www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(1): 356-360

www.thepharmajournal.com
Received: 18-10-2022
Accepted: 20-11-2022

Pawar SA
Department of Food Business Management, College of Food Technology VNMKV Parbhani Maharashtra, India

More DR
Department of Food Business Management, College of Food Technology VNMKV Parbhani Maharashtra, India

Shelke KA
Department of Food Business Management, College of Food Technology VNMKV Parbhani Maharashtra, India

Kale PR
Department of Food Business Management, College of Food Technology VNMKV Parbhani Maharashtra, India

Corresponding Author:
Pawar SA
Department of Food Business Management, College of Food Technology VNMKV Parbhani Maharashtra, India

Effects of blanching and drying on nutritional, mineral and colour properties of Tarota (*Cassia tora*)

Pawar SA, More DR, Shelke KA and Kale PR

DOI: https://doi.org/10.22271/tpi.2023.v12.i1d.18009

Abstract
In the present investigation efforts had been taken to evaluate the effects of different blanching techniques and drying methods in combination to obtain powder from unexploited green leafy vegetable *viz*., tarota (*Cassia tora*). Blanching and drying methods used in combination were: hot water blanching, sodium carbonate (1%) and magnesium oxide (1%) blanching in combination with sun drying, shade drying and cabinet drying. It was found that tarota treated with 1% magnesium oxide solution blanching and cabinet drying reported higher retention of colour characteristics, nutritional content specially protein, fibre and ash content. There was also higher retention of minerals with respect to calcium, iron ad zinc in vegetable powder treated with magnesium oxide blanching and cabinet drying.

Keywords: Blanching and drying methods

Introduction
Hunger is one of today's most important problems, and using wild edible plants is one of the potential answers. The term "wild edible plants" (WEPs) describes plant species that are not domesticated or grown but can be found in a variety of natural habitats and are used for food. WEPs are often collected by various cultures around the world from a variety of habitats, including forests, arable land, and even anthropogenically degraded areas like roadsides and wastelands. Many ethnic groups and local populations living in developing nations rely heavily on wild flora for subsistence and way of life. Despite the fact that agricultural crops are the mainstay of the majority of cultures, the custom of using WEPs has not yet disappeared. A report from the Food and Agricultural Organization (FAO) estimates that at least one billion people consume wild food. WEPs are crucial to the fight against poverty, ensuring food security, diversifying agriculture, generating income sources, and reducing malnutrition (Bhatia *et al*., 2018) [3].

Green leafy vegetables (GLVs) were crucial to the food supply since they contain enough vitamins and minerals for humans. Ascorbic acid, carotenoids, riboflavin, folic acid, and minerals including calcium, magnesium, and phosphorus are all abundant in these. There are a variety of neglected green vegetables with enticing nutritional value found in nature that can satiate an expanding population. The majority of them are adaptable, sturdy, and responsive to unfavourable weather conditions. Unused goods are becoming more important today as a technique to increase the nutritional supply per person (Akubugwo, 2007) [2].

Small annual herbs or underbushes known as *Cassia tora* Linn are widespread weeds in Asian nations. It grows like a weed all over India. The plant that is used in many traditional medicines to treat a wide range of illnesses. The weed is reported to have hepatoprotective, antiproliferative, hypolipidemic, immunostimulatory, anticancer, and antimutagenic properties. Anthraquinones, chrysophanol, emodin, rhein, euphol, basseol, palmatic, isostearic, behenic acid, and other chemicals have all been identified from this plant. The information on the botany, ethnopharmacology, phytochemistry, biological activity, and toxicity of the *Cassia tora* plant is summarised in the review that is being presented (Niranjan *et al*., 2010) [7].

A semi-wild annual herb known as *Cassia tora* Linn. (Caesalpinaceae) is widely cultivated throughout south-east Asia, including India, Northern Australia, and the Americas. This plant species is well known for having potential in conventional medical treatments for a range of problems and illnesses, from minor coughs to diabetes and hypertension. Recent scientific research has revealed the phytochemical and biological potential of this substance. The therapeutic value of C. tora has been established due to its antibacterial, antioxidative, antihypertensive, antidiabetic, and antimutagenic properties, to name a few.

This essay provides a thorough analysis of *Cassia tora* L.'s phytochemical and biological properties (Sarwa *et al*., 2012) [11].

The well-known plant *Cassia tora* Linn., member of the Leguminosae family, is found in abundance throughout India and other tropical nations. It thrives in untamed wastelands and is an annual under shrub. The plant's leaves, seeds, and roots are among the parts that are said to have medicinal properties. It is a well-known laxative in traditional medicine and is effective in treating leprosy, ringworm infection, ophthalmology, skin, and liver conditions. This plant has yielded a number of chemical substances, including anthraquinone glycosides, naphthopyrone glycosides, phenolic compounds, flavonoids, etc. (Pawar & D'mello, 2011) [8].

Materials and Methods

1. Physical properties and yield

The physical properties of tarota leaves such as length, width and thickness were determined by using a digital vernier calliper. The weight of leaves determined by stacking 10 leaves and colour was visually determined.

Yield of fresh tarota leaves was determined in percentage by calculating the weight of edible portion and waste portion.

2. Proximate and mineral composition

Estimation of moisture

It was worked out by weighing 5g sample accurately and subjecting to oven drying at 105 °C for 4-6 hrs. Oven dried samples were cooled in desiccator and weighed. The drying was repeated until the constant weights were obtained. The resultant loss in weight was calculated as per cent moisture content. (A.O.A.C., 2000) [1].

$$\text{Moisture (\%)} = \frac{\text{Initial weight} - \text{Final weight}}{\text{Total weight of sample}} \times 100$$

Estimation of crude fat

5 g of ground sample was weighed accurately in thimble and extracted with petroleum ether (60-80 °C) in K plus Soxhlet apparatus for 6-8 h. The resultant ether extract was evaporated and crude fat was calculated (A.O.A.C., 2000) [1].

$$\text{Crude fat (\%)} = \frac{\text{Final weight of flask} - \text{Empty weight of flask}}{\text{Weight of sample}} \times 100$$

Estimation of crude protein

Protein content was determined by Micro-kjeldhal method using 200 mg of sample by digesting the same with concentrated sulfuric acid containing 1 g of catalyst mixture for 2-3 h at 100 °C. Then it was distilled with 40% NaOH and liberated ammonia was trapped in 4% Boric acid and then it was titrated against 0.1N HCl using mixed indicator (Methyl red: Bromocrysol green1: 5) Then % Nitrogen was calculated by formula and % protein was estimated in sample by multiplying with factor 6.25 (A.O.A.C., 2000) [1].

$$\text{\% N} = \frac{\text{(Sample-blank)} \times \text{Normality of Hcl} \times \text{vol. made for distillation} \times 0.014 \times 100}{\text{Aliquot taken for distillation (ml)} \times \text{weight of sample (g)}}$$

$$\text{\% Protein} = \text{\% N} \times 6.25$$

Estimation of total ash

5 g of finely ground sample was weighed in silica crucible and ignited on low flame. Then it was transferred to muffle furnace and heated at 550 °C for 5-6 h for complete oxidation of organic matter and resultant ash content was calculated (A.O.A.C., 2000) [1].

$$\text{Total ash (\%)} = \frac{\text{Weight of crucible with ash} - \text{Weight of empty crucible}}{\text{Weight of sample (g)}} \times 100$$

Determination of carbohydrate content

The sample was accurately weighed (0.5 g) in the test tube and kept for a few minutes in ice water bath followed by the addition of cold H_2SO_4 (72 per cent) with gentle agitation. The viscous paste was combined with distilled water to get final acid concentration of 2 N. This was then refluxed to attain complete hydrolysis at 98 ^{0}C for 3-4 hours. Phenol-H_2SO_4 process estimated the sugar amount using glucose as standard. On spectrophotometer the orange yellow colour was read at 480 nm. The calibrated curve measured the sugar concentration in hydrolysate and quantified the per centage of total sugar in the sample (Ranganna, 2011) [9].

Estimation of crude fibre

About 2-5 g of moisture and fat free sample was weighed into 500 ml beaker and 200 ml boiling 0.25 N (1.25w/v) sulfuric acid was added. The mixture was boiled for 30 min keeping the volume constant by addition of water at frequent intervals. At the end of this period the mixture was filtered through a filter paper and residue was washed with hot water till it becomes free from acid. The material then transferred to the same beaker and 200ml of boiling 0.313N NaOH solution was added. After boiling for 30 min the mixture was filtered through filter paper. The residue was washed with hot water till free from alkali followed with some alcohol. It was then transferred to crucible, dried overnight at 80-100 °C and weighed. The crucible was heated in muffle furnace at 550-600 °C for 2-3 h and cooled and weighed again. The difference in weights represents the wt of crude fiber. (A.O.A.C., 2000) [1].

3. Analysis of minerals

Mineral content of tarota leaves was estimated by method given by Ranganna, (2011) [9].

a) Estimation of phosphorous

Spectrophotometric method was used to determine phosphorus content. With dry ashing, 5 ml of ash solution was collected. In ash solution 5 mL of molybdate reagent was added and mixed. Then 2 ml of a solution of aminonaphthol sulphonic acid was mixed and made volume up to 50 ml. Instead of sample a separate blank was prepared using water. The solutions were expected to stand for 10 minutes and colour was measured at 650 nm by setting the blank transmission to 100 per cent.

$$\text{Phosphorous (mg/100g)} = \frac{\text{mg of phosphorous in aliquot x total volume of ash solution taken for estimation} \times 100}{\text{ml of ash solution taken for estimation x wt. of sample}}$$

b) Estimation of calcium

Calcium was measured with titrimetric method. Aliquot of 25

ml of mineral solution was taken and dissolve in distilled water to make 150 ml final volume. In this solution, add 2-3 drops of methyl red indicator. Strong ammonia has been applied to neutralize the solution that converts pink to gold. The mixture was then permitted to heat for a few minutes, adding 10 ml of ammonium oxalate. Mixture was boiled again for 2 minutes, adding glacial acetic acid until the colour becomes pink. The mixture was held aside in a warm position (overnight) and the supernatant was evaluated with a drop of ammonium oxalate as precipitate settled to verify precipitation was achieved.

Precipitate was filtered with filter paper with Whatman No.4, then washed with warm distilled water. The precipitate was transferred to a beaker by making a hole in the filter paper centre and twice giving H_2SO_4 washings (2 N, 5ml). The solution was then heated to 70 °C and titrated to 1 N/100 $KMnO_4$. Titration endpoint was persistent pink colour. A blank was run at the same time.

1 ml of 0.01N $KMnO_4$ = 0.2004 mg calcium

c) Estimation of iron

Iron content of tarota was determined by using a-a, dipyridyl method AOAC (2000) [1]. Accurately take 10 ml of wet digested wild vegetables sample solution into volumetric flask of 25 ml capacity by pipetting in triplicate. Hydroxylamine hydrochloride solution (1 ml), acetate buffer solution (5 ml) and a-a, dipyridyl solution (2 ml) were added into each volumetric flask. By using distilled water made up the volume to 25 ml and mix the content. The developed color intensity was read in spetronic 20 at 510 nm. Iron content of the digested wild vegetables sample solution was read from the standard curve of known iron concentration.

Standard curve preparation

Take 0.0, 0.5, 1.0, 1.5, 2.0, 3.0 and 4.0 ml of standard solution of iron in to a series of 25 ml volumetric flasks and add to each of them flask accurately 0.2 ml of concentrated hydrochloride solution. Dilute each sample with distilled water to exactly 10 ml, then add chemicals in the same way as for the sample, Plot the quantity of iron in mg against the spectrophotometric absorbance.

$$\text{Iron content} = \frac{\text{Quantity of Fe in aliquot (Calibration curve)}}{\text{Aliquot of ash solution taken}} \times \frac{\text{Total volume of ash solution}}{\text{wt. of the sample}} \times 100$$

d) Estimation of copper and zinc

By using Atomic Absorption Spectrophotometer (AAS) from the department of Soil Science and Agricultural Chemistry, College of Agriculture, VNMKV, Parbhani examined the copper, manganese and zinc.

Nutritional Composition of Fresh Dried Tarota Leaves

The blanching and drying of fresh tarota vegetable were done by hot water, 1 per cent sodium bicarbonate solution, and 1 per cent magnesium oxide solution. The data pertaining the impact of blanching and drying on nutritional composition of fresh leafy green vegetables are summarized in Table 1.1.

(Blanching Hot water + sun drying) Tarota (H_1T_1)
(Blanching Hot water + shade drying) Tarota (H_1T_2)
(Blanching Hot water + cabinet drying) Tarota (H_1T_3)
(Blanching $NaHCO_3$ water 1% + sun drying) Tarota (S_1T_1)
(Blanching $NaHCO_3$ water 1% + shade drying) Tarota (S_1T_2)
(Blanching $NaHCO_3$ water 1% + cabinet drying) Tarota (S_1T_3)
(Blanching MgO water 1% + sun drying) Tarota (M_1T_1)
(Blanching MgO water 1% + shade drying) Tarota (M_1T_2)
(Blanching MgO water 1% + cabinet drying) Tarota (M_1T_3)

The data presented in table 1.1 showed the impact of blanching on proximate composition of tarota vegetable. The tarota leaves blanched by 1% magnesium oxide and subsequent cabinet drying observed minimum loss of nutrient constituents of leaves whereas the leaves blanched by hot water had highest loss of nutrients and slight difference in nutrient composition were also observed in 1 % sodium bicarbonate methods of blanching. Magnesium oxide treated sample with subsequent cabinet drying was having highest amount of ash, fat, protein, fiber and lowest amount of carbohydrate and moisture than all blanching treatments.

Table 1: Nutritional Composition of fresh dried tarota

Green leafy vegetables	Moisture (%)	Fat (%)	Protein (%)	Ash (%)	Fibre (%)	Carbohydrates (%)
Tarota (H_1T_1)	6.2	1.3	11.2	4.7	11.4	60.5
Tarota (H_1T_2)	6.0	1.4	11.3	4.9	11.7	60.2
Tarota (H_1T_3)	5.7	1.5	12.5	5.8	11.7	60.1
Tarota (S_1T_1)	6.1	1.5	13.2	5.8	12.9	59.1
Tarota (S_1T_2)	6.0	1.6	14.4	5.9	12.9	59.0
Tarota (S_1T_3)	6.8	1.8	15.7	6.0	13.2	58.7
Tarota (M_1T_1)	6.2	1.7	14.8	6.0	13.1	58.8
Tarota (M_1T_2)	6.1	1.8	15.8	6.1	13.2	56.7
Tarota (M_1T_3)	6.2	1.9	16.4	6.2	13.5	56.4

From table 1.1 it was found that lowest fat content in tarota leaves ttreated with hot water blanching and sun drying while highest protein, ash and fibre reported in sample treated with magnesium oxide blanching and cabinet drying.

Thus, from the research it was found that blanching of tarota leaves in solution of 1 % magnesium oxide with subsequent cabinet drying was superior than other blanching process, and hence this process was followed for blanching of leaves prior to drying.

Mineral Composition of Fresh Tarota Leaves

The effect of drying methods on mineral composition of dehydrated tarota vegetables powder were discussed in table 1.2. Calcium content in fresh tarota leaves was (3.31 mg/100 g). Highest calcium content was observed in magnesium oxide treatment with cabinet dried powder (4.5 mg/100 g). Lowest calcium content was observed in hot water treatment with sun dried powder (3.2 mg/100 g). There was significant increase in calcium content of dried leaves as compare to fresh leaves. The similar findings were also reported by

(Kamble and Dhage, 2019) [5] who studied physico-chemical properties of *Cassia tora* Linn. leaves powder.

The phosphorus content of fresh tarota leaves showed (3.44 mg/100 g). In dried leaves powder highest phosphorus content was in treatment of magnesium oxide with cabinet drying (4.7 mg/100 g) followed by treatment of magnesium oxide with shade drying (4.5 mg/100 g), treatment of sodium bicarbonate with cabinet drying (4.45 mg/100 g) and treatment of magnesium oxide with sun drying (4.38 mg/100 g). There was significant increase in phosphorus content of dried leaves powder as compare to fresh leaves. According to Murray *et al*. (2003) [6] the higher phosphorus helps in bone formation and development, energy metabolism and nucleic acid metabolism.

Iron content of fresh leaves was (0.38 mg/100 g). The highest iron content was observed in treatment of magnesium oxide with cabinet drying (1.2 mg/100 g) followed by treatment of magnesium oxide with shade drying (1.15 mg/100 g), treatment of hot water with cabinet drying (1.08 mg/100 g) and treatment of sodium bicarbonate with cabinet drying (1.05 mg/100 g). The significant increase in iron content was observed in all dried samples as compare to fresh leaves.

Zinc content of fresh leaves was (1.17 mg/100 g). The zinc content in powder was in the range (1.2-2.05 mg/100 g) and it was maximum in treatment of magnesium oxide with cabinet drying (2.05 mg/100 g) and minimum in treatment of hot water with sun drying (1.2 mg/100 g).

Fresh leaves showed the copper content (0.567 mg/100 g). The copper content of powder was found in the range of (0.78 – 1.3 mg/100 g). The treatment of Magnesium oxide with cabinet drying method showed the highest copper content (1.3 mg/100 g) and treatment hot water with sun drying method showed the lowest copper content (0.78 mg/100 g).

Table 2: Mineral composition of fresh tarota

Green leafy vegetables	Calcium (mg/100 g)	Phosphorous (mg/100 g)	Iron (mg/100 g)	Zinc (mg/100 g)	Copper (mg/100 g)
Tarota (H_1T_1)	3.2	3.84	0.71	1.2	0.78
Tarota (H_1T_2)	3.41	3.98	0.78	1.38	0.89
Tarota (H_1T_3)	3.52	4.27	1.08	1.58	1.16
Tarota (S_1T_1)	3.48	4.11	0.81	1.65	0.81
Tarota (S_1T_2)	3.56	4.28	0.85	1.78	0.92
Tarota (S_1T_3)	3.64	4.45	1.05	1.85	1.19
Tarota (M_1T_1)	3.77	4.38	0.88	1.95	1.24
Tarota (M_1T_2)	3.89	4.51	1.15	2.0	1.28
Tarota (M_1T_3)	4.5	4.7	1.2	2.05	1.3

Results of Nutritional Assessment of *Cassia tora* Leaves from Different Regions in Rajasthan were similar to results reported by (Rathore & Kumar, 2020) [10].

However, the value of mineral content increased in relation to the drying methods as compare to fresh leaves. It may be due to the removal of water molecule by drying and the powder was in concentrated form.

Color Values of Dried Tarota Powder

The color values of dried tarota powder with subsequent sun, shade and cabinet drying wild were discussed in table 1.3.

Table 3: Colour of fresh tarota

Green leafy vegetables	L*	a*	b*
Tarota (H_1T_1)	38.50	0.57	21.50
Tarota (H_1T_2)	39.51	-0.1	22.33
Tarota (H_1T_3)	38.93	0.49	18.36
Tarota (S_1T_1)	37.44	0.30	19.31
Tarota (S_1T_2)	40.36	0.53	17.96
Tarota (S_1T_3)	38.17	0.62	21.80
Tarota (M_1T_1)	38.56	0.49	19.38
Tarota (M_1T_2)	39.51	0.55	19.86
Tarota (M_1T_3)	36.43	-0.58	26.61

The data related to color values of dried vegetables powder were presented in table 1.3. Tarota powder with treated sodium bicarbonate and shade drying was found significantly superior than other treatments like hot water and magnesium oxide with respect to lightness (L* value). The L* value was higher for tarota treated with sodium bicarbonate and shade drying (40.36) than chamkora treated with magnesium oxide and hot water. It indicates that the dried powder darkens when time required for drying increases which might be due to increase in browning reaction with increase in the time require for drying.

The a* (greenness value) indicates the greenness of dried powder. Highest greenness was observed for tarota powder treated with magnesium and cabinet drying (-0.58) and lowest greenness was observed for tarota powder treated with sodium bicarbonate and cabinet drying (0.62).

The b* indicates the yellow to blue color. The highest b* value was observed for tarota powder treated with magnesium oxide and cabinet drying (26.61) and lowest b* value was observed for tarota powder treated with sodium bicarbonate and shade drying (17.96).

Jawake *et al*. (2017) [4] analyzed the colour value in (L, a and b) with hue and chroma of dried green leafy vegetables powder.

Conclusion

The present research work focused on the the indigenous vegetable such as tarota which wass pre-treated with different blanching treatments and then dried using different drying techniques such as sun, shade and cabinet drying. The dried vegetable were further grinded into. The blanching in 1% magnesium oxide solution was found to be suitable for better retention of nutrients and preventing the leaching losses however there was slight reduction in nutritional composition due to blanching. Prepared vegetable powder was further analysed for proximate, mineral and colour value. It was observed that vegetable powder was nutritionally rich with respect to macro and micro nutrients.

References

1. A.O.A.C. Offical Methods of Analysis. Association of Official Analytical Chemist., EUA, 2000.
2. Akubugwo IE, Obasi NA, Chinyee GC, Ugbonu AE. Nutritional and chemical value of *Amaranthus hybridus*

L. leaves from afikpo, Nigeria. African Journal of Biotechnology. 2007;6(2):2833-2839.
3. Bhatia H, Sharma Y, Manhas R, Kumar K. Traditionally used wild edible plants of district Udhampur, J&K, India. Journal of Ethnobiology and Ethno medicine. 2018;14(73):1-13.
4. Jawake PD, Mudgal VD, Rajpurohit D. Effect of packaging materials and methods on quality characteristics of dehydrated fenugreek (*Trigonella foenum graecum* L.) leaves during storage. International Journal of Seed Spices. 2017;7(2):26-32.
5. Kamble KJ, Dhage S. Study of physico-chemical properties of *Cassia tora* Linn. leaves powder. International Journal of Agricultural Engineering. 2019;12(2):235-242.
6. Murray RK, Granner DK, Mayes PA, Podwell VW. Harper Illustrated Biochemistry. 2nd ed., New York, c2003.
7. Niranjan US, Meena AK, Yadav AK, Singh B, Nagariya AK, Rao MM. *Cassia tora* Linn: A review on its ethnobotany, phytochemical and pharmacological profile. Journal of Pharmacy Research. 2010;3(3):557-560.
8. Pawar HA, D'mello PM. *Cassia tora* Linn.: An Overview. International Journal of Pharmaceutical Sciences and Research. 2011;2(9):2286-2291.
9. Ranganna S. Handbook of analysis and quality control for fruits and vegetable products. IInd edition. Tata McGraw-Hill Publ. Co., New Delhi, India, c2011.
10. Rathore M, Kumar H. Nutritional Assessment of *Cassia tora* Leaves from Different Regions in Rajasthan. Journal of Advances in Biology & Biotechnology. 2020;22(4):1-5.
11. Sarwa KK, Rudrapal M, Debnath M, Kumar A, Verma VK. Phytochemical and Biological Potential of *Cassia tora* Linn. European Journal of Medicinal Plants. 2014;4(8):946-963.