BACTERIOLOGICAL EXAMINATION OF SOFT DRINKS

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Prohibition has boomed soft drinks so that more than ever there is need of rigid inspection. Dr. Stokes finds beverages with five-figure counts and empty "sterile" bottles always with some bacteria, sometimes with millions. This paper should attract the attention of health officers to their soft drink problems.

THE recent search for that evasive substance known as a ptomain has emphasized the fact that most of the cases of so-called ptomain poisoning are either due to bacterial infection or to such other causes as oxalic acid poisoning, over-eating, tartar emetic poisoning, acute and chronic nephritis and other similar conditions, as shown by the work of Rosenau* and his assistants.

These bacterial infections are usually produced by various members of the intermediate or hog cholera group such as the Alpha and Beta paratyphoid bacillus and *B. enteritidis. Proteus vulgaris,* an intestinal organism, can also produce intestinal disturbances, and all of these infections are due to the increase of the organisms in the intestine and definite infection at times accompanied by bacteremia with the presence of the organisms in the blood.

B. coli, a normal inhabitant of the intestine, seems to produce certain poisons in the foods before they are eaten, and the *B. botulinus,* a deadly anaërobic organism, also produces its soluble toxin in sausages, meat puddings and canned corn products when these materials have been subjected to inefficient sterilization. These two latter organisms do not produce direct infection by increase in the intestine but produce their poisonous products of metabolism in the food. When the food is consumed the poisons produce serious and even fatal intestinal diseases.

Owing to these facts the State Department of Health through Dr. Frederick C. Blanck, State Food and Drug Commissioner, instituted an examination of the various soft drinks which are being sold throughout the state. Many of these drinks were sold in large quantities at the various cantonments during the war, and this suggested an additional reason for their careful supervision. A great many of these drinks contain the various carbohydrates, and it is well known that the intestinal organisms develop favorably in such media, even splitting up the sugars into various gases and minute traces of alcohol.

Allen, LaBach, Pinnell and Brown,** of the Kentucky Agricultural Experiment Station, made a thorough investigation of the bacteriological condition of the various non-alcoholic, carbon-

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ated beverages sold in Kentucky. They also made a number of examinations of various materials involved in the processes of production. Their article contains a complete tabulated report upon a large number of examinations of these beverages as well as the city or filtered water used in the manufacture of the beverages, the rinse water used for the bottles, the water from caps, old caps, and the supposedly clean or sterile empty bottles before filling. The city waters examined showed counts ranging from 100,000 to 300,000 bacteria per cubic centimeter, the filtered water from 120,000 to 700,000 per c.c., the water used for rinsing bottles from 180,000 to 960,000 per c.c., the water off caps (one examination) 750,000 per c.c. old caps (one examination) 165,000 per c.c., and the clean or sterile empty bottles from 1,900 to 310,000 bacteria per c.c. The various beverages showed counts ranging from 10,000 to 850,000 bacteria per c.c.

Although the water used for manufacture very often showed a high bacterial count yet the products often showed very low bacterial counts, and they accounted for this result by the destructive or inhibitory effect of carbodioxide upon bacteria.

The unfiltered water contained a maximum *B. coli* count of 5,190 and a minimum of 0; the filtered water contained no colon bacilli. The rinse water showed a maximum of 106 and a minimum of 0; the empty bottles had a maximum of 1,440 and a minimum of 0 and the beverages showed a maximum *B. coli* count of 450 and a minimum of 0.

They believe that the bottles should be cleaned of all possible dirt by the proper kind of bottle washer and then sterilized with live steam for from 30 to 40 minutes, and the bottler should guard against any possible recontamination brought about by cooling with contaminated water. If filtered water be used the filter should be frequently examined in order to see that a pure filtrate is obtained, and it goes without saying that the water used should be free from colon bacilli and with a low bacterial count.

Our investigation is explained in detail in the following tables, the object of this investigation being to determine the number of bacteria present in the samples and to see whether any of these goods contained intestinal organisms. No special search was made for organisms other than the colon bacillus, the normal inhabitant of the intestine, but the presence of this organism in the fluids certainly suggests danger from the other pathogenic intestinal bacteria. The results which were obtained are set forth in detail in tables 1 and 2.

I am indebted to Mr. S. Caskey for much assistance in the routine examination of the above products named below. (See next page.)

CONSIDERATION OF RESULTS OBTAINED.

An examination of table No. 1 will show that in a number of instances the maximum count of these soft drink products was innumerable whilst other maximum counts show results of five figures. A large number of the samples also showed the presence of sugar-splitting or fermentative bacteria, as shown by positive presumptive tests in 10 cubic centimeters, 1 cubic centimeter and even 1/10 of a cubic centimeter. In the final attempt to isolate the colon bacillus, as expressed by the final test, it can be seen that we were often unable to isolate this organism, but the fermentation may have been produced by yeasts, the lactose splitting aërobic spore-bearing organisms recently isolated from water, the anaërobic spore-bearing organisms, or other aërobic gas producing bacteria. In many instances we were unable to obtain any colonies from the plates

examined, but no special attempt was made to isolate other organisms besides the colon bacillus.

We tested out a number of empty bottles for sterility and found a maximum count of innumerable and a minimum count of 500 bacteria per bottle. Colon bacilli were isolated in a number of samples even in as small a quantity as 1/10 of a cubic centimeter. This is an interesting point, since it may be that improperly sterilized bottles are often a cause of the bacterial contamination of the soft drinks, and we

TABLE No. 1

TABLE OF SOFT DRINKS SHOWING BACTERIAL COUNTS AND COLON TESTS

Flavor	Bacterial Count 37°		No. Exam.	Colon Examinations Presumptive Test			Final Test		
	Max.	Min.		10 cc.	1 cc.	0.1 cc.	10 cc.	1 cc.	0.1 cc.
Ginger Ale	In.*	0	92	43	22	1	17	8	0
Lemon	In.	0	83	41	13	0	10	4	0
Sarsaparilla	In.	0	83	40	26	4	16	14	3
Orange	2,800	0	42	19	11	3	4	2	0
Strawberry	In.	0	44	24	17	5	12	8	3
Root Beer	350	0	14	3	2	0	2	2	0
Birch Beer	20,000	0	7	3	3	1	0	0	0
Vanilla Soda	450	5	6	4	2	0	2	2	0
Chocolate	In.	0	10	3	3	0	0	0	0
Grape	38	0	8	3	3	0	0	0	0
Coca Cola	600	3	6	4	2	0	0	0	0
Champagone	275	0	8	2	2	2	0	2	2
Raspberry	3,200	20	6	4	0	0	1	0	0
Miscellaneous	38,000	0	47	8	5	0	4	3	0

EMPTY BOTTLES FOR STERILITY

	Per Bottle								
Bottles	In.	500	26	17	12	8	15	12	8

*In. indicates Innumerable.

TABLE No. 2

TABLE OF SOFT DRINKS SHOWING NUMBER OF BACTERIAL COUNTS ACCORDING TO GROUPS

	0	1-50	51-100	101-250	251-500	501-1000	1001-5000	50001-10000	10001-20000	20001-50000	Innumerable
Ginger Ale	8	54	7	4	4	4	8	1	0	0	2
Lemon	10	47	5	4	2	4	10	0	0	0	1
Sarsaparilla	10	26	12	3	4	7	8	5	0	0	5
Orange	10	23	3	2	2	0	2	0	0	0	0
Strawberry	6	23	5	1	1	0	3	3	0	0	2
Root Beer	5	7	0	0	1	0	0	0	0	0	0
Birch Beer	2	2	0	0	0	0	0	1	1	1	0
Vanilla	0	2	1	1	1	0	0	0	0	0	0
Chocolate	3	2	0	1	0	0	1	0	0	0	3
Grape	2	6	0	0	0	0	0	0	0	0	0
Coca Cola	0	4	0	0	0	1	0	0	0	0	0
Champagone	2	3	0	1	1	0	0	0	0	0	0
Raspberry	0	0	2	3	0	0	1	0	0	0	0
Miscellaneous	15	17	6	5	2	0	1	0	0	1	0

EMPTY BOTTLES FOR STERILITY

Bacterial Count Per Bottle

	1-500	501-1000	1,001-50,000	50,001-1000,000	100,001-250,000	250,001-500,000	500,001-1 mil.	1 m. 5 m.	5 m. 20 m.	In.*
Bottles	1	1	2	1	2	2	5	3	2	2

*In. indicates Innumerable.

usually found a small amount of fluid in the bottom of the bottles. Even a few bacteria remaining after sterilization might increase in this fluid and thus produce the high bacterial counts often obtained from the washings from the bottles. These bottles were washed out with 100 cubic centimeters of sterile water and the dilutions were made from such an amount.

An examination of table No 2 will show the bacterial counts arranged according to groups between certain fixed limits. A certain number of the soft drinks tested, therefore, showed no bacteria present; others showed bacteria varying between a count of 1 to 50, and these groups are continued to as high a limit as from 20,000 to 50,000, A few of the plates showed innumerable colonies and could not therefore be estimated.

An examination of the bacterial counts for sterility shows that some of the bottles contained millions of bacteria per bottle, and, as mentioned before, this is probably explained by the great increase which may take place in the small amount of water often left in the bottle after sterilization.

CONCLUSIONS

1. Many soft drinks contain variable numbers of bacteria and this large bacterial content may be partially explained by the improper sterilization of bottles.

2. A few bacteria remaining in the bottles may increase in the small quantity of water often left in the bottles after sterilization. Dust organisms getting into the bottles may also resist sterilization even if the bottles are properly dried.

This matter may be of some importance in relation to the possibility of intestinal infection, since the organisms which produce so-called food poisoning often find a favorable culture medium in the carbo-hydrates of these soft drinks.

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Poland 200 Years Behind in Therapy.—The native doctors in Poland are using the drawing of blood for their principal curative method, just as was the custom generally a couple of hundred years ago. In just the same way these doctors usually combine the profession of the barber with that of "leech," just as in the olden time, and indeed the striped barber's pole is merely a sign of the blood-letting capacity of this artificer when the sign was invented. And just as these men applied leeches for the purpose, whereby the name of the worm became a synonym for the practicer of medicine, so their modern disciples in Poland have been in the habit of using the leech. If the man got well the barber-doctor had made a miraculous cure; if he died, it was but the will of God.

Recently this ancient system of practice has been violently overthrown. American Red Cross doctors and nurses came into the district and found typhus and many other diseases flourishing, with no medical attention except that which the barber could bestow. An American hospital with all modern medicines and equipment was installed and the barbers soon lost the medical and surgical end of their practice. Their aid was enlisted, however, in closely shaving be-whiskered men and clipping short the hair of those who were infested with vermin. Just now, after weeks of strenuous medical campaigning, headway is being made against the disease which the barbers' leeches had so long failed to cure. Leech-craft has gone out of Poland.