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# Effect of different aqueous extracts of garlic on some electrolytes and urea levels in rats

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**Abstract**

Studies on the effect of fresh and dried aqueous extracts of garlic (cold and hot) on $Na^+$, $K^+$, $Cl^-$, $HCO_3^-$ and urea levels of rats were carried-out. Animals were divided into 5 groups of 5 rats each. Groups I and II were treated with fresh cold and hot extract respectively, while groups III and IV received dried cold and hot extract respectively. Group V served as untreated control. Treatment was by oral administration at 100mg/kg body weight for seven consecutive days. Analysis of the results showed significant ($P < 0.05$) decease in $Na^+$ and $Cl^-$ levels of the treated groups when compared with the control. However, reduction in the levels of $K^+$ and $HCO_3^-$ was insignificant ($P > 0.05$). The extracts appeared to have no effect on urea level when compared with the control group. The decrease observed in these electrolytes monitored were more with fresh cold extract than with others. The results therefore suggest that fresh cold garlic extract may be useful in the management of electrolyte related disorders.

*Keywords*: Garlic; Electrolytes; Urea

## Introduction

Measurement of plasma $Na^+$, $K^+$ and $HCO_3^-$ usually accompanied by plasma urea or creatinine and sometimes $Cl^-$ concentrations together make up the most frequently requested group of tests presently carried out by clinical laboratories (Whitby *et al.*, 1988). The principal univalent cations in the extracellular fluid (ECF) and intracellular fluid (ICF) are $Na^+$ and $K^+$ respectively. The bulk of research on the role of diet in the pathogenesis, treatment and prevention of hypertension has focused on the two monovalent cations - sodium and potassium and divalent cations - calcium and magnesium (Whitby *et al.*, 1988). The laboratory determinants of hypertension include increase in serum renin, aldosterone and sodium levels; decrease in serum potassium level with increase in urinary potassium (Battle *et al.*, 1993). However, when heart failure occurs, there is moderate rise in serum urea level (Whitby *et al.*, 1988). In chronic renal failure, $Na^+$ balance is maintained provided large changes in $Na^+$ intake are avoided. When the limited ability to adapt to changes in $Na^+$ intake is exceeded, $Na^+$ and water tend to be retained and oedema develops whenever

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dietary $Na^+$ is increased (Whitby *et al.*, 1988). Excessive renal losses of $K^+$ occur only rarely in chronic renal disease. However, the $Na^+$ depletion which sometimes occur in renal disease may be associated with secondary aldosteronism, which causes severe loss of $K^+$ (Whitby *et al.*, 1988).

Garlic (*Allium sativum*) is a plant ascribed with several medicinal potentials (Williams *et al.*, 1985).Garlic has been shown to have not only preventive but also a curative role in heart disease (Santos 1995). Previous studies demonstrated that powdered garlic reduces total and harmful LDL cholesterol levels, serum triglycerides, and blood pressure (Koscieiny *et al.*, 1999). Garlic also inhibits cholesterol oxidation and platelet aggregation (Santos 1995). Its role in the metabolism of calcium in vascular tone regulations (Siegal, 1992), and as protection against heavy metal poisoning suggest some interesting interactions with physiological electrolytes which are involved in homeostatic regulations such as osmotic pressure regulation of the body fluids and tissues.

This work is therefore aimed at investigating the effect of various aqueous garlic preparations on $Na^+$, $K^+$, $HCO_3^-$, $Cl^-$ and urea levels.

## Experimental

*Experimental animals.* The experiment was performed using adult male Wistar rats weighing between 200g and 250g. The rats were fed with grower's mash (Vital Feeds Ltd.) and water *ad libitum*.

*Extraction and administration.* The garlic bulbs were purchased from Jos Main Market. The dried sheaths were removed leaving the succulent fresh bulbs. Some were oven dried at 370°C for 3 days. Both dried and fresh garlic was reduced to coarse forms and soaked in hot or cold water and allowed to extract for two hours as described by Kafaru (1993). A total of twenty five rats, divided into 5 groups of 5 animals each were used. The fresh cold, fresh hot, dried cold and dried hot extracts were orally administered at 100mg/kg body weight to groups I, II, III and IV rats respectively, for 7 consecutive days. Group V. animals served as untreated control.

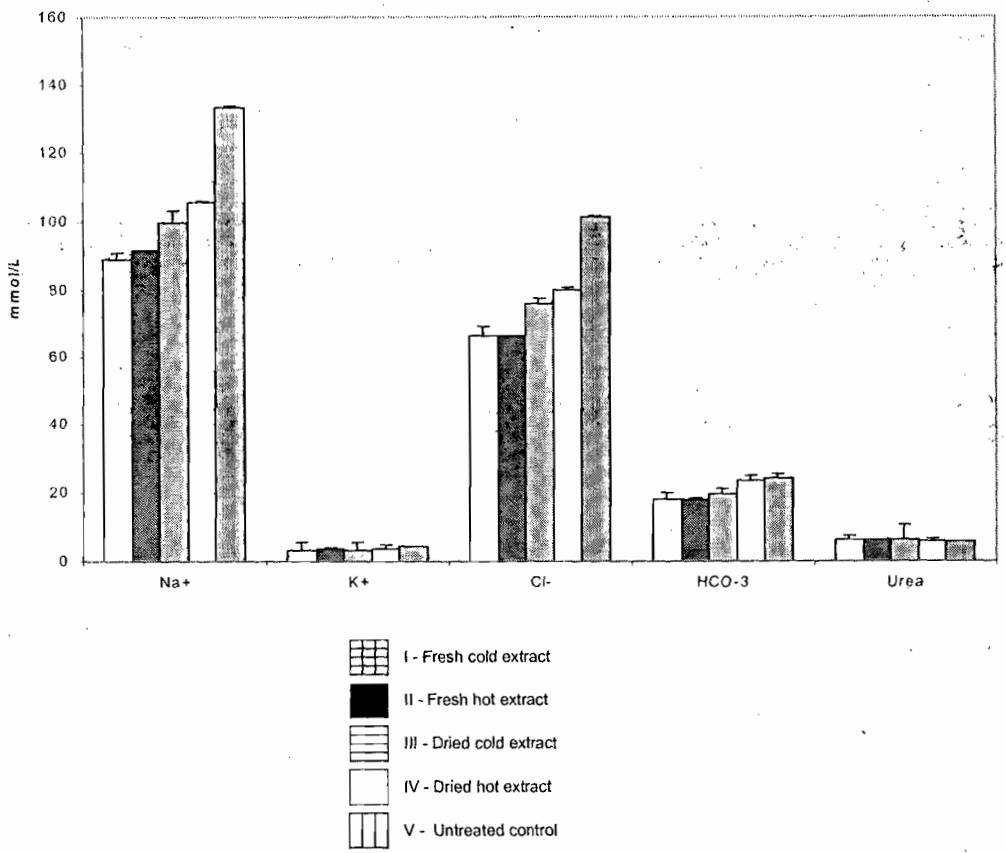
*Serum collection and analysis.* After the last administration, the animals in all the groups were fasted for 12 hrs before they were sacrificed for blood and serum collection. The serum collected was analysed for sodium ($Na^+$), potassium ($K^+$) using flame photometer as described by Tiez (1987); chloride ($Cl^-$) by mercuric nitrate titrimetric method (Schales and Schales, 1941); urea (March *et al.*, 1965 ) and bicarbonate levels.

## Results and Discussion

The result for $Na^+$, $K^+$, $Cl^-$, $HCO_3^-$ and urea levels are presented in Figure 1. Treatment with all the garlic extracts resulted in reduced $Na^+$, $K^+$, $Cl^-$ and $HCO_3^-$ levels. The data is summarized as mean $\pm$ standard deviation. On analysis of this result, significant ($P<0.05$) decrease was observed only in $Na^+$ and $Cl^-$ levels of the treated groups when compared with untreated control. However reductions in $HCO_3^-$ and $K^+$ levels were insignificant ($P>0.05$). Urea levels of treated animals are comparable to untreated control.

Various preparations of garlic are used traditionally in the management of several diseases of man and animals. The result obtained from this study has clearly demonstrated the beneficial effect of garlic. All the extracts have a decreasing effect on $Na^+$ and $Cl^-$ concentration ($P<0.05$), particularly the fresh cold extract (Fig I). There was a statistically insignificant ($P>0.05$) decrease in $K^+$ and $HCO_3^-$ concentrations. However, none of the extracts showed effect on urea concentration. $Na^+$ and $Cl^-$ ions are significantly involved in the maintenance of normal distribution of water, osmotic pressure and anion-cation

balance in ECF (Cutter *et al.*, 1997). Salt intake has been linked to hypertension (Starmler *et al.*, 1991).




The ability of garlic to decrease blood viscosity and to increase the capillary flow rate resulting in decreased blood pressure has been reported (Silagy and Neil, 1994). The hypotensive effect of garlic has been associated with long term garlic supplementation (Sofowora, 1982), and it has been shown not to lower blood pressure of persons with normal blood pressure, suggesting that it is adaptogenic (Silagy and Neil, 1994).The results obtained from this investigation is in agreement with these observations on hypotensive property of garlic especially with the fresh cold extract. Consequently, its ability to lower $Na^+$, and $Cl^-$ levels could be another possible mechanism by which it can be utilized in the management of hypertension in addition to its hypolipidaemic effect . The concentration of $K^+$ in the body is mainly affected by acidosis, alkalosis and acute or chronic renal failure. (Whitby *et al.*, 1988). The result obtained showed no significant change in $K^+$ concentration and this may suggest that garlic does not change or affect acid-base balance and has no toxic effect on renal function. The bicarbonate concentration is a reflection of the pH of plasma which is affected by acidosis, alkalosis and glomerulonephritis (Whitby *et al.*, 1988). This investigation also showed no significant change in $HCO_3^-$ concentration and this further supports earlier observation that garlic extract does not cause change in acid-base balance and therefore has no effect in the buffering capacity of bicarbonate. Plasma urea concentration is a

measure of renal function. The impairment in renal function such as in chronic or acute glomerulonephritis affects glomerular filteration rate (GFR), thus resulting in changes in plasma urea concentration (Ware, 1981). All the various garlic extracts used in this study have shown no effect on serum urea concentration and this suggests that garlic extracts may not affect kidney function.

## Conclusion.

This work has shown that oral administration of aqueous extracts of garlic particularly the fresh cold extract has the potential to decrease $Na^+$ and $Cl^-$ concentrations. The extracts did not affect the $HCO_3^-$ as well as urea levels. Consequently the fresh cold garlic extract could be beneficial in the management of some electrolyte-related disorders.

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