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SERUM CONCENTRATIONS OF SOME ELECTROLYTES (SODIUM, POTASSIUM AND BICARBONATE) IN WISTAR RATS FED WITH CARROT (*DAUCUS CAROTA*) EXTRACT

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ABSTRACT

Background to the study: Plasma electrolytes regulate many physiological processes necessary for cellular survival. The present study investigated the effects of carrot (*Daucus carota*) extract on serum concentrations of some electrolytes (sodium, potassium and bicarbonates) in wistar rats. **Methodology**: The study involved 28 male wistar rats separated into 4 groups of 7 rats each. Group 1 served as control and was given distilled water, whilst groups 2, 3 and 4 served as test groups and were given aqueous extract of *Daucus carota* at daily doses of 200mg/kg, 400mg/kg and 600mg/kg respectively. The experiment lasted for 28 days and thereafter the animals were sacrificed under anesthesia and blood samples collected for determination of serum potassium, sodium and bicarbonate concentrations using standard laboratory techniques. **Results and Discussion**: The results of our study showed that daily oral administration of 200mg/kg and 400mg/kg carrot extract caused a dose-dependent increase in the serum concentrations of potassium, sodium and bicarbonates, although not significantly. However, administration of 600mg/kg of carrot extract caused a significant increase in sodium concentration. Therefore, increasing the daily dosage of carrot might distort the physiological homeostatic processes with resultant significant increase in plasma sodium concentration. Excessive consumption of dietary sodium is discouraged because of risk of developing cardiovascular and other disorders. **Conclusion**: Conclusively, moderate consumption of carrot did not have any significant effect on the serum concentrations of potassium, sodium and bicarbonates and by implication did not alter the physiologic homeostatic processes. Higher doses of carrot extract significantly increased serum sodium necessitating cautious consumption of large amounts of carrot.

KEYWORDS: Serum electrolytes, Sodium, Potassium, Bicarbonate, *Daucus carota*, Wistar rats.

INTRODUCTION

Electrolytes in the blood essentially regulate many body functions; water balance, nerve and muscle function, acid-base balance, blood pressure control, maintenance of heart rate and rhythm, bone and teeth function (Jomova et al., 2022). These roles are necessary for the optimal functioning of vital organs of the body. In physiological condition, the concentrations of the different electrolytes in the blood must be maintained within their respective normal ranges. Therefore, adverse deviations from the physiologic ranges could be detrimental to cellular survival. Many of the electrolytes are derived from our diets especially fruits and other plant products (Fernandez & Marette, 2017; Qian, 2018; Kalaycıoğlu & Erim, 2019; Alwis et al., 2020; Sultana et al., 2021; Muhammad et al., 2024). In deficiency disorders or in conditions requiring higher demand for specific electrolytes, preformed supplements are often administered. Carrots are mainly orange coloured root vegetables (Carlos & Dias, 2014; Bahrami et al., 2018) which are consumed as food and also used in herbal preparations. Some of the health benefits of carrots have been documented in previous studies (Tanaka et. al., 2012; Fiedor & Burda, 2014; Bystricka et al., 2015; Obia et al., 2025). Although some researchers have reported significant amounts of electrolytes in a various fruits and vegetables, our study investigated the effect of carrot consumption on the serum concentrations of potassium, sodium and bicarbonates.

MATERIALS AND METHODS

The experiment was carried out at animal house of the department of Human Physiology, faculty of Basic Medical Sciences, University of Port Harcourt in the year, 2019. Ethical approval was obtained from the university of Port Harcourt Research Ethics Committee with approval number; UPH/CEREMAD/REC/MM67/012. A total of twenty eight male wistar rats weighing 120 to 150g were purchased and acclimatized for a period of two weeks. These animals were separated into 4 groups of 7 rats each, housed in plastic cages and allowed to feed and drink *ad libitum* with Top feed Finisher mash and clean water. Their immediate environment (beddings) was changed daily, the temperature of the environment kept at normal conditions while the external environment was cleaned and disinfected regularly.

Preparation and administration of carrot extract

Mature carrot tubers were bought from Oil Mill market in Obio Akpor Local Government Area of Rivers State, Nigeria. The plant was identified at the department of Plant Science and Biotechnology, University of Port Harcourt; *Daucus carota L*, in the family; Apiceace with assigned herbarium number; UPH/C/132. The tubers were washed with water to remove soil particles. About 2kg of the fresh carrot was cut into tiny pieces and air dried for seven days. The dried carrots were blended using a blender and carefully poured into a maceration jar containing four liters of water. The mixture was allowed to macerate for 24hours after which a Whatman filter (20-25µm, pore size) was used to get a clear filtrate. The filtrate was now poured into an evaporating dish and dried in a water bath at 45^{o}C to obtain a semi-solid aqueous extract of *Daucus carota*. The dosages administered in the study were based on the lethal dose (LD50) of 5000mg/kg which was previously determined (Ayeni et al., 2019). Following acclimatization, the wistar rats were weighed and separated into four groups of seven rats each. Group 1 served as control and was given distilled water, whilst groups 2, 3 and 4 served as test groups and were given aqueous extract of *Daucus carota* at daily doses of 200mg/kg, 400mg/kg and 600mg/kg respectively. The experiment lasted for 28 days. Thereafter the animals were sacrificed under anesthesia and blood samples collected for determination of serum potassium, sodium and bicarbonate concentrations using standard laboratory techniques.

Statistical analysis was done using SPSS software version 22.0. Results were presented in tables. Continuous variables were expressed as mean ± Standard error of mean (SEM). Statistical difference was determined using analysis of variance (ANOVA) and at $p < 0.05$.

RESULTS AND DISCUSSION

Table 1: Effect of Carrot extract on serum potassium, sodium and bicarbonate concentrations of wistar rats.

Group	Potassium (mmol/l)	Sodium (mmol/l)	Bicarbonate (mmol/l)
Control	5.73±0.73	128.50±2.23	25.67±0.95
200mg/kg	6.45±0.32	129.17±3.25	27.17±0.40
400mg/kg	7.43±0.45	142.83±7.93	29.00±0.86
600mg/kg	8.70±0.40	163.00±5.72*	30.67±0.67

* Significantly different compared to control.

The results of our study showed that oral administration of carrot extract caused a dose-dependent increase in the serum concentrations of potassium and bicarbonates, although not significantly. Also the 200mg/kg and 400mg/kg of carrot extract caused a non-significant increase in sodium concentration. However, administration of 600mg/kg of carrot extract caused a significant increase in serum sodium concentration.

Despite the numerous benefits of electrolytes in the blood, the concentration and type of electrolyte consumed is of utmost importance. Most diets are enriched with sodium either to taste or as a preservative (Sambu et al., 2022; Warner, 2024; Yu & Rhee 2024) to the extent that our daily dietary sodium requirement is often exceeded. Deficiency of plasma sodium resulting from inadequate dietary intake rarely occurs since it is richly available in our daily meals. However, hyponatremia may occur in malnutrition (Baez et al., 2024) or during conditions resulting to excessive loss of sodium (Puckett, 2023). Moderate consumption of carrot as shown in the present study will add just enough sodium in the plasma that is within the physiologic limit. Increasing the daily dosage of carrot up to 600mg/kg/day distorted the physiological homeostatic processes with resultant significant increase in plasma sodium concentration. Excessive consumption of dietary sodium is discouraged because of risk of developing cardiovascular and other disorders. Therefore, carrot should be consumed moderately to obtain its benefits. Many studies support the moderate consumption of natural products for optimal benefit (Obia et al., 2018; Obia & Eifuobhokhan, 2024; Obia & Emmanuel, 2025).

Although, some refined foods are fortified with potassium, dietary supplementation of this electrolyte is not a common practice in most food cultures. For this reason, potassium-rich foods are to be intentionally consumed to meet the daily potassium requirement. Potassium deficiency has been implicated in many diseases including cardiovascular diseases, osteoporosis and kidney stone (Palmer et al., 2016; Averin et al., 2020). Studies have shown that sodium bicarbonate composition of certain fruits and vegetables are capable of reducing dietary acid by half (Goraya et al., 2012) which is a protective effect against kidney injury. The bicarbonate content of carrot can be beneficial in patients with excessive gastric acidity as it can have possible antacid potential.

Conclusively, moderate consumption of carrot did not have any significant effect on the serum concentrations of potassium, sodium and bicarbonates and by implication did not alter the physiologic homeostatic processes. Higher doses of carrot extract significantly increased serum sodium necessitating cautious consumption of large amounts of carrot.

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