

THE BACTERIOLOGICAL ESTIMATION
OF THE PASTEURIZED CANNED MEAT PRODUCTS IN POLAND,
FROM THE VETERINARY SANITARY POINT OF VIEW.

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The pasteurized canned meat products are made chiefly for export purposes in Poland. According to the appropriate regulations having been issued by the Minister of Agriculture on 10th of December 1950, every batch of export meat products is the subject of compulsory laboratory examinations. These examinations include the scrutiny of the separate stages of the production cycle and the estimation of the ready made product. The purpose of these examinations is to eliminate the pathogenic microorganisms and then the organisms which may bear upon the quality and the stability of the ready product.

For the bacteriological examination two tins of the canned pasteurized meat of a given assortment and of the same shape are taken from the batch produced in the process within one day's work.

The following points are taken into consideration with the bacteriological examination:

1. The examination for leaks of tins.
2. The examination of stability of the product by means of the thermostatic test, performed in an incubator at the temperature of 37°C during three days of time. A half of the total quantity of tins collected for examination is submitted to the thermostatic test.

3. The bacterioscopic preparation made of superficial and deep layers of the canned products. /Direct imprint of the examined sample on the glass, and stained by the use of Gram's method/.
4. The impressed direct inoculation on the nutritive agar, made of superficial and deep layers. In the justifiable cases the homogenization of the examined material is carried out and then more detailed quantitative examination is performed.
5. Inoculation on the selective and enriching media with the purpose of the determination of the kind of microorganisms appearing in the examined material. Particular attention is paid to the isolation of the microorganisms, the presence of which in the semi-preserved products is intolerable, like e.g. gram-negative bacteria, anaerobes /Clostridium/, enterotoxic Staphylococci and other microorganisms of the pathogenic group.

The Estimation of the Product.

In case when the pathogenic microorganisms like *Salmonella*, *Shigella*, *Clostridium botulinum*, *Clostridium perfringens*, enterotoxic *Staphylococci* are detected in the examined canned meat the whole batch of commodity is declared as unsuitable for consumption. With the confirmation of the other non-admissible microorganisms like gram-negative or anaerobically growing bacilli the examined batch is made questionable. Its eventual conditional admission for the consumption depends upon further supplementary examination.

When the leaks have been disclosed in a certain percentage of tins of a given batch, the canned products are estimated both as unsuitable for export and unsuitable for the storage

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inside the country. They are allowed to be distributed at once on the home market.

The positive thermostatic test inform of the blowing or of some other organoleptical changes is the proof to disqualify the examined batch from export. If the changes were caused by non-pathogenic microorganisms, and that part of the canned products from a given batch which was not submitted to the thermostatic test shows regular organoleptical properties, then the batch can be admitted for instantaneous consumption at home directly, or after certain thermal treatment.

If in the bacterioscopic preparations made of the examined products 40 microorganisms are found in 20 fields of vision of the microscope, then, with the absence of any other objections, the canned meat is directed for sale at home without being admitted for export.

Up to now, there are no bacteriological standards in Poland with regard to the admissible quantity of microorganisms in 1 gram of canned pasteurized meat products. Therefore the quantitative bacteriological estimation is carried out in the majority of cases on the ground of the results obtained from the direct-imprint inoculations on the solid media. According to the regulations by the Veterinary Department Ministry of Agriculture of 10th July, 1959 it is adopted that the product, which is to be admitted to the trade without any objections, must not show in the imprint inoculations on the solid media more than 2 colonies of bacteria over 1 square cm. of the imprint. In case of greater quantity of microorganisms the examined batch can be admitted for sale on the home market directly, or after repeated

pasteurization.

Discussion.

The detection of the pathogenic microorganisms disqualifies the examined batch of canned meat from the consumption. These microorganisms appear in our pasteurized canned meat products very rarely, and practically they do not present any problems. However, certain difficulty in estimation may be caused by the disclosure of the microorganisms from the groups of Enterobacteriaceae, Pseudomonas, Achromobacter, Flavobacter. Their presence in the tightly closed canned pasteurized products is the proof of faulty pasteurization. With an insignificant quantity of the microorganisms the product can be admitted to the repeated pasteurization, and, after the repeated bacteriological examination, it can be, eventually, distributed on the home market. The similar problem is arising with the detection of small quantities of non-pathogenic anaerobic bacilli, the development of which during the storage period is difficult to be foreseen.

As it has been mentioned, in case of detection of any leaks the examined batch of canned products is made questionable for export purposes, and can be dispatched for instantaneous sale at home. The leaking tins of canned pasteurized meat were frequent during an examination at the Institute for Meat Research at Kulmbach, German Federal Republic /20/. With tins made in Poland this defect appears very rarely. Apart from that, the micro-leaks may cause a lot of difficulty with the judgment of a batch of commodity, e.g. it is difficult to find whether the leaks in one of the examined tins are incidental ones, or whether they come repeatedly in a series.

of time. The examinations of the whole batch in this respect is a very troublesome thing. Our observations made on the various canned products in our country, and on the imported products showing the ~~microbiological~~ ~~microbiological~~, in majority of cases, they do not affect the stability of the stored product, provided it is stored in proper conditions.

The stability test is carried out in an incubator at the temperature of 37° during three days of time. It is accepted that the product which does not show any changes after the thermostatic test is stable and can be stored for 6 months in cold storage room /1/. It is difficult to establish for canned pasteurized products any correlation criteria between the set of factors "time - temperature" acting during a short time in an incubator in comparison with the period of storage of several months in a refrigerator. For instance, it has been noticed that the canned pasteurized hams of the same animal /e.g. left buttocks/ have blown after three days of the thermostatic test, whilst the others /right buttocks/ did not show any changes after a prolonged storage in a refrigerator. Similarly, our own investigations made at the Institute for Veterinary Research and at the laboratory of the Quality Inspection Office of the Ministry of Foreign Trade /1/ have shown that the quantities of the faecal Streptococci and also quantities of the aerobic Bacilli in hams made of the same pigs /left, right/ differed considerably in the canned preserved products submitted to the three-days thermostatic test, in comparison with those stored in a refrigerator /temperature about 4°/ during six months of time. The quantity of faecal Streptococci was considerably larger in the canned products in a refrigerator than in those of the incubator.

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Aerobic bacilli behaved in an opposite manner.

A lot of research work has been attempted up to now with regard to the stability of canned preserved products. There have been many suggestions to lower the temperature of the thermostatic test up to about $30 - 32^{\circ}\text{C}$, together with the extension of the time for stability test /24, 31/. However, taking into consideration the fact that the cause of spoilage in canned pasteurized products are as a rule the mesophilic microorganisms /11, 14, 31/, the estimation of the stability of the product based upon the thermostatic test carried out at the temperature of 37°C seems to be justified. There is a right tendency in Poland towards the extension of the time needed for the thermostatic test with the semipreserves from three to five days.

Any deduction of correct conclusions with regard to the value of the product, made upon the quantity of microorganisms found in the bacterioscopic preparation, seems to be very difficult. For instance, it is not possible to make here evident gram-negative bacteria, even, if, before the pasteurization of the product they might have been in large quantities. At the examination of the separate stages of the production cycle of the semipreserves, not once large quantities of gram-negative bacteria have been found, whilst the bacterioscopic preparation made of the ready product did not show any gram-negative microorganisms. From the lots of gram-positive microorganisms the bacterioscopic preparations made of our canned products show usually the presence of cocci, and above all faecal Streptococci. The permissible in Poland quantity of 40 microorganisms in 20 fields of vision under microscope seems to be only an agreed hint towards the criteria of judgment. An acceptance of precise

quantitative limits, especially with regard to the cocci, is not justifiable for that reason, that during the bacteriological examinations the canned products are found which in the bacterioscopic preparations show large quantities of microorganisms and the inoculations on bacterial media give as a result small quantities of bacteria, and sometimes even do not contain any living microorganisms at all. At the same time the organoleptical examination does not show any changes which may prove the action of microorganisms. Sometimes it is even so, that the bacterioscopic preparations made of canned products contaminated with large quantities of living microorganisms do not show relatively large quantities of cells of bacteria. It seems that any attempt to fix precise quantitative limits for microorganisms that appear in the bacterioscopic preparations made of pasteurized canned products showing correct organoleptical properties, has not a full justification. The bacterioscopic preparation should be considered only as the assisting mean, without having any decisive influence on the estimation of the product, which otherwise does not show any objections.

It has been mentioned above, that in this country there are no, up to now, any bacteriological standards concerning the quantities of living microorganisms which may appear in the canned pasteurized meat products. In practice it is, however, adopted, that the canned pasteurized products for export, submitted for routine examinations, should not show more than two colonies of bacteria on 1 square cm. of the imprint inoculation on the solid media./Ministry of Agriculture Veterinary Department Instruction of 10th July, 1959/. The batches of product showing higher infection can be made

admissible for inland consumption.

An essential problem with the sterilization of canned pasteurized meat products is presented in our country by the faecal Streptococci. The production of canned products free of living faecal Streptococci is a difficult matter in so far, that the applied technological process offers relatively great chances for growth and survival of those microorganisms in comparison with the other bacteria. /21, 25, 27/. The pasteurization temperatures of canned products, as used in Poland, like in many other countries, are very frequently not high enough to destroy these microorganisms /3, 21/. On the contrary, the rise of pasteurization temperature results in the decrease of organoleptical value of the product. The presence of faecal Streptococci in semipreserved products is, from hygienic, nutritive and organoleptical points of view, still an open question. For instance, it is not yet known what pathogenic potential have these microorganisms for a man. In principle, up to now, no food-borne infections or intoxications have been noticed, which could be caused by the faecal Streptococci after the consumption of the canned meat infected by these microorganisms. Up to now, investigations and observations concerned the pathogenic possibilities of these bacteria were carried out with the use of the cultures grown in the other food articles like milk, ice-cream, cheese, meat /16, 26, 30/, and even if some of the types /Str. faecalis, Str. liquefaciens/ have caused certain pathogenic symptoms like light diarrhoea, then the conclusions deducted from these examinations do not yet say that the canned pasteurized meat products ~~carrying~~

indicator of either human or animal faecal contamination /9, 12, 13, 22/. However, numerous ~~investigations of this subject~~ have shown that these microorganisms are largely spread outside of the human and animal bodies /1, 8, 19/, and that, owing to their ubiquitous character, not always they can serve as an indicator of faecal contamination. The influence of the faecal Streptococci on the decrease of organoleptical properties of the canned pasteurized meat products /sour or cheesy odour, instability of colour/ was the subject of many investigations and observations /11, 12, 13, 29, 51/. It seems however, that the organoleptical changes of canned pasteurized products caused by the presence of large quantities of faecal Streptococci come to appearance only under certain definite conditions. So, the souring is very likely connected with a definite level of sugar in the canned products. It is, however, known that this level depends on both the initial quantity of sugar added to the pickling brines and on the other factors of the processing. In the semipreserved products made in our country, souring caused by the activity of microorganisms is not very rarely. Similarly rarely we meet also so called "centres of emolition" caused by the proteolytic faecal Streptococci. The appearance of cheesy odour caused by the large quantity of faecal Streptococci is met with in Poland similarly to some other countries. This odour is noticeable directly after the tin is opened and disappears relatively quickly. It is to be added that the similar odour was met with also in the canned products with very small quantities of living microorganisms. According to the observations made in the recent years on the pre-packaged semipreserved products it is to be assumed that the product contaminated with large quantities of faecal Streptococci shows after certain time its instability of colour. There are still

gaps in the literature on this subject, and therefore it seems that the question needs still further elaboration.

The estimation of semipreserved canned products, bearing in mind the established for this product eventual bacteriological standard, seems to be complicated. Similarly to Kelch and Coratti /20, 10/, we too, in our own investigations have met with the canned meat products showing very large quantities of living bacteria /mainly faecal Streptococci/, without any traces of organoleptical and gustatory changes. These products did not also show any changes after the thermostatic test and proved to be stable when stored in a refrigerator during the period of several months of time. The examined product was dispatched in those cases for sale inside the country. On the other side, there were canned products showing smaller quantities of microorganisms, but their organoleptical qualities caused serious objections. It is to be mentionned that during the bacteriological examination carried on the separate stages of the production cycles of the canned pasteurized meat products in our meat factories a satisfactory state of hygiene was not usually with, whilst the ready product collected from those days of production showed sometimes considerable infection.

Many attempts have been made in various countries up to now to establish quantitative bacteriological standards for semi-preserved canned meat products. Various limits have been designed for the quantities of living microorganisms in 1 gram of the product. For instance, Goldenberg, Shoppey and Robson /12/ have considered that the semipreserves, if they are to comply with the bacteriological standards, should contain less than 10 living microorganisms in 1 gram. According to Hobbs /13/ the pasteurized ham, if without objection, should contain less

than 1000 sporing bacilli in 1 gram, whilst not showing any vegetative microorganisms. Ingram /14/ stated that in England the limit accepted was 100 microorganisms in 1 gram of pasteurized ham. Buttiaux /6/, Ingram, Ghoftal, Claremburg, Lorch, Buttiaux and Mossel /15/ and Jepsen /17/ allowed for 10 000 living bacteria, and according to the opinion of Kelch and Corcetti /10, 20/, with the present state of knowledge, there are no reasons to disqualify the canned pasteurized meat products contaminated with living microorganisms but showing otherwise regular organoleptical properties after they have passed stability test and not containing pathogenic or toxigenic microorganisms. One of the most important factors which decide about the state of contamination of canned pasteurized meat products, apart from the other conditions of manufacture and quality of raw material, is the temperature of pasteurization. The production of canned pasteurized products showing high organoleptical standard calls for relatively low pasteurization temperatures, but in that case, it is difficult to establish precise bacteriological standards, which might determine permissible quantity of microorganisms in a product. So, for the estimation of canned pasteurized products it is important that they do not show any organoleptical changes after they have passed the stability test, that they do not contain pathogenic and toxigenic microorganisms and the microorganisms which belong to the groups like Enterobacteriaceae, Achromobacter, Flavobacter, Pseudomonas.

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