

The fall is not necessarily premortal: thus, one of our animals recovered completely after fall of 9°C. from hydrocinchonine; Simpson⁸ reported recovery of a monkey after fall of 24.6°C. from ether anesthesia and chilling. Shivering is occasionally seen. Fall is not always immediately associated with collapse: a quinidine-injected animal with temperature 31.3°C. moved around at this time quite normally and drank water.

Partly as a result of these observations, one of us (W.T.D.) has since been led to accumulate data on determination of comparative toxicity, *e. g.*, the toxicity of a substance such as quinidine, capable of producing serious fall in temperature, is measured against that of a "standard" related substance, such as quinine, injected in doses toxicologically comparable, on the same day or days and as nearly as practicable just before or after, so that the heat loss conditions are substantially the same for the animals of both groups over the succeeding period during which death or recovery occurs.

7845 C

Nutritional Value of Human Milk, Cows' Milk and Goats' Milk.

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Prolonged feeding with pure milk leads to a series of anemic conditions which generally are classified under the term of nutritional anemia of infancy (MacKay¹). Different reactions of the organism to various kinds of milk have been observed clinically and experimentally, and attempts have been made to separate the types of goat milk anemia and cow's milk anemia from the simple anemias of breast-fed infants (Baar²). But the formerly believed identity between the anemic conditions caused by goats' milk and cows' milk has been disputed lately by various authors (Brouwer³), and the experimental work of Rominger and coworkers⁴ seems to justify a doubt in the identity of both forms of nutritional anemias. In our

⁸ Simpson, S., *J. Physiol.*, 1902, **28**; *Proc. Phys. Soc.*, xxxvii.

¹ MacKay, H. M. M., *Nutritional Anæmia in Infancy*, London, 1931, p. 9.

² Baar, H., *Beih. Jahrb. f. Kinderheilk.*, 1927, **16**, 1.

³ Brouwer, E., *Jahrb. f. Kinderheilk.*, 1923, **102**, 257.

⁴ Rominger, E., Meyer, H., and Bomskov, C., *Z. f. d.*, 1933, **89**, 786.

present series of experiments we studied under the best possible observance of equal conditions the effect of feeding human milk, cows' milk and goats' milk upon the development and the blood picture of growing albino rats.

Each of 8 large and 2 small litters of our normal breeding stock including 78 animals was divided into 3 groups and the animals fed with equal amounts of human milk, cows' milk and goats' milk. The human milk was obtained from the Obstetrical Wards of the State Charity Hospital and collected daily with a glass breast pump into a pyrex flask. The goats' milk was furnished twice a day by 2 goats which were kept on the hospital grounds and fed with dry food and fresh grass. The goats were milked directly into a chemically clean pyrex container. The young rats were put on the milk diet after weaning at an age of 4 weeks and at an approximate weight of 20-25 gm. Each rat was kept in a separate cage of galvanized iron and the body weight, erythrocyte count and hemoglobin content of the blood were determined at weekly intervals. Stained blood smears were examined repeatedly for pathological cell forms and *Bartonella muris*. As soon as an animal succumbed, an autopsy was performed and the organs fixed in formalin for histological study. Adult animals fed with the specific type of milk and young rats, which were killed by means of starvation and vitamin deficiency, served as controls for the pathological findings on the milk-fed young animals.

Our results are compiled in Table I.

TABLE I.

Diet	No.		No. Anemic		No.	
	Litters	Animals	Litters	Animals	Dead	Animals
Human milk	6	17	0	0	0	0
Cows' "	8	28	3 (37.5)	7 (25)	2 (7.1)	
Goats' "	8	33	7 (87.5)	26 (78.7)	18 (54.5)	

None of the animals fed with human milk became anemic and only 37.5% of the litters of our breeding stock showed anemia after prolonged feeding with cows' milk. Only 2 out of 28 animals died from cows' milk anemia during an observation period of 20 weeks. In contrast to those findings, goats' milk produced in 7 out of 8 litters a severe anemia and over half of the animals (54.5%) died in their course. In the same litters of animals and under the same experimental conditions goats' milk produced therefore an anemia in a higher percentage and of a more severe degree than the cows' milk.

Table II gives the compiled figures of body weight, hemoglobin content of the blood and erythrocyte count of each of the 3 groups on milk diets:

TABLE II.

Diet	Determinations of	Normal Values	Weeks of Milk Diet									
			2	3	4	5	6	7	8	9	10	
Human Milk	Weight (gm.)	24	32	36	43	61	66	74	78	96	89	
	Hemoglobin (gm.)	9.7	9.7	11.1	10.6	10.1	10.9	10.0	9.5	9.5	9.2	
	Erythrocytes (millions)	5.31	5.9	7.1	7.4	7.7	7.9	8.3	8.3	8.4	8.6	
Cows' milk	Weight (gm.)	26	44	46	51	62	83	68	83	84	90	
	Hemoglobin (gm.)	9.3	7.1	6.2	5.7	4.8	3.9	too low to read				
	Erythrocytes (millions)	5.1	4.4	4.4	3.6	3.1	2.9	2.4	2.0	1.9	2.0	
Goats' milk	Weight (gm.)	24	35	51	51	49	48	46	65	69	—	
	Hemoglobin (gm.)	9.2	6.8	5.8	4.5	3.8	3.2	too low to read				
	Erythrocytes	5.5	3.2	3.1	2.7	2.3	2.8	2.6	2.0	2.3	—	

The rate of growth as represented by the curve of the body weight determinations seems to be more rapid in the animals fed with cows' milk and goats' milk than with human milk. Later, however, as the effects of the anemia become apparent, the body weight of the animals fed with goats' milk and cows' milk comes to a standstill or even a decline in the weight curve can be noted. The effect of the anemia upon the gastrointestinal tract of the animals must be taken as the cause of this phenomenon.

The hemoglobin content of the blood remains on an equal level in the group fed with human milk and declines rapidly in the groups fed with cows' milk and goats' milk. No principal difference between both groups can be noted. After 5 to 6 weeks of diet the hemoglobin level is too low to give accurate results with the Newcomer method of determination.

The number of erythrocytes rises slowly but continuously in animals fed with human milk. The decrease of erythrocytes is more rapid in the group fed with goats' milk and in the group fed with cows' milk although after a certain time no difference between the erythrocyte counts in both groups can be noted. This fact explains the slight hyperchrome character of the goats' milk anemia during the first weeks as compared with the distinct hypochrome character of cows' milk.

Summary and Conclusions. The feeding of various types of milk to young albino rats of the same litter has a different effect

upon the growth, the erythrocyte count and the hemoglobin content of the animals. Goats' milk produces in many instances a severe anemia of hyperchromic character, cows' milk produces a distinctly hypochromic anemia in a smaller percentage of the animals, and human milk does not have any deleterious effect upon the growth or the red blood picture of the growing albino rat.

7846 C

Further Evidence of Insusceptibility of the Rat to a Dietary Deficiency of Vitamin C.

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Svirbely¹ has reported that the adrenal gland and liver tissues of rats and mice, reared for several generations on a diet devoid of vitamin C, were rich in the anti-scorbutic substance. As far as one can ascertain from the literature, the vitamin C requirement of the rat had been investigated chiefly from the standpoint of growth and fertility, since the characteristic scorbutic lesions such as osteoporosis, sub-periosteal hemorrhages, and petechiae of cutaneous and mucous surfaces had not been observed in this species.² Moreover, such observations had not been extended, as a rule, to more than one generation. Therefore in order to obtain further evidence that the rat requires no dietary supplement of vitamin C, the incisors of animals maintained and reared for 3 generations on scorbutic diet were examined histologically according to the method of Höjer,³ as one of the most specific and sensitive criteria of the scorbutic process.

A small series of 6 female and 7 male rats was placed on a diet of boiled whole milk and dried bread. This diet, tested on guinea pigs, was found to be scorbutic; but in other respects complete and adequate. The substitution of fresh whole milk not only prevented and cured scurvy, but maintained guinea pigs in good health. After

¹Svirbely, J. L., *Biochem. J.*, 1933, **27**, 960.

²Harden, A., and Zilva, S. S., *Biochem. J.*, 1918, **12**, 408; Drummond, J. C., *Biochem. J.*, 1919, **13**, 77; Parsons, H. T., *Biochem. J.*, 1920, **14**, 587; Kennedy, *Quart. J. Exp. Physiol.*, 1926, **16**, 281; Hartwell, G. A., *Biochem. J.*, 1930, **24**, 967; Gùdjonsson, S. V., *Biochem. J.*, 1930, **24**, 1591.

³Höjer, A., *Brit. J. Path.*, 1926, **7**, 356.