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### The effect of an exclusive milk diet on intestinal amoebae.\*

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While working with culture rats, Kessel<sup>1</sup> noted that amœba-positive rats, given an exclusive milk diet for two weeks, were found to be amœba-negative when autopsied at the end of that time. It has been shown by Rettger and Cheplin<sup>2</sup> and Cannon and McNease<sup>3</sup> that a milk diet changes the flora of rats from a predominant *Bacillus coli* type to a predominant *Bacillus acidophilus* type. Hegner<sup>4</sup> further found that an exclusive milk diet is disadvantageous for the growth of *Giardia*, *Trichomonas* and *Hexamitus* in rats, the flagellates being reduced in numbers during the feeding. These facts together with the knowledge that milk is often prescribed as a beneficial diet during treatment for dysentery or for intestinal protozoan infections<sup>5</sup> led to the following experimental work on monkeys and on children to ascertain the possible value of a milk diet as a therapeutic measure in cases of infection with intestinal amœbæ.

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<sup>1</sup> Kessel, J. F., *Univ. Calif. Publ. Zool.*, 1924, **xx**, 489.

<sup>2</sup> Rettger, L. F., and Cheplin, H. A., *The intestinal flora with special reference to the implantation of *Bacillus acidophilus**. New Haven, Yale Univ. Press, 1921, p. 135.

<sup>3</sup> Cannon, P. R., and McNease, B. W., *J. Inf. Dis.*, 1923, **xxxii**, 175.

<sup>4</sup> Hegner, R. W., *Am. J. Hyg.*, 1923, **iii**, 180.

<sup>5</sup> Routine Division Circular No. 16 of the South African Institute for Medical Research

In the work here recorded, the routine methods of examining stools, first by the iodine-eosin smear method and later by the iron-hematoxylin permanent smear method, were employed, similar to those established in the Parasitological Diagnostic Laboratory in Peking Union Medical College (Kessel<sup>6</sup>). Gram stains also were made, (1) prior to the milk feeding, (2) during the milk feeding and (3) after the conclusion of the experiment. These stains corroborated the fact that there is a change in the flora from a predominant Gram-negative type before feeding to a predominant Gram-positive type during the milk feeding.

Preliminary fecal examination was made of the monkeys and of the children on six or more days prior to starting the milk diet. The stools were then examined daily during the milk feeding and in the follow-up examinations two weeks after the last day of feeding and later two and three months after the last feeding. Six or more daily examinations were made at each follow-up period.

Two monkeys and two children positive for amœbic infection were kept in each experiment as controls and in each instance amœbæ appeared in the stools throughout the period of the experiment.

The accompanying tables (I-III) giving the results of the experimental work, bring out the following points:

*I. Boiled milk fed to monkeys for two weeks.*

In a preliminary feeding experiment in which unboiled milk was used, two monkeys died of an infection apparently acquired in the milk. Hence boiled whole milk was fed during this experiment purely for precautionary measures. Although there was a reduction and in some cases a disappearance of the amœbæ from the stools during the milk feeding, the amœbæ, for the most part, were found again in the stools at the end of the first follow-up examination two weeks after the milk diet had been completed.

*II. Unboiled milk fed to monkeys for two weeks.*

Unboiled milk was again tried in this experiment, this time with no detrimental results to the health of the monkeys. It is to be noted that the results of this experiment are more satisfactory from a therapeutic point of view than those of Experiment I, since in this experiment 60 per cent of the monkeys became

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<sup>6</sup> Kessel, J. F., *China Med. J.*, 1925., xxxix, 85.

Tables showing results of exclusive milk diet.  
TABLE I. Boiled Milk to Monkeys.

	No. 1			No. 2			No. 3			No. 4			No. 5		
	B. T.	D. T.	A. T.	B. T.	D. T.	A. T.	B. T.	D. T.	A. T.	B. T.	D. T.	A. T.	B. T.	D. T.	A. T.
	<i>E. dysenteriae</i>	+	0	0	+	3	+	+	0	+	+	0	+	+	0
<i>E. coli</i>	0	0	0	+	0	+	+	0	+	+	0	+	+	0	+
Endolimax	+	4	+	+	1	+	+	1	+	+	4	+	+	3	+
Iodamecoba	+	0	0	+	0	+	+	0	+	+	0	+	+	0	+

TABLE II. Unboiled Milk to Monkeys.

	No. 6			No. 7			No. 8			No. 9			No. 10		
	B. T.	D. T.	A. T.	B. T.	D. T.	A. T.	B. T.	D. T.	A. T.	B. T.	D. T.	A. T.	B. T.	D. T.	A. T.
	<i>E. dysenteriae</i>	+	0	0	+	0	+	+	0	+	+	0	+	+	0
<i>E. coli</i>	+	0	0	+	0	+	+	0	+	+	0	+	+	0	+
Endolimax	+	0	0	+	2	+	+	0	+	+	2	+	+	0	+
Iodamecoba	+	0	0	0	0	+	+	0	+	+	0	+	+	0	+
Chilomastix	+	0	+	+	2	+	+	+	+	0	+	+	0	+	0

TABLE III. Unboiled Milk to Children.

	No. 1—Age 10			No. 2—Age 10			No. 3—Age 9		
	B. T.	D. T.	A. T.	B. T.	D. T.	A. T.	B. T.	D. T.	A. T.
	<i>E. dysenteriae</i>	+	0	+	+	0	0	+	0
<i>E. coli</i>	+	3	+	+	0	0	+	0	+
Endolimax	+	2	0	+	0	0	+	1	+
Iodamecoba	+	0	0	+	0	0	+	0	+
Trichomonas	0	0	0	0	0	0	+	3	+
Chilomastix	0	0	0	+	0	+	0	0	0
Giardia	+	3	+	+	0	+	0	0	0

Explanation of Tables (I-III).

B. T.—Infection with protozoa determined by six or more daily examinations of feces, prior to milk diet.

D. T.—Number of times positive by daily examination for protozoa during milk treatment after the third day of feeding.

A. T.—Results of follow-up examinations after treatment.

permanently negative for *E. dysenteriae*, 100 per cent for *E. coli*, 40 per cent for *Endolimax*, and 80 per cent for *Iodamoeba*.

### III. Unboiled milk fed to children for ten days.

Since the results obtained from giving a whole unboiled milk diet to monkeys were found to be promising, three children who were heavily positive for amœbae, but who demonstrated no important clinical symptoms at the time of the experiment, were placed on an exclusive unboiled milk diet for a period of ten consecutive days. Since the children objected to such a diet and began losing weight it was impossible to continue the milk diet longer. The results, however, show a marked decrease in the presence of amœbae during the feeding, and in Child No. 2 a complete and permanent riddance of the amœbic infection. Child No. 1 was cleared of *Endolimax nana* only and Child No. 3 of *E. dysenteriae* only.

From Tables II and III it will be seen that the flagellates did not respond so readily to the milk diet as did the amœbae.

#### CONCLUSIONS.

During the feeding of an exclusive raw milk diet there is almost always a reduction in the number of intestinal amœbae and in certain instances the intestinal tract has been cleared of *E. dysenteriae* and other forms and has remained clear for a period of three months following the conclusion of the experiment. This diet, however, cannot be recommended as a therapeutic measure since the results are so uncertain, the diet inadequate and offensive to some and since the possible dangers of infection in feeding raw milk are considerable.