EFFECT OF BLANCHING TIME ON NUTRITIONAL QUALITY OF BUSH BEAN AT DIFFERENT POD AGE STAGES

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ABSTRACT

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The study was conducted to find out the nutritional quality of pods harvested at different ages (10, 15 and 20 days after pod initiation) after blanching at 50^0c for 5, 10 and 15 minutes of bush bean genotypes. Ascorbic acid, protein and dry matter retention percent were decreased as well as losses were increased with the increase of blanching time, but total sugar content was increased with the increase of blanching time. The highest 49.55 percent ascorbic acid retention was observed in V_2 after 5 minute blanching and 91.00 percent losses were observed in V_3 after 15 minutes blanching among all genotypes respectively. Similarly, the highest 97.98 percent protein retention was found in V_2 and lowest 90.68 percent protein retention was observed in V_4 after 5 minute blanching. On the other hand, V_4 genotype was contained higher percentage of protein retention after 10 and 15 minute blanching. Percent retention of protein was higher in 20 days pod age for all genotypes. Dry matter retention was found 86.26 to 97.67%, 82.90 to 94.62% and 82.83 to 93.27% among genotypes when blanched at 5, 10 and 15 minutes respectively. But total sugar content retention was observed 79.94 to 160.80%, 91.11 to 165.60% and 98.45 to 169.28% at 5, 10 and 15 minute after blanching respectively. The highest increasing sugar content was observed in V_4 at all blanching.

Key words: Pod age, Blanching time, Nutritional quality, Genotypes

INTRODUCTION

Popularity trends of bush bean are increasing day by day in Bangladesh due to its higher nutritive value, good taste, export potentiality and wide range of use. To maximise nutritional quality and fulfill overseas market demand of bush bean, it is important to harvest bush bean pods at different ages, as pod age is an important factor for organoleptic and nutritional qualities. Post harvest losses of vegetable can be reduced by many physical treatments. Among those treatments heat treatment is a common low cost method, known as blanching. Blanching is known to delay chlorophyll loss in green tissue (Klein and Lurie, 1991; Paull, 1990). According to Amiruzzaman (1994) blanching is an important step, which involves exposing the vegetables very quickly to heat to inactivate naturally occurring enzymes and would prolong refrigerated and frozen storage of plant materials. But heating can cause undesirable losses of visual and nutritive qualities. For maximum storage sufficient heat treatment is needed to stabilize the product against enzymatic deterioration but at the same time it is necessary to minimize quality losses due to heating. The optimization of blanching conditions implies a concomitant between keeping the nutritional, organoleptical and structural quality of the food, and stability during the storage as a result of enzyme inactivation. Considering the above facts the experiment objective is to know the nutritional status of bush bean at different pod ages after blanching.

MATERIALS AND METHODS

The experiment was carried out in the laboratory of the Department of Horticulture, Bangabondhu Sheikh Mujibur Rahman Agricultural University (BSMRAU), Gazipur, from December 2004 to March 2005. The bush bean was grown in the Agronomy Research Farm, BSMRAU, Gazipur. The experiment was laid in Completely Randomized Design with three replications. Four bush bean genotypes e.g. BB3 (Bush bean3), BB9 (Bush bean9), BB13 (Bush bean13) and BB15 (Bush bean15) were used as plant materials. Bush beans from all treatment combination were blanched at 50^0c for 5, 10 and 15 minutes. Ascorbic acid (%), Total sugar (%), Protein (%) and Dry matter (%) were recorded on 10, 15 and 20 days after pod initiation. Bush bean genotypes were designated as, V_1=BB3, V_2= BB9, V_3= BB13, V_4= BB15 and pod age stages were designated as M_1=10 days after pod initiation, M_2=15 days after pod initiation, M_3=20 days after pod initiation

Ascorbic acid content was determined as per the procedure described by Pleshkov (1976). The total ascorbic acid content was quantified by using the following formula.

Ascorbic acid (mg/100g) = (T.F.V. 100)/Vw

Where,

Titrate volume of KIO_3 ml

T=0.088 mg of ascorbic acid per ml of 0.001N of KIO_3

F=Total volume of the sample extracted

V=Volume of the extract (ml) taken

W=Weight of the sample taken (g)

Sugar contents were estimated according to Somogyi (1952), using Bertrand A, Bertrand B and Bertrand C solutions. Total sugar content was calculated comparing tabulated values. Before calculation of total sugar factor of 0.4 $KMnO_4$ was determined.

Total nitrogen and protein content of the collected sample was determined by Kjeldahl method using $CuSO_4$ and K_2SO_4 mixture (1: 9) as catalyst.

The total nitrogen was calculated by the following formula: $\% \ N = 14.007 \times F \times (T - B) \times \frac{100(ml)}{10(ml)} \times {}^{100}\!/_{1000} \ w(g)$

Protein was estimated by multiplying 6.25 to the value of total nitrogen.

Dry matter (%) was calculated using this formula- $\% \ Dry \ \ matter \ = \frac{Dry \ \ weight}{Fresh \ \ weight} \times 100$

Procedure of blanching

Fresh harvested bush bean was blanched in hot water bath. Bush bean was immerged in hot water and covers the pot. For immersion of bush bean Hot Water Bath was used. Blanching duration was counted after immerging the bush bean in hot water. One-gallon water was used for each pound of bush bean. The same water was used only two times because hot water can cause toughening of bush bean. Bush bean was cooled (to avoid boiling) immediately after blanching in pans of ice cold water. Then bush bean was drained thoroughly.

RESULT AND DISCUSSION

Ascorbic acid

Ascorbic acid retention and losses of bush bean genotypes at three pod age stages after blanching are presented in Table 1. it was found from Table 1 that with the increase of blanching time percent ascorbic acid retention were decreased while at the same time losses were increased . Due to 5 min blanching, the highest (49.55%) ascorbic acid retention was observed in $V_2$where loss was 50.45%. The lowest retention (40.13%) was found in V_3 where loss was highest. After 10 and 15 minute blanching V_2 also contained the highest retention percentage. Considering pod age stages, the highest (48.79%) ascorbic acid retention was found in 20 days old pods and the lowest was found in 10 days old pods at 5 minute blanching. In case of 10 and 15 minute blanching the highest ascorbic acid retention was 30.42% and 19.81%, respectively. Regarding interaction effect, the highest retention (60.00%) was found in V_2 for 20 days old pods at 5 minute blanching. The lowest retention (8.64%) was observed from V_3 for 10 days old pods at 15 minute blanching. The prime reasons for ascorbic acid losses during blanching might be due to the solubility in water, thermal destruction and enzymatic oxidations. Lisiewaska *et al.*, 2003 suggested the same reasons for ascorbic acid losses during blanching. In short term boiling, water-soluble vitamins can be lost by leaching (Petersen, 1993).

Protein

It can be described from Table 2 that Percent retention of protein gradually decreased due to blanching. After 5 min blanching the highest (97.98%) protein retention was observed in V_4 and the lowest (90.68%) was observed in V_2 (Table 2). Similarly, at 10 and 15 minute blanching V_4 was also contain higher retention percent. Percent retention of protein was higher in 20 days pod for all genotypes. In case of interaction effect between, the highest (99.42%) protein retention was observed in V_2 at 15 days old pods after 5 minute blanching and the lowest (83.25%) protein retention was observed in V_4 at 15 days old pods after 15 minute blanching. It may be concluded that According to Vaintraub *et al.* (1979). It may be concluded that protein content decreased due to heating, and after denaturation and digestion by pepsin and trypsin about 94.40% proteins are hydrolyzed.

Table1.Effect of blanching time (blanched at 50^0 C temp.) on ascorbic acid of bush bean genotypes at three pod age stages

Treatments	5 min		10 min		15 min	
Genotypes	Retention (%)	Loss (%)	Retention (%)	Loss (%)	Retention (%)	Loss (%)
V_1	43.7	56.3	29.22	70.78	23.39	76.61
V_2	49.55	50.45	32.50	67.50	24.02	75.98
V_3	40.13	59.88	23.04	76.96	9.00	91.00
V_4	42.19	57.81	30.33	69.67	18.08	81.92
Pod age						
M_1	42.63	57.37	26.19	73.81	17.41	82.59
M_2	42.93	57.07	30.22	70.78	17.76	82.24
M_3	48.79	51.21	30.42	69.58	19.81	80.19
Interaction						
V_1M_1	42.31	57.69	36.92	63.08	26.46	73.54
V_1M_2	44.55	55.45	26.73	73.27	22.73	77.27
V_1M_3	44.55	55.45	22.73	77.27	20.45	79.55
V_2M_1	46.36	53.64	29.14	70.86	26.20	73.80
V_2M_2	45.51	54.49	27.19	72.81	19.25	80.75
V_2M_3	60.00	40.00	36.54	63.46	27.73	72.27
V_3M_1	37.50	62.50	20.00	80.00	8.64	91.36
V_3M_2	42.73	57.27	25.00	75.00	9.36	90.64
V_3M_3	40.91	59.09	24.91	75.09	9.09	90.91
V_4M_1	42.86	57.14	38.93	61.07	28.57	71.43
V_4M_2	38.93	61.07	26.43	73.57	11.07	88.93
V_4M_3	45.45	54.55	32.00	68.00	13.64	86.36

Table 2 Effect of blanching time (blanched at 50^0 C temp.) on protein of bush bean genotypes at three pod age stages

Treatments	5 min		10 min		15 min	
Genotypes	Retention (%)	Loss (%)	Retention (%)	Loss (%)	Retention (%)	Loss (%)
V_1	94.99	5.01	93.97	6.03	92.96	7.04
V_2	90.68	9.32	88.57	11.43	87.14	12.86
V_3	96.25	3.75	95.51	4.50	93.36	6.64
V_4	97.98	5.02	95.91	4.09	95.88	4.21
Pod age						
M_1	94.50	5.50	93.35	6.65	93.25	6.75
M_2	94.53	5.47	93.48	6.52	93.19	6.81
M_3	95.63	4.37	93.66	6.34	93.71	6.29
Interaction						
V_1M_1	96.04	3.96	94.59	5.41	94.30	5.70
V_1M_2	92.84	7.16	92.33	7.67	91.05	8.95
V_1M_3	96.15	3.85	95.05	4.95	93.57	6.43
V_2M_1	98.95	1.05	94.30	5.70	94.30	5.70
V_2M_2	99.42	0.58	99.42	0.58	98.84	1.16
V_2M_3	96.35	3.65	93.75	6.25	92.71	7.29
V_3M_1	97.22	2.78	97.22	2.78	92.78	7.22
V_3M_2	97.30	2.70	97.30	2.70	96.22	3.78
V_3M_3	93.33	6.67	92.31	7.69	91.33	8.67
V_4M_1	90.66	9.34	87.91	12.09	86.81	13.19
V_4M_2	89.04	10.96	85.35	14.65	83.25	16.75
V_4M_3	92.31	7.69	92.31	7.69	91.18	8.82

Dry matter

Percent retention of dry matter gradually decreased and percent losses were increased due to blanching time increased (Table 3).Dry matter retention varied from 86.26 to 97.67%, 82.90 to 94.62% and 82.83 to 93.27% among genotypes when blanched at 5, 10 and 15 minutes, respectively(Table 3). The genotype V_1 contained the highest amount of dry matter and the lowest retention was found in V_2. Regarding pod age, dry matter retention was higher in 20 days old pods, where losses were minimum. In case of interaction, the highest (98.75%) dry matter retention was found from V_4 for 20 days old pod at 5 minute blanching. From this Table it may be

concluded that dry matter retention decreased and losses were increased due to increased blanching time. This might be due to loss of soluble solid during blanching (Tomasula *et al.,* 1990). Lisiewaska and Kmiecik (1996) found similar results and reported that blanching reduced of 9-10% dry matter in cauliflower.

Table 3. Effect of blanching time (blanched at 50^0 C temp.) on dry matter of bush bean genotypes at three pod age stages

Treatments	5 min		10 min		15 min	
Genotypes	Retention (%)	Loss (%)	Retention (%)	Loss (%)	Retention (%)	Loss (%)
V_1	97.67	2.33	94.62	5.38	93.27	6.73
V_2	86.26	13.74	82.90	17.10	82.83	17.17
V_3	90.80	9.2	86.96	13.04	84.37	15.63
V_4	97.56	2.44	93.61	6.39	90.62	9.38
Pod age						
M_1	90.17	9.83	86.13	13.87	85.63	14.37
M_2	95.23	4.77	91.59	8.41	89.70	10.30
M_3	96.80	3.20	93.25	6.75	90.45	9.55
Interaction						
V_1M_1	97.50	2.50	91.40	8.60	91.20	8.80
V_1M_2	95.45	4.55	92.27	7.73	92.18	7.82
V_1M_3	99.00	1.01	96.88	3.13	95.31	4.69
V_2M_1	82.11	17.89	90.63	9.38	85.94	14.06
V_2M_2	88.24	11.76	85.29	14.71	85.29	14.71
V_2M_3	90.63	9.37	78.95	21.05	75.79	24.21
V_3M_1	94.68	5.32	89.36	10.64	89.36	10.64
V_3M_2	95.74	4.26	93.62	6.38	90.43	9.57
V_3M_3	94.68	5.32	80.00	20.00	76.00	24.00
V_4M_1	93.75	6.25	97.50	2.50	90.00	10.00
V_4M_2	98.00	2.00	98.75	1.25	93.75	6.25
V_4M_3	98.75	1.25	88.54	11.46	88.54	11.46

Table 4. Effect of blanching time (blanched at 50^0 C temp.) on total sugar of bush bean genotypes at three pod age stages

Treatments	5 min		10 min		15 min	
Genotypes	Retention (%)	Increased (%)	Retention (%)	Increased (%)	Retention (%)	Increased (%)
V_1	202.90	102.90	211.07	111.06	214.36	114.36
V_2	179.94	79.94	195.63	95.63	214.63	114.63
V_3	189.43	89.43	196.11	91.11	198.45	98.45
V_4	260.80	160.80	265.60	165.60	269.28	169.28
Pod age						
M_1	191.53	91.30	196.14	96.14	204.86	104.86
M_2	199.86	99.85	209.41	109.76	217.15	117.15
M_3	235.30	135.30	243.75	143.75	251.69	151.69
Interaction						
V_1M_1	181.82	81.82	187.50	87.50	190.91	90.91
V_1M_2	190.24	90.24	199.00	99.00	200.25	100.25
V_1M_3	250.42	150.42	261.27	161.27	267.11	167.11
V_2M_1	169.69	69.68	192.81	92.81	203.28	103.28
V_2M_2	169.59	69.59	192.98	92.98	216.37	116.37
V_2M_3	185.65	85.25	201.64	101.64	223.02	123.02
V_3M_1	231.48	131.48	235.45	135.45	238.10	138.10
V_3M_2	289.29	171.43	274.64	174.64	284.64	184.64
V_3M_3	271.43	131.48	279.79	176.79	285.71	185.71
V_4M_1	171.59	71.59	176.14	76.14	176.10	76.10
V_4M_2	176.68	76.68	176.68	76.68	182.57	82.57
V_4M_3	233.72	133.72	233.72	133.72	253.76	153.76

Total sugar

Increased percentage in total sugar with the increase of blanching duration was found in this study. Among genotypes, increasing in total sugar varied from 79.94 to 160.80%, 91.11 to 165.60% and 98.45 to 169.28% at 5, 10 and 15 minute after blanching respectively (Table4). The highest increase was observed in V_4 among all blanching. Regarding pod age stages, the highest (151.69%) increasing was found in 20 days old pods at 15 minute blanching and the lowest (91.30%) in 10 days old pods after 5 minute blanching. In interaction effect, the highest (285.71%) sugar retention was found in V_3 for 20 days old pods after 15 minute blanching. From

this table it may be concluded that sugar content increased due to blanching. This might be due to increased in sucrose and fructose during hot water treatment. W. Hu *et al.* (2004) found the similar results in the case of sweet potato sucrose and glucose content increased due to hot water treatment (50^0C for 30 minute).

CONCLUSION

Ascorbic acid retention percent found to be decreased and losses were increased with the increase in blanching time due to 5 minute blanching at 50^0c; the maximum (49.55%) ascorbic acid retention was recorded from V_2 and the lowest in V_3. But the minimum retention was observed from 15 minute blanching condition. In this case 20 days age stage contained maximum retention percentage of ascorbic acid. The highest (97.98%) protein retention percentage was found in the genotype V_4 at 5 min blanching condition and 20 days pod age stage. The loss of protein due to blanching varied from 3.75-12.86% among genotype and 4.37-6.75% among pod age stages. Dry matter retention was highest (97.67%) in V_1 when blanched at 5 minute and loss was highest (17.17%) after 15 blanching. Regarding total sugar, the highest retention (269.28%) was found in V_4 among the four bush bean genotypes. Total sugar retention percentage found to be increased with the advancement of blanching time. So, the highest amount of nutrition was observed from 5 min blanching except total sugar, and highest ascorbic acid, protein, dry matter and total sugar content was higher in 20 days pod.

REFERENCE

Amiruzzaman, M. and J. Choudhury. C. S. 1994. Improved technologies for vegetable processing. In: Vegetable development in Bangladesh: Proceeding of a symposium in recent advances in vegetable development in Bangladesh, BARI, Joydebpur, Gazipur, Bangladesh, 24-25 April 1994. Asian Vegetable Research and Development Centre, Shanhua, Taiwan (Roc). Publication no. 94-430. P: 168

Klein, J. D. and S. Lurie. 1991. Post harvest heat treatment and fruit quality. Post harvest News Info. 2: 15-19.

Lisiewska, Z. and W. Kmiecik. 1996. Effects of level of nitrozen fertilizer, processing conditions and period of storage of frozen broccoli and cauliflower on vitamin C retention. Food Chemistry 57 (2): 267-270.

Lisiewska, Z., J. Shupski and E. Zuchowicz. 2003. Effect of temperature and storage period on the preservation on vitamin C, Thiamin, Riboflavin in frozen Dill (*Anethum graveolens* L.). Food Science and Technology 6(2)

Paull, R. E. 1990. Post harvest heat treatments and fruit ripening. Post harvest News Info. 5: 355-363.

Petersen, M. A. 1993. Influence of sous vide processing, steaming and boiling in vitamin retention and sensory quality of broccoli florets. Zeitschrift for Lebensmittel-Untersuchung Und- Forschung. 197: 375-380.

Pleshkov, B. P. 1976. Practical works in plant biochemistry. Moscow, Kolos, pp. 236-238

Somogyi, J. M. 1952. Notes on sugar determination. J. Biol. Chem. 195: 19-23

Tomasula, P. M., Kozempel, M. F. and Craig, J. C. Jr.1990. Biotechnol Prog 6: 249-254.

Vaintraub, I. A., P. Seliger and A. D. Shutor. 1979. The action of pepsin on the reserve proteins of some leguminous seeds. Die Nahrung. 23, 15.

W. Hu, T. Shun-ichiro and H. Yoshiaki. 2004. Effect of heat treatment on quality of sweet potato in wrapper type cold store during long-term storage. J. Fac., Kyushu Univ., 49(1), 129-138.