

ANP SECRETION IN THE ATRIA OF SHEEP

Fatma ŞAHİN, PhD*, Neyhan ERGENE, PhD**

* Atatürk Faculty of Education, University of Marmara, İstanbul, Turkey

** Faculty of Medicine, Selçuk University, Konya, Turkey.

ÖZET

Koyun Atriumunda ANP Sekresyonu

Bu çalışmanın amacı koyun ANP'in tür özelliğinin ve diyetle tuz alımının ANP salgısına etkisinin araştırılmasıydı. ANP'in tür özelliğinin anlaşılması için koyun atrial ekstresi sıçanlara enjekte edilmiş, plazma ve idrar Na^+ , K^+ ve osmolalite değerleri belirlenmiştir. ANP salgısında tuzun rolü, yemlerine farklı konsantrasyonlarda tuz katılan sıçanlardaki tayı ile araştırılmıştır.

Koyun atrial ekstreleri enjekte edilen sıçanların idrar Na^+ ve K^+ değerleri artarken osmolalite azalmıştır. Yemlerdeki tuz konsantrasyonları artırıldığında benzer şekilde plazma Na^+ ve K^+ değerleri artmış ve osmolalite düşmüştür.

Bu sonuçlara göre etkisi tür özelliği taşımayan ANP memelilerde tuz atılımını kontrol etmekte, muhtemelen diğer hormonal etkiler yanında plazma ve idrar Na^+ , K^+ ve osmolalite değerleri ANP salgısına bağlı olmaktadır.

Anahtar Kelimeler : Koyun atriumu, ANP

SUMMARY

The aim of this study was to determine whether sheep's ANP is species specific and if there is a relationship between the diet salt concentrations and ANP. Sheep atrial extracts were injected into rats and the levels of Na^+ , K^+ and the osmolality in the plasma and urine were measured in order to study the species specificity of ANP. The role of diet salt concentration in the production of ANP was studied as the rats fed by the food with different concentration of salt and some determinations were carried out.

Results indicates that, when the sheep extracts injected into rats, the urine Na^+ and K^+ levels were increased whereas the osmolality was decreased. When the diet salt concentration increased, similarly plasma and urine Na^+ and K^+ levels were increased whereas osmolality was decreased.

According to this results it is concluded that, the effect of ANP in mammals may not be species specific, the factor which controls the salt excretion is probably ANP, and plasma and urine Na^+ , K^+ and osmolality levels probably also depend on ANP besides other hormonal effects.

Key Words : The atria of sheep, ANP

INTRODUCTION

Atrial cardiocytes of mammals contain granules similar to those of other cells which secrete peptide hormones (1,2,3.). These granules are observed densely around the nucleus and contain biologically active peptides called atrial natriuretic peptides (ANP) (2,4,5,6,7). The number of granules change with the body water content and sodium concentration. The atria are believed to have fluid volume receptors (8,9,10). These peptides may play an important role in regulating the water and electrolyte content of extracellular fluid (11). The target organ for ANP is

kidneys. ANP mainly effects glomerular filtration and distal tubular absorption (12,13). ANP inhibits the secretion of aldosteron thereby reducing the re-absorption of Na^+ and water and creating rapid natriuresis and diuresis (7,14). Its action is mediated by an increase of intracellular cGMP activity as second messenger (15).

In this study, atrial extracts of sheep and rats were injected intravenously and the excretion of Na^+ , K^+ and urine osmolality and levels of plasma Na^+ , K^+ and osmolality were investigated.

MATERIALS AND METHODS

In the experiment, 40 wistar albino rats (200-259g) were used in 4 groups. Each group received diets containing different levels of Na^+ for one week. Blood and urine samples were collected three times, once before the infusion, blood and urine samples were collected as the control period. Then 0.5 ml of atrial extract was infused via coccygeal vein. Blood and urine collections were repeated 5 minutes and 15 minutes following the injection of atrial extracts. Metabolic cage was used for collection of urine.

Group 1 were fed on the standart diet (protein content 21 %, sodium 0.21%) with 4 % by weight of NaCl added. Sheep atrial extract was injected.

Group 2 were fed on the normal rat diet and atrial extract was injected.

Group 3 were fed on normal rat diet and sheep atrial extract was injected.

Group 4 were fed on normal rat diet without salt and sheep atrial extract was injected.

Preparation of Atrial Extract

Atrial extracts were prepared as described by de Bold et al (16) and Thibault et al. (17). The animals (sheep and rats) were decapitated, their hearts rapidly excised. Tissues were put in ice and they were brought to laboratory about in an hour. Both atria were dissected in laboratory at 4°C. After drying with tissue papers, weighed. 5 ml glacial acetic acid was added for each gram of atrial tissue and centrifuged and diluted with 2 ml 0.1 M acetic acid, then centrifuged for 5 minutes at 3000 rpm and stored at -70 °C until used.

Chemical Analyses

Na^+ and K^+ determinations were carried out by using a flame photometer (Eppendorf Type 700). Osmolality of urine and plasma were measured cryoscopically (Fisce osmometer).

Statistical Analyses

Standart deviations of each group and the results were analysed statistically with student's t tests.

RESULTS

Sodium, potassium and osmolality values for all

groups are shown in Figures 1-6. In the salt added group before the extract injection though Na^+ , K^+ levels in both urine and plasma were higher, osmolality was seen to be lower than the others. 5 minutes after the injection in all groups Na^+ , K^+ levels were increased while osmolality dropped compared with the pre-injection level and their level were closer again with the pre-injection level in 15 minutes. The increase in Na^+ , K^+ levels were more obvious in the salt added group and less in no salt diet group.

DISCUSSION

The effects of ANP were determined bu using different techniques in different animals (4,18). In this study sheep atrial extracts were given to rats and their effects were observed. Five minutes after the atrial extract injection, Na^+ and K^+ excretion increased whereas the osmolality was decreased in plasma and urine. 15 minutes later these values were approached to basal levels. Although those values were slightly lower, the changes were in the same direction as reported by Atlas (19) and Rain (20). Those values were approached to basal levels reported by Vaughan (21). While Atlas and Rain obtained extractions from rats, Vaughan got them from rabbits. As it mentioned earlier since the rats have a greater atrial granules then the other mammals this can be a reason for the discrepancy. Although Atlas and Rain anaesthetized the animals but in this study they were not.

In this study in order to determine the species specificity of ANP, sheep and rats' atrial extracts were injected into rats and they were compared. Sheep and rat atrial extracts produced comparable changes in rat's atrial extracts produced comparable changes in rats as can be seen by comparison of group II and III. This suggests that at least for these species there is no species specificity. It was shown that when synthetic human ANP were injected into different animals had physiological effects (22, 23).

According to these results it is concluded that the effect of ANP in mammals may not be species specific. There was a relationship between the diet salt concentrations and ANP. For this purpose in this study different salt concentrations were used in 3 different groups. (Group 1, 3, 4).

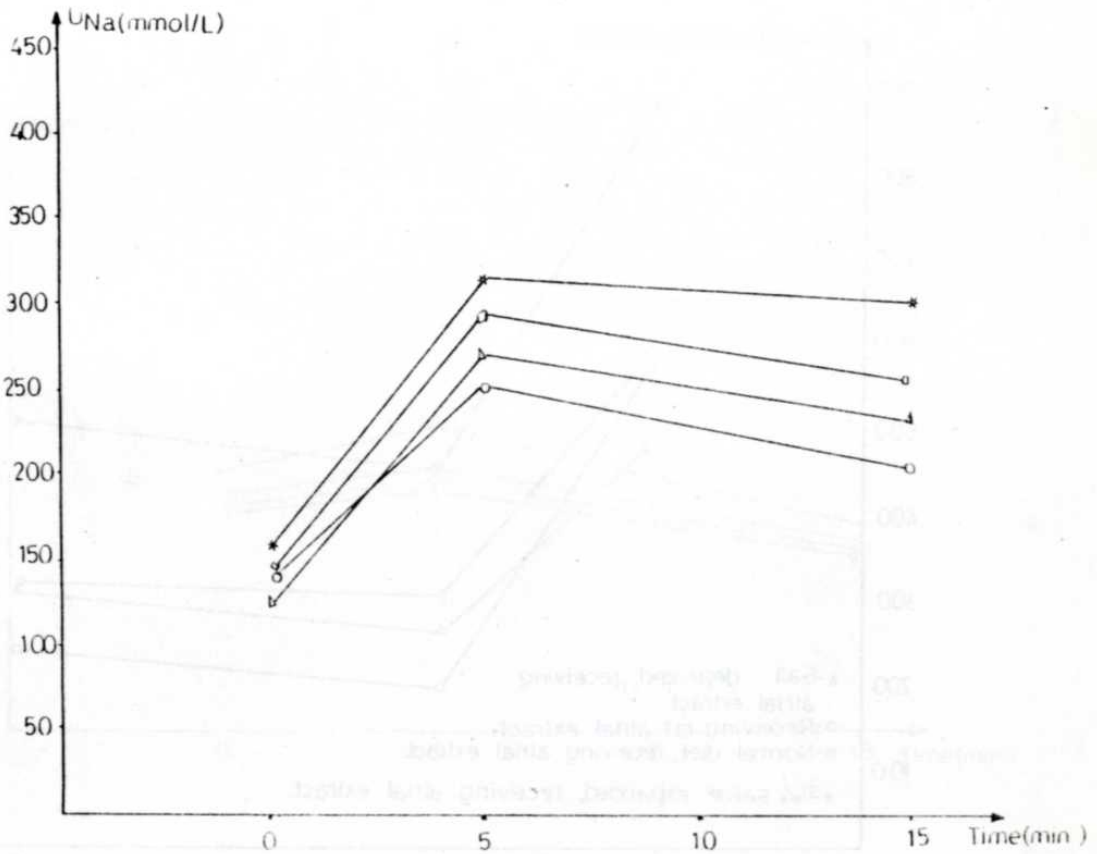


Figure 1. Urine Na⁺ values

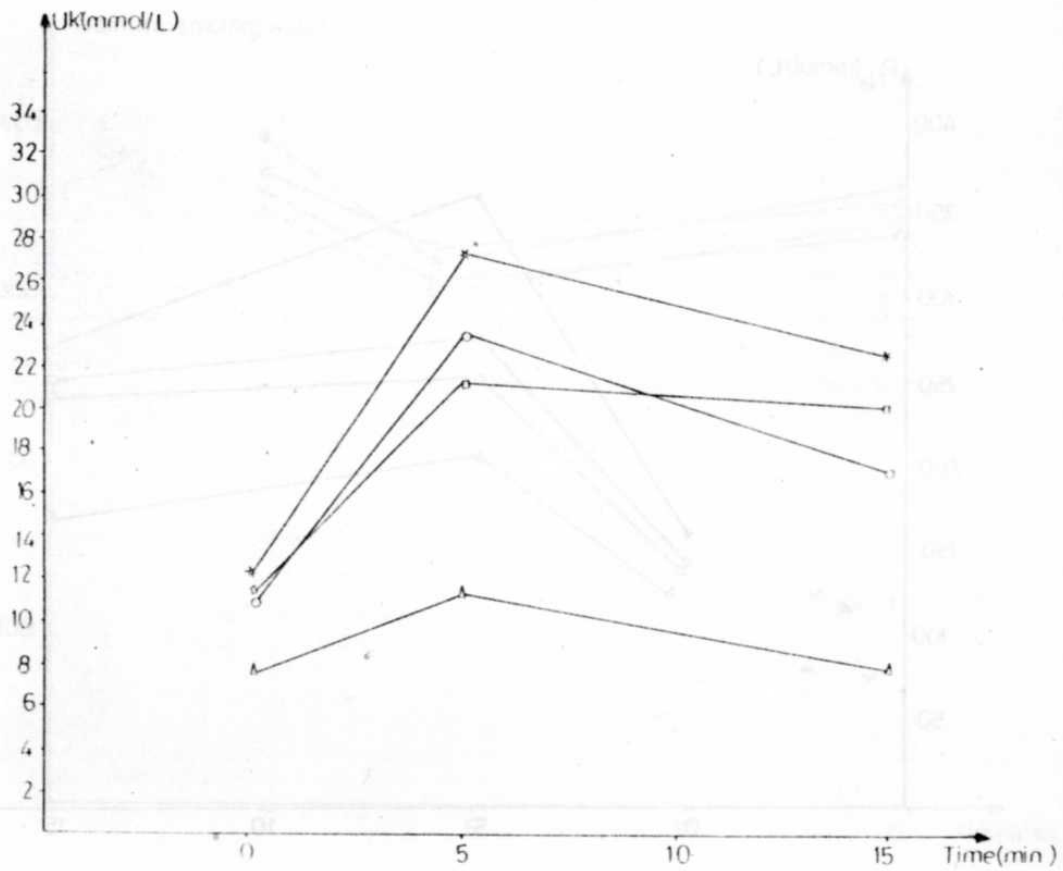


Figure 2. Urine K⁺ values

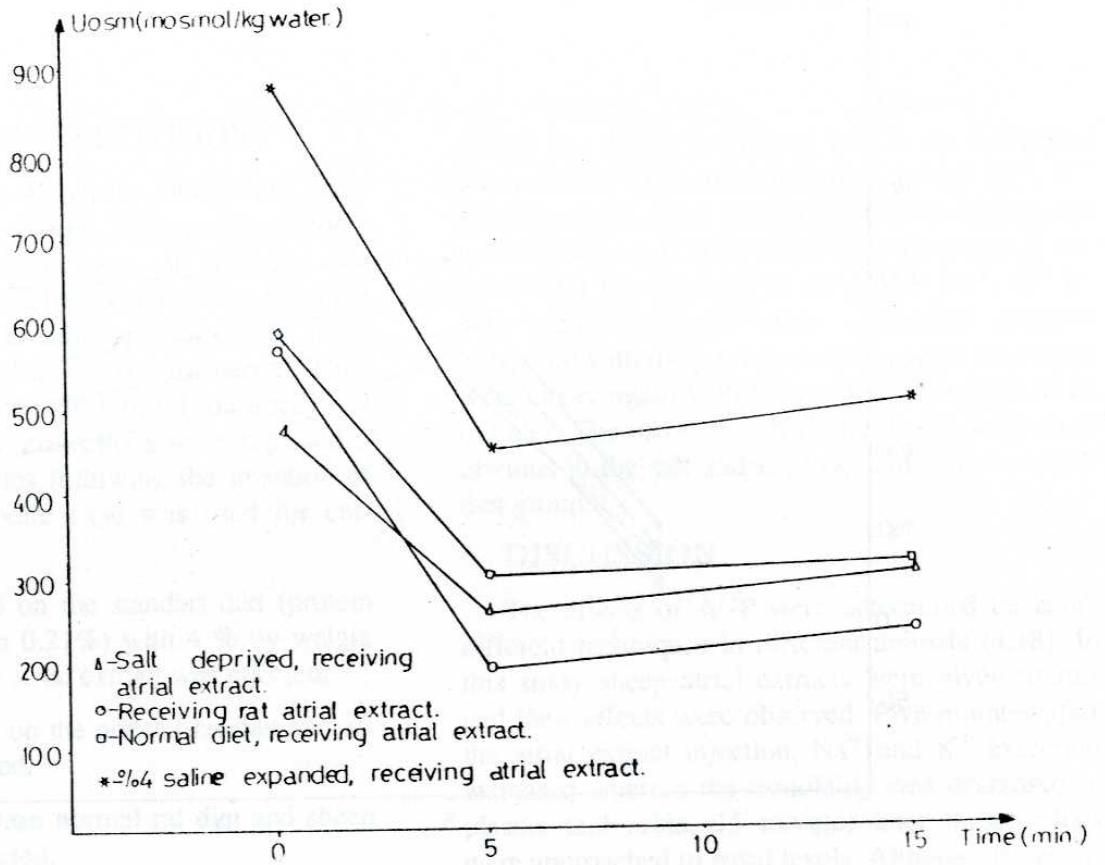


Figure 3. Urine osmolality values

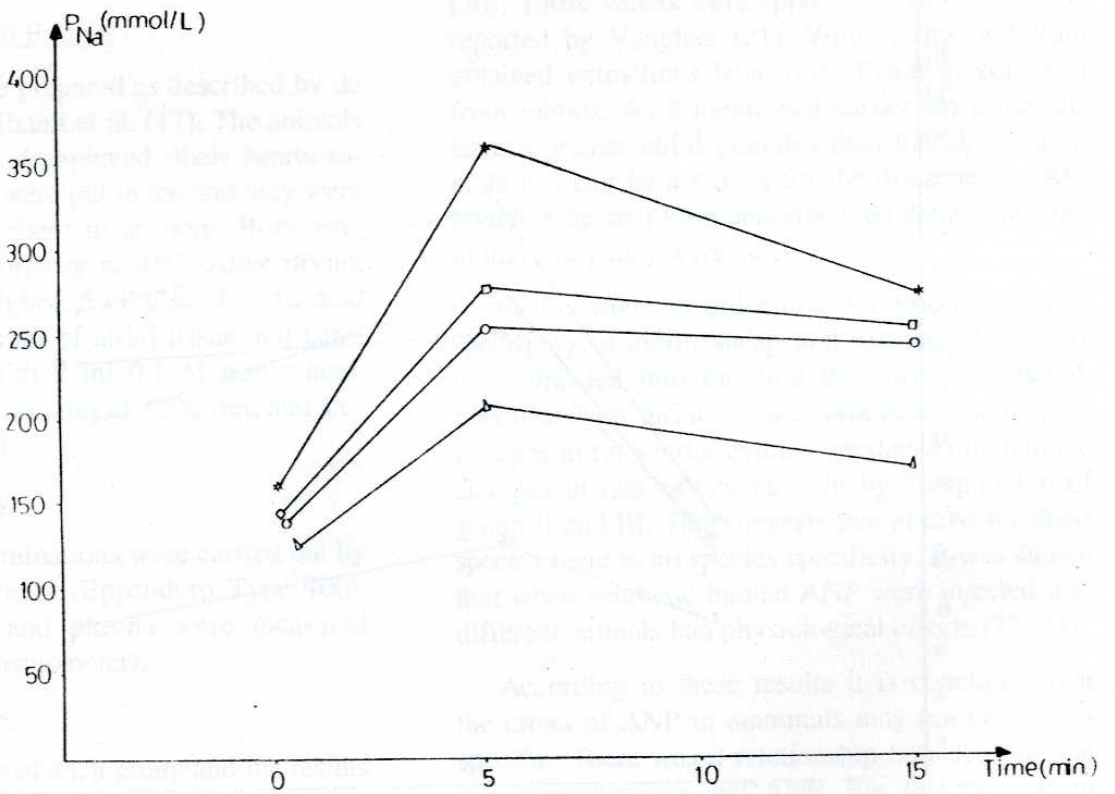


Figure 4. Plasma Na⁺ values

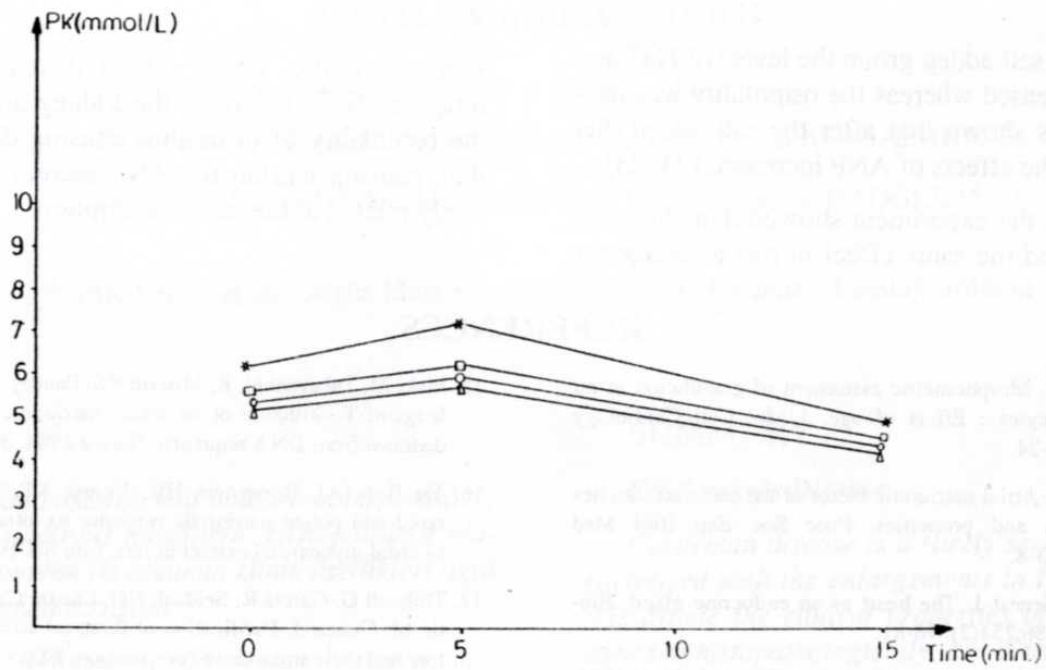


Figure 5. Plasma K^+ values

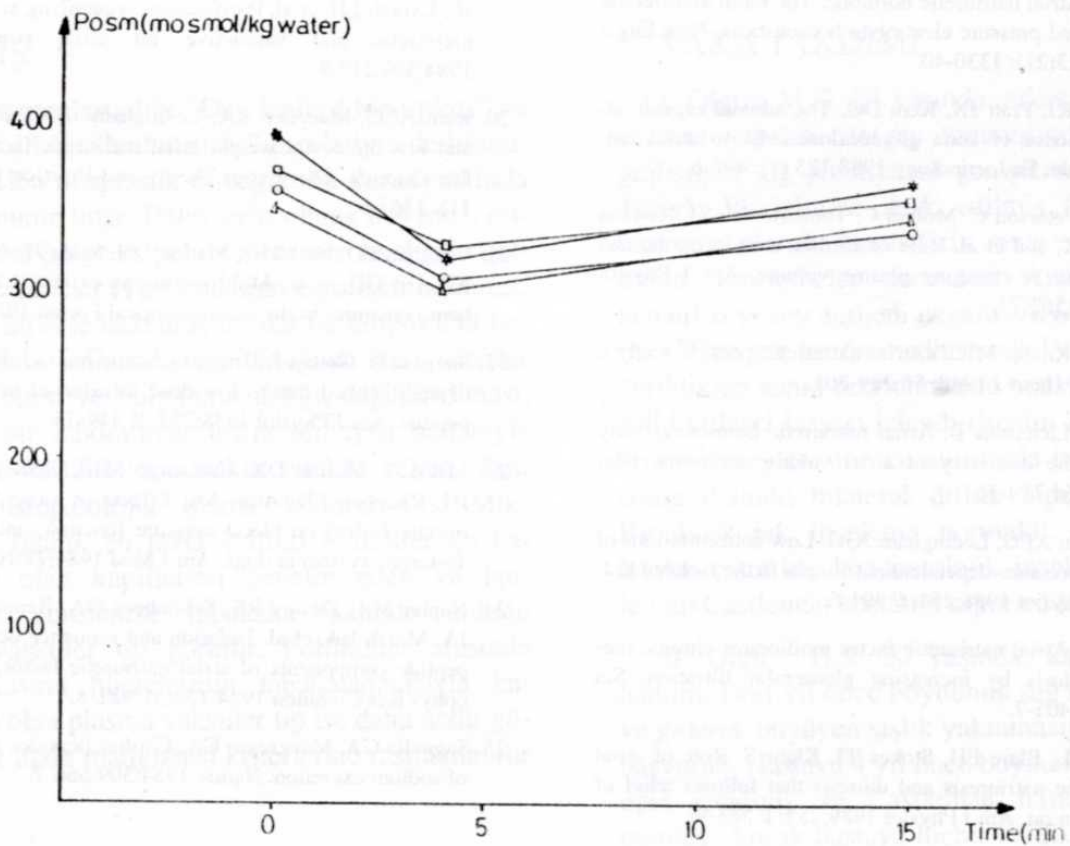


Figure 6. Plasma osmolality values

In the 4% salt added group the levels of Na⁺ and K⁺ were increased whereas the osmolality was decreased. It was shown that after the salt added diet applications the effects of ANP increased (24, 25).

Results of the experiment showed that sheep atrial extract had the same effect in rats as being not

species specific. Atrial extract increased the excretion of Na⁺, K⁺ from the kidney and decreased the osmolality of urine thus causing diuresis more than causing natriuresis. ANP secretion is also directly related to the salt consumption.

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