

Non Pharmacological Use of *Daucus Carota* Juice (Carrot Juice) as Dietary Intervention in Reducing Hypertension

Sana Sarfaraz*, Najaf Farooq, Nida Ashraf, Ayesha Aslam and Ghulam Sarwar

Faculty of Pharmacy, Jinnah University for Women, Karachi, Pakistan

*Corresponding author: Sana Sarfaraz, Faculty of Pharmacy, Jinnah University for Women, Karachi, Pakistan, Tel: +92 21 36620857; E-mail: Sana.sarfraz@live.com

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Abstract

Introduction: Fruits and vegetables are important constituent of daily life. They contain variety of vitamins and anti-oxidants and are rich source of carbohydrates and proteins. Recently studies are being conducted to evaluate their therapeutic potential.

Objective: The present study has been conducted to evaluate the consumption of carrot by laymen, awareness regarding its composition and benefits. An experimental study was also conducted to evaluate the diuretic activity of *Daucus carota* juice.

Methodology: A cross sectional survey was conducted comprising of N=200 individuals both males and females belonging to age group 18-55 years from different universities and locations in Karachi. The questionnaire was designed to evaluate awareness in population regarding carrots benefit, composition and use.

Experimental study consisted of six mice which were taken into three groups and were marked as Control, standard and Test. Control group received same quantity of water as test. Standard group received furosemide 40 mg/70 kg, while test group received pure carrot juice in two different doses 200 mg/kg and 400 mg/kg. Metabolic cage was used in order to evaluate the diuretic activity.

Result: Survey shows 40% layman consume carrot weekly, 75% people thought it could be used as non-pharmacological therapy for improving eyesight. 24% laymen thought it could lower the blood pressure. 51% population knew it was a good source of potassium and 71% knew it was rich source of vitamin A.

Our experimental results showed that mice which were administered carrot juice at dose of 400 mg/kg urinated 0.9 ml in 24 hours which is almost equal to the standard diuretic drug furosemide 1 ml in 24 hours.

Conclusion: We came to the conclusion that majority of the population of Karachi consumes carrot but does not have information regarding its use as diuretic that can be beneficial in reducing blood pressure.

Keywords: Diuretic; Carrot; Metabolic cage; Hypertension

Introduction

The word diuresis is derived from the Greek word ourein which means "to urinate". The diuretic agents are not only involved in the excretion of water but also capable to remove or excrete other urinary constituents which may be beneficial in the treatment of different conditions like hypertension, edema [1]. Diuretic agents reduce morbidity and mortality related to stroke and congestive heart failure in hypertensive patients [2].

Hypertension can be defined as sustained increase in systolic blood pressure greater than 140 mmHg and diastolic pressure greater than 90 mmHg [3]. Generally hypertension is classified into two types, based on the causes i.e., Primary hypertension of unidentified etiology and secondary hypertension due to any disease state or drug use [4]. Dietary salt intake, [5] kidney function, smoking, obesity and effect of hormones are the factors which may initiate hypertension [6].

So diuretic agents are used to remove excess fluid and electrolyte that have been retained in the body [1], specifically the excretion of sodium, chloride and bicarbonate. These are those ions which are largely restricted in different conditions [7]. Although diuretics may also be employed for irrigating the urinary passages with water, for promoting dehydration, or for establishing a normal urinary output in oliguria states [1]. In actual practice it turns out that all of the useful diuretics produce their effects by interfering with the reabsorption of sodium from the tubular lumen [8,9]. Diuretic agents differ in their mode of action, pharmacodynamics and pharmacokinetic properties [10].

It is frequently noted in hypertensive patients that continuous reduction of blood pressure with antihypertensive agents other than diuretics will result in an accumulation of extracellular fluid [11,12]. In this case, the arterial blood pressure apparently has been forced below a level at which the hypertensive kidney can maintain homeostasis of the ECF [13].

Electrolyte imbalance and dose-related reversible or irreversible ototoxicity may complicate treatment with loop agents. Reported

idiosyncratic reactions to diuretics include interstitial nephritis, non-cardiogenic pulmonary edema, pancreatitis, and myalgias [14].

Thiazide and loop diuretics were associated with increased gout risk, an association mediated by a change in serum urate [15].

Therefore nowadays, a development has been seen in uncontrolled hypertension due to non-adherence to diuretic agents by patients. Uncontrolled hypertension can further promote the risks of cardiovascular diseases [6]. Therefore, currently focus is being shifted towards herbal treatment because herbs can grant positive therapeutic effects, are safer to use and is cost effective therapy [16,17].

Herbs have been used as medical treatments since the beginning of civilization and some derivatives (e.g., aspirin, reserpine, and digitalis) have become mainstays of human pharmacotherapy [18].

Carrot (*Daucus carota* L) is one of the well-liked root vegetables grown throughout the world. *Daucus carota* is a biennial plant. Biochemically carrot is loaded with β -carotene, fiber and many essential micronutrients and functional ingredients. Carrots contain 88% water, 4.7% sugar, 2.6% protein and 0.2% fat [19]. Cellulose is the main dietary fiber present in carrot. It also contains smaller amounts of hemicellulose, lignin and starch [20]. Free sugars present are glucose, fructose and sucrose. Carrots are good source of minerals specially potassium (320 mg) and 69 mg sodium [21]. Carrots are also rich in Vit A (835 μ g), Vitamin B6 (0.138 mg), Vit K (13.2 μ g) and Vitamin C (5.9 mg) [22].

The presence of high concentrations of carotenoids, especially β -carotene in carrot roots makes them to inhibit cancers, free radical scavengers, anti-mutagenic and immuno-enhancers [22]. Carrot possesses antifungal activity due to a constituent, carotol [23]. Two new guaiane-type sesquiterpene terpenoids containing an interesting epoxy unit, daucuside and daucusol, have been isolated from fruits of *D. carota* [24,25].

The purpose of our study was to evaluate the trend of consumption of carrot in laymen, awareness regarding its composition and benefits. Experimental study was carried out to evaluate its diuretic activity.

Materials and Methods

Survey

A cross sectional survey was conducted comprising of N=200 individuals both males and females belonging to age group 18-55 years from different universities and locations in Karachi. The questionnaire was designed to evaluate awareness in population regarding carrots benefit, composition and use. The answers were recorded as open and close ended.

Experimental procedure

Experimental animals: The experimental study was designed comprising of albino mice of either sex weighing 20 gm-24 gm kept at room temperature ($25 \pm 2^\circ\text{C}$). The mice were taken from the animal house of Jinnah University for Women. They were given food and water *ad libitum*.

Material

The carrots were purchased from local market identified by Department of Pharmacognosy Jinnah University for Women and then their juice was taken.

Phytochemical analysis: A preliminary study of Carrot juice was done to investigate it for presence of alkaloids, saponnins, tannin, glycosides, flavonoids, steroids, terpenes, carbohydrates, anthraquinones, and reducing sugar using the standard laboratory procedures described by Trease and Evans [26] and Sofowora [27].

Dosing protocol

Six mice were taken into three groups and were marked as Control, standard and Test. Control group received same quantity of water as test. Standard group has received furosemide 40 mg/70kg, while test group received pure carrot juice in two different doses 200 mg/kg and 400 mg/kg. Metabolic cage was used in order to evaluate the diuretic activity.

Procedure

The mice were placed in metabolic cage designed in such way to separate urine and feces and one mouse of each group was housed separately in metabolic cage. The urination sample was collected after 24 hours in cylinder and its volume was measured [28].

Results and Discussion

Statistical interpretation was carried out using SPSS version 20 and tests used were percentile, Binomial test, Chi-square test and Student T- test.

Carrot is one of the important root vegetables rich in bioactive compounds like carotenoids and dietary fibers with appreciable levels of several other functional components having significant health-promoting properties. The consumption of carrot and its products is increasing steadily due to its recognition as an important source of natural antioxidants [19].

Table 1 shows that 24% population is aware of use of carrot in reducing blood pressure, 29% consider it effective as a diuretic agent and 53% know that it is good source of potassium. Table 2 shows that consumption of carrot is highest weekly (40%), majority of population knew only about presence of vitamin A (73%) in carrot. Whereas 85% population thought that its main use is in improving eyesight.

	Yes	No
Use of Carrot in Blood Pressure Control	24%	76%
Use of Carrot as Diuretic	29%	71%
Carrot as source of Potassium	53%	47%

Table 1: Percentage population showing awareness regarding potassium content and use of carrots in lowering blood pressure and as diuretic.

Carrots contain dietary fiber which is an indigestible complex carbohydrate found in structural components of plants. They cannot be absorbed by the body and therefore, have no calorific value

however, the health benefits of eating fiber rich diet are immense including prevention of constipation, regulation of blood sugar, protection against heart diseases, reducing high levels of cholesterol and prevention of certain forms of cancers [19].

Consumption of Carrot	Percent	Source of Vitamin	Percent	Benefits of Carrot	Percent
Daily	13%	Vitamin A	73%	Improves eye sight	85%
Weekly	40%	Vitamin B	6%	Cancer	1%
Monthly	23%	Vitamin C	18%	Hypertension	2%

Once in a while	24%	Vitamin D	3%	All of the above	12%
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Table 2: Percent of daily consumption, source of vitamin thought to be prevalent and benefits of carrot.

Table 3 shows binomial test and shows highly significant result ($p < 0.0001$) of unawareness among population regarding use of carrot in reducing blood pressure and as a diuretic. Carrot has been used in traditional medicine to treat HTN. Activity-directed fractionation of aerial parts of *D. carota* resulted in the isolation of two coumarin glycosides coded as DC-2 and DC-3 which were thought to produce this effect [29].

		Category	N	Observed Prop.	Test Prop.	Exact Sig. (2-tailed)
Blood Pressure Control	Group 1	Yes	48	0.24	0.5	0
	Group 2	No	152	0.76		
Source of Potassium	Group 1	yes	107	0.54	0.5	0.358
	Group 2	No	93	0.46		
Carrot as Diuretic	Group 1	yes	57	0.29	0.5	0
	Group 2	No	143	0.72		

A value of $p < 0.05$ is considered significant, $p < 0.001$ as more significant and $p < 0.0001$ as highly significant.

Table 3: Binomial test.

Table 4 shows the result of chi-square test on consumption of carrot which depicts that weekly consumption is highest according to residual value. Similarly Tables 5 and 6 shows chi-square result on sources of Vitamin among which Vitamin A is most prevalent and benefits of carrot in which improved eyesight had more than expected results. The Carotenoids present in carrots are involved in the regulation of gene expression or effect cell functions like inhibition of monocyte adhesion and platelet activation [30]. These biological effects produce antioxidant property of carotenoids, through deactivation of free radicals and singlet oxygen quenching [31,32].

	Observed N	Expected N	Residual
Daily	26	50	-24
Weekly	80	50	30
Monthly	46	50	-4
Once in a while	48	50	-2
Total	200		

Table 4: Consumption of carrot (Chi-Square Test).

Serum cholesterol level has also shown to be reduced [33]. A further effect associated with eating 200 g carrot per 24 hr is an increase in fecal sodium, potassium, and calcium excretion, possibly as a result of the cation binding capacity of the carrot fiber. Two hundred grams of raw carrot eaten each day causes an increase in serum carotene levels [34].

Carrot intake may also improve the immune system; defend against stroke, high blood pressure, osteoporosis, cataracts arthritis, cardio vascular diseases, asthma and urinary tract infection [19].

	Observed N	Expected N	Residual
Vitamin A	145	50	95
Vitamin B	13	50	-37
Vitamin C	36	50	-14
Vitamin D	6	50	-44
Total	200		

Table 5: Source of vitamin (Chi-Square test).

	Observed N	Expected N	Residual
Improves eye sight	169	50	119
Cancer	2	50	-48
Hypertension	4	50	-46
All of the above	25	50	-25
Total	200		

Table 6: Benefits of carrot (Chi-Square test).

Table 7 shows the effect on diuretic activity. Our results show that the mice which were given furosemide a diuretic agent urinated more than the one having carrot juice. Since traditional times fruits and their juices have been known for their health promoting effects.

Furosemide is loop diuretic and works by inhibiting NA-K-Cl in thick ascending loop of Henley. It is used mainly for treatment of hypertension and edema [22].

Groups	Mean± SD	P value (control)	P value (Standard)
Standard (furosemide)	1 ml ± 0.89	0.0001***	
Control	0.25 ml ± 0.54		0.0001***
Test 200 mg/kg	0.4 ml ± 0.51	0.001**	0.0001***
Test 400 mg/kg	0.9 ml ± 0.43	0.0001***	I.S
Values are mean ± S.D. N=6= number of animals			
***p<0.0001 = highly significant			
**p<0.001= moderately significant I.S Insignificant			

Table 7: Effect on diuretic activity.

Our results shows that after dosing when urination was observed after 24 hours it has been observed that mice given carrot juice (200 mg) had urinated but when compared to standard i.e., Furosemide it was highly significantly reduced. At higher dosing i.e., 400 mg/kg the result was same as furosemide.

Carrots are widely regarded as one of the most effective diuretic vegetables. This is as because of the vitamins, minerals and antioxidants they contain. Some of the Phytochemical in carrots are lutein, lycopen, carotenes, zeaxanthin and xanthophyll.

These phytochemicals can promote detoxification and increase the rate of metabolism and in the process discharge vitamins and minerals. Part of the detoxification achieved by these phytochemicals in carrot is done through dieresis [35].

Table 8 shows that carrot juice contains carbohydrates, tannins, alkaloids, flavonoids, anthraquinones, Cardiac glycoside, phenolics compounds and Saponins. According to the literature studies done all of the above constituents are present in carrot [36].

Carrot is an important source of phytonutrients including polyacetylenes [37], phenolics [38], and carotenoids [26]. Carrot is loaded with β-carotene, ascorbic acid and tocopherol [39]. Due to considerable compounds present; carrots are well thought-out as a functional food having health promoting activities.

Test	Observation	Results
Carbohydrates	Benedict's test	Red precipitate +
	Molisch test	Red violet ring +
	Seliwanoff's test	Red color +
	Barfoed's reagent	Brick red precipitates +

Tannins	Lead acetate test	White precipitate	+
Phenolic compound	Ferric chloride test	Green color	+
Alkaloids	Wagner test	Reddish color	+
Cardiac glycoside	Salkowski test	Reddish brown color	+
Anthraquinone	Borntrager's test	Orange color on ammonia layer	+
Flavonoids	Lead acetate	Yellow color	+
	Sodium hydroxide	Yellow color (decolorizes on adding HCl)	+
	Ammonia test	Light yellow stain on filter paper	+
	Ferric chloride test	Green color	+
Test for Saponin	Froth test	Foam Formation	+

Table 8: Phytochemical constituents of *Daucus carota*.

Conclusion

We have concluded that pure carrot juice is a better option as a non-pharmacological therapy in hypertensive patients due to its potential diuretic activity. Natural compounds have a tendency to treat several diseases with minimum side effects so, by adding carrots in diet, hypertension can be reduced.

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