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Effect of Scrapping and Keeping Time on Vitamins and Phytochemical Retention Ability of Carrot (*Daucus carota L*)

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ABSTRACT
Scrapping of carrots before packaging for sale is a new method adopted by most carrot sellers in Umuahia and its environs. Scrapping of carrots may enhance leaching out of nutrients and spoilage. The study was designed to evaluate the effect of scrapping and keeping time on some chemical composition of carrot. The β-carotene, riboflavin, niacin, thiamin, phenol, saponin and tannin were determined spectrophotometrically, while ascorbic acid was determined using titration method while flavonoid was determined by gravimetric oven drying method as described by Harborne. The data generated were analysed using Statistical Package for Social Science version 20. The result showed significant ($p<0.05$) difference between the β-carotene (4083.3µg/100g) content of the unscrapped carrot and the β-carotene (3956.7µg/100g) content of the freshly scrapped carrot. Vitamin B_1 content of the carrot samples ranged between 0.02 to 0.04mg/100g. Vitamin B_1 content of the freshly scrapped carrot reduced with about 25% while Vitamin B_1 content of carrots scrapped and kept for 24hr and 48hr reduced with about 50% each respectively. Vitamin C (4.20 – 5.24mg/100g) and folate (11.80 – 13.83mg/100g) showed reduced of about 0.9 -19.1% vs 6.7 – 14.6% respectively. Scrapping alone reduced the flavonoid content of the carrot with about 22% while scrapping and keeping time reduced the value of flavonoid in carrot with about 24 – 39%. Reduction due to effect of scrapping and keeping time were also observed in saponin, phenol and tannin. Saponin was reduced with about 13 -27%, phenol (8 -25%), and tannin 11.4 – 17%. The study showed that scrapping and keeping time are capable of reducing micronutrients and other phytonutrients of carrot.
Keywords: Scrapping, keeping time, carrot, β-carotene

INTRODUCTION
Carrot (*Daucus carota* L) of the family *Apiaceae* (Kaur *et al.*, 2009) is a root vegetable, with a crispy texture when fresh (Dreosti, 2013). This vegetable is grouped among the most important root vegetables cultivated worldwide (FAOSTAT, 2021). Its grouping among the most important root vegetables may probably be due to its medicinal and

nutritional benefits. Record showed that carrot was first used for medicinal purposes and gradually used for food (Kaur *et al.*, 2009).

The yellow and the purple fleshed cultivar were the first carrot species to be cultivated, the orange specie were developed much later in Central Europe around the 15th and 16th centuary (Simon, 2000: Dreosti, 2013). A rapid rise in the popularity of orange carrots compared to the purple specie was attributable to its high pro-vitamin A content (Simon, 2000). Apart from being a good source of pro-vitamin A, carrots generally are good sources of vitamin B-complex and minerals (Kaur *et al.*, 2009; Tanveer *et al.*, 2019). They also possess phytochemicals like carotenoids, flavonoids, polyacetylenes and polyphenols which act as antioxidants, anticarcinogens and immune enhancers (Bhara, 2020). Consumption of carrot has been shown to reduce xerophthalmia and other vision disorders such as macular degeneration (Riaz *et al.*, 2022). Carrot is diversely used as beverages, jam, jelly or carrot chips (Krivokapić *et al.*, 2020). In Nigeria it is majorly consumed as snack and in preparation of vegetable salad and sauce. When harvested carrots were usually sold either washed or unwashed in time past in Umuahia and its environs, but these days, carrots are washed, scrapped and package in polythene bags before being sold by traders; a process that may enhance nutrient losses and spoilage. In light of this, this study seeks to assess the effect of scrapping and keeping time on β-carotene and other chemical composition of carrot.

PREPARATION OF SAMPLES

A 4 Kg of freshly harvested carrots (Old Royal seed specie) purchased from Orie Ugba Market, Umuahia were used for the study. The carrots were washed under running tap water to remove dirt. They were then divided into 4 parts of 1 Kg each using a Manual Kitchen weighing scale. The first part (unscraped) were cut into small circular sizes of about 1mm using a kitchen knife, oven dried at 60°C and milled using attrition mill. The second part were scrapped with blunt end of a kitchen knife, cut into small circular sizes of about 1mm using a kitchen knife, oven dried at 60°C and milled using attrition mill. The third part

were scrapped with blunt end of a kitchen knife and left at room temperature for 24hr, they were then cut into small circular sizes of about 1mm using a kitchen knife, oven dried at 60°C and milled using attrition mill. The 4th sample was scraped left at room temperature for 48hr, cut into small circular sizes of about 1mm using a kitchen knife, oven dried at 60°C and milled using attrition mill.

CHEMICAL ANALYSIS

The β – carotene, thiamin, riboflavin, and niacin content of the products were determined spectrophotometrically, while ascorbic acid was determined titration method as described by AOAC (2006). Saponin was determined by gravimetric oven drying method as described by the method of AOAC (2006). Phenol was determined by the folin-ciocatean spectrophotometry method (AOAC, 2006). Flavonoid was determined by gravimetric oven drying method as described by Harborne (1973). Tannin content of the sample was determined spectrophometrically as described by Kirk and Sawyer (1991).

STATISTICAL ANALYSIS

Data were analyzed using SPSS program version 20 SPSS Inc., USA. Means and standard deviation were calculated. Analysis of variance (ANOVA) was used to separate the means. Significant difference was accepted at $p<0.05$.

RESULTS AND DISCUSSION

The result of the effect of scrapping and keeping time on vitamin contents of carrot is presented on Table 1. β-carotene values ranged between 3906.7 to 4083.3µg/100g. Unscrapped carrot had the highest β-carotene (4083.3µg/100g) content, while the scrapped carrot, kept at room temperature for 48hours had the lowest β-carotene (3906.7µg/100g) value. There was significant ($p<0.05$) difference between the β-carotene (4083.3µg/100g) content of the unscrapped carrot and the β-carotene (3956.7µg/100g) content of the freshly scrapped carrot. But there was no significant difference ($P>0.05$) between the β-carotene (3956.7µg/100g) content of the freshly scrapped

carrot (FSC) and β-carotene content of scrapped and stored carrot at room temperature for 24hours (3920.0μg/100g) and 48hr (3906.7 μg/100g) respectively. This may implies that β-carotene value of carrot reduces significantly with scrapping but not so with keeping time. Insignificant reduction in amount of β-carotene with keeping time is expected, and this is because β- carotene is not water soluble and so does not leach out with rinsing. Reduction in β-carotene content was also reported in a similar study carried out by Kenny and O'Beirne (2010) but values of β-carotene obtained in this study were not however compared with the values obtained in that study because of difference in processing.

Among the various carotenoids in nature, β-carotene is the most abundant in fruits and green leafy vegetable, and has the maximum vitamin A activity (Rajyalakshimi *et al.*, 2001) and apart from being precursor of vitamin A, β-carotene as a member of the carotenoids also acts as antioxidant (Rao and Rao, 2007).

The results of water soluble vitamins showed that thiamin and folate compositions of the carrots were significantly reduced by scrapping while B_2, B_3 and vitamin C were significantly reduced by scrapping and keeping time. Significant reduction of the water soluble vitamins with keeping time could be due to leaching effect. Vitamin B_1 content of the carrot samples ranged between 0.02 to 0.04mg/100g with un-scrapped carrot having the highest B_1 value and scrapped carrots having the lowest values. Vitamin B_1 content of the freshly scrapped carrot reduced with about 25% while Vitamin B_1 content of carrots scrapped and kept for 24hr and 48hr reduced with about 50% each respectively. Vitamin C (4.20 – 5.24mg/100g) and folate (11.80 – 13.83mg/100g) showed reduced of about 0.9 -19.1% vs 6.7 – 14.6% respectively. This study showed that if carrot must be scrapped, it should be consumed within few hours in other to prevent losing its water soluble nutrients.

The effect of scrapping and keeping time on phytochemical composition of carrot is shown in Table 2. Phytochemicals are plant components that help to protect them (Adefegha and Oboh, 2013). Some of them contribute to reduction of risk of cancer and heart disease

(Bruce, 2000). The most abundant phytochemical in the study was flavonoid. Flavonoid is said to have cardio-protective activity through inhibition of lipid peroxidation and it has been shown to be effective anti-cancer agent (Erdman *et al.*, 2008). Flavonoid ranged between 69.0 – 114.04mg/100g. The result showed that the effect of scrapping alone reduced the flavonoid content of the carrot with about 22% while effect of scrapping and keeping time reduced the value of flavonoid in carrot with about 24 – 39%. The study revealed that scrapping as well as keep time reduces flavonoid significantly in carrot. Reduction due to effect of scrapping and keeping time were also observed in saponin, phenol and tannin. Saponin was observed to be reduce with about 13 -27%, phenol (8 -25%), and tannin 11.4 – 17%. In fresh and un-stored carrots, reduction in phenol compounds with peeling was reported (Zhang, and Hamauzu, 2004; Hellström *et al.*, 2020). Similarly, puree obtained from unpeeled carrots contained higher levels of phenols and other chemical components compared with manually peeled roots (Talcott, 2000).

CONCLUSION

The study revealed that scrapping of carrot had significant effect on its β-carotene, B_1 and all the phytochemicals that were evaluated. While B_2, B_3, vitamin C were significantly reduced by scrapping and keeping time.

RESULTS

Table1: Effect of scrapping and keeping time on the vitamin composition of unscrapped and scrapped carrot (*Daucus carota*)

SAMPLES	B-carotene (mcg/100g)	VitaminB_1 (mg/100g)	VitaminB_2 (mg/100g)	VitaminB_3 (mg/100g)	Vitamin C (mg/100g)	Folate (mcg/100g)
USC	$4083.3^{a}\pm4.62$	$0.04^{a}\pm0.01$	$0.02^{a}\pm0.01$	$0.24^{a}\pm0.02$	$5.24^{a}\pm0.06$	$13.83^{a}\pm0.41$
FSC	$3956.7^{b}\pm2.52$	$0.03^{b}\pm0.01$	$0.02^{a}\pm0.00$	$0.23^{a}\pm0.01$	$5.19^{a}\pm0.03$	$12.90^{b}\pm0.04$
SC_{24}	$3920.0^{b}\pm2.00$	$0.02^{c}\pm0.01$	$0.01^{b}\pm0.00$	$0.21^{b}\pm0.01$	$4.23^{b}\pm0.05$	$12.11^{c}\pm0.03$
SC_{48}	$3906.7^{b}\pm2.31$	$0.02^{c}\pm0.00$	$0.01^{b}\pm0.00$	$0.21^{b}\pm0.01$	$4.20^{c}\pm0.04$	$11.80^{c}\pm0.42$

Values show means ± standard deviation of triplicate analysis. Figures with different superscripts in the column are significantly different ($P<0.05$). KEY: USC= Unscrapped Carrot, FSC=Freshly Scrapped Carrot, SC_{24}=Scrapped and kept for 24hours, SC_{48}=Scrapped and kept for 48hours

Table2: Effect of scrapping and keeping time on the phytochemical composition of un-scrapped and scrapped carrot (*Daucus carota*)(mg/100g)

Samples	flavonoids	saponnin	phenol	Tannins
USC	$114\text{-}04^{a}\pm0.05$	$15.04^{a}\pm0.02$	$12.67^{a}\pm0.01$	$35.75^{a}\pm0.02$
FSC	$89.81^{b}\pm0.03$	$13.06^{b}\pm0.01$	$11.02^{b}\pm0.03$	$31.04^{b}\pm0.02$
SC_{24}	$87.0^{c}\pm0.01$	$11.44^{c}\pm0.02$	$9.32^{c}\pm0.02$	$29.01^{c}\pm0.03$
SC_{48}	$69.0^{d}\pm0.05$	$11.38^{c}\pm0.01$	$9.28^{c}\pm0.03$	$25.11^{d}\pm0.01$

Values show means ± standard deviation of triplicate analysis. Figures with different superscripts in the column are significantly different ($P<0.05$). KEY: USC= Unscrapped Carrot, FSC=Freshly Scrapped Carrot, SC_{24}=Scrapped and kept for 24hours, SC_{48}=Scrapped and kept for 48hours

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