

## Relationship of Dietary Sodium Chloride to Aortic Ruptures in Turkeys Induced by Diethylstilbestrol.\* (30849)

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It has been reported that high dietary levels of NaCl did not increase the incidence of aortic ruptures in turkeys induced by *Beta*-aminopropionitrile(1). However, the incidence of the disease in poultts injected with diethylstilbestrol (DES) was increased by feeding a 3% NaCl diet as compared to a control diet containing a recommended level of 0.5% NaCl(2). This report is a continuation of a study to determine the effects of dietary NaCl on aortic ruptures in turkeys induced by DES by comparing the influence of NaCl-free, normal NaCl, and high NaCl diets on the disease syndrome.

**Materials and methods.** One-day-old Broad-Breasted-Bronze male turkeys were started in electric brooders and fed a 20% protein commercial-chick-starter mash. At 4 weeks of age, 12 groups of turkeys, each containing 10 poultts, were fed a 19% protein diet containing 0.5% NaCl, and 8 groups were fed the same diet with 3% NaCl. Beginning at 7½ weeks of age, all birds were fed a 23% protein diet containing 6% added animal fat(3). Of the 12 groups previously fed 0.5% NaCl, 4 were placed on the new diet with no added NaCl; a second 4 groups were fed the diet with 0.5% NaCl, and the third 4 groups were fed the same diet having a NaCl content of 3%. Four of the groups previously fed the 19% protein diet with 3% NaCl were changed to the 23% protein diet without NaCl, and the dietary NaCl content of the other 4 groups was maintained at 3%. Each group of poultts consisted of 10 birds, 8 of which were treated weekly with 30 mg of DES(2) starting at 6 weeks of age, and 2 of which were maintained as untreated controls. This experiment was replicated 3 times, and the data from all 3 experiments were combined for this presentation.

Weighing, bleeding and indirect systolic

blood pressure measurements(4) were commenced at 7 weeks of age and continued until the experiments terminated at 11 weeks of age. Total plasma lipids, cholesterol, and calcium were determined(5,6,7).

**Results and discussion.** Decreasing the level of NaCl in the diet reduced mortality caused by aortic ruptures. Diminution of NaCl from 3% to 0% caused a significant reduction in mortality. Reduction of dietary NaCl from 0.5% to 0% resulted in a numerical, but not a significant decrease in the incidence of the disease (Table I).

Increasing NaCl in the diet from 0.5% to 3% at 7½ weeks of age significantly increased the incidence of aortic ruptures. Mortality rate was the same when 3% NaCl was fed from 4 weeks of age to the end of the experiment (Table I). The results of these experiments not only confirmed previous observations that the incidence of aortic ruptures induced by DES injections is increased by elevating dietary NaCl levels(2), but also indicated that mortality rates can be reduced by lowering the NaCl content of the diet.

Injection of poultts with DES caused relative hypotension, as has been reported previously(2). However, dietary NaCl levels had no influence on this factor. The indirect systolic blood pressure of DES-treated turkeys was about 172 mm Hg at 11 weeks of age as compared to 230 mm Hg for control birds. Turkeys treated with DES developed hyperlipemia and hypercholesterolemia (Table I) as described previously(2,8). However, total plasma lipid value in the present experiments were higher than those reported previously (2,8), in which methanol extraction was used (9). A chloroform-methanol extraction method(5) was found to be more accurate. In addition, in the present work it was found that DES-treated poultts also developed hypercalcemia. At 11 weeks of age, treated turkeys had plasma calcium levels of 15.5 to 19.5 mEq per liter of plasma while control turkeys

\*Supported in part by a grant from Nat. Heart Inst., U.S.P.H.S. Florida Agri. Exp. Stations Journal Series No. 2339.

TABLE I. Influence of DES and Dietary NaCl on Aortic Ruptures, Blood Pressure, and Plasma Composition of Turkeys (Avg of 3 exp).

| % dietary NaCl |                | % mortality†    | Systolic blood pressure*<br>DES/control<br>(mm Hg) | Total lipid*<br>DES/control<br>(mg/100 ml) | Total cholesterol*<br>DES/control<br>(mg/100 ml) | Plasma calcium*<br>DES/control<br>(mEq/l) |
|----------------|----------------|-----------------|----------------------------------------------------|--------------------------------------------|--------------------------------------------------|-------------------------------------------|
| 4-7½ weeks age | After 7½ weeks |                 |                                                    |                                            |                                                  |                                           |
| .5             | .0             | 35 <sup>b</sup> | 169/230                                            | 13,270/482                                 | 1,248/138                                        | 15.5/7.5                                  |
| .5             | .5             | 41 <sup>b</sup> | 172/240                                            | 12,820/530                                 | 1,016/130                                        | 19.5/7.3                                  |
| .5             | 3.0            | 54 <sup>a</sup> | 174/220                                            | 12,350/456                                 | 1,040/130                                        | 19.4/6.8                                  |
| 3.0            | .0             | 38 <sup>b</sup> | 172/230                                            | 11,310/600                                 | 1,035/139                                        | 16.2/7.3                                  |
| 3.0            | 3.0            | 55 <sup>a</sup> | 172/230                                            | 13,340/620                                 | 1,191/139                                        | 19.5/7.5                                  |

\* At 11 weeks of age.

† Means with different superscripts are significantly different according to Duncan's Multiple Range Test.

had concentrations of 7 to 7.5 mEq per liter. Variations in dietary NaCl levels apparently had no influence on total plasma lipid, plasma cholesterol, or plasma calcium levels induced by estrogen treatments.

The results of this study suggest that therapy in vascular disease in some other species might include reduction of dietary NaCl levels. Some experimental data in rats also adds support to this belief because it has been shown that in this animal elevated dietary NaCl may increase lipid deposition in the aorta(10). However, most of the interest in the relationship of electrolytes to the development of atherosclerosis pertains to the relationship of NaCl to hypertension(11).

**Summary.** The incidence of aortic ruptures in turkeys induced by injections of DES was decreased by reducing dietary NaCl levels from 3.0% to 0% or from 0.5% to 0%. The incidence of the disease was increased by elevating dietary NaCl levels from 0.5% to 3% or feeding 3% for the entire trial. Hyperlipemia, hypercholesterolemia, and hypercalcemia associated with the disease induced by DES injections was not influenced by the various levels of NaCl fed.

The technical assistance of J. W. Carlisle and C. J. Miller is acknowledged.

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Received October 27, 1965. P.S.E.B.M., 1966, v121.