

Residual Viruses in Processed Meat Products: A Review

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Introduction: There are a variety of meat products and by-products in the international trade originating in countries having animal diseases that do not exist in the importing countries. Some of these products could serve as a means of introducing disease.

The virus diseases discussed in this review will be (1) foot-and-mouth disease (FMD), (2) swine vesicular disease (SVD), (3) hog cholera (HC) and (4) African swine fever (ASF).

Objective: Examine the affect of commercial processing on FMDV, SVDV, HCV and ASFV. The commercial processing methods include thermal, drying, salting and aging.

Methods: The products treated by the following processes were all made from the carcasses of animals infected with the specific disease and sacrificed at the peak viremic phase. (1) Heat processing - heat processing times and temperatures were determined by heat penetration studies performed with thermocouple probes inserted into the center ("cold spot") of the test product or temperature indicator discs (Figs 1 & 2). (2) Drying and curing - salami and pepperoni sausage meat, respectively, were thoroughly mixed with the recommended amount of additives including sodium nitrite and sodium nitrate, starter culture was added, and product was processed and smoked as per commercial procedures and dried for the minimal period of 25 days. (3) Salting and aging - procedures vary somewhat but, in general, the product is packed for 15 days in common granular salt at a temperature of 4-10°C and then air dried for various periods of time. In some cases, the temperature and humidity was controlled throughout the curing period. (4) Virus isolation - virus isolations and assays were made in tissue cultures or by animal inoculation or both (McKercher et al., 1978; McKercher et al., 1980).

Results: Thermal Processing - the viruses of FMD, SVD, HC and ASF were not recovered from partially cooked hams heated to 69°C. Similarly, none of these viruses were recovered from ground lymph nodes from infected swine when the ground material was heated to 69°C (Table 1).

In studies by Heidelbaugh and Graves, 1968, the virus in lymph nodes from infected cattle was inactivated by heating to 69°C. In contrast, Blackwell et al. (1982) found the virus present in lymph nodes from infected cattle after heating for two hours at 69°C, one hour at 87°C and 0.25 hours at 90°C.

Drying and Curing - FMDV was not recovered from the dry salami and pepperoni sausages (McKercher et al., 1975). However, Dhennin et al. (1980) recovered FMDV of low virulence in sausages up to 56 days as detected by inoculation of suckling mice.

McKercher et al. (1978) recovered ASFV and HCV from dried pepperoni and salami sausages up to 15 and 30 days of curing, respectively.

Salting and Aging - FMDV survived for 190 days in salted bacon and up to 183 days in ham fat, Dhennin et al. (1980).

ASFV was recovered in the muscle of salt cured hams up to five months and in the bone marrow of these hams up to six months, Botija (1962).

In current studies with SVDV, the authors have recovered the virus in ham muscle, bone marrow and fat up to 90 days.

Discussion: It would appear that 69°C is a critical temperature in the thermal processing of animal products. All four viruses discussed were relatively sensitive to this temperature (McKercher et al., 1980).

In all instances where FMD virus infected products were heated by retort cooking to internal temperatures of 69°C, the virus was inactivated. However, the survival of the virus in infected lymph node suspensions after heating at 69°C for 2 h (Blackwell et al., 1982) points out the importance of experimental logistics in determining inactivation data.

In the above study, "come-up" times of 1 to 1.5 min were experienced in the heating of 1g samples to 69°C, whereas the virus was inactivated in lymph node tissue and in partially cooked hams from infected pigs after retort cooking to internal temperature of 69°C over 25. to 5 h, respectively.

In addition, contrasting results reported from similar experimental approaches (Blackwell, 1981; McKercher, 1980) suggests that species of infected animals is also a factor in virus survival.

Chemical changes, especially the increase in hydrogen ion concentration (formation of sarcolactic acid) that occurs as part of the aging process of meat, enhanced the gradual inactivation of foot-and-mouth disease (FMD) virus present in muscle tissue (Blackwell et al., 1982).

In our studies, the host animal proved more sensitive than tissue culture for detecting viable viruses. Most of these studies have involved a limited number of products and these products have been processed from animals at the peak of infection.

The amount of virus in the products, prepared from selected carcasses, in general, would be greater than would occur under more natural conditions. The cumulative effect of the interactions of food components, temperature, time of exposure and type may or may not aid in virus survival. No attempt has been made at this time to study anything but primary contamination, but such contamination is in itself a serious threat to the livestock industry.

The work of Dhennin et al. (1980) and Botija (1962) indicates that the recognized procedure for salt cured hams might not eliminate the risk of spreading viruses such as FMDV and ASFV.

The use of temperature indicator discs as described by Blackwell et al. (1982) demonstrate that quantifiable temperature measurements can be achieved in product processing.

Although the risk of infecting livestock from human food products that could contain residual viruses is small, nevertheless, one must be aware that there is a risk, however slight.

References:

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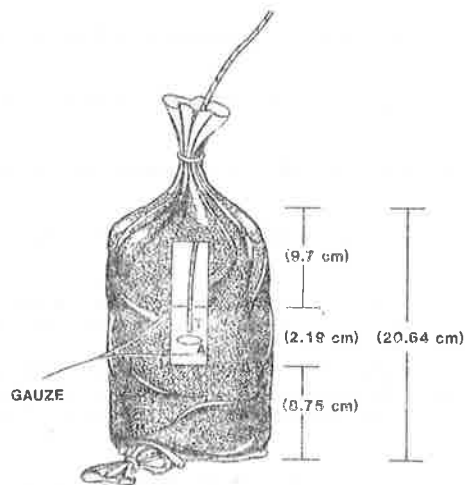


Fig. 1---Schematic of nylon cooking tube containing FMD virus-contaminated ground beef showing placement of temperature indicator disc (A) and thermocouples (T).

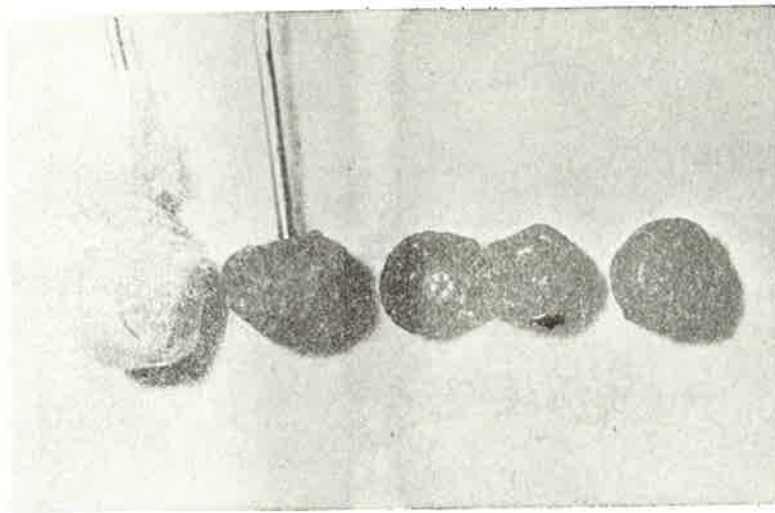


Fig. 2--Preparation of temperature monitor meatball showing right to left, intact meatball, placement of temperature indicator disc in sliced meatball, positioning of thermocouple perpendicular to disc and securing meatball and thermocouple with gauze.

TABLE 1.

DAYS RECOVERY OF RESIDUAL VIRUSES

<u>PRODUCTS</u>	<u>SVDV</u>	<u>FMDV</u>	<u>ASFV</u>	<u>HCV</u>
PARTLY COOKED CANNED HAMS	0	0	0	0
DRIED SALAMI SAUSAGE	401	0	30	15
DRIED PEPPERONI SAUSAGE	377	0	30	15
INTESTINAL CASINGS	780	250	97	147