Effect of Sucrose in the Initial Drinking Water of Broiler Chicks on Mortality and Growth

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ABSTRACT Commercial poultry companies in the Southeastern United States have experienced high mortality when chicks are hatched from eggs laid by young breeding flocks. Hatching eggs weighing 47-54 g from 28-week-old breeders were collected on the farm, hatched in a commercial hatchery, and housed in a typical environment-controlled broiler house.

A total of 7600 mixed-sex broilers was used in two experiments to determine the effect of adding sucrose to the drinking water on broiler chick mortality and growth. In each experiment, four groups of 950 broilers each were offered either an 8% sucrose solution or tap water, with or without feed, for the first 15 hr after housing.

Broiler chick mortality was reduced from an average of 4.60% for the group of birds not receiving the sucrose treatments to 2.90% for the groups receiving the sucrose treatments. Presence or absence of feed during the first 15 hr of housing had no effect on mortality. Body weights were unaffected by dietary treatments. Thus, sucrose added to the initial drinking water of broiler chicks successfully reduced mortality of broilers without sacrificing market body weights.

INTRODUCTION

McNaughton *et al.* (1978) found that age of parents and hatching egg weight influenced broiler chick mortality. Chicks hatched from eggs laid by 29-week-old breeders had a significantly higher mortality from their offsprings than chicks from eggs laid by 58-week-old breeders. Skoglund *et al.* (1952) found that chicks from eggs weighing less than 50 g will not grow into as profitable broilers as chicks from larger eggs because of high mortality and lower weight of broilers hatched from small eggs. They further stated, however, that in periods of egg scarcity, the smaller eggs can be used, particularly if both unfavorable shipping and early brooding conditions can be avoided. The broiler industry is currently hatching the total collection of hatching eggs without regard to egg weights. Therefore, attempts were made at this station to reduce mortality of broilers hatched from egg weight groups normally found to have high mortality.

Thaxton and Parkhurst (1976) suggested that hydration accompanied by a readily available energy substrate favor metabolism that results in broiler growth. These researchers found that broiler chicks that received a sucrose solution (10% solution) before they were placed on feed showed larger body weights and lower feed conversion ratios than the chicks that received only water before feed. However, differences were not significant among groups fed sucrose water and tap water.

Houpt (1958) observed that the newborn animal is characterized by profound physiological changes as it adapts to its new and more variable environment, the most critical change being new nutritional sources. The egg serves as a readily available energy source for the growing embryo during embryonic development. However, when chicks hatch, this energy source is partially eliminated. Only the functional yolk sac and limited available dietary carbohydrates serve as energy sources for the newly hatched chick. Graham *et al.* (1941) found glucose to be the most critical substance in the starvation death of newborn pigs. Hypoglycemic states occur quickly in pigs (Hanawalt and Sampson, 1947), lambs (Sampson *et al.*, 1955), calves (Goodwin, 1957), and broiler chicks (Houpt, 1958). Therefore, it seems logical the first nutrient required by the chick after birth is an available energy source.

The broiler industry in the Southern United States is currently using hatching eggs from breeders that are 26 to 65 weeks old. Because McNaughton *et al.* (1978) found mortality to be as high as 6% when chicks were hatched from 29-week-old breeder eggs weighing 47-54 g, research was conducted to reduce the high mortality normally found in the offspring of young breeders. Therefore, the objective of this

TABLE 1.—*Frequency distribution of hatching eggs from 28-week-old breeders*

Egg weight groups (g)	Percent of total
43–44	2.05
45–46	4.79
47–48	16.44[a]
49–50	20.55[a]
51–52	34.25[a]
53–54	12.33[a]
55–56	6.85
57–58	2.74
Total	100.00

[a]Group of eggs selected for hatching.

study was to determine the effectiveness in reducing mortality by adding sucrose to the chick's drinking water for the first 15 hr after housing.

EXPERIMENTAL PROCEDURE

Two experiments were conducted to determine the effectiveness of adding sucrose to the drinking water of chicks for the first 15 hr after housing. In each experiment, 3800 mixed-sex broilers (Ross × Arbor Acre) were housed in an environment-controlled broiler house. Solar heat as the energy source and partial-house brooding techniques developed by Reece (1977) were used. Space allowances were .02 m^2/bird from 1 to 14 days, .04 m^2/bird from 14 to 28 days, and .08 m^2/bird from 28 to 53 days of age.

Hatching eggs collected from 28-week-old breeders were weighed individually and eggs weighing 47–54 g were separated for hatching. Eggs from 28-week-old breeders were used in these experiments because previous research indicated that mortality was high in the offspring of these breeders. The frequency distribution of a sample of eggs from which eggs weighing 47–54 g were taken is shown in Table 1. A total of 83.57% of the total eggs which were collected for hatching weighed 47–54 g. All eggs used in both experiments had an average weight of 50.76 g. Eggs were hatched in a commercial hatchery and the chicks were housed at one day of age.

Tindell and Morris (1964) found that chicks hatched from various egg weight groups and intermingled tended to have greater mortality than chicks hatched from the same egg weight groups but penned separately. The poultry industry is currently feeding birds in open-type houses, so all test groups in this study were intermingled. Chicks were toe-clipped at time of housing for identification.

All broiler chicks were debeaked and then vaccinated for Newcastle disease and bronchitis at the hatchery. All chicks were given Gumboro vaccine at 8 days of age.

In each experiment, after all chicks were housed, two groups of 950 birds were given an 8% sucrose solution (weight-weight basis) by fountain-type waters for 15 hr with and without feed. Two groups of 950 birds were also given normal tap water by fountain-type waterers for 15 hr with and without feed. Eight 4-liter waterers were provided per 950 birds. After 15 hr, all 3800 birds were given feed and water in box feeder lids and 2.4-m long waterers. After 3 days, the birds were fed from tube-type feeders. Starter and finisher diets used were the same as those reported by McNaughton *et al.* (1978).

TABLE 2.—*Mortality of broilers with and without sucrose in the initial drinking water*

	Mortality				
	Experiment 1		Experiment 2		
Treatment[c]	No.	%	No.	%	Mean, %
Tap water + feed	38/950[d]	4.00	49/950	5.16	4.58[b]
Tap water − feed	37/950	3.89	51/950	5.37	4.63[b]
Sucrose solution + feed	29/950	2.42	32/950	3.37	2.90[a]
Sucrose solution − feed	24/950	2.53	31/950	3.26	2.90[a]

[a,b]Means within a column and without a common superscript are significantly different ($P<.05$).

[c]Tap water or an 8% sucrose solution was given for the first 15 hr after housing with and without feed.

[d]Total number of birds dead/total number started on test.

TABLE 3.—*Weights of broilers with and without sucrose in the initial drinking water*

Treatment	Mean broiler weight (g)[a]			
	Experiment 1		Experiment 2	
	28 days	53 days	28 days	53 days
Tap water + feed	624	1693	673	1600
Tap water − feed	615	1716	663	1608
Sucrose solution + feed	618	1698	677	1616
Sucrose solution − feed	599	1748	682	1602

[a]No significant differences were found at either 28 or 53 days of age.

Body weights of 100 birds/test group were determined when the birds were 28 and 53 days old in both experiments. Mortality was recorded daily. Feed efficiency was not determined because all test groups were intermingled.

Analysis of variance (Steel and Torrie, 1960) was used for statistical examination of all data except mortality. Duncan's new multiple range test (1955) was used to determine differences between means. Mortality was analyzed by Chi Square (Steel and Torrie, 1960). All statements of significant differences refer to the 5% level of probability.

RESULTS AND DISCUSSION

Broiler mortality results are shown in Table 2. Broiler chick mortality was significantly lower when an 8% sucrose solution was given to chicks, either with or without feed, for the first 15 hr after housing than when the sucrose solution was not given. Results were essentially the same in both experiments. No significant differences were found in either 28- or 53-day body weights due to treatments (Table 3). Apparently there were very few weak birds that continued to live due to the sucrose solution.

Thaxton and Parkhurst (1976) found that broiler chicks receiving a 10% sucrose solution before they were placed on feed showed larger body weights and lower feed conversion ratios than the chicks that received only water and lower feed conversion ratios than the chicks that received only water before feed. Results of our study do not confirm these conclusions. However, results of this study indicate that mortality is less when chicks are given a sucrose solution the first 15 hr after housing than when not given the sucrose solution.

Thaxton and Parkhurst (1976) postulated that dehydration occurs during the first few hours after housing and that sucrose in the drinking water of broiler chicks helps alleviate dehydration. We postulate that sucrose serves as a readily available energy source quickly after the chick hatches and allows for a healthy broiler between the time it is housed and the time it is marketed.

Further evidence was presented by Graham *et al.* (1941) who found glucose to be the most critical substance in the starvation death of newborn pigs. Also, Houpt (1958) found that hypoglycemic states occur in chicks hatching. McNaughton *et al.* (1978) found that body fat of one-day-old broiler chicks was lowest in groups having the highest mortality. Therefore, sucrose can serve as a readily available energy source for young broiler chicks.

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