

## PREPARED MEAT FOODS IN RELATION TO DISEASE CAUSATION,

BY

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THE term preserved meat foods, while not very definite, is a convenient expression to denote foods, prepared from the meat of different animals, which are subjected to a certain amount of preservation or preparation before being put upon the market. The term is used to include such classes of foods as brawn, sausages, saveloys, polonies, meat pies, salted meats, and tinned meat foods.

I know of no statistics as to the extent to which these foods are consumed, but it is common knowledge that they are prepared and eaten very extensively and throughout the country.

Foods of this class may serve theoretically as a vehicle for the spread of disease in two ways. They may be prepared from diseased, or at least infected, animals, and so contain pathogenic bacteria derived from the animals furnishing the meat. They may become contaminated during or after preparation for sale by disease producing bacteria which have gained access to them from outside sources.

There is a considerable body of epidemiological evidence, some of which will be touched upon later, implicating this group of foods as being concerned in outbreaks of disease, but apart from this the problems raised involve a number of definite questions which are, or should be, capable of scientific answers, and with some of these I propose to deal.

The diseases affecting animals which can be conveyed by food are fairly numerous, and I do not propose to traverse them in detail, but wish to make the point that, apart from any question of subsequent bactericidal action by heat or chemicals, not only it is obvious that all such diseases can equally well be conveyed through made-up meat foods, but that the dangers of such conveyance are increased for certain of these groups of foods. Some of them, for example, sausages, are not invariably prepared from muscular tissue, but internal organs (liver in particular) and blood are used in their preparation. Kidney is a common constituent of pies. The use of such internal organs is particularly prevalent in Germany, and other parts of the Continent.

Numerous continental investigators (Conradi, Bicrotti, and Machida, Horn, Zwick, and Weichel, Messner, Junach, Grebert, and Mergell, etc.) have studied the bacterial content of the musculature and internal organs of healthy animals, and while bacteria have been found in the muscles in a small proportion of cases, they have always been found both more numerous and in a higher proportion of cases in the internal organs, particularly the liver, lungs, and kidneys. Again, in emergency slaughtered animals—that is, animals slaughtered because of definite signs of illness or disease, while the muscles are frequently sterile, bacteria are usually present in the internal organs. For example, Bugge only found bacteria in 22 (19 per cent.) out of 116 muscle samples from necessity slaughtered animals, and Junach in 9 (10 per cent.) out of 89 suspicious animals.

In definitely diseased animals which I have examined, the examination of the muscles has given variable results (usually negative), while the pathogenic organisms have been readily isolated from the internal organs.

The greater therefore the extent to which internal organs are used in the process of manufacture, the greater the likelihood of pathogenic bacteria being included in the food.

A further consideration of importance is the fact that from their very nature, sausages in particular, and some other foods to a lesser extent, invite the use of inferior meat, and even possibly diseased meat. This is not to suggest that such food is frequently used in preparing such foods, indeed I believe it to be a rare occurrence, but obviously foods which lend themselves to such practices require special supervision. Inferior meat is less readily detected in foods of this nature. Horse-flesh has been found from time to time in sausages, but I am not aware of any systematic investigations into this question in this country.

One of the most serious of the many unsatisfactory features of the existing conditions under which food is prepared for sale, is the inadequate arrangements made for the separation of the places of food preparation from those in which animals are slaughtered.

We are all aware that in very few indeed of the existing private slaughter houses is a separate cooling room provided in which the carcasses can be hung to set. Unsatisfactory as is this feature, even less satisfactory is the

fact that in a considerable proportion of these private slaughter houses food preparation processes are also carried out. For the past seven or eight years I have made special enquiry on this point in both urban and rural areas, and in numerous instances the slaughter-house has also been used for the preparation of sausages, while in many other instances it is also used as the place in which meat is salted. When spoken to in regard to these matters, the usual reply of the occupiers is that they have no other premises available, that this work is never carried out when slaughtering is in progress, and finally that it is not prohibited by the byelaws.

Also, in small urban or rural areas I have but rarely found that any attention has been paid to these matters, either by the medical officer of health or by the sanitary inspector.

When these processes are carried out in the same room, there is a strong probability that knives, vessels, etc., used in connection with slaughtering will also be used for food preparation work.

The pickling tubs are sometimes uncovered altogether, while others have loose, ill-fitting wood covers. They are liable to be splashed with blood or intestinal contents, and in this way to become contaminated.

Even when these food preparation places are distinct from the slaughter-house, they are frequently most unsatisfactory and unhygienic. Any little hole or room, if conveniently near the slaughter house, is considered good enough by the butcher who prepares small quantities of these foods, and I have noted a good many with very inadequate lighting and ventilation, and with floors of the most unsatisfactory description.

The larger businesses which make a feature of the preparation of such prepared meat foods, are often fairly satisfactory from a sanitary point of view, but even for these unhygienic arrangements are not uncommon.

Facilities to encourage the employees to scrupulous cleanliness are usually very meagre, while little or no attention is paid to the state of health of the workers, or the possibility of their being carriers of disease.

Equally unsatisfactory in many cases have been the places where the finished foods have been set to cool or to await sale. In connection with my investigations into food poisoning outbreaks, I have carefully studied the local conditions under which the implicated food was prepared for sale (as far as such information

was given in the reports) in over 130 outbreaks of food poisoning. In many little or no information was given, and only a proportion refer to outbreaks due to prepared meat foods, but the reports left on my mind a very strong impression as to the highly unsatisfactory conditions under which these food preparation processes are carried out, and the immense amount of contamination which must result.

In connection with these questions of contamination, certain bacteriological considerations deserve attention.

Most of these prepared foods form very suitable nutrient media for the multiplication of pathogenic or other bacteria. I have shown elsewhere that Gartner group bacilli (the organisms commonly responsible for food poisoning outbreaks) multiply with extreme rapidity in sausage meat, brawn, etc. I have also shown that when unsterilized meats are used these bacilli can survive for relatively long periods in spite of the competition of the numerous other bacilli present.

A further point of importance is the extent to which preparation for sale kills infecting bacteria. Most of these made meat foods are subject to heat, either during preparation, after preparation as a means of preservation, or before consumption, while others are subject to chemical treatment (salting, etc.) as part of the process of preparation.

Brawn is usually said to be well "boiled" by makers of this comestible. If by boiling is meant heating to 100°C., then it is clear that Gartner group bacilli would be killed, and my own examinations of *quite freshly* made brawn have usually shown freedom from *B. coli*, which favours this assumption. At the same time, a study of recorded outbreaks of food poisoning from brawn makes it evident that in several of the outbreaks meat infected with Gartner group bacilli made into brawn still contained these organisms, and we must conclude either that the so-called "boiling" was not actual boiling, or that re-infection took place during cooling from utensils, etc., used to handle the infected meat. In the Tollesbury case, infection was probably during cooling, but in the Murrow outbreak, which I personally investigated, it was evident that the cooking was insufficient to kill the Gartner bacilli present in the meat used to make the brawn. In this outbreak the method employed was one of slow heating with a so-called "boil" at the finish.

The available facts show clearly that while the method of preparation is usually sufficient

to kill pathogenic bacteria, it cannot be accepted as invariably sufficient for this purpose, while the highly nutrient slowly cooling brawn offers an extremely favourable medium for the rapid multiplication of pathogenic bacteria, should they gain access at this stage. I have found brawn samples containing as many as 30,000 *B. coli* per gramme. Sausages are not subjected to heating in preparation, while domestic cooking cannot be relied upon to kill pathogenic bacteria.

Meat pies are subjected to cooking, but the careful investigations of Delépine and Howarth in connection with the Derby outbreak have shown that the temperature reached might easily be insufficient to kill out pathogenic bacteria. These observations have been confirmed by other workers. Also for this group of foods the chief danger is undoubtedly from the gravy which is added *after* baking. This jelly or gravy is not subjected to efficient sterilization, for if thoroughly boiled is kept for some time until needed.

In the preparation of tinned meats, while no doubt the heating given as a necessary part of the preparation is a valuable means of eliminating any pathogenic bacteria, there is clear evidence that it is not always efficacious. The experiments of Beveridge and Fawcus are of interest in this connection, while in certain food-poisoning outbreaks it was evident that living Gærtner group bacilli had survived any cooking to which the food was subjected. For example, in two outbreaks from tinned salmon in 1907 (Tunstall and Longton) the facts showed that living bacilli were present in the fish before the tins were opened.

In particular for this group of foods, while the bacilli may be killed by the heating, in many cases their toxins have not been destroyed and there are a number of outbreaks recorded in which they have caused outbreaks of disease.

In the preparation of salted meat it can by no means be accepted that the chemicals added are sufficient to eliminate pathogenic bacteria. In a series of experiments with commercial brines and artificial salt solutions, I showed that a rapid elimination of both Gærtner and *Coli* bacilli took place, at all the temperatures tested, in solutions containing 15 per cent. or more of salt. In 10 per cent. salt solutions the death of the bacilli was also rapid, but less so than for more concentrated solutions, while in one experiment the bacilli persisted for as long as 28 and 38 days respectively.

It is important to remember that while the food-poisoning bacilli (Gærtner group) are fairly easily killed, their toxins are notoriously heat-resisting, and can withstand heating to 100° C. for at least 30 minutes.

From the available facts it may be deduced that while the processes of preparation may do a good deal to diminish the amount of bacterial infection pre-existing, they cannot be relied upon to remove it. They certainly cannot be accepted as any sufficient reason for the relaxation of ordinary cleanliness and hygienic precautions in preparation, on the supposition that everything is made right by the subsequent cooking.

A consideration which has already been touched upon incidentally, is the fact that for several of these foodstuffs, *i.e.*, brawn or meat-pies, the food is heated and allowed to cool slowly. If during the cooling process infective bacteria gain access, they will be provided with a highly nutrient material at a favourable temperature, thus furnishing ideal conditions for their rapid multiplication.

As regards the vehicle of infection by which infective bacteria gain access, very little information is available as to specific cases, but from our general knowledge it is possible to advance many likely methods. Infection from specifically contaminated dust and carriage by flies doubtless play a part in certain cases. Direct contamination by splashing of the intestinal contents of animals being slaughtered or from the cleaning of the intestines, is probably of great importance. In some of the slaughter-houses which I have inspected, contamination from this source of some of the brine tubs containing salted meat must have been of common occurrence. Where the food slaughtering and food preparation places are not kept quite distinct, the use of the same instruments and utensils as a vehicle of infection cannot be ignored.

In a paper published in 1908 I recorded instances in which I had found sausage meat put up in sausage-skins prepared by the makers themselves direct from the slaughtered animals, and used in a nearly fresh condition; while I have recently come across fresh instances of this practice. A more likely method of infecting the sausage meat can hardly be thought of, while bacteriological examination of such freshly-prepared casings showed abundance of *B. coli*.

Considerations of time prevent me from dealing with the important question of the addition of chemical preservatives to these meat-foods, but the available evidence shows that although considerable quantities may inhibit the growth of these pathogenic bacteria, they cannot be relied upon to kill them, while in small doses they may be especially dangerous by inhibiting objective decomposition, yet allowing the more important Gærtner group of bacilli to develop unhindered by numerous saprophytic organisms.

The outbreak of illness in which these made foods have been shown to be the vehicle of infection are chiefly cases of food poisoning. Details of a large number of such outbreaks are given in my Report to the Local Government Board upon Bacterial Food Poisoning and Food Infections (1913), so it will be unnecessary to refer to them in detail, and it will be sufficient to give the following summary of the vehicle in 66 outbreaks in Great Britain due to meat-poisoning for which particulars are available :—

Brawn (in one case with roast pork)	10
Meat pies (in several cases with other meat) .. .. .	14
Brawn and meat pies .. .. .	1
Flesh (different forms but not tinned)	17
Tinned meat .. .. .	9
Tinned fish .. .. .	4
Sausages .. .. .	1
Potted meat (apart from brawn) ..	4
Other forms .. .. .	6
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	66
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It will be seen that in the great majority the vehicle of infection was some form of prepared meat, either simply tinned (20 per cent.) or usually specially prepared (about 45 per cent.). In no less than 38 per cent. of the cases brawn or meat pies was the vehicle of infection.

In the nature of things, and with our imperfect information as to the distribution of non-notifiable illness, it is impossible to say how much illness is due to the consumption of these foods, but one cannot but believe that the total must be very considerable.

From the above considerations it is evident that these groups of food offer special facilities for contamination, and in the interests of public health we would naturally expect that special powers of legal supervision and control would be in force. The exact opposite is the case.

There are apparently no powers dealing specially and directly with these classes of food, but certain of the legal enactments dealing with meat and other foods are applicable to them. Section 116 of the Public Health Act 1875 gives powers to inspect such foods. The second part of this section provides for the seizure of such foods if diseased, unwholesome, or unfit for the food of man.

Section 28 of the 1890 Amendment Act extends this section to "all articles intended for the food of man."

Section 169 of the Public Health Act 1875 gives powers to make byelaws for slaughter-houses. As regards such byelaws, the Local Government Board consider that the statutory terms of the section do not warrant the extension of the scope of the byelaws to regulations directly affecting the structure of the premises.

A study of the model byelaws issued by the Board shows that they do not in any way deal with the question of made foods. The preparation of sausages and other foods in slaughter houses is not prohibited by them, nor is it forbidden to keep salted meat or other varieties of made foods in such places.

As far as I am aware, there are no legal enactments which require these foods to be either prepared under sanitary conditions or stored in situations where contamination is reduced to a minimum. They can be inspected when made, or in course of manufacture, and if found unfit, seized, but there is no legal weapon to prevent their preparation under manifestly unsatisfactory conditions.

In consequence, a direct consequence, as far as I am in a position to judge, comparatively little attention is paid by local authorities and their officers to these classes of food.

In several districts I have had difficulty on various occasions in inducing local authorities to refrain from granting licenses in respect of slaughter houses in which meat was prepared for both animals and man. The following glaring instance in my own experience shows the existing inadequate legal powers and the absence of enforcement of those we do possess. In a rural district in Somerset a quite large slaughter-house, with extensive accessory premises, was erected and licensed. The structural condition of the premises was satisfactory, and I have no complaint on this score. They were allowed to be used for the slaughter and preparation of meat for *both* man and animals, and were so used. In the centre of

the group of buildings was a room used for the preparation of sausages, and provided with a large sausage-making plant. There was only one sanitary inspector who was also surveyor for the rural area, which was a large one. He held no meat-inspector's certificate, and was not well versed in this branch of work, while he lived about five miles away, and had no time to visit frequently. The premises were separated from the main road by two fields belonging to the slaughter-house people, and through which the inspector had to pass to gain access to the slaughtering and food preparation places, so that anything in the nature of a surprise visit was impossible, more particularly since the area was fenced round closely and kept locked. Access from the other side was cut off by the railway, and a special siding to the slaughter house. Conditions to make food inspection a farce could not be better devised. When the inspector came (or when I have myself visited), his visit was known an appreciable time before he could be on the spot, and even if he did detect a diseased animal, there was nothing to prevent a declaration (rightly or wrongly) that it was for animal food. The convenience of the sausage manufactory speaks for itself. Added to that the licensee had been convicted of dealing with diseased meat before he came to Somerset. He was granted an annual licence.

To complete the story, diseased meat consigned from this slaughter house was seized in London, and traced to this place, and to escape conviction the lessee fled the country. I know nothing about the destination of the sausages. They were made by a German, and he disappeared at or just before the outbreak of the war.

A further interesting point was the fact that the clerk to the rural authority took the line that the premises were structurally sound, and it was not within the powers of the rural sanitary authority to make it a condition of granting a licence that the premises should not be used for the slaughter of food for both man and animals.

#### MEASURES REQUIRED TO CONTROL THE PREPARATION OF MADE FOODS.

If it is right that bakehouses should be registered, bread being a food far less liable to bacterial contamination than made foods, it is certainly not less important that premises for the preparation of the latter class of foods should be subject to equal restrictions. I am of opinion that these foods should only be

allowed to be prepared upon premises approved by the local sanitary authority, and which can be kept satisfactory by being subjected to an annual licence. Conditions governing the granting of such licences should be laid down by the Local Government Board in the same way as they have done for slaughter-houses. Local authorities should also be required to frame byelaws, and to enforce them in regard to the usage of such premises. Such byelaws amongst other matters should deal with the separation of made-food preparation processes from food killing and dressing, including precautions in regard to utensils and cleanliness of the persons employed. Added powers of inspection and of sampling may be required.

Licensing and adequate byelaws will go far to ensure the provision of satisfactory premises, and the application of ordinary rules of cleanliness and avoidance of contamination during and after preparation for sale.

There are a few special points, some of which have been already mentioned, which should be included in the byelaws. For example, gut-scraping should be forbidden in any slaughter-house or on premises where made foods are prepared. The use of sausage casings in a comparatively fresh condition should be forbidden. Illness amongst the staff should be required to be reported to the local sanitary authority. The vexed question of the addition of chemical preservatives is too large to be adequately dealt with here, but we are all likely to agree that if any are added, that fact and the amount should be required to be stated prominently on the package.

Bacteriological standards for these foods have been suggested, but while bacteriological examinations are very valuable as an aid to administrative action, and as a measure of the degree of cleanliness adopted, our existing knowledge does not warrant us in setting up definite standards with a penalty for their infringement.

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#### CORRESPONDENCE.

*The Editor does not accept responsibility for the opinions of correspondents.*

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#### THE WAR AND AFTER.

*To the Editor of PUBLIC HEALTH.*

SHEFFIELD.

DEAR SIR, 18th March, 1918.

Mr. Bonar Law, speaking in the House of Commons on 7th March, said he did not believe the spirit of this country was weakening in the war, and that if the question could be put, "Are you