

# OCCURRENCE OF THE COLON GROUP ON COMMERCIAL CANDIES \*

JOHN WEINZIRL, PH.D., DR.P.H., FELLOW A.P.H.A.

*Professor of Bacteriology, University of Washington, Seattle, Washington*

IN RECENT years the consumption of candy has increased to such huge proportions that it now averages about 5 pounds per capita per year. The manufacture and sale of 500,000,000 pounds of candy involves its being handled by approximately 100,000 persons of whom some are slovenly in their habits, some are disease carriers, and some are actually diseased. It would be helpful if we knew the extent of the danger involved in the consumption of candies. Very few researches have been made that aid in evaluating this danger.

Stiles<sup>1</sup> found that the used-over starch, employed in molding certain kinds of chocolate centers, contained *Escherichia coli*, while Cummins<sup>2</sup> found chocolate cakes free from this organism. Cummins also made some inoculation experiments which showed that *Esch. coli* and *Eberthella typhi* remain alive 24 days or longer. Tanner and Davis<sup>3</sup> analyzed 30 samples of candy but found no members of the colon group.

It would seem that the investigations made thus far still leave us with only a vague idea as to the probable contamination and the relative amount of danger involved. The present investigation was undertaken with the purpose of increasing the data and of obtaining more definite information as to the occurrence of the colon group on candy.

## METHODS EMPLOYED

From the experience gained in the examination of other foods it was appar-

ent that a direct search for pathogens was likely to prove futile, and that it would be necessary to rely upon indirect evidence. In the case of water such evidence is furnished by demonstrating the presence of the colon group which in certain numbers is held to indicate probable sewage contamination, and therefore it is assumed that the water is likely to carry *Ebert. typhi* and other disease bacteria. Obviously similar evidence may be secured in relation to candy by determining the frequency with which the colon group occurs and basing judgment upon that evidence.

In order to save the time consumed in weighing, the unit adopted in this investigation was the "piece" of candy. The method employed was to make enrichment tubes as in water examinations, each tube of lactose bouillon receiving a single piece of candy. If a given piece was too large it was divided and the several portions added to the tube. Controls were made by inoculating a number of tubes with both the candy and *Esch. coli* to make certain that neither the sugar nor the flavoring substance in the candy prevented the enrichment of the colon group if it were present. The enrichment tubes were incubated 24 and 48 hours at 37° C., then Endo agar plates were made from all tubes showing gas. If coli-like organisms appeared on the plates, they were fished, cultured and examined microscopically for verification of colon group.

Samples of candy of different varieties were obtained from a large number of shops in order to secure a wide range of conditions in manufacturing and hand-

\* Read before the Food and Drugs Section of the American Public Health Association at the Fifty-fifth Annual Meeting at Buffalo, N. Y., October 12, 1926.

ling. The candy was analyzed as soon as possible after purchasing, usually within a few hours. The following items were noted: (1) kind, (2) color, (3) flavor, (4) source, and (5) manner of handling, *i.e.*, whether with scoop or with fingers.

EXPERIMENTAL RESULTS

In the first study 613 pieces of candy were tested for presence of colon group of bacteria with the results shown in the following table:

TABLE I  
SHOWING THE OCCURRENCE OF COLON GROUP ON 613 PIECES OF CANDY

Kind	No. of Pieces	Colon Group		
		Present	Absent	Per Cent Positive
Hard Glucose . . . . .	193	3	190	1.5
Satin Pillows . . . . .	90	2	88	2.2
Hard Mints . . . . .	50	0	50	0.0
Fudge . . . . .	40	0	40	0.0
Taffy . . . . .	9	0	9	0.0
Caramels . . . . .	69	5	64	7.2
Chocolate Creams . . . . .	77	1	76	1.3
Jelly Beans . . . . .	85	4	81	4.7
Total . . . . .	613	15	598	2.5

Of the eight varieties of candy tested, the caramels showed the highest percentage of positives for the colon group. This result was a surprise because this type of candy is usually wrapped in waxed paper and should therefore be protected from subsequent contamination. Apparently the contamination occurred at the time of wrapping or earlier.

The second highest contamination was shown by the jelly beans. It would appear that this contamination occurred during dispensing. Apparently the same explanation also holds for the other types showing contamination. This explanation seems highly plausible in the case of the satin finish pillows which are slightly sticky and hence would readily pick up bacteria and hold them.

Assuming that all the apparent contamination was due to handling of the candy, it would seem that the percentage is too high, since there is no valid excuse for such contamination. Either the contamination is excessive or it is not due to handling during the dispensing process.

To increase the number of determinations and to discover, if possible, the

source of contamination, a second series was undertaken. The same technic was followed, but all the cultures belonging to the colon group were saved and later their species determined. This additional step was undertaken in order to shed some light on the question of whether the contamination observed was actually fecal. The results found are as follows:

TABLE II  
SHOWING THE OCCURENCE OF COLON GROUP ON 525 PIECES OF CANDY

Kind	No. of Pieces	Colon Group		
		Present	Absent	Per Cent Positive
Hard Glucose . . . . .	75	0	75	0.0
Satin Pillows . . . . .	75	1	74	1.3
Nut Pillows . . . . .	50	5	45	10.0
Hard Mints . . . . .	75	3	72	4.0
Taffy . . . . .	25	1	24	4.0
Jelly Beans . . . . .	25	0	25	0.0
Caramels . . . . .	25	0	25	0.0
Nut Caramels . . . . .	25	2	23	8.0
Hoarhound . . . . .	25	0	25	0.0
Cinnamon Drops . . . . .	50	0	50	0.0
Easter Eggs . . . . .	25	0	25	0.0
Chocolate Creams . . . . .	50	2	48	4.0
Totals . . . . .	525	14	513	2.6

Table II shows that the colon group was present on or in 14 of the 525 pieces of candy, and that the apparent contamination was 2.6 per cent. This percentage is practically identical with that of the first series which gave 2.5 per cent.

The percentage of contaminated samples for the different varieties of candy is highest for the nut pillows and nut caramels, 10 per cent and 8 per cent respectively. On the other hand the plain caramels are free from the colon group, while the plain or satin finish pillows show it present in only 1.3 per cent of the samples. Further, the two nut candies furnished 50 per cent of all the apparent contamination, but only 14.3 per cent of the total number of pieces. It appears highly probable that the contamination was carried by the nuts.

The other types of candy showing colon group present were: hard mints, taffy and chocolate creams with 4 per cent each; satin pillows with 1.3 per cent. With the exception of the hard mints this group includes candies which may be described as more or less sticky to the touch. This result agrees with that for the first series. Apparently sticky candies are

more liable to pick up contamination than are the hard varieties.

In this series the cultures isolated from the samples showing colon group positive were replated to insure purity, then their species were determined according to the requirements as given by Levine<sup>4</sup> for the classification of the colon group, as follows:

COLON GROUP: Methyl red, +; Voges-Proskauer, —; Starch, —.

- (1) *E. coli*: Sucrose, —; Salicin, +.
- (2) *E. acidi-lactici*: Sucrose, —; Salicin, —.
- (3) *E. communior*: Sucrose, +; Motility, +.
- (4) *E. Neapolitana*: Sucrose, +; Motility, —; Salicin, +.
- (5) *E. pseudocorscorobae*: Sucrose, +; Motility, —; Salicin, —.

Answering to these prescriptions the results were as follows:

TABLE III  
GIVING SPECIES FOUND FOR THE COLON GROUP CULTURES

Sample No.	Kind of Candy	Species Found	Times Found
124	Hard peppermints	<i>E. communior</i>	1
320	Nut pillows	<i>E. coli</i>	1
363	Nut caramels	<i>E. acidi-lactici</i>	1
372	Nut caramels	<i>E. neapolitana</i>	1
505	Chocolate creams	<i>E. pseudocorscoroba</i>	1
91	Taffy	Could not identify	1
104	Hard mints	Could not identify	1
121	Hard mints	Could not identify	1
251	Chocolate creams	Could not identify	1
278	Nut pillows	Could not identify	1
292	Nut pillows	Could not identify	1
324	Nut pillows	Could not identify	1
325	Nut pillows	Could not identify	1
495	Pillows	Could not identify	1

If only *Esch. coli* and *Esch. communior* are classed as fecal, then it is surprising to find that nearly all the cultures were non-fecal. The source of the non-fecal bacteria is to be found apparently in the materials entering into its composition, especially the nuts. If this be true, then it follows that the contamination due to handling the candies after manufacture is less serious than the percentages would seem to indicate.

#### DANGERS IN HANDLING

As to method of handling, the data are insufficient since only 172 out of 542 pieces, or 30 per cent, were dispensed with a scoop. Two of these samples, or 1.2 per cent, gave apparent contamination. On the other hand the data sheets rarely showed gas-formers of any kind on glucose or hard candies in the making of which the materials are boiled and hence practically sterilized. These candies have

the same chance of contamination by handling as do the others, but practically they never show the presence of the colon group. From the data at hand, it is obviously impossible to state how much of the contamination is due to handling at the time of dispensing.

The data sheets also showed that in several instances the control cultures (three tubes containing candy and inoculated with *Esch. coli*) failed to show either gas or growth. Such failure occurred with the cinnamon drops and some peppermints. This would indicate that the essence used in flavoring the candy either inhibited or actually killed the bacteria, assuming that no other disinfectant was present.

That contamination may occur is obvious on a *priori* grounds. If the person handling the candy is uncleanly in habits, contamination will occur.

#### REASONS FOR REFORM

While there is no basis for serious apprehension regarding candy, it would seem that there are valid reasons for definite reform in the handling of this product. (1) Candy should not be exposed to flies and dust. This practice is quite generally observed at the present time. (2) Candy should always be handled with a scoop. This seems not to be the prevailing practice. (3) Paper boxes, bags, glass jars, and other containers should be employed to a much greater extent than at present.

#### SUMMARY AND CONCLUSIONS

1. A total of 1,138 separate pieces of candy purchased in the open market were examined for the presence of the colon group, which was found 29 times or on 2.5 per cent of the samples.

2. The preponderance of the apparent contamination occurred in candies containing unsterile ingredients such as nuts. The significance of this type of contamination remains uncertain.

3. Sticky candies apparently are liable to contamination by handling. The use

of a scoop seemed to lessen the contamination.

4. The bacteria isolated as belonging to the colon group were mostly atypical and hence do not seem to indicate fecal contamination. Typical *Esch. coli* or *Esch. communior* were found only twice in 525 trials.

5. The danger of candy carrying disease bacteria can readily be eliminated

NOTE—The assistance of Miss Florence Swanson and Miss Sylvia Johnson is gratefully acknowledged.

by sterilizing the products from which the candy is made, and by using well-known sanitary devices in handling and dispensing it.

#### REFERENCES

1. Stiles, George W. Some Bacteriological Problems Arising Under the Food and Drugs Act. *Am. Food J.*, 10:471, 1915.
2. Cummins, Earl H. Certain Sanitary Aspects of Candy Manufacture. *A. J. P. H.*, 5, 11:1148 (Nov.), 1915.
3. Tanner, Fred W., and Davis, Esther. Some Observations on the Sanitary Conditions of Confections. *A. J. P. H.*, 12, 7:605 (July), 1922.
4. Levine, Max. Bacteria Fermenting Lactose and Their Significance in Water Analysis. *Ia. State Col. Eng. Exp. Sta. Bull.*, 62, p. 42, 1921.

## INDUSTRIAL MORBIDITY DATA AND THE PHYSICIAN\*

C. O. SAPPINGTON, M.D., DR.P.H.

*Medical Director, Montgomery Ward & Co., Oakland, California*

NO degree of proficiency in the practice of his art; no amount of erudition in theoretical medicine; no boasted expertness in the management of clinic or hospital will serve the physician in prevention without continuous concise knowledge of the ill-health that exists in the plant and the specific conditions under which it occurs.

It was only a few years ago that this wise dictum was enunciated by Edgar Sydenstricker, statistician of the U. S. Public Health Service.

The extensive collection and analysis of industrial morbidity material is still in the embryonal stage and is beset with all the difficulties attendant upon the development of an unstandardized and inexact procedure.

Due credit must be given the excellent work done by the Informal Committee on the Classification of Industrial Morbidity Statistics. The U. S. Public Health Service, through the efforts of Assistant Statistician Dean Brundage, has also

made several comprehensive industrial sickness studies. It is only by such attempts to stimulate coöperative interest that a common basis for comparison and discussion of disability experience can be developed.

Some virgin territory still exists, however, and it is with the risk of repetition of much of the old, but with a possibility of some new suggestion, that reconsideration of a perennial subject is proposed.

#### TYPES OF DATA

Industrial morbidity material may be easily and naturally segregated under three headings which will be briefly considered in order of their importance.

*Sickness*—Several extensive studies have shown that sickness disability has caused approximately ten to twenty times the number of cases of absenteeism as have accidents, and in addition the loss of five to seven times the amount of working time.

*Physical defects*—A great mass of experience is gathered throughout industry each year. To what use can this material be put?

\* Read before the Industrial Hygiene Section of the American Public Health Association at the Fifty-fifth Annual Meeting at Buffalo, N. Y., October 14, 1926.