THE INFLUENCE OF EXPERIMENTAL THYROID INTOXI-CATION ON THE POTASSIUM, SODIUM, AND WATER CONTENT OF THE MYOCARDIUM

By EATON M. MACKAY AND H. C. BERGMAN

(From the Scripps Metabolic Clinic, La Jolla, Calif.)

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Harrison et al. (1) analyzed samples of cardiac and skeletal muscle obtained from patients who had died of congestive heart failure and found them to be abnormally poor in potassium. It is their belief (2, 3) that this diminution in the potassium content is related to overwork and the attendant fatigue. The heart in experimental thyrotoxicosis seemed to offer a possible opportunity of examining the hypothesis in question under controlled conditions. In addition, the effect of thyroid intoxication on the potassium content of the greatly enlarged heart has an interest of its own.

Thirty-six male albino rats 140 days old and 14 rats 100 days old were divided into two groups on the basis of body weight. For two weeks they all received a special diet described elsewhere (4). In addition the diet of one group had 0.2 per cent of desiccated thyroid (Wilson Laboratories) intimately mixed with it. At the end of the period the rats were etherized and the heart removed, freed of adherent blood by blotting on filter paper, weighed on an analytical balance, and preserved for analysis. The water content of the tissue was determined by drying to constant weight at 80° C. in vacuo. The residue was then ashed with the aid of nitric acid and heat. Either sodium or potassium was determined on the ash, the small quantity of sample precluding both determinations upon a single heart. For sodium the modification of the uranyl zinc acetate method described by Butler and Tuthill (5) was used and for potassium the volumetric modification of the chloroplatinate method described by Shohl and Bennett (6). The potassium content was determined in the hearts of 15 animals of each group and the sodium content measured in those of the remainder.

The results have been tabulated in Table I. The administration of thyroid substance, although producing the usual marked increase in the weight of the heart, was without demonstrable effect upon the water, potassium or sodium content of the myocardium.

The data tabulated here give no support to the idea that overwork or fatigue causes a diminution in the potassium content of cardiac muscle insofar as the effect of thyroid substance is concerned. They

TABLE I The influence in the albino rat of experimental thyroid intoxication upon the potassium, sodium and water content of the myocardium

Body weight Initial After Again death Heart Again death Heart Again death Heart Again death Process of the peach of t				Controls	80					Thyroid fed	. pəj	
weight High Value Per cent of wet heart Per cent of wet heart Initial death meght After High High High Heart heart Initial death meght High High High High High High High High	weig	ht	Heart			Na		weight	t co	Heart	м	Na
** per cent per cent of <	₩₽	ofter eath	weight			Per cent of wet heart		After death	weight	Hro	Per cent wet heart	Per cent of wet heart
598 75.8 0.378 *129 228 1053 77.1 0.349 694 75.2 0.376 *158 176 806 75.2 0.375 691 76.0 0.328 *163 175 75.3 0.347 691 76.0 0.326 *156 164 755 75.4 0.347 681 75.9 0.320 *156 164 755 75.4 0.347 760 75.4 0.322 *156 164 755 75.4 0.341 600 76.0 0.304 *15 170 116 77.0 0.296 600 75.6 0.302 170 185 184 842 75.1 0.296 600 75.6 0.302 170 116 75.3 0.297 0.297 526 74.5 0.304 170 168 844 76.6 0.297 526 74.5 0.304 191 <		grams	mgm.	per cent	per cent of fresh tissue	per cent of fresh tissue	grams	grams	mgm.	per cent	per cent of fresh tissue	per cent of fresh tissue
677 75.8 0.370 *158 176 806 75.2 0.375 694 75.2 0.358 *158 176 806 75.2 0.347 681 75.0 0.326 *158 182 879 75.3 0.347 681 75.4 0.320 *156 164 75.3 0.341 681 75.4 0.322 *182 194 75.3 0.341 769 75.4 0.300 *185 1116 77.0 0.297 600 75.0 0.300 170 116 77.0 0.297 600 75.0 0.302 170 148 842 75.3 0.297 606 75.6 0.302 170 168 844 75.5 0.317 520 74.5 0.304 191 197 875 75.2 0.310 540 75.4 0.300 203 214 207 875 75.2 <t< td=""><td></td><td>213</td><td>298</td><td>75.8</td><td>0.378</td><td></td><td>229</td><td>228</td><td>1053</td><td>77.1</td><td>0.349</td><td></td></t<>		213	298	75.8	0.378		229	228	1053	77.1	0.349	
694 75.2 0.358 238 220 1024 75.8 0.347 691 76.0 0.326 *156 164 75.3 0.341 681 76.0 0.326 *156 184 879 75.3 0.341 769 75.4 0.322 *182 879 75.4 0.327 760 75.4 0.322 *182 879 75.4 0.327 600 76.0 0.304 *185 184 842 75.3 0.327 600 75.0 0.302 170 168 844 76.6 0.297 520 74.7 0.312 245 226 1044 76.5 0.297 540 74.5 0.304 191 197 875 0.297 540 74.5 0.304 213 194 940 75.5 0.304 521 75.0 0.289 200 197 75.7 0.256 <td< td=""><td></td><td>258</td><td>229</td><td>75.8</td><td>0.370</td><td></td><td>*158</td><td>176</td><td>908</td><td>75.2</td><td>0.375</td><td></td></td<>		258	229	75.8	0.370		*158	176	908	75.2	0.375	
691 76.0 0.326 **163 182 879 75.3 0.341 681 75.9 0.320 **156 164 755 75.4 0.327 754 75.4 0.322 **186 164 75.3 75.4 0.327 754 76.0 0.304 **182 194 945 75.1 0.327 600 75.0 0.302 **182 184 842 75.1 0.327 600 75.0 0.302 170 168 844 76.5 0.297 600 75.0 0.302 170 168 844 76.5 0.297 520 74.7 0.304 170 168 844 76.5 0.297 540 74.5 0.304 214 207 875 0.297 540 75.1 0.202 213 194 940 75.3 0.275 520 75.2 0.289 200 197		248	694	75.2	0.358		238	220	1024	75.8	0.347	
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769 75.4 0.322 270 270 1116 77.0 0.296 754 76.1 0.304 *182 194 945 75.1 0.296 600 76.0 0.304 *185 184 842 75.3 0.317 600 76.0 0.302 170 168 844 76.5 0.297 526 74.7 0.312 245 226 1044 76.5 0.297 526 74.5 0.304 191 197 875 75.2 0.304 624 75.3 0.292 214 207 856 75.5 0.304 624 75.0 0.289 213 194 940 75.5 0.295 520 75.0 0.289 203 197 77.9 0.256 527 75.4 0.289 200 193 77.4 0.256 520 75.1 0.088 *128 148 75.6		223	681	75.9	0.320		*156	164	755	75.4	0.327	
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600 76.0 0.300 185 184 842 75.3 0.317 660 75.6 0.302 170 168 844 76.6 0.297 526 74.7 0.312 245 226 1044 76.5 0.297 540 74.5 0.304 214 207 856 75.2 0.304 624 75.3 0.209 213 224 940 75.5 0.304 592 75.0 0.289 213 224 903 75.7 0.256 772 75.4 0.258 0.096 197 213 940 75.3 0.259 520 75.2 0.289 220 210 1118 75.3 0.256 520 75.2 0.088 200 193 77.4 77.4 520 75.1 0.086 *128 148 75.6 77.0 540 75.1 0.068 220 199 866		295	754	76.1	0.304		*182	194	945	75.1	0.322	
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582 75.2 0.064 235 236 1021 75.6 715 76.3 0.064 222 221 860 76.3 656 75.6 0.054 *142 154 680 75.3 649 75.6 0.316 0.074 199 200 917 76.1 0.311		294	803	75.7		990.0	200	199	998	77.0		0.076
715 76.3 0.064 222 222 221 860 76.3 656 75.6 0.054 *142 154 680 75.3 649 75.6 0.316 0.074 199 200 917 76.1 0.311		222	582	75.2		0.064	235	236	1021	75.6		0.080
656 75.6 0.054 *142 154 680 75.3 649 75.6 0.316 0.074 199 200 917 76.1 0.311		227	715	76.3		0.064	222	221	98	76.3		0.077
649 75.6 0.316 0.074 199 200 917 76.1 0.311		245	929	75.6		0.054	*142	154	089	75.3		0.074
045 75.0 0.510 0.514 155 200 511 70.1		924	640	75.6	0.216	7200	100	000	017	16.1	0.211	0.001
		234	649	75.6	0.316	0.074	199	700	917	76.1	0.311	

* 100 days old.

cannot, however, be interpreted as directly opposing this hypothesis proposed by Harrison (2,3), for there is some doubt (7) that heart failure ever occurs in goiter with hyperthyroidism as its sole cause. If this is true our assumption that thyroid intoxication produces overwork and fatigue of the myocardium may be incorrect.

The constancy in the potassium content of the heart muscle before and following thyroxinization is very interesting. It would appear to indicate that the increase in heart weight is a simple hypertrophy, the tissue having essentially the same composition after the remarkable weight increase as before the administration of thyroid material.

SUMMARY

The increase in heart weight which ensues when active thyroid material is administered to the albino rat is without demonstrable effect upon the potassium, sodium or water content of the myocardium.

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