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The creatine content of muscle during starvation and its relation to urinary creatine.

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There has recently arisen some little discussion with regard to the creatine concentration of muscle during starvation. Data have been submitted to show that inanition in the rabbit results in an increase in the content of muscle creatine, and it has further been argued that there is an actual increase in creatine formation. In other quarters, it has been claimed that starvation (experiments with the dog) produces a marked decrease in the percentage content of muscle creatine.

From nine experiments which we have already completed on starving rabbits, we can agree with both of these observations as regards an increase or a decrease in the content of the muscle creatine. In three experiments, a decided increase in the content of creatine in muscle has been found; in one the per cent. of creatine was normal, while in five it was even more strikingly below normal. In addition to the increased or normal creatine content of muscle, the first four animals mentioned showed an increased percentage content of creatine in the body. This we are not inclined to ascribe to an increased creatine formation.

The reason for this increased or decreased content of body and muscle creatine appears to be satisfactorily explained by our results. The animals having an increase in the content of muscle creatine eliminate a comparatively small amount of creatine in the urine, while those in which the muscle and total body creatine has been considerably depleted, eliminate an equally large amount of creatine in the urine. In other words, the content of muscle creatine during starvation is dependent upon the amount of and the rate of creatine excretion in the urine. Just why some animals eliminate creatine more rapidly than others, we are as yet unable to explain, although we assume that this is connected with the length of the fast and the state of nutrition of the animal. The

rate of the loss of creatine appears to closely parallel that of the total nitrogen.

Still an added factor in this loss of creatine from the body is the excretion of creatinine. In experiments where the creatine of the urine plus that of the tissue does not entirely account for the creatine which should normally be present in the body, it is found that a considerable amount of creatinine has been eliminated in the urine, *e. g.*, in the case of a comparatively long fast. When this creatinine in terms of creatine is added to the creatine of the tissue and urine, this total exceeds the total normal body creatine by about 10 per cent., this excess probably representing the amount of creatine and creatinine formation. It would seem probable from these data that during starvation, the creatine storehouse was depleted not only by a loss of creatine in the urine, but also by the loss of creatinine.

It has been assumed for some time that the creatine appearing in the urine during starvation and in various pathological conditions was derived from the creatine of the muscle, and measured the amount of muscle disintegration, though so far as the authors are aware this point has never been conclusively demonstrated. In our experiments, we have found that when the weight of the creatine excreted in the urine was added to the weight of creatine still remaining in the body after the period of starvation, the amount of creatine was only slightly below that which would have been found in the body had the animal been killed prior to starvation. This would seem to demonstrate that the creatine appearing in the urine in starvation was derived from the creatine of the muscle.

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Reversal of the cardiac mechanism.

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The subject of investigation, H. M., came under observation at the Vanderbilt Clinic July 15, 1912. He has had a persistent