TAURINE CONTENT OF CARDIAC TISSUE IN SPONTANEOUSLY HYPER-TENSIVE RATS

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ABSTRACT
The taurine content of cardiac tissue was determined in normotensive rats (NWR) and spontaneously hypertensive rats (SHR) at different ages from 2 to 26 weeks. Taurine content increased with age in both NWR and SHR. At 6 weeks taurine content of the NWR heart was higher than SHR. But the taurine content of SHR increased significantly higher than NWR by 6 weeks and remained high throughout the age period studied.

KEY WORDS
taurine; SHR; heart; age

Taurine (2-aminooethanesulfonic acid) is a simple, stable amino acid that is found in varying concentrations in many animal tissues; however, in spite of its ubiquitous distribution, its physiological or pathological function still remains obscure. In the heart, taurine accounts for over 60% of the total amino acid pool and it has been implicated in a broad variety of cardiac phenomena such as potentiating the isotropic action of strophanthidin K in guinea pig atria15, preventing the epinephrine-induced premature ventricular contractions in dog16 and delaying the appearance of cardiac lesions in the genetically myopathic hamsters17. Moreover, in rat, dog, and man, myocardial taurine content is markedly elevated in congestive heart failure18,19. Elevated level of taurine in blood has been reported in myocardial infarction20.

This study was undertaken to examine whether similar changes in tissue taurine occur in the heart during the development of spontaneous hypertension. These experiments were made possible by the recent acquisition of a small population of a strain of spontaneously hypertensive Wistar rats (SHR), first developed by Oka-moto and Anoki as a model of essential hypertension21. Several studies on this model have already revealed alterations in the properties and responses of cardiac tissue, particularly to various pharmacological agents. Only a few have demonstrated any biochemical changes. Therefore, this study was undertaken to examine whether similar changes in tissue taurine occur in hearts of SHR during the development of hypertension.

MATERIALS AND METHODS
Male and female normotensive rats (NWR) and SHR of different ages were used. These rats were bred in our laboratories so that a constant supply of age and sex matched rats was assured. The original stock of SHR was obtained from the National Institutes of Health animal center.

The rats were anesthetized with ether. Hearts were quickly excised, freed from connective tissues and blood, and weighed. The hearts were stored at -20°C until ready for processing.

The hearts from age and sex matched NWR and SHR were homogenized in 2 volumes of ice-cold 50% trichloroacetic acid (TCA). The homogenate was centrifuged at 3000 x g for 30 min. The supernatant was extracted with water saturated ether.

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Results

Taurine content in the hearts of NWR and SHR rats at 2, 4, 5, 10, 12, 14, 16, and 24 wks was determined and the results are included in Table 1. The amount of taurine in the hearts of both NWR and SHR increased with age. At 4 wks, taurine in NWR heart is greater than in 4 wks old SHR; however, the taurine content of SHR increases with age. Table 2. Systolic blood pressure measured by a Narco Bio-Systems Model PE-300 sphygmomanometer on tail, 15 rats/group, ±SD

<table>
<thead>
<tr>
<th>Age (wks)</th>
<th>NWR (mm Hg)</th>
<th>SHR (mm Hg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4±5</td>
<td>107±21</td>
<td>110±21**</td>
</tr>
<tr>
<td>10±11</td>
<td>136±16</td>
<td>151±23***</td>
</tr>
<tr>
<td>16</td>
<td>136±16</td>
<td>203±27***</td>
</tr>
<tr>
<td>22</td>
<td>137±12</td>
<td>202±23**</td>
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</tbody>
</table>

Commenes to exceed NWR by 6 wks, and is significantly higher in SHR than in NWR by the 10th wk. This higher level is maintained in SHR throughout the age period studied.

The pattern of change of taurine content in NWR and SHR seems to follow the changes in blood pressure. Table 2 incorporates the changes in blood pressure of NWR and SHR from age 4 wks to 22 wks.

Discussion

Earlier reports in the literature on taurine content in SHR and NWR hearts are contradictory. Nara et al.12) reported no difference at 12 wks, while Huxtable and Bressler13) reported higher taurine content in SHR.

The data presented here indicate that the taurine content in the hearts of both NWR and SHR increases with age. However, the rate of increase in SHR is greater by 4th wk and 10th wk taurine content in SHR is significantly higher than NWR. This higher level is maintained up to 24 wks.

Although the concentration of taurine is significantly higher in SHR, it is difficult to explain the reason for this increase. The level of taurine can be regulated by 9 mechanisms; 1) catabolism of taurine, 2) endogenous biosynthesis, or 3) uptake of taurine from circulation. Chu14) and Huxtable15) have reported an increase in

*** P<0.01 as compared to NWR.
taurine content in isoproterenol-induced cardiac hypertrophy and have shown that this elevated taurine level is due to an increased influx of taurine. In formulating a possible mechanism for the regulation of taurine influx, they suggest a β-adrenergically activated cyclic AMP-mediated mechanism controlling isoproterenol induced taurine influx. Whether or not the taurine level in SHR is regulated by a β-adrenergic-cyclic AMP mechanism, cannot be answered at the moment. Since our earlier results have shown decreased cyclic AMP content in the hearts of SHR com-

menting at 8 wks, it is possible that taurine level in SHR is not under the strict control of β-adrenergic-cyclic AMP system.

It is interesting to note that taurine content in SHR is higher than NWR and the rate of increase parallels the increase in blood pressure. In order to understand the effect of taurine on blood pressure, Nara et al. have supplemented taurine in the diet. They have observed that taurine supplement had no effect on blood pressure in normal rats, while it reduced the blood pressure of stroke prone-SHR to the level of SHR. The stroke prone-SHR normally have significantly higher blood pressure than the SHR, and taurine appeared to equalize blood pressure in these two strains. However, the effect of taurine on the blood pressure of SHR was only marginally. Our results presented here seem to suggest that increased taurine content in SHR has probably no effect on the blood pressure. Further work is necessary to define the possible role of taurine in regulating blood pressure or in the development of spontaneous hypertension.

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