

stimulating effect of chocolate was attributed to the high fat content of this beverage. Very ripe fruit increased the catalase of the blood quickly and extensively, while less ripe fruit did not. This was attributed to the fact that the very ripe fruit contained much sugar, which was quickly absorbed, taken to the liver, and stimulated this organ to an increased output of catalase, whereas the less ripe fruit contained less sugar and hence did not stimulate the liver so strongly. The meat digest increased the catalase of the blood very quickly and extensively, whereas meat, eaten as such, did not act so quickly, due presumably to the time taken for digestion. The meat extract and beef juice produced a small increase in catalase.

Dogs were used in studying the effect of moderate exercise on catalase. The animal was placed in a treadmill and by a little coaxing was induced to run and thus turn the wheel at a rate of about five miles per hour. The catalase in 0.5 c.c. of blood taken from the external jugular was determined before the exercise as well as at 15-minute intervals during the exercise. It was found that the effect of moderate exercise was to increase the catalase of the blood from 15 to 20 per cent. in most of the dogs used.

Domestic rabbits were used in studying the effect of strenuous exercise and fatigue on catalase. The rabbits were also placed in the wheel, which was turned slowly by hand so that the direction in which the wheel was rotated could be changed to suit the direction in which the rabbit took a notion to run. A few slow turns of the wheel was sufficient to tire and fatigue the rabbit. Every precaution was taken not to abuse or injure the animal in any way. It was found that the strenuous exercise and fatigue decreased the catalase of the blood in some cases by as much as 30 per cent. and that during rest for an hour, the catalase returned to the normal amount and in fact above normal in several instances.

We had already shown that the output of catalase from the liver was increased by stimulating electrically the nerves (splanchnics) distributed to the liver. The explanation that

suggested itself for the increase in catalase during moderate exercise was the stimulation of the liver over the splanchnics to an increased output of this enzyme, while the decrease in catalase during violent exercise and fatigue was due to the using up of catalase in the oxidative processes of the muscles more rapidly than it was being replenished by the liver. The increase in catalase during the periods of rest after hard exercise was attributed to the fact that the liver was putting out catalase in the blood more rapidly than it was being used up in the muscles.

According to the chemical theory as set forth by Ranke,⁴ fatigue is due to the accumulation of substances, acid in nature, such as lactic acid, which inhibits or depresses the power of the muscles to contract. It is recognized that the accumulation of these acid substances is due to incomplete or defective oxidation. The decrease in catalase observed in the experiments reported in this paper is offered as the cause for the defective oxidation during hard muscular work and fatigue while the helpful effect of moderate exercise is attributed, in part at least, to the increase in catalase produced in this type of exercise.

From the experiments reported in this paper, the conclusion is drawn that food and exercise produce an increase in catalase with resulting increase in oxidation by stimulating the liver to an increased output of this enzyme.

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⁴ Ranke, "Tetanus," Leipzig, 1865.

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