by shade and oven drying method were found in the category of "liked very much" whereas sun and solar dried powder "liked moderately" by panel members.

Aroma :

Table 1 depicted the mean score of aroma secured by powders after various treatments and unrolled that shade dried powder secured 5.4, followed by sun dried (5.3), oven dried (4.3) and solar dried (5.0) powders.

Texture :

Table 1 reported that shade dried powder obtained 5.3 mean score for texture whereas sun, oven and solar dried powder obtained 5.2, 5.0 and 5.1 mean score, respectively. It was observed that shade dried powder secured higher mean score followed by sun, solar and oven drying.

Overall acceptability :

Table 1 presented shade dried sample rated highest mean score (5.3) for overall acceptability while lowest scores recorded by oven dried powder (4.9). Sun drying (5.2) and solar drying (5.0) secured closer values. Mean overall acceptability score found in the category of "liked very much" by the panel members.

Hence, among all dried powder the shade dried powder was selected for further study. Similarly, Joshi and Mehta (2010) assess the effect of different methods of drying (sun, shade and oven) on the nutritive value of leaves with its fresh counterparts and concluded that shade dried sample had highest nutrient retention followed by sun dried and oven dried samples.

Conclusion:

Samples of drumstick leaves were dried in oven drier, solar tray drier, open sun and shade drier separately. The mechanical drying of drumstick leaves required less time

Table 1 : Organoleptic acceptability of drumstick leaves powder

Sr. No.	Powders	Mean score of sensory characteristics on nine point hedonic ranking scale			
		Colour	Aroma	Texture	Overall acceptability
1.	Sun dried	4.8±1.135	5.3±0.674	5.2±0.918	5.2±0.788
2.	Shade dried	5.2±0.918	5.4±0.516	5.3±0.823	5.3±0.823
3.	Oven dried	5.1±0.737	4.3±1.251	5.0±0.942	4.9±0.875
4.	Solar dried	4.9±0.567	5.0±0.666	5.1±0.994	5.0±0.666

Values are mean ±SD of ten penalists

for drying (5-6 hrs) followed by solar drying (10-12 hrs), open sun drying (14-16 hrs) and shade drying (24-28 hrs). Shade dried sample rated highest mean scores (5.3) for overall acceptability while lowest scores recorded by oven dried powder (4.9). Sun dried (5.2) and solar dried (5.0) secured closer values.

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