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THE VALUE OF VARIOUS FEEDS IN THE CONTROL OF COCCIDIOSIS IN CHICKS



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SYNOPSIS

The feeding of buttermilk materially decreased the mortality of chicks that were artificially infected, at eleven and twelve days of age, with *Eimeria Avium*, the germ of coccidiosis, a troublesome disease of chicks. The mortality for the lots getting no buttermilk was 63.6 per cent; for those getting the condensed buttermilk, diluted with water in the proportion of one quart of condensed buttermilk to six quarts of water, the loss was 44.8 per cent. With lots receiving condensed buttermilk, diluted in the proportion of one quart condensed buttermilk to three quarts of water, the mortality was only 26.0 per cent.

No advantage was gained by the use of greens except in the case of a lot which received greens and no buttermilk. In this lot the loss was only 38.3 per cent while it was 69.9 per cent and 82.6 per cent in the other two lots receiving no buttermilk. Other data are needed to prove whether or not this lower loss was due to the feeding of greens.

No advantage was gained by the use of cod-liver oil up to the time the chicks were eight weeks of age when the disease is considered to have run its course.

The gain in weight was greatest with the chicks receiving the 1-3 buttermilk and smallest with those receiving no buttermilk. The amounts of grain, mash, and milk consumed were in proportion to the gain in weight.

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THE VALUE OF VARIOUS FEEDS IN THE CONTROL OF COCCIDIOSIS IN CHICKS

R. M. SHERWOOD

INTRODUCTION

This is the first of a series of experiments at this Station to study whether any food materials or methods of management are of value in controlling coccidiosis. In this experiment the work was limited to a study of the value of buttermilk with and without greens and cod-liver oil. The disease, coccidiosis, is probably the worst that poultry raisers of this State have to contend with. This is especially true where large numbers of chickens are raised together and during seasons when rainfall is plentiful. The disease is caused by a parasite called *Eimeria Avium* or *Coccidium Avium*. This disease develops after the chicks are three to six weeks old and is accompanied by bloody diarrhoea. There is some dispute as to the carriers of this parasite. Hadley¹ stated that, "In infected yards, this organism has been found as a pathologic agent in the guinea, duck, pheasant, grouse, quail, pigeon, and sparrow although the degree of susceptibility to the parasite varied greatly in these different species."

Hadly² further stated that, "A study of the morphology of the coccidium of the sparrow demonstrated that it was identical with the coccidium of blackhead in turkeys, and of coccidial white diarrhoea of chicks." Johnson³ stated that his work did not bear out the findings of Hadley with reference to sparrows, turkeys, and ducks. Johnson stated that coccidian forms were found in sparrows but they were not those causing coccidiosis in chicks.

Fantham⁴ and Beach⁵ found that buttermilk and sour skimmed milk were of value in controlling the disease. Johnson³ reported that chickens receiving sour milk and no water to drink did not respond to treatment and actually developed the disease. Beach and Corl⁶, in a late report, state that, "The constant feeding of buttermilk with the diet otherwise restricted appears to be an effective means of controlling out-breaks of coccidiosis. Feeding sweet skim milk or a solution of condensed whey also appears to have considerable, although less marked value."

THE EXPERIMENT

Time of Test: This experiment started May 15th, 1924, and continued eight weeks, ending July 9th, 1924.

Objects: The principal object of the experiment, the first year, was to test the value of condensed buttermilk in the control of coccidiosis. This was fed with and without greens and cod-liver oil. The condensed buttermilk used in this experiment was analyzed by State Chemist Dr. G. S. Fraps. The analysis was as follows:

Protein	8.50%
Fat	1.73%
Nitrogen-Free Extract ...	10.65%
Water	76.48%
Ash	2.64%

The analysis of Dr. G. S. Fraps also showed 4.12% of Free Acid or Lactic Acid.

Stock Used: Eight hundred and thirty Single Comb White Leghorn chicks, of similar breeding, were used in this experiment. They were hatched from eggs that were produced on the Station farm and were incubated in a mammoth incubator. In dividing the chicks into nine lots

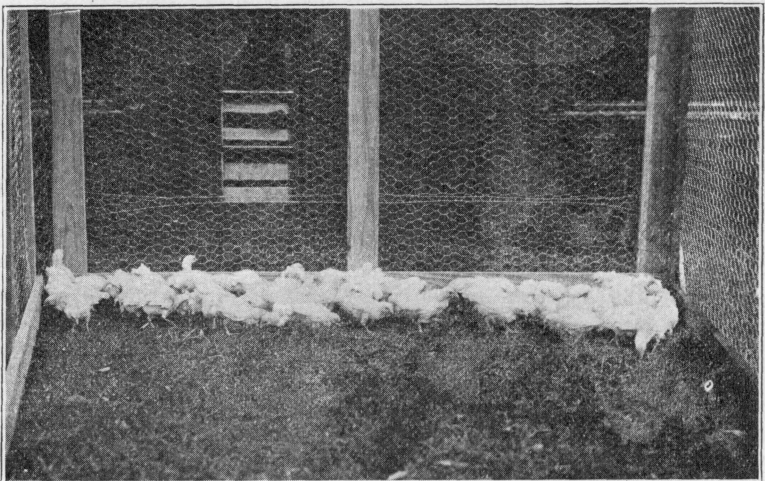


Figure 1. Chicks at three weeks of age; just before they showed symptoms of coccidiosis.

every precaution was taken to have the lots as uniform as possible. All lots were housed and brooded in a long brooder house and were supplied with heat by a coal-heated hot-water brooder system. Very little direct sunlight entered the house. The chicks were not allowed on range at any time during the experiment.

Feeds Used: Each lot of chicks received the same basal ration. During the first two weeks the mash consisted of:

White Corn Meal	80 pounds
Grey Wheat Shorts	20 pounds
Chick Size Oyster Shell...	5 pounds
Chick Size Bone Meal....	5 pounds

During the last six weeks ten pounds of 65 per cent protein meat scrap was added to the ration. Cracked white corn was used for scratch feed throughout the experiment.

Lots 1, 4, and 7 received water to drink; lots 2, 5, and 8 were given buttermilk diluted in the proportion of one quart of condensed buttermilk to six quarts of water; lots 3, 6, and 9 received buttermilk, diluted in the proportion of one quart of condensed buttermilk to three quarts of water. The chicks receiving buttermilk were given no additional water to drink. On June 3rd when the chicks were nineteen days old, each of the lots receiving water was divided equally; one-half of the chicks were removed for other work. The size of the pens, for these lots, was also cut in half so that the floor space per chick, for the various lots, remained approximately the same. In all of the tables the data for lots 1, 4, and 7 are weighted to allow for the chicks removed. The data on all lots are, therefore, comparable.

Lots 1, 2, and 3 received no feeds other than those described above; lots 4, 5, and 6 were supplied with greens. During the first two weeks lettuce was fed; after that time growing oats and Sudan grass were supplied. The oats and Sudan grass were not very tender and the chicks did not eat them as readily as they did the lettuce. Lots 7, 8, and 9 received cod-liver oil. Two per cent was added to the mash. A fresh supply was mixed every three or four days.

Infection of Chicks*: On May 26th and May 27th all chicks were artificially infected with *Eimeria Avium* (*Coccidium Avium*) by feeding infectious material mixed with the mash. This material consisted of droppings that were collected from chickens showing signs of coccidiosis. This fecal material which contained numerous oocysts was placed in cotton-stoppered flasks, containing a 10 per cent solution of potassium bichromate, and was allowed to stand at room temperature (between 80° and 90° F.) for four and five days. Most of the potassium bichromate solution was removed by centrifuging and washing with saline solution. The fecal material was mixed with the mash in quantities sufficient to allow one-fourth gram to the chick. No efforts were made to prevent the already infected chicks from spreading the infection or becoming reinfected.

Progress of the disease: On June 2nd, coccidian forms could be readily found in the cecal contents and scrapings of the mucus membrane of the ceca and duodenum of dead chicks. Coccidia could be found in large numbers in practically all the chicks dying for three weeks following a six-to seven-day incubation period, after which time coccidian forms were difficult to demonstrate on autopsy. Most of the chicks dying, after this time, appeared emaciated and very enemic. During the three-weeks period noted above, most of the chicks in all of the lots showed the characteristic symptoms of the disease.

*Credit is due Dr. R. C. Dunn, of the Veterinary Department of the College, for his cooperation in this project. He prepared the material for infection and made examinations of all dead chicks.

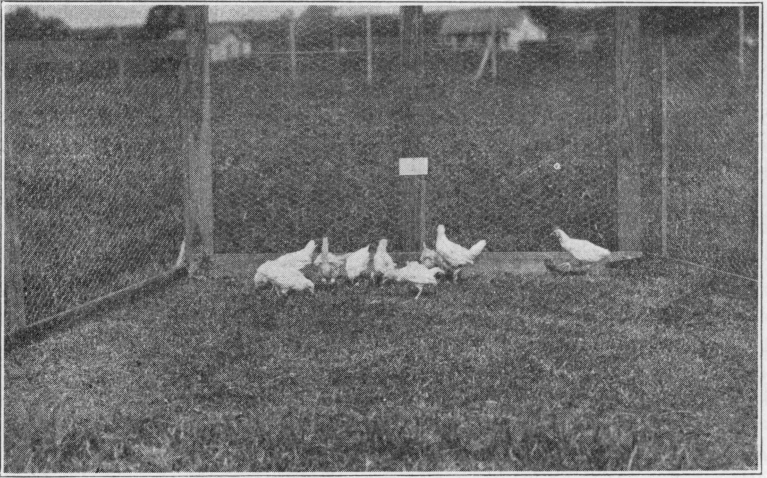


Figure 2. The chicks in lot 1 (receiving no buttermilk) at the close of the experiment. It must be remembered that one-half of the chicks from this lot were removed on June 3rd.

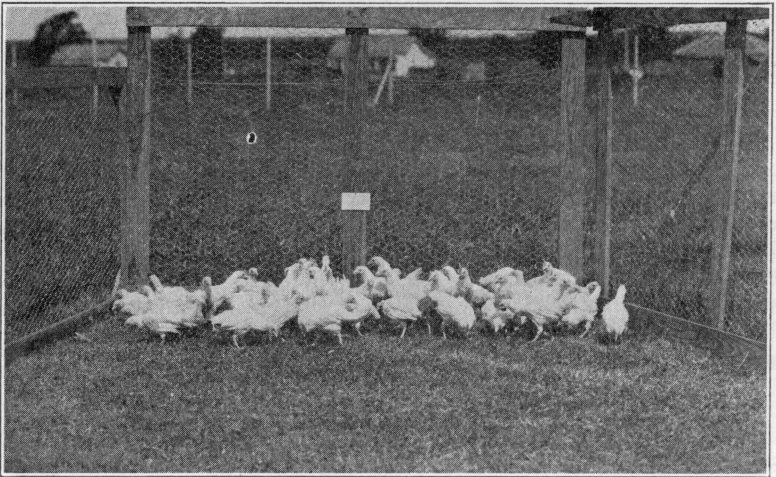


Figure 3. The chicks in lot 2 (receiving 1-6 buttermilk) at the close of the experiment.

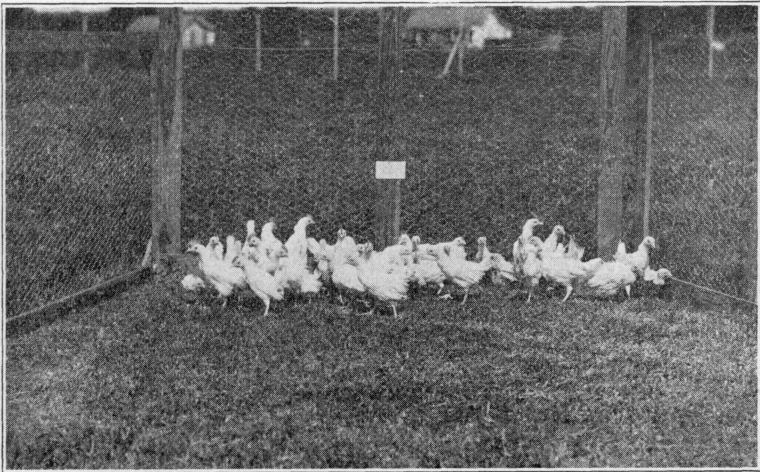


Figure 4. The chicks in lot 3 (receiving 1-3 buttermilk) at the close of the experiment.

Mortality: The mortality of the various lots is given in Tables 1 and 2. During the first week seventeen chicks were killed by a rat. These losses are not included in Tables 1 and 2 or in Figures 5 and 6.

Table 1. Per Cent Original Number in Lots That Died Each Week

Lot Number	Feed in Addition to Basal Ration	Number In Lot	Week Number								Total
			1	2	3	4	5	6	7	8	
1	Water	93	5.4	2.2	4.3	31.6	25.8	6.5	2.2	2.2	69.9
2	1-6 Buttermilk	92	4.3	4.3	3.3	6.5	15.2	2.2	3.3*	4.3	48.5*
3	1-3 Buttermilk	93	1.1	4.3	...	2.2	2.2	2.2	3.2	2.2	17.2
4	Water, Greens	81**	3.7**	3.7	6.2	...	14.8	4.9	2.5	2.5	38.3
5	1-6 Buttermilk, Greens	86***	4.7***	2.3	11.6	5.8	5.8	2.3	7.0	4.7	44.2
6	1-3 Buttermilk, Greens	92	5.4	3.3	2.2	7.6	6.5	3.3	1.1	...	29.3
7	Water, Cod-Liver Oil	92	4.3	7.6	9.8	19.6	21.7	8.7	6.5	4.3	82.6
8	1-6 Buttermilk, Cod-Liver Oil	92	6.5	9.8	8.7	6.5	6.5	4.3	2.2	2.2	46.7
9	1-3 Buttermilk, Cod-Liver Oil	92	4.3	7.6	...	6.5	3.3	3.3	4.3	2.2	31.5

*One killed by accident, not figured in total.

**Does not include eleven killed by rat.

***Does not include six killed by rat.

Table 2. Per Cent Mortality at End of Test

Lots Receiving	Per Cent Mortality in Lots Receiving			Average
	No Additional Feeds	Greens	Cod-Liver Oil	
Water	69.9	38.3	82.6	64.7
Buttermilk 1-6	48.5	44.2	46.7	44.8
Buttermilk 1-3	17.2	29.3	31.5	26.0
Average*	43.5	37.3	53.6	44.9

*Due to the slight variation in the number in each lot, the original numbers in all lots concerned were used to obtain these averages.

It is noted in Tables 1 and 2 that in all cases except lot 4 the greatest loss was with the chicks receiving no milk and the lowest loss was with the chicks receiving the 1-3 buttermilk. Lot 4 received greens in addition to the feed given lot 1. This may partially account for the lower mortality. The greens were used to supply vitamins, which were lacking in the feed for lot 1, and protein in addition to that supplied lots 1 and 7.

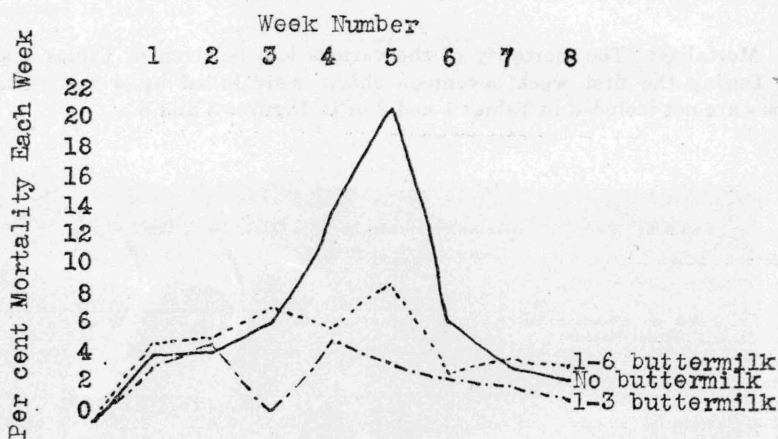


Figure 5. Per cent Mortality Each Week (Based on original number)

In Figures 5 and 6 all of the lots receiving water are thrown together as are those receiving the 1-6 buttermilk and the 1-3 buttermilk. Figure 5 shows that the mortality, for the lots receiving no buttermilk, was very high during the fourth and fifth weeks. This was during the latter part of the second week, the third week, and the early part of the fourth week following the infection, as the chicks were eleven and twelve days old when they were infected. Figure 6 shows the total per cent mor-

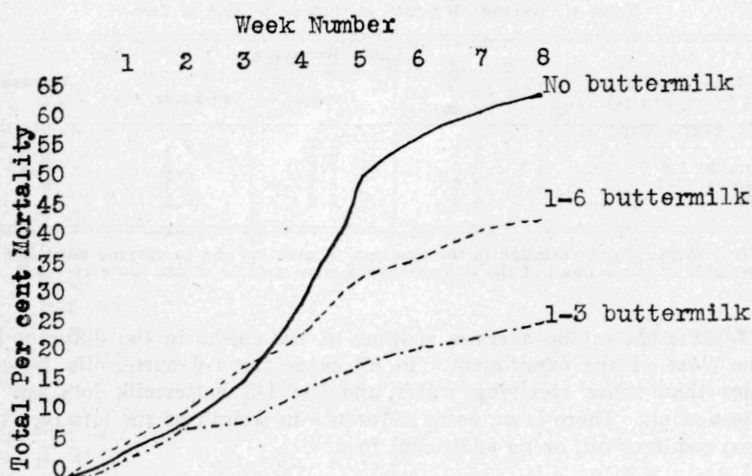


Figure 6. Total Per Cent Mortality at End of Each Week (based on original number).

tality up to the end of each week. It is noted that the highest mortality is in the lots getting no buttermilk and the lowest mortality is in the lots receiving 1-3 buttermilk.

Growth of Chicks: Table 3 gives the average weight of the chicks in each lot, at the end of each week. It is noted that in all cases the gains are lowest with the lots receiving no buttermilk and highest with the lots receiving 1-3 buttermilk. The chicks in lot 4 showed no advantage in gains over lots 1 and 7 even though they had green feed in addition to the basal ration. It is remembered that the mortality was low in this lot as compared with lots 1 and 7.

Table 3. Weight per Chick, in Ounces, at End of Each Week

Lot No.	Feed in Addition to Basal Ration	Week Number							
		1	2	3	4	5	6	7	8
1	Water	1.5	1.7	1.8	2.1	3.0	4.3	5.2	5.8
2	1-6 Buttermilk	1.7	2.3	2.8	3.5	4.5	5.7	6.8	7.8
3	1-3 Buttermilk	1.8	2.4	3.2	4.0	5.0	6.4	7.7	9.0
4	Water, Greens	1.5	1.7	2.0	2.5	3.0	3.9	3.9	5.1
5	1-6 Buttermilk, Greens	1.7	2.3	2.8	3.6	4.7	6.1	7.4	8.8
6	1-3 Buttermilk, Greens	1.7	2.5	3.0	3.7	4.8	6.4	7.5	8.7
7	Water, Cod-Liver Oil	1.3	1.5	1.6	1.9	2.4	3.0	3.4	4.1
8	1-6 Buttermilk, Cod-Liver Oil..	1.7	2.2	2.7	3.4	4.5	6.0	7.0	8.2
9	1-3 Buttermilk, Cod-Liver Oil..	1.7	2.3	3.0	3.7	4.6	6.3	7.7	9.1

Table 4. Average Weights, in Ounces, at End of Test

Lots Receiving	Lots Receiving			Average*
	No Additional Feeds	Greens	Cod-Liver Oil	
Water	5.8	5.1	4.1	5.1
Buttermilk, 1-6	7.8	8.8	8.2	8.3
Buttermilk, 1-3	9.0	8.7	9.1	8.9
Average*	8.0	7.6	8.2	7.9

*Due to the slight variation in the numbers in each lot and to varying mortality the final weights of those in all of the lots concerned were used to obtain these averages.

Table 4 shows the average weights of the chicks in the different lots at the close of the experiment. In all cases the 1-6 buttermilk lots are heavier than those receiving water and the 1-3 buttermilk lots are the heaviest of all. There is no great difference in weight of the lots receiving greens, cod-liver oil, or no additional feed.

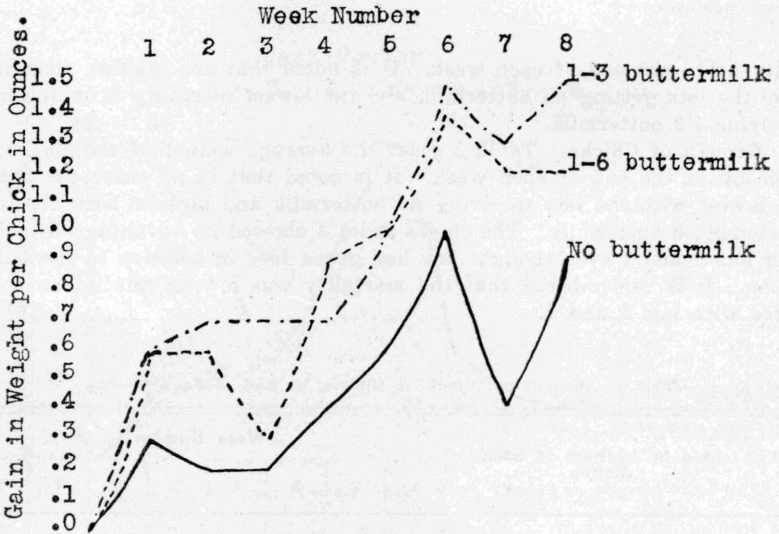


Figure 7. Gain in Weight, in Ounces, per Chick per Week.

In Figures 7 and 8 the lots are grouped as in Figures 5 and 6. These figures show that the rate of growth for lots receiving the 1-6 buttermilk and the 1-3 buttermilk was nearly the same after the first three weeks. During that time the lots receiving the 1-3 buttermilk gained slightly faster than those getting the 1-6 buttermilk.

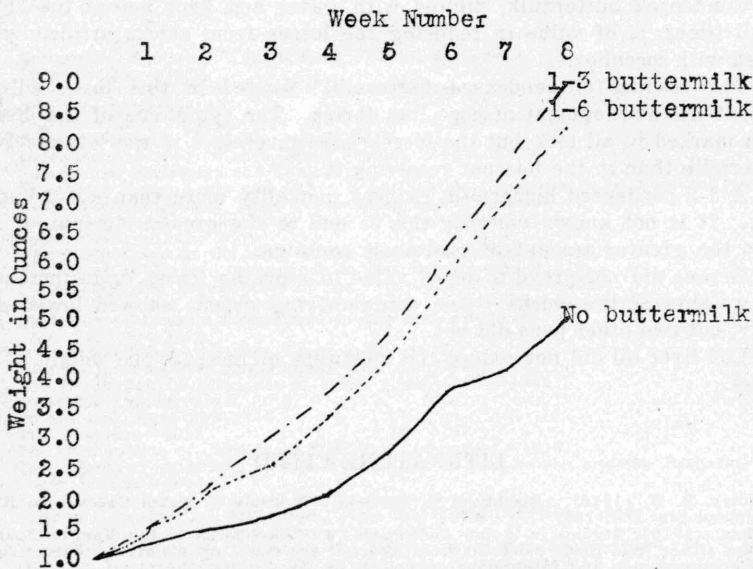


Figure 8. Average Weight, in Ounces, at End of Each Week.

Table 5. Total Pounds Feed Consumed

Lot No.	Feed in Addition to Basal Ration	Number in Lot		Feed Consumed			
		At Beginning	At Close	Grain	Mash	Greens	Liquid
1	Water	93	28	26.9	58.3		96.4
2	1-6 Buttermilk	92	51	31.9	68.1		224.7
3	1-3 Buttermilk	93	77	37.0	85.6		282.0
4	Water, Greens	81	50	39.6	64.6	31.8	101.9
5	1-6 Buttermilk, Greens	86	48	34.1	67.0	25.7	203.1
6	1-3 Buttermilk, Greens	92	65	41.1	68.6	29.3	240.3
7	Water, Cod-Liver Oil	92	16	21.6	64.1		64.8
8	1-6 Buttermilk, Cod-Liver Oil	92	49	35.0	74.2		204.6
9	1-3 Buttermilk, Cod-Liver Oil	92	63	39.5	79.6		234.3

Feed Consumed: Table 5 gives the feeds consumed by the different lots. The chicks were allowed all they would eat at all times except during the first week. In all cases the lots receiving the 1-3 buttermilk drank the largest amount of liquid and consumed the greatest amounts of grain and mash. In these lots the mortality was the lowest; therefore, as would be expected, the feed consumption per lot was high.

Conclusions: The results of this experiment seem to justify the following conclusions:

Condensed buttermilk, diluted with water and kept before the chicks at all times, is of value in reducing the losses from chicks artificially infected with coccidiosis.

The feeding of condensed buttermilk, as fed in this test, will not prevent the development of coccidian forms. The symptoms of the disease were marked in all lots, but the losses were much less in the lots receiving buttermilk than in the lots not receiving it.

A 1-3 condensed buttermilk reduces mortality more than a 1-6 buttermilk. It is not known whether this is due to the greater amount of acid or to the greater amount of protein it contains.

Greens did not prove to be of value in reducing losses or in increasing the weights of the chicks. One pen receiving greens showed lower mortality, but two other pens did not.

Cod-liver oil did not reduce the mortality or increase the weight of the chicks.

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