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CALCIUM SALTS IN THE DETOXICATION OF GOSSYPOL

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Gossypol is a normal constituent of the cotton seed. Our interest in gossypol lies in its toxic properties which have been definitely established for several species of animals by different investigators. Several years ago Jones and Waterman (1) found that gossypol inhibited the peptic-tryptic digestion of casein and cottonseed globulin *in vitro* and suggested that the low apparent digestibility of the proteins in cottonseed meal is due to the presence of this compound. We wished to know whether the observed inhibition was particular to the cleavage of protein or whether gossypol inhibited other enzymic processes as well. Accordingly, a study was made of the effect of gossypol on the rate of hydrolysis of fat by different lipase preparations in various media.

The first studies were carried out with a commercial preparation of lipase acting on an artificial acacia milk containing 4 per cent olive oil. The technique employed was essentially that developed by Palmer (2). Gossypol when dissolved in the oil previous to emulsification only slightly retarded the rate of hylrolysis. Suspension of the gossypol in the emulsion or allowing the gossypol to stand in contact with the enzyme for 30 minutes previous to its addition to the emulsion had no effect on the rate of hydrolysis.

The next experiments were made with a glycerol-water extract of fresh pig's pancreas as a source of lipase. The substrate was olive oil emulsified in an alkaline buffer solution with $CaCl_2$ and egg albumin acting as accelerators (3). The pH of the solution was 8.9 at 30° C. In the absence of $CaCl_2$, gossypol when disolved either in the oil or the buffer previous to emulsification only slightly retarded the rate of hydrolysis. In the presence of the calcium salt (10 mg.) gossypol retarded hydrolysis to a marked degree, and when gossypol was increased from 2 mg. to 8 mg. the reaction was practically stopped. Similar results were obtained when the reaction was carried out in an acid medium.

This pronounced effect of gossypol in the presence of $CaCl_2$ suggested that calcium might act as a detoxicating agent in the animal body. Gossypol diets were therefore prepared with cotton seeds and the calcium content of the diets was altered by the addition of $CaCO_3$ and $CaCl_2$. The reaction of the diets was maintained the same or altered by the addition of $NaHCO_3$. The results of this study, in which the growth and food consumption of over 200 albino rats was recorded, show that the deleterious effects of gossypol may be partly overcome by the presence of excess base in the diet.

Sodium proved to be nearly as effective as calcium. The best results were obtained when 2 per cent $NaHCO_3$ and 2 per cent $CaCO_3$ were included in the diet.

SUMMARY

Gossypol inhibits the enzymic hydrolysis of fat. The inhibitive effect of gossypol is most pronounced in the presence of calcium salts and probably involves a breakdown or precipitation of the enzyme-activator complex. The detoxication of gossypol in the animal body has been accomplished with considerable sucess by using diets of high calcium content.

BIBLIOGRAPHY

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