International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2015): 78.96 | Impact Factor (2015): 6.391

Effect of Drying Methods on Ash Contents and Moisture Content of Leafy Vegetables

Manisha Sonkamble[1], Narayan Pandhure[2]

Department of Botany, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad-431001

Abstract: ***Green vegetables are packed with healthy nutrients such as Vitamins A, C, E and K. They are good source of micronutrient. Nutrients could be retained from these vegetables depending upon their keeping quality. Secondly ash content from vegetables is a measure of the total amount of minerals present within it, whereas the mineral content is a measure of the amount of specific inorganic components present within vegetables such as Ca, Na, K and Cl. During the present piece of work, vegetables such as Spinach, Radish, Chuka, Cowpea and Gawar were taken. These vegetables were dehydrated by sun drying, oven drying and shade drying. These vegetables were turned into ash and ash content was recorded. Result indicates that, shade drying is more effective method than sun drying and oven drying.***

Keywords: Ash content, Sun drying, Oven drying, Shade drying, Leafy vegetables

1. Introduction

Vegetables are rich and comparatively cheaper source of vitamins. Consumption of these items provides taste, palatability, increases appetite and provides fiber for digestion and to prevent constipation. Leafy vegetables to the important value of major source of vitamin and minerals to the balanced diet. (Seidu ,2012) . The knowledge on different phytochemical presence and its content in these vegetables is important for an appropriate choice of products according to the physiological needs. Phytochemicals are a large group of plant derived compounds, the plant`s way of protecting itself. In addition they appear to have significant physiological effects in the human body. There are more than thousand known phytochemicals (Mara Duma , 2014). The ash content is a measure of the total amount of minerals present within a vegetable, whereas the mineral content is a measure of the amount of specific inorganic components present within a food, such as Ca, Na, K and Cl. Determination of the ash and mineral content of vegetables is important for a number of reasons:

a) **Nutritional labeling:** The concentration and type of minerals present must often be stipulated on the label of a vegetables.
b) **Quality:** The quality of many vegetables depends on the concentration and type of minerals they contain, including their taste, appearance, texture and stability.
c) **Microbiological stability:** High mineral contents are sometimes used to retard the growth of certain microorganisms.
d) **Nutrition:** Some minerals are essential to a healthy diet (e.g., calcium, phosphorous, potassium and sodium) whereas others can be toxic (e.g., lead, mercury, cadmium and aluminum).
e) **Processing:** It is often important to know the mineral content of foods during processing because this affects the physicochemical properties of vegetable and foods.

Different drying methods affect on the stability of phytochemicals and other nutrient composition of the dried green leafy vegetable. This research is therefore focused on the effect of drying techniques such as oven drying, sun drying and shade drying on the proximate and mineral composition of *Spinacia oleracea* (spinach), *Raphanus sativus* (Raddish), *Rumex vesicarius* , (Chuka), *Vigna unguiculata* (cowpea and *Cyamopsis tetragonoloba* (Guar). (Emelike , 2016).

2. Materials and methods

a) Sample collection: Fresh samples of *Spinacia oleracea* (spinach), *Raphanus sativus* (Raddish), *Rumex vesicarius*, (Chuka), *Vigna unguiculata* (cowpea) and *Cyamopsis tetragonoloba* (Guar). were purchased from a local market in Begumpura, Aurangabad.

b) Sample preparation: Samples of *Spinacia oleracea* (spinach), *Raphanus sativus* (Raddish), *Rumex vesicarius*, (Chuka),*Vigna unguiculata* (cowpea) and *Cyamopsis tetragonoloba* (Guar) were thoroughly washed with clean tap water. The moisture content of the samples was determined. These samples were dried in shade, Oven and Sun and finely fine powder was prepared which was used for further analysis.

1. **Sun Drying:** - 200 gms of each vegetable samples were used for the experiment. The fresh leafy vegetables were washed and evenly spread on a tray and left to dry in the sun for at least seven hours per day for four days until the vegetables were brittle and considered to be dry.
2. **Oven drying:** - 200 gms of each samples were washed in ordinary tap water. The vegetables were oven dried at 65°c until properly dried.
3. **Shade drying:-** 200gms of each samples were washed in tap water. Shade drying in enclosed Cabinet drier which protect the drying vegetables from the direct sunlight is also practiced.
4. **Physico-chemical Analysis:-** The parameter studied were total ash, Acid insoluble ash (AIA) and Acid soluble ash (ASA).
5. **Total Ash**:- Place about 2 to 4 gms of Plant material ,accurately weighted ,taken in a silica crucible .spread the material in an even layer and crucible keep in muffle furnace allow the temperature to each 600°c and constant for 2 hours ,until it is white ,indicating the absence of carbon cool in desiccators and weight .Ash can be Calculated by using formula ,

$$\text{Ash value (\%)} = \frac{\text{Weight of Ash}}{\text{Weight of sample}} \text{x } 100$$

6. **Acid Insoluble ash:-** The total ash obtained was boiled with 50 ml of 5N HCL for 5-10 minutes and the insoluble matter was collected on ash less filter paper and was washed with hot water ,ignited ,cooled in a desiccators and weighed. Percentage of AIA was calculated with reference to the dried samples.

$$\text{Acid Insoluble Ash value (\%)} = \frac{\text{Weight of Acid insoluble Ash}}{\text{Weight of sample}} \text{x } 100$$

7. **Acid Soluble ash:-** The total ash obtained was boiled with 50 ml of 5N HCL for 5-10 minutes and the insoluble matter was collected on ash less filter paper and was washed with hot water ,ignited ,cooled in a desiccators and weighed. Percentage of AIA was calculated with reference to the dried samples.

$$\text{Acid soluble Ash value (\%)} = \frac{\text{Weight of Acid soluble Ash}}{\text{Weight of sample}} \text{x } 100$$

3. Experimental Results

Three drying methods were employed which significantly affected the proximate composition of moisture content, total ash, acid Insoluble ash and acid soluble ash (Table, 1, 2, 3). Effect of drying methods on moisture content of five leafy vegetable samples i.e. Spinach, Radish, Chuka, Cow pea and Guar were studied using different drying methods. Among the three drying techniques, sun and oven drying had no significant effect on Ash and moisture content of the dried leaves. Shade dried sample had higher ash and moisture content.

Table 1: Effect of Sun drying on nutritional quality of vegetables

Sr. No.	Name of Vegetable	Fresh weight	Dry weight	Moisture content	Total ash	Acid insoluble ash	Acid soluble ash
1	*Spinacia oleracea*	200	21.19	7.06	8.38	1.12	12.40
2	*Raphanus sativus*	200	18.18	6.05	10.89	2.11	8.77
3	*Rumex vesicarius*	200	14.15	4.71	5.28	0.39	4.88
4	*Vigna unguiculata*	200	19.88	6.62	11.22	1.48	9.73
5	*cyasmopsis tetragonoloba*	200	18.69	6.23	3.96	0.62	3.33

Table 2: Effect of oven drying on nutritional quality of vegetables

Sr. No.	Name of Vegetable	Fresh weight	Dry weight	Moisture content	Total ash	Acid insoluble ash	Acid soluble ash
1	*Spinacia oleracea*	200	13.59	6.79	18.5	2.35	16.15
2	*Raphanus sativus*	200	18.45	9.22	18	3.35	14.65
3	*Rumex vesicarius*	200	22.35	11.17	17	1.5	15.5
4	*Vigna unguiculata*	200	20.65	10.32	6.5	2.45	4.05
5	*cyasmopsis tetragonoloba*	200	15.35	7.67	7	1	6

Table 3: Effect of shade drying on nutritional quality of vegetables

Sr. No.	Name of Vegetable	Fresh weight	Dry weight	Moisture content	Total ash	Acid insoluble ash	Acid soluble ash
1	*Spinacia oleracea*	200	24.98	12.49	24.5	4.55	19.95
2	*Raphanus sativus*	200	19.22	9.61	16	1.3	14.7
3	*Rumex vesicarius*	200	14.65	7.32	18	1.85	16.15
4	*Vigna unguiculata*	200	17.27	8.63	7.5	4.8	2.7
5	*cyasmopsis tetragonoloba*	200	14.88	7.44	7.5	1.25	6.25

The value for moisture content ranged from 12.49%, 9.61%, 7.32%, 8.63% and 7.44%. The highest value was observed from the sample which was shade dried.

The observed moisture value reported here from oven dried were 6.79%, 9.22%, 11.17%, 10.32% and 7.67% which were low in moisture content. From Sun dried samples moisture content recorded was 7.06 %, 6.05 %, 4.71%, 6.62% and 6.23% and equally low compared to dried vegetables. Ash content recorded was 24.5%, 16%, 18%, 7.5% and 7.5%. The highest recorded value was from shade dried sample. This is high compare to ash content of spinach leaves. Ash content of oven dried samples recorded was 18.5%, 18%, 17%, 6.5 &7 %. and Sun dried samples was 8.38%, 10.89% ,5.28% , 11.22% and 3.96 %. From the above observations it could be concluded that, variation in reading is due to location where vegetables grow, variety, soil type and temperature at which the leaves were dried. Loss in moisture value of dried leaves increased ash content nutrient density. It could also concluded that, the moisture and ash content of the dried leaves was reported here high compare to Shade dried, Oven dried and sun dried samples. Similar results were recorded using different vegetables (Iheanacho et.al 2009).

4. Conclusion

Different vegetables are considered as sources of human health promoting components. Leaf vegetables are widely used in human diet; they are low in calories and fat, but high in dietary fibers, content of minerals, such as iron and calcium and very high in phytochemicals such as vitamin C, carotenoids, lutein and others. On the one hand phytochemicals are a plant's way of protecting itself. Preservation techniques such as drying are helpful to retain the nutrients from leafy vegetables. During present

investigations among the three drying techniques studied, shade drying was effective in increasing the moisture of the vegetables. The moisture and ash content of the dried leaves was reported high compare to Shade dried, Oven dried and sun dried samples. On the other hand they have beneficial effect on human health.

5. Acknowledgement

Authors are thankful to University Grants Commission for financial assistance in the form of RGST to carry out the research. Secondly authors are also thankful to Head, Department of Botany, DR. Babasaheb Ambedkar Marathwada University, Aurangabad for providing laboratory facilities.

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