Survival of Selected Viruses on Processed Pork Products

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Summary and Implications

Contamination of food with viruses of human health significance is primarily due to human carriers. While cooking or fermenting and drying will inactivate viruses, products can be contaminated post-processing. The data show that the changes produced in pork products by processing will have little effect in decreasing viral numbers if post-processing contamination occurs.

Introduction

Viruses can contaminate meats through fomites, through a carrier handler, and through a carrier animal which contaminates its meat during processing. For those viruses that are of concern to human health, the human carriers are considered to be of primary importance.

Studies done with the meat-borne viruses of importance to livestock (swine vesicular disease, African swine fever, hog cholera, and foot-and-mouth disease) have shown that cooking or fermenting and drying will inactivate these viruses. Human food-borne viruses are not known to be any more durable, so these processing methods will produce a safe product. Fermenting and drying also result in product changes, which increase resistance to spoilage organisms.

This experiment modeled survival of viruses that were inoculated onto various post-processed products.

Materials and Methods

Pseudorabies virus (PRV) was used as a model for the enveloped viruses. Echovirus 7 was used as the representative of the large and diverse enterovirus genus, which also includes hepatitis A and the polioviruses. Reovirus type 1 was a model for the intermediate-sized, non-enveloped viruses.

Viral inocula were used that might approximate that found in a naturally occurring contamination of a food product. Inocula were mixed with the food product, the mixture was refrigerated for 24 hours to allow any virus-meat interaction to occur, and viruses were recovered. Viral titers were quantitated in cell culture and expressed as the log of the titer. Survival in fresh pork sausage, frankfurters, and summer sausage was compared to that in fresh ground pork. Previous work has shown that viral contaminants in ground pork will survive at refrigerator temperatures longer than the product remains useable, making this a good product for comparison of survival characteristics.

Results and Discussion

There was a drop in the average titers for all viruses that were inoculated into the sausage when compared to the ground pork (Table 1). This decrease was significant for the PRV and Echovirus but not for the Reovirus. However, this decrease is not in itself enough to markedly increase consumer safety, since the infectious dose for human enteric viruses is generally quite low. However, since this product is cooked before consumption, it will be safe unless there is further contamination post-cooking.

Average titers for all three viruses were significantly higher from the frank than from the ground pork (Table 2). The Echovirus had a significantly higher titer from the summer sausage than from the ground pork, while there was no difference with the other viruses (Table 3). While processing can be relied upon to inactivate viruses in the original meat products, the changes in these products due to processing do not appear to be of any help in reducing numbers of post-processing viral contaminants. Attention to handling and packaging will be critical to prevent contamination at this point.

Franks are generally warmed prior to eating. This may help to inactivate some virus particles, but thorough cooking would be needed to produce a totally safe product. Summer sausage is eaten with no further processing, so proper handling is especially important.

Table 1. Average viral titers from sausage vs. pork.

Virus	Sausage	Pork	Prob.
PRV	3.87	4.12	0.007
Echo	4.76	5.33	0.01
Reo	4.05	4.26	NS

Table 2. Average viral titers from frank vs. pork.

Virus	Frank	Pork	Prob.
PRV	5.49	5.24	0.0004
Echo	5.32	4.89	0.016
Reo	6.01	5.14	0.0002

Table 3. Average viral titer from summer sausage vs. pork.

Virus	Sum. sausage	Pork	Prob.
PRV	5.20	5.24	NS
Echo	5.47	4.89	0.005
Reo	5.32	5.14	NS