

A STUDY OF THE ANTISCORBUTIC VALUE OF HONEY.

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The recent paper of Dutcher¹ showing that honey contains a small amount of antineuritic vitamine (probably due to included pollens rather than to the soluble constituents) naturally raises the question whether honey contains other vitamins as well. No investigation regarding antiscorbutic vitamine in honey has appeared and it was to throw light on this point that the present study was made.

A series of ten guinea pigs was fed on a diet of oats and water, which is known to produce scurvy in guinea pigs, and in addition white sage, comb honey bought in the open market and extracted from the comb on the day of administration was offered. In a preliminary period of from 5 to 6 days (Animals 1 to 6) it was found that undiluted honey was refused. A watery solution, one part of honey to fifteen parts of water, was accepted. This was administered for a period of 13 days. The strength was then increased to two parts of honey to fifteen parts of water. In the case of Animals 7 to 10 of the series, the 2:15 mixture was administered from the beginning up to the 21st day, when a 1:5 mixture was offered and taken. Daily inspection of the animals was made for tenderness of the joints, general behavior, and appearance of "face ache" position. The animals were weighed every 3 days. Though all the guinea pigs showed a progressive loss of weight, none, excepting No. 6, showed clinical evidence of scurvy until the 4th or 5th week. Marked tenderness of the knees was noted only in No. 6. This animal beginning on the 26th day behaved in a peculiar manner. When examined in the morning he was found lying on his back. When the knees were

¹ Dutcher, R. A., *J. Biol. Chem.*, 1918, xxxvi, 551.

TABLE I.

Effect on Guinea Pigs of Diet of Oats, Water, and Honey.

Animal No.	Initial weight.		Lived.	Final weight.	Died or killed.	Honey.		Scurvy.	Remarks.
	gm.	days				gm.	Total intake.		
	gm.	days	gm.			cc.	cc.		
1	525	42	300	Died.		190.4	6.03	++	Refused honey first 5 days. Honey intake measured last 30 days only. Teeth loose. Ribs: hemorrhage; ends enlarged; white line.* Hemorrhage of cecum and colon. Hemorrhage of right femur.
2	500	37	375	"		163.5	5.85	+++	Refused honey first 5 days. Honey intake measured last 28 days only. All teeth loose, cutting edges worn and black. Ribs: ends enlarged; white line; many hemorrhages. Large swellings and hemorrhages of both knees.
3	525	40	325	"		199.2	8.30	++	Refused honey first 5 days. Honey intake measured last 24 days only. Teeth loose. Ribs: ends enlarged; white line; several hemorrhages. Hemorrhage of one knee.
4	575	38	350	"		160.6	5.04	+	Refused honey first 6 days. Honey intake measured last 30 days only. Teeth slightly loose. Ribs: white line; 2 hemorrhages; no enlargements. Mandible much thinned.

* This "white line" is a macroscopic chalky white band of necrotic bone running transversely across the end of the rib at or near the cartilaginous junction, and probably corresponds with the radiographic "white line" found at the ends of the diaphyses of the long bones in human cases of scurvy. In guinea pigs with scurvy the costal white line is strikingly constant and is probably pathognomic of the disease.

TABLE I—*Concluded.*

Animal No.	Initial weight.		Final weight. <i>gm.</i>	Died or killed.	Honey.		Scurvy.	Remarks.
	<i>gm.</i>	<i>days</i>			Total in- take.	Average daily intake.		
5	200	35	150	Died	137.9	5.31	+	Refused honey first 6 days. Honey intake measured last 26 days only. Teeth loose; alveolar hemorrhage. Ribs: few epiphyses enlarged. Hemorrhage in marrow of one femur.
6	200	27	175	Killed.	71.9	3.99	(?)	Refused honey first 6 days. Honey intake measured last 18 days only. Killed because of squealing when knees were pinched; weakness, etc. No gross lesions of scurvy. No microscopic examination.
7	200	26	130	Died.	214.4	8.25	++	Teeth loose. Ribs: ends enlarged; white line; several shafts fractured. Extensive hemorrhage of thoracic wall, left side. Hemorrhage of patellar ligament.
8	150	26	100	"	218.0	8.38	++	Teeth loose. Ribs: few small hemorrhages; ends enlarged; white line. Knees swollen and hemorrhagic.
9	210	26	150	"	161.4	6.21	++	Teeth loose. Ribs: several enlarged epiphyses; white line. Large recent hemorrhage of one knee; small hemorrhage of right knee. Subperiosteal hemorrhage of one femur.
10	150	30	125	"	191.8	6.39	+	Teeth not loose. Ribs: epiphyses enlarged; white line. Fresh hemorrhage of one knee.

pinched he squealed vigorously and when placed on his feet he moved about the cage in circles with an unsteady gait. The next morning he appeared to be normal but the following afternoon the peculiar symptoms reappeared. He was then killed but no characteristic gross lesions of scurvy were found. Through an unfortunate accident specimens for microscopic examination were not saved. It is quite possible that incipient scurvy, as suggested by the tenderness of the knees, was present. All the other animals died between the 27th and 42nd days and showed the characteristic lesions of scurvy, mostly of a recent and severe type.

The average daily intake of honey was between 3.99 and 8.30 cc. and between 0.88 and 5.58 cc. per 100 gm. of initial body weight. The degree of severity of the lesions was apparently unrelated to the amount of honey ingested.

It was at first thought because of the failure of scorbutic symptoms to develop until the 30th day in the six animals first tested that there was some evidence of protection against scurvy, since most animals fed on oats and water alone show signs of scurvy before this time.² The almost simultaneous appearance of severe scurvy in five of the six guinea pigs of the first set after the 30th day and in all of the last four at a still earlier period made such an assumption impossible. There seems to be no evidence that honey, at least in the quantities which guinea pigs can be induced to take, has any antiscorbutic value.

CONCLUSIONS.

1. In nine out of a series of ten guinea pigs fed on a diet of oats, water, and honey, severe scurvy developed in 4 to 6 weeks.
2. It is probable that no antiscorbutic vitamine is present in honey.

² Holst, A., and Frölich, T., *Z. Hyg.*, 1912, lxxii, 1.