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Development of Botulism Microbe in Canned Foods for Children

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Presently, the assortment of canned foods for children in the domestic production includes approximately 30 kinds of different varieties. Yet, so far, no specific articles have been written on a possibility of development of botulism microbe in canned foods for children, while the available data pertinent to this question remain contradictory.

So, we decided to investigate the thermal resistance, the rate of development of botulinal microbe and its toxin production in various canned foods for children.

We determined the thermal resistance of spores of Cl. botulinum A/96 in cans containing a "vegetable-meat soup-puree with squash", "tomato soup-puree" and "vegetable-meat soup-puree with tomatoes".

Avoiding sterilization, we contaminated prepared canned foods with calculated 100,000 to 200,000 spores in 1 ml and then we set 4 ml of the material into each ampoule. The hermetically sealed ampoules were heated in glycerin bath at various temperatures and

time intervals. We heated 5 to 10 ampoules of each variant material. The ampoules were kept in the incubator at 35°C. After 3 months, we opened the ampoules to determine the development of Cl. botulinum and its toxin production, using biological test on white mice. The results of the experiment are shown in Table 1.

Table 1

Nutrient medium	pH	Time in minutes required for the suppression of activities of Cl. botulinum spore at various temperatures.		
		115°C	120°C	125°C
Vegetable soup-puree with squash	5.6	24	8	5
Vegetable meat soup-puree with squash	5.3	24	10	6
Tomato soup-puree	5.7	15	6	5
Vegetable meat soup-puree with tomatoes	5.3	15	6	4

The obtained results indicate that the spores of botulism microbes had a lower thermal resistance in canned foods with tomato paste than in canned foods with similar ingredients, but without the tomato paste. This diversity in the thermal resistance appeared particularly at 115°C temperature. Spores remaining after heating canned foods with tomatoes continued to develop and to produce their toxin.

We also established a possibility that spores of botulism microbes not thoroughly heated can grow in other kinds of canned foods for children. For this purpose we contaminated with detoxicated spores of Cl. botulinum A/98 or B/233 ready products in cans No.83-5,

or in ampoules and, avoiding sterilization, we kept this material in the incubator at 35°C.

We determined that in canned foods like "ground beef", "liver puree with rice", "chicken soup-puree with vegetables", "vegetable meat soup-puree with green peas", "vegetable meat soup-puree with squash", "vegetable soup-puree with cauliflower", "tomato soup-puree", "green pea soup-puree", "green pea soup-puree with milk", "squash soup-puree with milk" and "pumpkin soup-puree with milk", all having active acid content in the pH range from 5.3 to 6.2, the spores of botulism microbe developed and produced their toxin after we injected 100,000 to 200,000 spores into each can No.83-5 (smaller quantities of inoculum were not used in these experiments). The biological test produced positive reaction on the third day after the inoculation.

The conditions found in processing canned foods for children (homogenizing, hot packing and vacuum sealing) seemed to favor a development of botulism microbes. The gas that forms in the first hours (sometimes during the first several days) of the development of bacterial cells, is absorbed by the product, thus the production of gas has been manifested slightly. A considerable production of gas in canned foods infected with Cl. botulinum followed simultaneously or even some time later after the production of botulinal toxin in the cans.

Basically, the smell of canned foods, in which the botulinal microbe grows, is determined by the ingredients of the canned products. In canned foods like the "vegetable soup-puree", "vegetable meat soup-puree with tomatoes" and "beef soup-puree", a development of the

botulism microbe caused the appearance of a strong putrescent smell. In the "chicken soup-puree with vegetables" appeared a strong cheesy smell; in the "vegetable soup-puree with cauliflower" - a rancid smell of oil; in the "green pea puree" - a smell of a sour product; in the "squash puree with milk" and in the "pumpkin puree with milk" - a faint contaminant smell. The development of botulism culture in the "tomato soup-puree" passed without any appearance of the contaminant smell.

The development of botulism microbe in the enumerated kinds of canned foods for children was also accompanied by the separation of the contents into layers, by the separation of liquid, by the formation of a compact grain structure in the product and by the appearance of more intense coloration in the product.

But all these changes not always emerged effectively in many kinds of canned foods, even up to the moment of the production of toxin. The "vegetable soup-puree with squash", the "tomato soup-puree", the "green pea puree" and the "pumpkin puree with milk", all evidenced their changes in a mild form; they could be distinguished only by comparison with the control material not infected with the specimens.

Of particular interest was a study of the behavior of botulism spores in the "carrot puree" and in the "carrot puree with semolina", because it has previously been stated*) that botulinal spores do not grow in a juice of boiled carrots.

After the "carrot puree with semolina" had been inoculated with the botulism culture types A and B, we detected on the second day a

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*) - N.G. MIKHOZOVA. Botulism microbes in the canning industry. Pishchepromizdat, 1957.

formation of gas in 50% of the specimens. However, the biological test of the specimens failed to disclose botulinal toxin on the third day. Subsequently, the contents contaminated with the specimens acquired a fine-grain structure and became separated into layers, but the changes were manifested in a very mild form. Later, the biological test performed on the tenth day after contamination of canned foods disclosed the presence of the botulinal toxin in all specimens infected with the type A culture and in two out of three specimens infected with the type B culture. Therefore, the botulinal toxin develops in the "carrot puree with semolina", but irregularly and slower than in other canned foods for children.

In the "carrot puree" we detected gas on the second day in two out of 23 specimens infected with spores of Cl. botulinum type A or B. The gas-forming specimens disclosed on the tenth day the presence of botulinal toxin that corresponded to the A and B types. We stored the other 21 specimens for 3 months and we observed no changes in their organoleptic properties and no development of toxin.

The inoculation of the same infected "carrot puree" on the casein-fungous medium disclosed that the botulinal spores, which failed to grow in the "carrot puree", maintained their vitality in this medium.

We also investigated a possibility of the development of Cl. botulinum types A and B in cans with fruit-berry foods for children, in the "apple puree with rice", "plum puree", "apple puree" and in the "fruit cocktail puree". We infected these specimens with 100,000 to 200,000 botulinal spores per 1 ml. Avoiding sterilization, we kept

this material in the incubator for 3 months at 35°C. We found no visible indications of spoilage, nor a production of toxin. The inoculation of the same specimens on the casein-fungous medium disclosed that the spores of Cl. botulinum types A and B appeared nonviable in 50% of the specimens of the "apple puree with rice" and in the "fruit cocktail puree". All specimens of the "apple puree" and the "plum puree" evidenced sterility. Thus, the spores of Cl. botulinum not only failed to grow in cans with the fruit-berry foods for children, but in due time they died out.

Hence, one can draw the following conclusions from the obtained findings.

The presence of tomato paste in a quantity compatible with a formula for canned foods for children reduces the thermal resistance of Cl. botulinum spores, but it does not inhibit a development of the culture and the production of botulinal toxin.

The botulism microbe can grow and produce its toxin in all kinds of meat, meat-vegetable and vegetable canned foods for children, except a carrot kind. Spores of botulism microbe intergrow irregularly in the "carrot puree" and in the "carrot puree with semolina".

Botulinal spores do not develop in cans with the fruit-berry foods for children and die out step-by-step.

The development of botulinal microbe and the production of toxin in canned foods for children is not always accompanied by the indications of spoilage.

Consequently, it is necessary to constantly maintain a high level of the sanitary conditions in the manufacture of canned foods

for children and to carefully watch for adherence to this rule.