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Effect on drying technique in preserving cauliflower and cabbage

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Abstract

Due to a market glut during peak season, cauliflower and cabbage are marketed at a very low price, resulting in significant losses for growers. Cauliflower and cabbage curd were pre-treated with hot water blanching, steam blanching for 3, 4 and 5 minutes and microwave blanching for 2, 3 and 4 minutes. Products were kept for analysis after blanching. The research shows that T₈ is the best treatment for keeping total soluble solids (TSS) and vitamin C. In comparison to the other treatments, T₅ had the greatest levels of total sugars (1.48%) and non-reducing sugars (0.24%) in cauliflower and in cabbage. T₉ is the most effective treatment for maintaining total soluble solids (TSS), vitamin C and total sugars. TSS, total sugar, reducing sugar, and vitamin C levels were significantly lower in T₃ in both cauliflower and cabbage samples.

Keywords: Cauliflower, cabbage, hot water blanching, steam blanching, microwave blanching

Introduction

Vegetables as a whole are considered natural sources of nutrients also provide adequate amount of many vitamins and minerals those are beneficial for human's health. They are rich source of carotene, ascorbic acid, riboflavin, folic acid and minerals like calcium, iron, and phosphorus (Fasuyi, 2006) [14]. Vegetable can be preserved by various techniques, but the widely used technique for vegetable preservation is drying. The removal of water from food to extend the shelf life of vegetables (Lussier, 2010) [19]. The reduction of losses, the preservation of quality, and the freshness of harvested products prior to consumption are critical in both domestic and export markets.

Cauliflower is a winter vegetable botanically known as *Brassica oleracea* var. botrytis belongs to the family Brassicaceae or cruciferae. In 1822, cauliflower was introduced in India (Lund *et al.*, 1972) [8]. India is the highest producer of cauliflower, but its productivity is lower than average (Mudgal and Pandey, 2008) [12]. Major states those are producing cauliflower in India is Bihar, Uttar Pradesh, Orissa, West Bengal, Assam, Haryana and Maharashtra. In India, west Bengal is a leading state of cauliflower with a production of 1,939.48 tone's (Data of NHB, 2017-18). The popularity and high consumer demand because of its nutritional quality and health benefits. Cauliflower contains high levels of Vitamins B, Vitamins C, Calcium (Ca), Iron (Fe) and phosphorus (P) and also has health promoting benefits. Cauliflower is a perishable crop because of its high moisture content. Only a small amount of cauliflower is processed, usually in canned and dried forms, while the major portion is consumed as fresh. Cabbage (*Brassica oleracea* var. capitata) is a common winter green leafy vegetable from the Brassicaceae or cruciferae family. India is one of the important cabbage growing countries in Asia. In India, west Bengal is also leading state of cabbage production of 2,288.50 tonnes (Data of NHB 2017-18). Cabbage is a highly perishable vegetable due to its increased moisture content and to extend its shelf life, it must be processed immediately by removing moisture (Zhang *et al.*, 2013) [18]. These crops are economically and nutritionally important cole crops, and grown in more than 90 countries in the world.

Materials and Methods

The present experiment was conducted during 2020-21 in the laboratory, Department of Post-Harvest Management, Faculty of Horticulture, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal. Cauliflower and cabbage were harvested early in the morning from farmer's field and that were brought to the laboratory within 2 hours.

The experiment used a completely randomized design, with nine treatments and each treatment three replications should be taken. T₁ (Hot water dip 3 min.), T₂ (Hot water dip 4 min.), T₃

(Hot water dip 5 min., T₄ (Steam blanching 3 min.), T₅ (Steam blanching 4 min), T₆ (Steam blanching 5 min.), T₇ (Microwave blanching 2 min.), T₈ (Microwave blanching 3 min.), T₉ (Microwave blanching 4 min.)

Fresh fully matured white and compact cauliflower heads and whole graded cabbage heads were selected for the experiment. Cauliflower and cabbage were washed into running tap water and after that in distilled water containing 50 ppm of chlorine to remove dirt. Whole cauliflower was cut with stainless steel knife and florets (edible portion) were kept for further study whereas in cabbage after trimming cut into small pieces and except core whole portion were taken for experiment. After that blanching treatment should be done and physicochemical characteristics should be recorded.

Observation recorded

Total soluble solid was determined by using Hand Refractometer (0-32 °Brix). Total Sugar (%) and reducing

sugar (%) level was determined by copper reduction method. (Ranganna, 2000) [14]. Non-reducing sugar content was determined by deducting the reducing sugar from the total sugar content. Ascorbic acid (mg/100g) was estimated by using 2,6-dichlorophenol indophenol dye titration method (Ranganna, 2000) [14].

Results and Discussion

Table 1: Physico-chemical parameters of Fresh (Raw) cauliflower and cabbage

Parameters	Cauliflower	Cabbage
TSS (°Brix)	8	6.8
Total Sugar (%)	1.53	3.70
Reducing Sugar (%)	1.30	3.38
Non-reducing Sugar (%)	0.23	0.32
Vitamin C (mg/100g)	48	40

Table 2: Effects on quality and physico-chemical composition in different blanching treatments of cauliflower and cabbage

Treatments	TSS (°B)		Total Sugar (%)		Reducing Sugar (%)		Non-reducing Sugar (%)		Vitamin C (mg/100g)	
	Cauliflower	Cabbage	Cauliflower	Cabbage	Cauliflower	Cabbage	Cauliflower	Cabbage	Cauliflower	Cabbage
T ₁ (Hot water dip 3 min.)	3.67	2.50	1.34	1.47	1.14	1.27	0.20	0.20	31	19
T ₂ (Hot water dip 4 min.)	3.53	2.40	1.32	1.44	1.15	1.25	0.17	0.22	28	16
T ₃ (Hot water dip 5 min.)	3.23	2.00	1.25	1.43	1.12	1.23	0.12	0.20	24	14.60
T ₄ (Steam blanching 3 min.)	6.50	3.26	1.47	3.28	1.26	3.19	0.20	0.09	35	30.83
T ₅ (Steam blanching 4 min.)	6.83	3.50	1.48	3.33	1.24	3.25	0.24	0.08	37	32.56
T ₆ (Steam blanching 5 min.)	6.93	4.06	1.47	3.37	1.26	3.25	0.20	0.12	38.67	33.06
T ₇ (Microwave blanching 2 min.)	7.20	3.76	1.45	3.35	1.27	3.28	0.18	0.07	39.33	32.66
T ₈ (Microwave blanching 3 min.)	7.46	3.76	1.43	3.38	1.25	3.26	0.18	0.12	39.83	34.50
T ₉ (Microwave blanching 4 min.)	7.36	3.96	1.39	3.39	1.28	3.23	0.11	0.16	38.33	34.76
Mean	5.859	3.248	1.403	2.718	1.221	2.580	0.182	0.142	34.574	27.556
S.Em (±)	0.2003	0.2123	0.0167	0.0126	0.0121	0.0112	0.0144	0.0109	0.7896	0.4995
CD at 5%	0.5951	0.6307	0.0237	0.0375	0.0359	0.0333	0.0429	0.0323	2.3460	1.4841

T₁ (Hot water dip 3 min.), T₂ (Hot water dip 4 min.), T₃ (Hot water dip 5 min.), T₄ (Steam blanching 3 min.), T₅ (Steam blanching 4 min.), T₆ (Steam blanching 5 min.), T₇ (Microwave blanching 2 min.), T₈ (Microwave blanching 3 min.), T₉ (Microwave blanching 4 min.)

Results and Discussion

Total Soluble Solids (TSS) (°B), Total Sugars (%), Reducing Sugar (%), Non-Reducing Sugar (%), Vitamin C (Mg/100g)

The data presented in table no 2 indicate that TSS of cauliflower varied in different treatments. It varied from 3.23 to 7.46. Maximum TSS value was recorded in T₈ treatment [Microwave blanching for 3 min. (7.46°B)] followed by T₉ treatment [Microwave blanching for 4 min. (7.36°B)] and T₇ treatment [Microwave blanching for 2 min. (7.20°B)]. The lowest TSS value was found in T₃ treatment [Hot water blanching for 5 min. (3.23°B)]. TSS value of cabbage also varied in different treatments. The highest TSS observed in T₆ treatment [Steam blanching for 4 min. (4.06°B)] followed by T₉ treatment [Microwave blanching for 4 min. (3.96°B)] and T₇ treatment [Microwave blanching for 2 min. (3.76°B)]. Lowest value of TSS was observed in T₃ treatment [Hot water blanching for 4 min. (2.0°B)].

In Cauliflower higher amount of total sugar was found in T₅ treatment [Steam blanching for 4 min. (1.48%)] followed by T₆ treatment [Steam blanching for 5 min. (1.47%)] and T₇ treatment [Microwave blanching for 2 min. (1.45%)]. Lowest value of total sugar was recorded in T₃ treatment [Hot water blanching for 5 min. (1.25%)]. Highest value of total sugar found in cabbage is T₉ treatment [Microwave blanching for 4 min. (3.39%)] followed by T₈ treatment [Microwave blanching for 3 min. (3.38%)] and T₆ [Steam blanching for 4

min. (3.37%)]. Lowest value of total sugar was found in T₃ treatment [Hot water blanching for 4 min. (1.43%)].

Cauliflower highest content of reducing sugar was recorded in T₉ treatment [Microwave blanching for 4 min. (1.28%)] followed by T₇ treatment [Microwave blanching for 2 min. (1.27%)] and T₆ treatment [Steam blanching for 4 min (1.26%)]. Lowest reducing sugar was found in T₃ treatment [Hot water blanching for 4 min (1.12%)]. In cabbage highest value of reducing sugar was observed in T₇ treatment [Microwave blanching for 2 min. (3.28%)] followed by T₈ treatment [Microwave blanching for 3 min. (3.26%)] and T₅ treatment [Steam blanching for 3 min. (3.25%)]. Lowest value of reducing sugar was recorded in T₃ treatment [Hot water blanching for 4 min. (1.23%)].

In the experiment, highest non-reducing sugar of cauliflower was observed in T₅ treatment [Steam blanching for 4 min (0.24%)] followed by T₄ treatment [Steam blanching 3 min. (0.20%)] and T₈ treatment [Microwave blanching for 3 min (0.18%)]. Lowest value of non-reducing sugar was observed in T₉ treatment [Microwave blanching for 4 min (0.11%)]. The higher amount of non-reducing sugar was recorded in cabbage is T₂ treatment [Hot water blanching for 3 min. (0.22%)] followed by T₃ [Hot water blanching for 4 min. (0.20%)] and T₉ [Microwave blanching for 4 min. (0.16%)]. Lowest amount of non-reducing sugar was observed in T₇ treatment [Microwave blanching for 2 min. (0.07%)].

Cauliflower the best result of vit- C content was found in T₈

treatment [Microwave blanching for 3 min (39.83 mg/100g)] followed by T₇ treatment [Microwave blanching for 2 min (39.33 mg/100g)] and T₆ treatment [Steam blanching for 5 min (38.67 mg/100g)]. The lowest value of vit-C was found in T₃ treatment [Hot water blanching for 4 min (24 mg/100g)]. Results indicate that highest content of vit- C in cabbage was

found in T₉ treatment [Microwave blanching for 4 min (34.76 mg/100g)] followed by T₈ treatment [Microwave blanching for 3 min (34.50 mg/100g)] and T₆ treatment [Steam blanching for 5 min (33.06 mg/100g)]. The lower content of vit-C was found in T₃ treatment [Hot water blanching for 4 min. (14.60 mg/100g)].

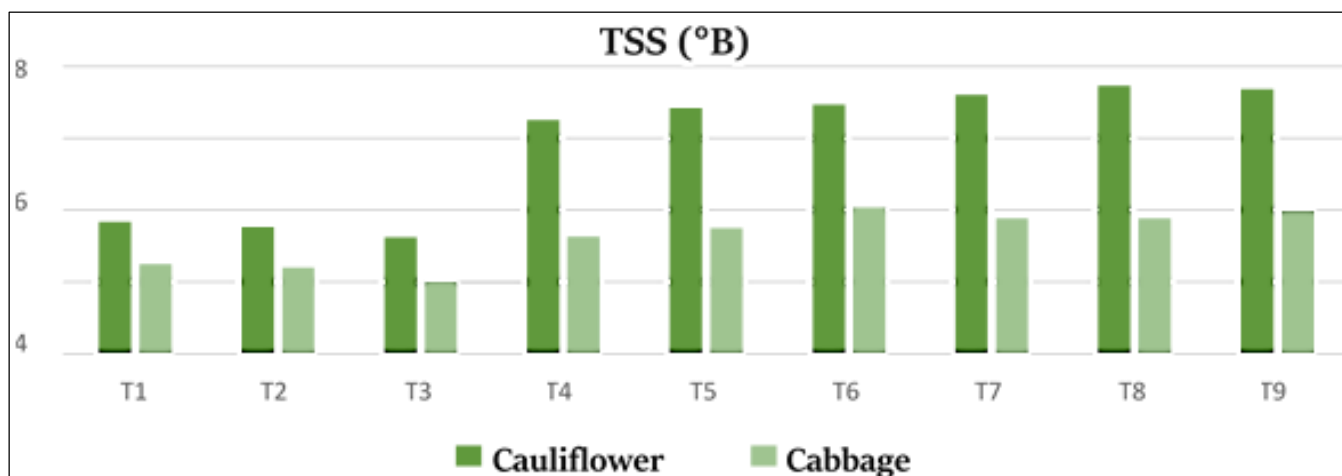


Fig 1: TSS

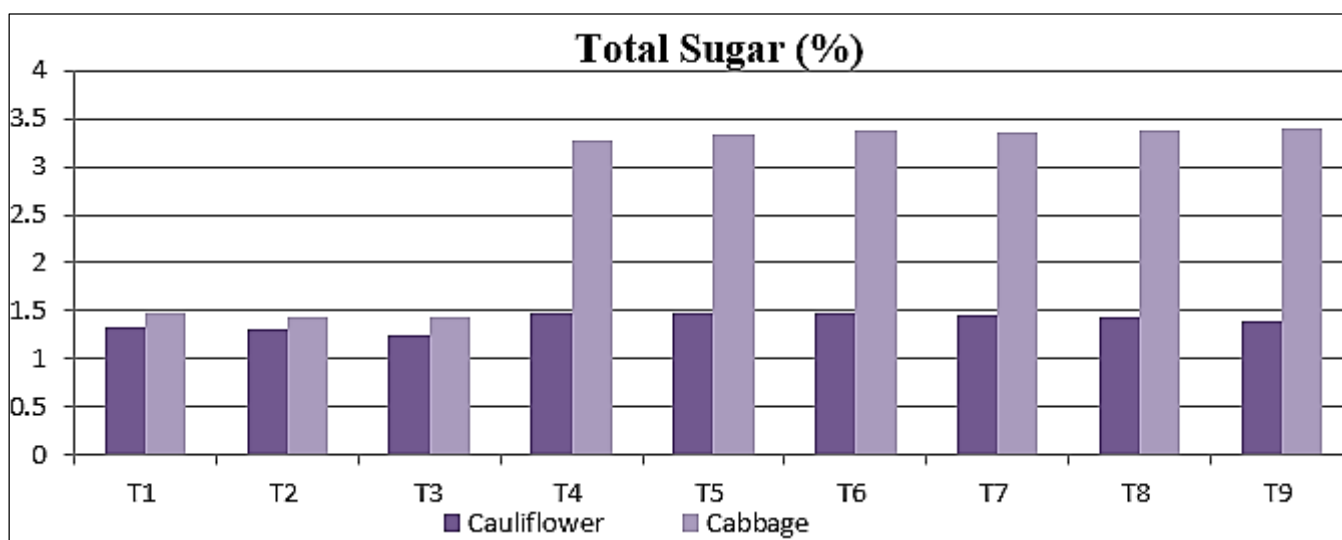


Fig 2: Total Sugar

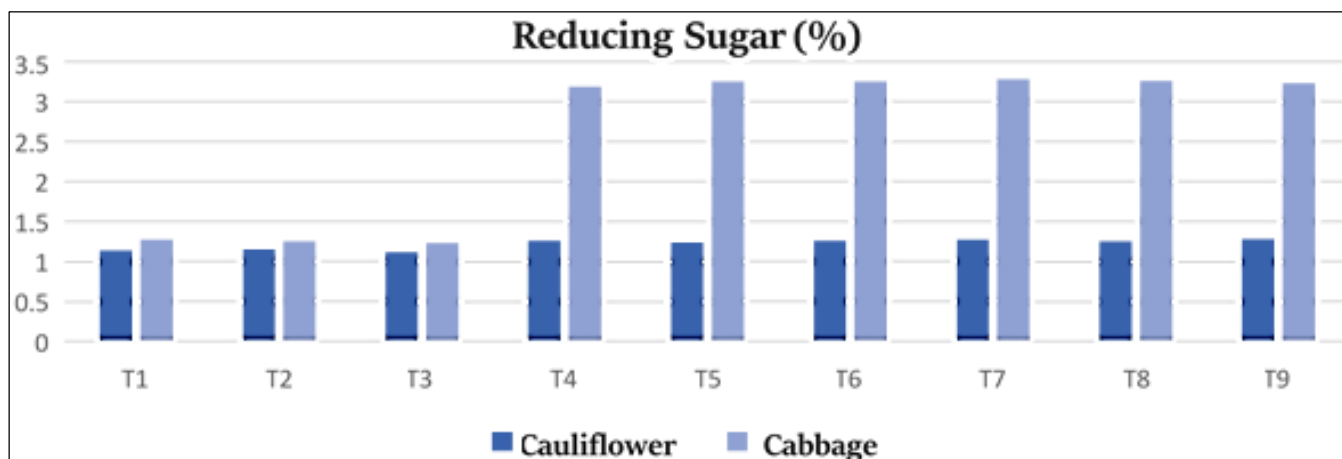


Fig 3: Reducing Sugar

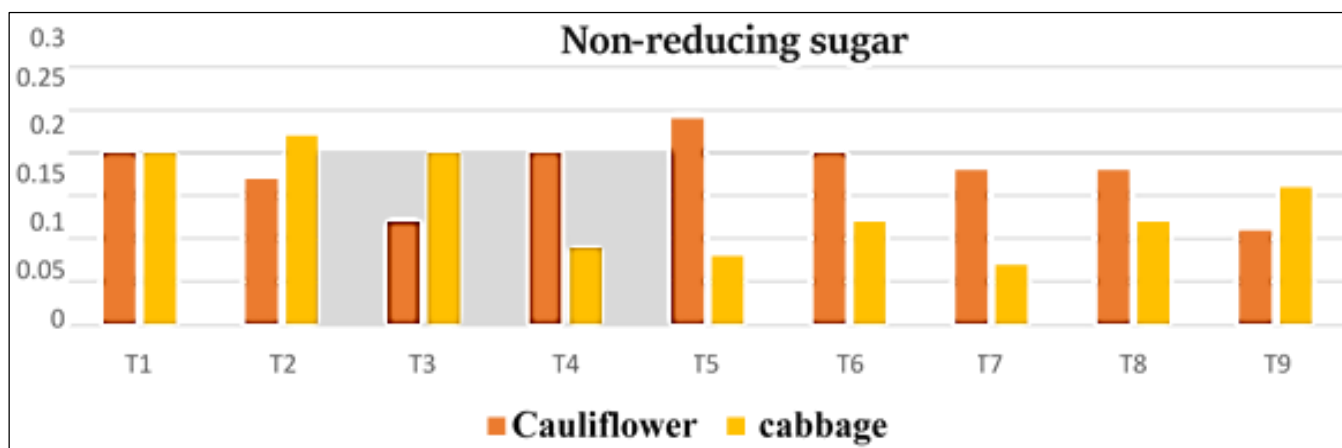


Fig 4: Non-reducing sugar

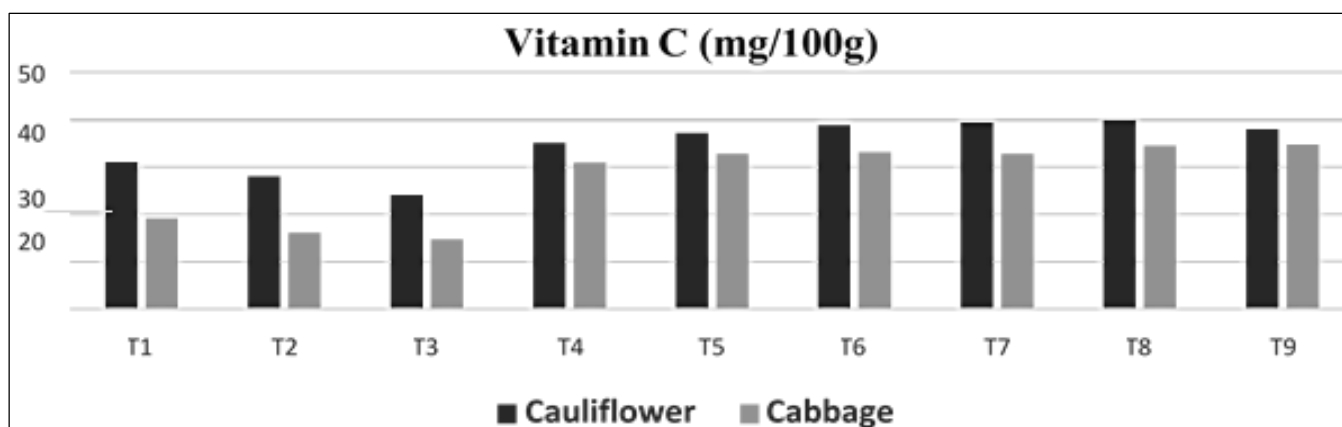


Fig 5: Vitamin C

Conclusion

Drying cauliflower and cabbage with nine different techniques was conducted in order to determine the biochemical properties of the dried products. The results of this investigation show that the nutritional content of dried samples is highly dependent on the pre-treatments used prior to drying. Microwave blanching is superior to steam blanching and hot water blanching among the various blanching techniques. The effectiveness of these pre-treatments is also influenced by the commodity's nature. Microwave blanching for 3 minutes before mechanical drying was found to be the most effective technique for retaining vitamin C and other components in dried cauliflower samples. In case of cabbage, microwave blanching for 4 minutes before drying has been proven to retain more nutrients than other pre-treatments.

Future scope

Future study should consider the following suggestions.

1. Using varied salt concentrations in hot water blanching can produce some surprising effects.
2. Blanching in hot water with various chemical concentrations may result in positive outcomes.
3. Future research on the storage behavior of dried cauliflower and cabbage products could be very useful in improving the storage life of cauliflower and cabbage by using drying techniques.

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