STIMULATION OF LIVER TRIGLYCERIDE SECRETION IN RATS BY CAPSAICIN

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CAPSAICIN (natural, *trans*-8-methyl-N-vanillyl-6-nonenamide), the pungent principle of the common spice 'red pepper', has attracted wide attention for its pharmacological and biochemical effects[1,2]. Our studies[3,4] showed no impairment of fat absorption by red pepper/capsaicin (natural)/synthetic analogue (N-vanillyl nonanamide) in rats fed with 10 or 30% fat diets in contrast to an earlier report[5]. This has again been confirmed by recent work[6]. Our studies repeatedly showed countering of liver triglyceride accumulation by red pepper/capsaicin in rats fed with low (10%) or high (30%) fat diets and also in other experimental conditions[3,7–9]. One of the possibilities of countering liver triglyceride accumulation is the enhancement of its secretion by capsaicin and this has been investigated and reported here.

Male adult wistar rats (body weight 235 g) were maintained on an adequate synthetic diet containing 10% groundnut oil or 30% hydrogenated fat with and without 0.2 mg% synthetic analogue of capsaicin (Fluka AG, Switzerland). After 4 weeks of feeding, the rats were starved overnight and Triton WR-1339 (Tyloxapol, Sigma USA, 225 mg/kg) in normal saline was injected intravenously. Blood samples (0.4 ml) were collected from retro-orbital plexus before Triton injection (0 min) and at 15, 30 and 90 min after Triton injection. The triglycerides in serum were determined according to Fletcher[10]. The results were evaluated using the student's *t* test[11].

Triton injection is known to inhibit the peripheral hydrolysis of very low density lipoproteins (VLDL) by lipoprotein lipase leading to triglyceride accumulation in the serum, the measure of which gives an idea of the secretion rate[12]. The secretion rates were linear up to 4 hr in the initial experiments. Capsaicin (0.2 mg%) showed a definite tendency to increase it in 10% fat fed rats. High fat diets are reported to reduce the secretion rate[13]. Experiments were therefore carried out to study the influence of capsaicin (0.2 mg%) in rats fed with high fat (30%) as well as normal fat (10%) diets. Capsaicin was found to increase it in the 10% fat fed rats and significantly so in 30% fat fed rats (figure 1). These observations explain the countering of the liver triglyceride accumulation by red pepper or capsaicin in rats fed with high fat or choline deficient diets and in those administered carbon tetrachloride, ethionine, fructose or ethanol[3,7–9]. Triton administration is known to cause hyperlipidemia[14]. It increased liver triglyceride in rats fed on 10% or 30% fat diet in the present experiments. Capsaicin tended to lower it in the 30% fat fed rats [liver triglyceride (mg/g fresh liver in 4–8 rats/group) Basal 8.70 ± 2.12; 10% fat + Triton 21.81 ± 2.46; 10% fat + 0.2 mg% capsaicin + Triton 23.06 ± 2.51; 30% fat + Triton 16.30 ± 2.43; 30% fat + 0.2 mg% capsaicin + Triton 14.85 ± 2.10.]

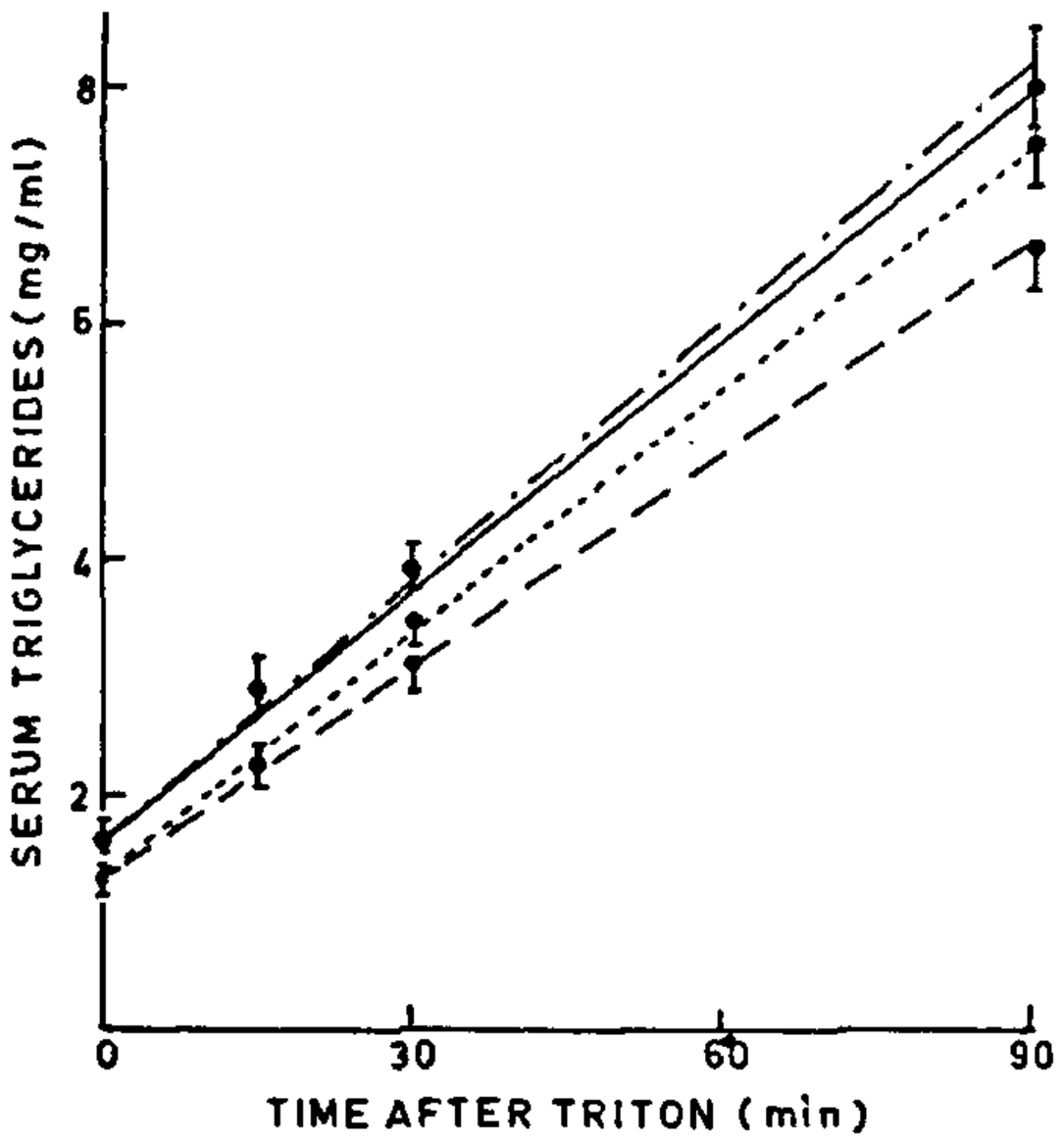

Figure 1. Triglyceride secretion rates in rats (8/group) fed with 10% fat (– – –); 10% fat + 0.2 mg% capsaicin (——); 30% fat (— —); 30% fat + 0.2 mg% capsaicin (— · — ·). Statistically significant (< 0.05) at 0, 15, 90 min and (< 0.01) at 30 min.

High fat diet is reported to decrease the triglyceride secretion rate in rats which is due to reduced VLDL production. The two processes of production and secretion of VLDL are thought to be linked in various metabolic states[13]. Capsaicin has been found to lower liver and serum triglycerides in fructose-fed rats and also inhibit some of the lipogenic enzymes in a normal 10% fat fed rats[9]. Hence factors other than lipogenesis are likely to be involved in the enhancement of secretion.

It is significant that a common dietary component, capsaicin, in the normal range of human intake

stimulates secretion of triglycerides from liver to serum and also helps to lower their level in the latter as observed from our recent studies in rats fed with 30% fat diets[15]. The triggering of liver triglyceride secretion is perhaps the first step in the enhancement of lipid metabolism by capsaicin/red pepper observed by us and the Japanese workers[3,6,9,15]. The mechanism by which this process is stimulated is of interest and is engaging our attention at present.

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A NOVEL, MICROBIAL METHOD FOR AUGMENTATION OF BIOGAS

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ATTEMPTS are being made all over the world to increase the calorific value of biogas evolved during anaerobic digestion, which normally contains three volumes of methane (CH_4) and two volumes of CO_2. If this proportion can be changed to four volumes of CH_4 and one volume of CO_2, then the evolved gas-mixture may be used for industrial purposes. In this laboratory, attempts were made earlier to enhance the content of methane, which we term 'augmentation of biogas', by microbial means. A digestor dome was designed[1-3] which would allow penetration of light to promote the growth of phototrophic bacteria (PTB) which could help the digestion process[4,5]. In the present work, we describe a novel method of increasing the methane content by introducing a strain of phototrophic bacterium, *Rhodospirillum rubrum* ATCC 11170 into the anaerobic digestion system, along with the heterotrophic bacteria natural to cowdung.

Cultures used in this study were maintained as follows: *R. rubrum* (ATCC 11170) was maintained anaerobically on a medium described by Ormerod *et al*[6] and under illumination. Subcultures were made every fourth day at 10% strength.

Heterotrophic bacteria (derived from cowdung) were maintained on sterile cowdung and subcultured every tenth day at 10% strength.

Fresh cowdung, mixed with water in the proportion 1:1.2 (w/v), was sterilized by autoclaving and used as substrate. Sterile 5 l aspirator bottles fitted with glass stoppers were used as reaction vessels. Both *R. rubrum* and the heterotrophic bacteria were inoculated at 1% level into the vessels. Vessels inoculated only with heterotrophic bacteria served as controls (C). Those vessels inoculated both with the heterotrophic bacteria and *R. rubrum* served as tests (T). Evolved gases were collected in football bladders and the volume was measured by downward displacement of water held in a 1000 ml graduated cylinder. All reactors were run as batches, each run lasting for 30 days.

Both sets of vessels were maintained in natural solar radiation of illumination level of 2000 lux (averaged over an 8 hr period from 8 a.m. to 4 p.m.) and at the ambient (temperatures max: 38°C; min: 29°C).