

## Serum Levels of Sodium and Potassium in Patients with Asthma on Salbutamol Therapy

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### Abstract

A total of 150 patients with asthma on salbutamol therapy were included in this study along with 90 apparently healthy adult person (control group) were investigated for the measurements of serum sodium and potassium levels. All patients and controls were fasting when sampled. Sodium and potassium serum levels have been performed by using flame photometer. All patients showed a normal serum sodium (mean 139.8 mmol/L) while the majority (73.4%) of the patients showed hypokalemia (mean 3.1 mmol/L) when compared to control. This study showed that salbutamol have no deteriorated effect on sodium, while it may reduce potassium levels in the majority of patients.

### قياس مستوى الصوديوم والبوتاسيوم في مرضى الربو الذين يتناولون عقار السلبوتامول

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### المستخلص

تضمنت الدراسة إجراء الفحوصات المختبرية لقياس مستوى الصوديوم والبوتاسيوم ل 150 من مرضى الربو الذين يتناولون عقار السلبوتامول و 90 شخص من الأصحاء (مجموعة سيطرة) كل هؤلاء كانوا صائمين عند اخذ العينات التي حدد مستوى الصوديوم والبوتاسيوم فيها بواسطة جهاز المطياف الضوئي وكان مستوى الصوديوم للمرضى ضمن الحدود الطبيعية بينما غالبيتهم (73.4%) كانوا يعانون من نقص مستوى البوتاسيوم (3.1 مول / لتر) عند مقارنتهم بالأشخاص الأصحاء. تبين من هذه الدراسة ان عقار السالبوتامول ليس له تأثير على مستوى الصوديوم بينما يقلل مستوى البوتاسيوم في معظم المرضى.

## Introduction

Asthma may be regarded as a diffuse, obstructive lung disease with hyperreactivity of the airways to a variety of stimuli and a high degree of reversibility of the obstructive process, which may occur either spontaneously or as a result of treatment. <sup>(1)</sup> Asthma is a complex disorder involving biochemical, autonomic, immunologic, infectious, endocrine and psychological factors in varying degrees in different individuals. In some patients with so called extrinsic or asthma attacks follow exposure to environmental factor such as dust, pollens, danders and foods, often but not always, such patients have increased concentrations both of total IgE and of specific IgE against the allergen implicated. In other patients with clinically similar asthma, which is seen most often in older adults "late onset" asthma, has been called intrinsic or non immunologic. <sup>(2)</sup> Asthma may have its onset at any age. The course and severity of asthma are difficult to predict. The majority of affected individual have only occasional attacks or slight to moderate severity managed with relative ease, a minority will develop severe, intractable asthma, usually perennial rather than seasonal <sup>(3)</sup> airway hyper reactivity relates to patient but generally is stable over time in the same patient except for temporary fluctuation. An acute decrease in airway irritability is observed following administration of  $\beta$ -receptor agonists, theophylline, and anticholinergic, and after chronic administration of chromolyn or corticosteroids, systemic or inhaled. <sup>(4)</sup> Sodium ions are the major cation of extracellular fluid representing 90% of the 154 mmol of inorganic cations per liter of plasma water, thus, sodium ions are responsible for almost half the

osmolarity of the plasma and play a central role in maintaining the normal distribution of water and osmotic pressure in the extracellular fluid compartment. <sup>(5)</sup> The average daily diet contains 130 - 260 mmol (8-15 g) of sodium chloride, which is nearly completely absorbed from the gastrointestinal tract. since the body requirement is only 1 - 2 mmol/day and the excess is excreted in the urine <sup>(6)</sup> Potassium is the major intracellular cation. the body requirement for potassium is satisfied by dietary intake of 50-150 mmol/day. Potassium absorbed from the gastrointestinal tract is rapidly distributed; a small amount is taken up by cells but most is excreted by the kidneys <sup>(7)</sup> Serum or heparinized plasma may be assayed for sodium. Erythrocyte contain only tenth the sodium present in plasma; thus, hemolysis of blood dose cause a significant decrease in observed sodium values for serum or plasma unless hemolysis is severe in which case there is a diluted effect. <sup>(6)</sup> specimens for serum or plasma assay of potassium must be collected in such away as to minimize hemolysis; release of potassium from as few as 0.5 mmol/L. Potassium levels in plasma have been shown to be 0.1 - 0.7 mmol/L lower than in serum. The difference is due to release of potassium from platelets ruptured in the coagulation process. these considerations now make plasma the specimen of choice and emphasize the necessity of noting on reports whether serum or plasma was assayed and whether the specimen was visibly hemolyzed. <sup>(8)</sup> Selective  $\beta_2$  agonists like salbutamol can provide effective bronchodilatation in asthma without the significant increase

in heart rate that may occur with isoproterenol or epinephrine, since the latter drugs stimulate both bronchial  $\beta_2$  receptors and cardiac  $\beta_1$  receptor, producing cardio acceleration, selective  $\beta_2$  drugs have essentially no  $\alpha$ -adrenergic activity and thus presser effect; accordingly, the patient dose not develop the pallor that may occur with epinephrine administration.<sup>(9)</sup>

**Aim of the study** the study was designed to measure the levels of sodium and potassium in asthmatic patients treated with salbutamol.

### Patients and methods

The study was conducted during the period starting from the first of October 2006 till the first of March 2008 in Tikrit Teaching Hospital. A total of 150 adult asthmatic patients (100 males and 50 females) using daily salbutamol either orally or in the form of inhaler for more than one month prior to the study, ranging in age from 18 to 75 years. The controls constitutes 90 healthy adult subjects (54 males and 36 females) of a comparable age group were also studied. Asthmatic patients using the salbutamol intermittently or using other drugs along with salbutamol were excluded from this study. A complete history, physical examination, and chest x-ray were used for the diagnosis of each patient with asthma on salbutamol therapy. From both patients and control after an overnight fast, 2 ml of venous blood were drawn into plastic syringes fitted with stainless steel needles, immediately transferred to metal - free tubes, allowed to clot and centrifuged. The serum obtained after centrifugation was transferred to another metal - free tube for storage at  $-20^\circ\text{C}$  until analysis, samples showed hemolysis were discarded. Serum sodium and potassium

were measured by a flame photometer.<sup>(10,11)</sup> Each samples was run in duplicate tubes and its mean value was considered.

### Statistical analysis

The significance of difference between the groups was assessed by students t - test analysis variations within and among groups were tested using the one-way analysis of variance  $P < 0.05$  was considered statistically significant.

### Results

The data obtained from the study recalled that all patients were isonatremic, 110 patients (73.3%) showed hypokalemia, while 40 patients (26.6%) were normokalemic (fig.1). The mean serum sodium level for patients was found to be 139.8 mmol/L (range : 136.6 to 144.9 mmol/L), while the mean serum sodium for the control group was 140.1 mmol/L (range were between 136.9 to 144.5 mmol/L). There was no statistical difference at a  $P < 0.01$  between the patients and the control group regarding the serum sodium level (fig.2). The mean serum potassium level for hypokalemic patients was 3.1 mmol/L (range : 2.9 to 3.31 mmol/L), while the mean serum potassium for the normokalemic patients was 4.22 mmol/L (range : 3.85 to 5.0 mmol/L). The mean potassium for the control group was 4.3 mmol/L (range : 3.8 to 4.9 mmol/L). It was found that there is a significant statistical difference between the hypokalemic and the normokalemic patients, as well as between the hypokalemic patients and the control group at a  $P < 0.05$ , while there was no significant statistical difference between the normokalemic patients and the control group (at a  $P < 0.05$ ), while there was no significant statistical difference

between the normokalemic patients and the control group (at a  $P > 0.05$ ), fig. 3.

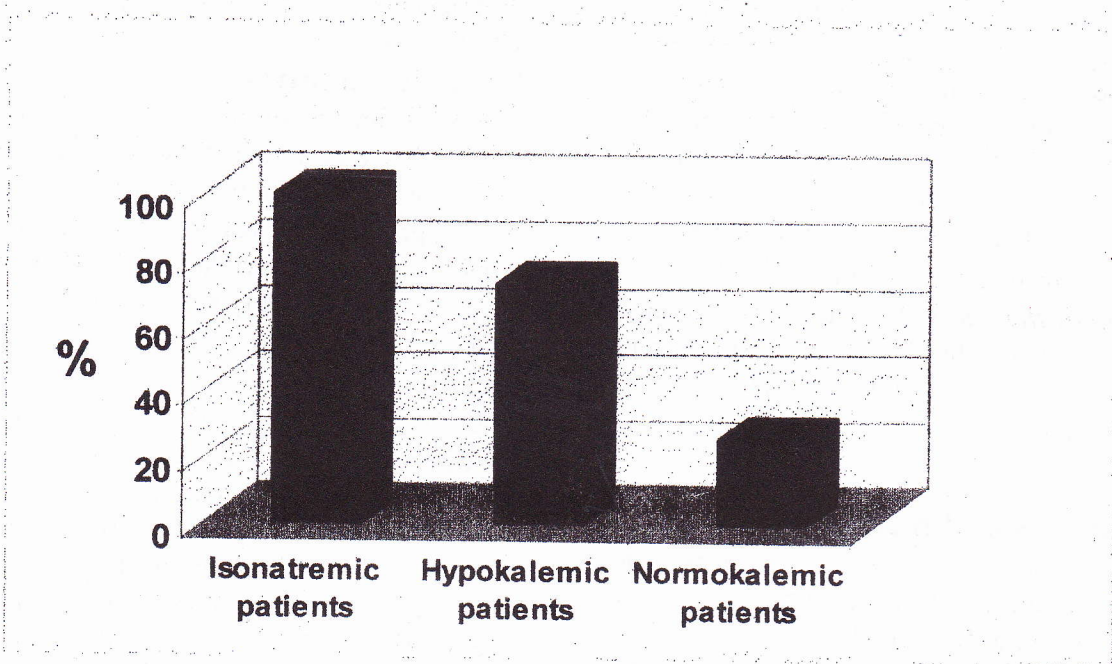


Fig (1): Incidence of isotremia, hypokalemia, and normokalemia in patients with asthma on sulbutamol therapy.

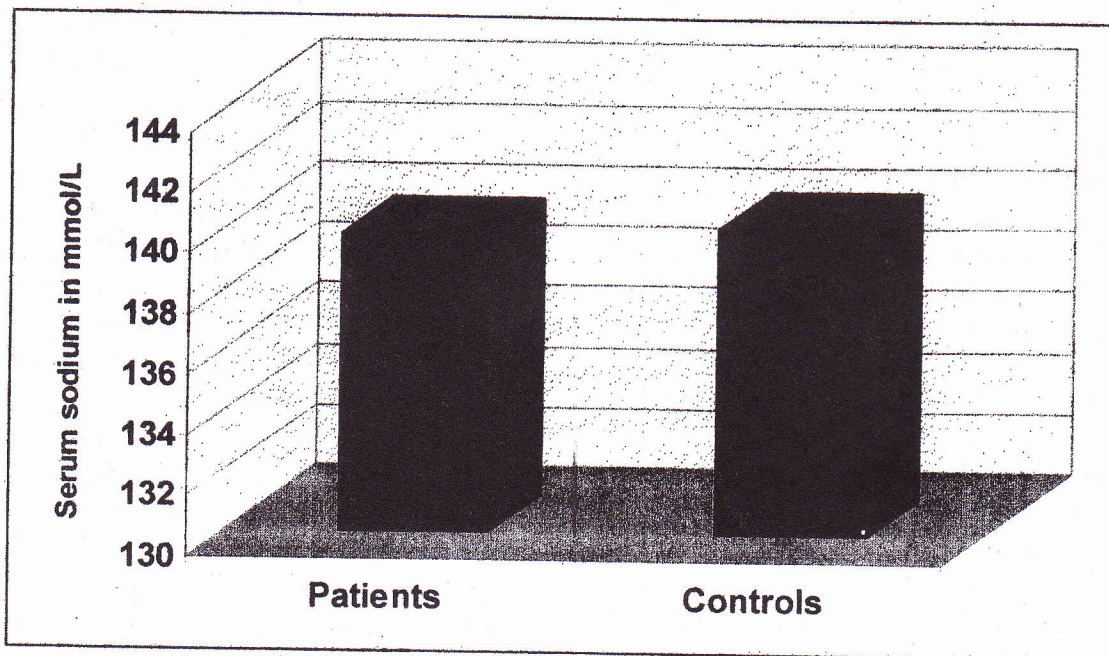


Fig (2): The mean serum sodium in patients and controls.

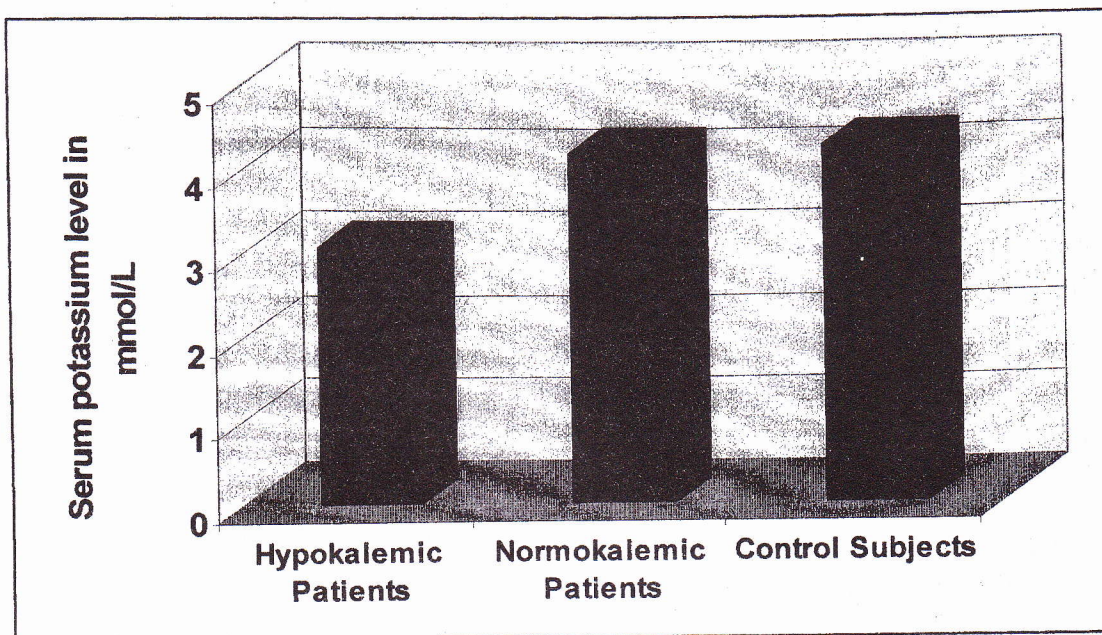


Fig (3): The mean serum potassium in patients and controls.

### Discussion

The laboratory findings for asthma are often non-specific, <sup>(12)</sup> it was evident from figure-1, that the patients with asthma on salbutamol therapy were isonatremic. This finding could be attributed to the patients included in this study because they are not dehydrated, and this finding is in agreement with the finding of Duplooy *et al* (1994). While the majority of patients (73.3%) were hypokalemic, this finding is in agreement with the finding of Bronchar (1995) who find that salbutamol causes hypokalemia after 10 minutes and this finding may be attributed to the hypokalemic effect of salbutamol, our results are in disagreement with the finding of Duplooy (1994) who found

that the effect of salbutamol is a dose related which could be hyper or hypokalemic effect. Udezue *et al* (1995) studied 2 adult asthmatic patients who became hypokalemic after inhalation of salbutamol by a metered-dose inhaler, while there was no effect on the serum level of sodium in those patients, this findings are in agreement with the findings in this study regarding the serum level of sodium and potassium. In conclusion, this study showed that serum potassium is significantly lower in patients with asthma on salbutamol therapy as compared with the healthy subjects (control), and they are isonatremic as compared with the controls. Further studies are recommended to study the effect of other

drugs like aminophylline when it is used to treated asthma.

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