2830

Trypsin and insulin injections into the pancreatico-duodenal artery.

T. E. FRIEDEMANN and P. K. WEBB (Introduced by P. A. Shaffer).

[*From the Laboratory of Biological Chemistry, Washington University School of Medicine, St. Louis, Mo.*]

According to Epstein[1] and co-workers, injection of trypsin, insulin, or saline solutions into the pancreatico-duodenal artery results in a hyperglycæmia and glycosuria in cats. Injection of trypsin into the portal vein also causes hyperglycemia, but NaCl or insulin does not lead to hyperglycæmia. On the basis of these results, certain conclusions were reached concerning the nature of the diabetic condition.

We have repeated these experiments on dogs, under conditions similar to those of Epstein and co-workers, with negative results. In no instance did glycosuria occur, nor were any marked increases of the blood sugar produced by the injection of solutions of trypsin, insulin or sodium chloride into the pancreatico-duodenal artery of dogs under amytal anesthesia. Following the injection of insulin into the pancreatic artery, the typical fall of blood sugar was regularly observed.

Dog No. 1. Injection of insulin into the pancreatico-duodenal artery.

Young female dog, weight 6.4 kg. 60 mg. amytal (Lilly) per kg. intraperitoneally. Catheterized. Laparotomy 20 minutes later; 3 cc. of insulin solution (12 units) injected into the pancreatico-duodenal artery. Abdomen closed in two layers.

Time	Blood sugar Shaffer-Hartmann Method	
	Per cent	
11:30 a. m.	.111	
11:40		Injection of 3 cc. (12 clinical units) into the artery.
11:41	.111	
11:48	.127	
12:01 p. m.	.083	
12:40	.056	
1:35	.032	
3:30	.100	Urine at no time was positive when tested with the Shaffer-Hartmann sugar reagent.

[1] Epstein, Rosenthal, et al., *Am. J. Physiol.*, 1925, lxxi, 316.

Dog No. 2. Injection of saline and trypsin into pancreatico-duodenal artery.

Young female dog, weight 5.6 kg. 60 mg. per kg. amytal intraperitoneally. Abdomen closed in three layers.

3 cc. normal saline at 9:22 a. m. March 7.			10 cc. very active trypsin in saline at 12:15 p. m. March 13.		
Time	Blood sugar Shaffer-Hartmann Method	Remarks.	Time	Blood sugar Shaffer-Hartmann Method.	Myers-Benedict Method.
9:08 a. m.	.104	Amytal at 8:30 a. m.	11:14 a. m.		.095
			11:22	.090	.104
9:23	.106	Laparotomy at 9:15 a. m.	12:15 p. m.	(10 cc. trypsin into pancreatico-duodenal artery.)	
9:27	.101	Abdomen closed immediately after injection.	12:20	.101	.113
			12:26	.97	.108
			12:36	.101	.108
9:30	.102		1:00	.098	.106
10:17	.094		2:27	.092	.094
10:39	.097		Tests of all urine specimens for sugar were negative.		
10:57	.101				
11:26	.101				
1:45 p. m.	.089				
5:00	.103	Urine sugar 0 at all times.			
March 8. Dog in good condition; eating meat.					

Dog No. 3. Injection of normal saline and trypsin into the pancreatico-duodenal artery.

Young female dog, 4.8 kg. 60 mg. amytal per kg. intraperitoneally. Catheterized

4 cc. saline at 9:54 a. m. March 6.			11 cc. Trypsin* in saline at 11:33 a. m. March 13.		
Time	Glucose Shaffer-Hartmann Method.	Remarks.	Time	Blood Sugar	
				Shaffer-Hartmann Method	Myers-Benedict Method
9:33 a.m	.112				
9:54	Injection 4 cc. saline		11:00 a. m.	.122	.119
10:15	.118		11:33	Injection 11 cc. trypsin	
10:34	.123		11:18	.125	.114
10:55	.110		11:25	.122	.110
11:20	.127		11:36	.106	.114
12:45 p. m.	.106		11:47	.106	.114
5:00	.092	Urine sugar 0 at all times.	12:00	.103	.107
			12:34 p. m	.114	.109
March 7. Animal eating meat; in good condition.			1:04	.102	.107
			2:32		.114
			Urine sugar 0 at all times. Dog killed at 2:45.		

*Aqueous solution purified as suggested by Epstein and Rosenthal.[1]

Dog No. 4. Injection of trypsin into the pancreatico-duodenal artery.

Female animal, wt. 5.75 kg. 60 mg. amytal per kilo intraperitoneally. 11 cc. trypsin solution injected at 3:41 p. m.

Time	Blood Sugar		
	Shaffer-Hartmann Method	Epstein Method	
3:14	.101	.075	
3:21	.104	.091	
3:41			Injection of trypsin
3:43	.121	.132	
3:49	.113	.150	
4:00	.101	.200	
4:20	.111	.125	
4:39	.117	.150	
5:40	.114	.155	
9:50	.122	.138	

Urine negative for sugar at all times.

Dog No. 5. Injection of trypsin into the portal vein.

Male animal, wt. 9.4 kg. 60 mg. per kilo, amytal injected intraperitoneally. 13 cc. trypsin solution injected into portal vein.

Time	Blood Sugar			
	Shaffer-Hartmann Method	Myers-Benedict Method	Epstein Method	
4:45	.113	.105	.126	
4:54	.106	.099	.116	
5:00				Injection of trypsin
5:03	.108	.103	.113	
5:08	.114	.097	.113	
5:18	.103	.104	.116	
5:40	.100	.100	.132	
6:00	.100	.099		
6:30	.102	.102	.117	
7:00	.102	.101		
9:05	.101	.093	.129	

Urine negative for sugar at all times.

Dog No. 6. Injection of trypsin into the portal vein.

Female dog. Wt. 9.8 kg. 60 mg. amytal per kg. intraperitoneally. 8 cc. trypsin injected into portal vein.

Time	Blood Sugar		
	Shaffer-Hartmann Method	Epstein Method	
(1) 1:07	.109	.126	
(2) 1:24	.106	.116	
1:32			Injection of trypsin
(3) 1:33	.114	.113	
(4) 1:41	.113	.113	
(5) 1:48	.101	.116	
(6) 1:55	.103	.132	
(7) 2:22	.108		
(8) 3:00	.100	.117	
(9) 4:05	.093		
(10) 5:55	.093	.129	

Urine negative for sugar at all times.

2831

Observation on the carbohydrate metabolism of acetone-butyl alcohol fermentations.

GEORGE W. FREIBERG (Introduced by P. A. Shaffer).

[*From the Laboratory of Biological Chemistry, Washington University, School of Medicine, St. Louis, Mo.*]

A study of the general reactions involved during acetone-butyl alcohol fermentations was undertaken. A general carbon balance was established in which 95 to 98 per cent of the carbon was accounted for. Efforts to write general reactions were not successful until different stages of the metabolism were analyzed separately. During the true metabolism stage, during which most of the acetone and butyl alcohol is formed, it was found that acetone is produced in accordance with the general reaction

$$C_6H_{12}O_6 + H_2O \rightarrow C_3H_6O + 3\,CO_2 + 4\,H_2;$$

while the butyl alcohol was formed as follows:

$$C_6H_{12}O_6 \rightarrow C_4H_{10}O + 2\,CO_2 + H_2O.$$