

THE EFFECT OF CAFFEINE CONTAINING BEVERAGES UPON GROWTH, REPRODUCTION AND LACTATION OF ALBINO RATS

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The caffeine containing beverages, tea, coffee and coca cola, commonly used by adults are generally accepted as fairly valuable additions to the diet though there is some difference of opinion as to their relative merits. It has long been held, however, that they are unsuitable beverages for children.

This latter idea has been founded, apparently, chiefly upon the knowledge that these drinks contain caffeine and that it is known to be a stimulant. Many nutrition workers have noted that malnourished children commonly use tea or coffee. Emerson found that 85 per cent of the mal-nourished children in his clinics in Boston, New York and Chicago used one or both of these beverages one or more times a day. He considers that their effect is at least largely that of causing "no appetite." Roberts considers that the chief objection to coffee for children is that it crowds out other important food, chiefly milk. She bases her idea upon repeated observations upon children: noting that physically superior children sometimes use coffee in addition to milk but that when the milk is up to 1½ pints per child per day coffee drinking decreases.

At the time these experiments were begun no reports were found in the literature of any tests "in vivo" to determine the effect of these beverages upon the rate of growth, or reproduction or lactation.

It was to try to find an answer to the question of the effect of tea, coffee and coca cola upon growth, reproduction and lactation that these experiments were undertaken.

EXPERIMENTAL

These experiments continued through parts of four years, being for the larger part, carried on during the first seven months of the years.

Young albino rats from local colonies were used. In all 124 adult animals and their 18 litters containing a total of 543 young, were considered in this study.

In every case effort was made to secure uniformly well started animals. The young were weaned at the usual age, 21 days, then kept on a good diet, including water and fresh milk until they were first given the experimental beverages.

The experiments were made by litters. When the litters were from 35 to 49 days of age they were divided into four similar groups, the same diet being given to all groups but a different beverage to each. All litters did not receive the same diet, but all diets used had been reported as satisfactory by experimenters. It was because we were not satisfied that all of our results were due to the beverages used that we used different diets. For beverages one group, the controls, received water, and the others only tea or coffee or coca cola. The beverages were given "ad libitum" to insure their being used.

The length of time of the different experiments varied from 27 days to 230 days, most of them continuing about 100 days. The effect of the intense heat of Oklahoma summers was the chief reason for the variation in the length of the experiments.

The manner of preparation of these beverages causes great variation in the amount of caffeine they contain. Hence in order to secure a

fairly uniform product a method of preparation that is commonly used was adopted for each beverage and used throughout the experiments.

The tea was prepared as follows: One rounding teaspoon of green tea was placed in a hot, enameled, covered container; $\frac{3}{4}$ measuring cup of boiling water was added; it was steeped three minutes; the liquid was poured off and let cool.

The coffee was prepared by adding one rounding tablespoon of coffee to $\frac{3}{4}$ measuring cup of boiling water in an enameled coffee pot; allowing it to boil slowly one minute; let settle three minutes; drained into a storage container.

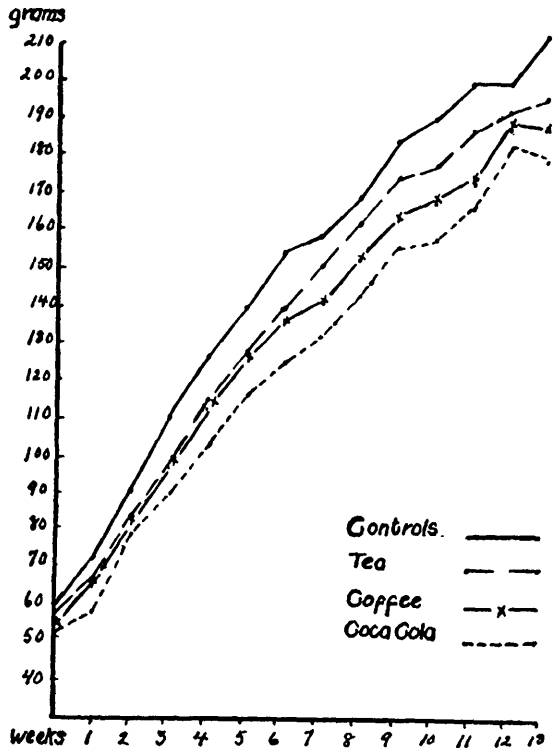
The coca cola syrup as used at the fountains was purchased and made up by adding one part of syrup to five parts of plain water. The druggists from whom we secured directions for making it told us that both plain and carbonated waters are used. Plain water was used here.

All beverages were made up in quantities to last four to seven days, all stored in covered glass jars and kept in the refrigerator until needed.

Samples of our beverages were analyzed for the caffeine content by a chemist (Miss Lila Heck) and were reported to contain per $\frac{3}{4}$ cup of tea 0.48 grains; for coffee 1.53 grains. According to the report of the manufacturers of coca cola its caffeine content per six ounces or $\frac{3}{4}$ cup is 0.43 grains.

Growth records were kept by recording the weight for each group of animals each week after the experimental beverages were begun. Later, averages were made for all the groups from the several litters for each beverage.

Growth curves for all groups from the several litters were plotted by the beverage used: that is, all control groups on one chart; all tea groups on another, etc. Also growth curves were plotted for the average of all animals using one kind of beverage. Further, charts were made for each litter plotting the average for each group.



Average Growth, All Animals Included

Reproduction records were kept including the age of the mother when each first gave birth to young; of the number of young born in each litter, and of the number and per cent of the young raised to weaning time and the beverage used by the mother. This was summarized and averages determined for each beverage.

Records were kept of the amount of the various beverages that the animals used for three of the litters.

RESULTS

The average effects on growth for all groups for each beverage are shown on the accompanying chart. From these it is evident that each caffeine containing beverage caused a somewhat poorer rate of growth in the experimental animals.

The growth records by litters showed that in more than half of the litters the groups using water were superior to all others.

The reproduction records showed an average age at which the mothers gave birth to young were in the following order: controls first, then coffee, next coca cola and tea last.

The average size of the litters for each beverage group was as follows: for the controls nine rats, for the others seven each. There were litters of from eight to ten on every beverage. As seven is considered a good size for a litter it would appear that none of the beverages interfered greatly with reproduction.

The young were not commonly successfully reared to 21 days on any of the diets for any of the beverages. The tea groups raised an average of 30 per cent of their young, the controls 26 per cent, the coca cola 24 per cent, the coffee 7 per cent. When listed by litters in descending order each beverage had some high and some low in the list so that there seemed to be no consistent relationship between the beverage used and the successful rearing of the young.

CONCLUSIONS

These experiments showed that caffeine containing beverages used in large amounts decreased the average rate of growth of young rats.

Those rats that did not use the caffeine containing beverages gave birth to young at an earlier age than did the others.

The control animals produced the largest average number of young to a litter but the other groups all had good average size litters.

The chief effect noted was the limiting effect of the caffeine containing beverages upon growth.

