PROCESSING OF DRY AND SEMIDRY SAUSAGES

WILLIAM J. SHANNON

MEAT INDUSTRY CONSULTANT
OMAHA, NEBRASKA

When we consider the total subject of sausage or dry sausage and semidry sausage we have, of course, to go back to Europe where sausages of this type primarily developed. And as you know, when you go into Italy you have a hot climate and there we have sausages which were primarily of the dry category. They were made in order to preserve the food and of course the basis of these was rather elementary-low moisture, high salt and in many cases a reduction in pH to the point where product would keep without any refrigeration. As you move north through Europe you go into Switzerland and you find different types of sausages being made. Here again it's interesting that we do have a typical dry sausage and in some cases this sausage is made by drying it high in the Alps which is quite interesting and was the method of preserving food in that particular strip of country. As we go into Germany we find the summer sausages and as you know, they were made in the winter with the thought in mind that they would keep fairly well and would be consumed during the summer period. We call these summer sausages, thuringer, etc. These sausages keep primarily because of the reduction in pH of the meat mass, and a fairly high salt content. When we consider the raw materials that are available to us in sausage making we can go to practically any source of lean meat and the fat is usually that of pork. As you know, in the New York City area we had a little trouble with people bringing horse meat in and labeling it as bull meat. We had people in New York making sausage out of this meat so the limits as far as red meat or lean meats are concerned are quite wide. You can make it out of horse meat, donkey meat if you wish to and almost anything else I suppose if it is available. Our government, of course, helps us stay in line and we have a good supply of beef and a good supply of pork. We don't have the problems that some of the other people have.

I thought it might be interesting to tell you how we make dry sausage. I think by talking to you in this way I can give you some of the problems that will help you understand where we are. In the first place, there is very little technical information available to us. In the semidry sausage, where our products keep because of pH we have had some good work performed by the American Meat Institute Foundation in the development of a starter culture which we mix in with the trimmings to give us an early beginning of the correct type of bacteria, and the correct drop in pH. Not everyone uses the starter culture in their sausage making. Many of our plants still rely on the normal presence of the desirable bacteria in meat. One point that I stress with sausage makers around the world is real simple and that is that you cannot make good sausage out of meat that is either old or has a high bacterial load or has a definite chemical age after slaughtering. In talking in Europe, and this is an interesting little sideline that shows you how things happen, I am working in Germany, Switzerland and Italy. I am Irish and here I am in the United States talking sausage

making to the people that started it all. That is because we are a little further ahead in technical problems. In talking in Germany, for example, with the sausage makers there, they tell us that if you are going to make good dry sausage the meat should be that of a sow that has had at least seven litters of pigs. In other words, they want the older meat, the more mature meat for the manufacture of sausage. So we have to keep in mind that the bacterial load must be very low in the beginning raw material, the chemical age from the standpoint of possible rancidity must also be controlled.

In the making of sausage we prefer to use the cutter method. The cutter is a piece of equipment of varying capacity. The bowl rotates and at the same time the bowl rotates we have very sharp knives that rotate which are fitted very tightly to the bowl to give us a very sharp cutting of the meat. Now the important thing in drying sausage is that the pieces of meat be reduced to discrete particle size without the smearing of the fat across the lean. So in our cutting operations we control the temperature so that our meat mass is about 26 to 28 degrees. We are using German cutters and of course cutters that are made in this country. The German cutters do a very excellent job. We run them usually with three knives instead of the large number that we use in the emulsion type product and our chopping cycle is controlled rigidly by either a revolution counting or by time. And again the important thing is the reduction of the meat to the desired size without the smearing of fat. And the seasoning, by the way, is normally put in at the very last part of the chopping cycle. This is in direct opposition to the manner in which we make emulsion type sausage. We do not want to have any extraction of the actomyosin from the lean meat in the manufacture of the dry sausage. We want to minimize what we would call the characteristic bind of an emulsion type sausage. After the meat has been removed from the cutter we prefer today, and this is in contrast with the way many people are doing it, we prefer now to stuff the meat directly into the suitable natural or animal casing or in the new synthetic casings that are being used. We are using a casing in Germany, for example, which has a high amount of silk fiber in it which seems to give us better drying. The type of stuffer used should be one that tends to minimize the smearing of the fat over the lean. We are using the V made stuffer which is a stuffer which employs a semi-vacuum type principle that works quite well. The piston type stuffers that we have in the plants are also very good. The important thing again is the temperature of the meat which has to be quite cold, down to 26 to 28 degrees. You can still find sausage makers today, who will take this mass of meat and spread it into pans to a depth of about 4 inches and they age the meat in aging pans.

Now we are going away from this because we are finding too much of a bacteriological contamination when we go through this procedure. We prefer, therefore, to stuff into suitable casings. This depends on diameter, market and all the rest of it. Then the product is moved into the first stage of fermentation. We have a very excellent sausage smokehouse which comes from John Kraus. One of the clients in New York has a smokehouse and he is selling them in this country. It is a very excellent piece of equipment. They have excellent refrigeration; the relative humidity can be controlled very, very accurately as can the temperature.

In making sausage on this particular type of equipment, we set the temperature at 68 degrees F. with a relative humidity of 95 percent.

We hold the sausage with about five air changes per minute and we hold the sausage at this very high humidity and the temperature is 68° for a period of 24 hours. At the end of 24 hours we begin a light cold smoke and we continue to hold the sausage at 68 relative humidity, quite high, for a period of approximately 6 days. This is a procedure when not using the starter culture. After the sausage has been in the aging room or green room a color will develop. We usually cut the sausage and see how the color has held up. If the color is good, looks bright, etc., our chemical reactions are going along; the pH is dropping and the color development due to the reaction of the nitrite with the opy-hemoglobin is progressing quite satisfactorily. The sausage is then moved to the drying room or the drying area and we hold the drying room very closely to 53 to 55° F. with a relative humidity of 80 to 82 percent. The sausage is left in this drying chamber for a period of three days to several weeks if necessary, depending upon the type of sausage that we are making. This will give us a characteristic dry type sausage. If we take it out in three days we can have the semidry, like thuringer and summer sausage.

One of the critical points that we have in the United States which is different from in Europe is the problem with trichina. Our pork is not free from the trichina parasite and therefore, our processors have to take this into consideration. We recommend in the smaller operations that we use certified pork which has been held under refrigeration for a prescribed number of days at a prescribed temperature to kill the parasites. We prefer this method to following the longer drying cycle or to use the heating up to over 137°. In the case of thuringer in summer sausage, which are semidry sausages, we have many places where we do not use certified pork and we do bring the temperature up to 142° F. in the finished product.

Just a quick discussion of how we make some of these products. When we go into Europe and look for quality sausage we find that the No. 1 product, the best product manufactured in Europe, is primarily pure pork. The No. 2 dry sausages are pork and beef. When we come to the United States, we have a variety of sausages depending upon where you are. In Pennsylvania you are dealing with the characteristic pure beef type sausage that is handled in a similar manner. You get out in the Northwest and you find someone who wants to hunt deer and the next thing you know he is making some dry sausage by mixing in some pork butts and things like this and cold smoking it, allowing it to stand for a number of days with high salt concentration. We have had some trouble with the home sausage makers where they have decided to make their own sausages because they apparently are not aware of the need for killing the trichina parasite. We have had some trouble in Wisconsin as well as other parts of the United States with home made sausage. Now I could stand here and talk to you for quite some time about the variety of sausages we are making. But I would prefer not to do that and would like to leave it more or less this way - that the field of dry sausage is an interesting one; it's one in which there is little information available. You can read the technical journals and you will find very little information. The people here in the United States, and we have people here in the audience whose companies do make good dry sausage, usually feel that their methods and procedures are highly secret and they are not made available. I get accused of simplifying sausage making because I tell you the manufacture of dry sausage is a simple procedure, and it is. All you have to do is control your bacteriologic picture, control the air

movement, the relative humidity, the temperature in the product and you have no trouble. And, of course, I wish it were that simple.

We go to the west coast and into San Francisco, the one city in the United States where the consumption of dry sausage is very high. We find another peculiar thing out there is that you must have a mold growth on the outside of the dry sausage or you can't sell it. This mold that develops is a peculiar mold; it's very white and gives the sausage a peculiar appearance; but this is necessary on the west coast. If you move to Europe, for example, you will find a variety of sausages depending upon the area you are in. Seasoning is very bland; in most cases much blander actually than we have in the United States.

Dry sausage is coming back in this country; we are making more of it every year. It was replaced here for a while with the emphasis on rapid turnover and automation. People are going back once more finding out that dry sausage is a wonderful thing to eat. So you can go to New York and Chicago and many of our cities; you will find the delicatessens are starting up again and we are handling real good dry sausage and real good semidry sausage. It is quite a treat to have these products when you have been consuming weiners and bologna that we over-emulsified and over-simplified and over-automated to the point where it is hardly possible to recognize them from the original meat with which we started. I heard it might be alright to have discussions and questions at this time.

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NEIL WEBB: I would like to open this very interesting discussion for questions at this time. I have one or two, but I would like to open it for you first. Anyone have any questions?

G. H. WELLINGTON, Cornell: Dr. Shannon, just thinking very generally now, we often say that there is little scientific information available on these processes in sausage making and particularly in dry sausages, I am wondering, still in general terms, if you would want to express your opinion as to which direction we would be most productive in directing our research on dry sausages.

WILLIAM SHANNON: I would say that one place where we in this country are deficient is the understanding of the chemistry that is going on; the changes in pH that we are running into, and the influence of the pH in the animal that is being used to manufacture sausage. In the company I am working with in Germany, for example, we measure the pH of every hog. Every single hog comes by and they check the pH of the ham and separate out the animals with the lower pH as being the most ideal for the manufacture of dry sausage or the manufacture of Westphalian ham. Now the important thing in good drying, as you people know, is basically this, that as the pH drops in the drying cycle, you are beginning to approach the iso-electric point of protein which is down around 5.4 or 5.5. At that point the sausage meat

gives up its moisture most readily and in a good drying operation you have to dry from the inside outward. It's in this area of the chemistry of drying that there is little information available to us. We have some people doing work studying the pH of meat. I was fascinated in Germany to realize the emphasis which they are placing on pH of the various meats used in sausage making and we set up a research project on just this last January, which we are going to run for a period of one year and the influence of breed of hog and pH of meat on the finished Westphalian ham as well as the quality of the dry sausage we are getting. So this is an area which I think could be very productive. The other one would be from the mechanical engineering standpoint and that is a better understanding of the air movement, relative humidity and temperature control in our smokehouse. The greatest development we have had in our total meat processing industry in the last five years has been improved smokehouses that have been brought out, where we have air changes now as high as 15 times a minute with tremendous air velocity and very, very high heat capacities. This area, of course, is quite interesting to us.

NEIL WEBB: Are there any other questions?

DR. BRATZLER, Michigan State: Do the Germans object to the pork with the low pH and soft watery pork?

WILLIAM SHANNON: The hogs that we are using in Germany are not the characteristic watery soft pork that we find in certain areas of Denmark. The low pH seems to give us the best product. Where we have, take ham for example, that fail to dry properly for some reason, the pH has stayed high. In other words, the pH is around 6, for example, in the original meat. We have a cut off point of 6. In other words, anything over 6 we will not put into Westphalian hams or dry sausage and this apparently is in line with some work being done in Germany. But of the watery pork, I can say I have not run into very much in Germany or in Switzerland.

NEIL WEBB: Any other questions? Yes Fred.

UNIDENTIFIED SPEAKER: Dry sausage, in my opinion, is the most difficult thing to make and that is why it is so secret. After 16 months of work I don't think we would tell anybody how we make it because there was a lot of money involved and I think Bill knows you can't do it overnight. It is easy to say air change and humidity but there seems to be a lot of things and nobody knows why they work. Finally you just hit it like that but it might take you years to hit it that way.

WILLIAM SHANNON: I could add to that, because I remember starting out about 20 years ago and decided to make thuringer. Now thuringer is really easy to make. There's nothing to it, believe me; but the only trouble was that we couldn't do it. So we finally ended up buying an old plant in Chicago that was in the Union Stock Yard area known as the Double O Sausage

Plant. We went down there to find out how to make thuringer. I don't know whether it was imagination or whether we cross seeded and got the right culture going by accident. But there is a lot, too, to the dry sausage operation and the people who are making it a success wouldn't believe me. Now I will tell you what they are doing. The reason for that is frequently that they are not quite sure themselves.

NEIL WEBB: Anyone else have a question? I think in the interest of time I would like to turn this over to Bob at this point.

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ROBERT SAFFLE: Thank you, Dr. Shannon for this very fine session. (Applause) Thank you Neil and Bill. Our fourth area is entitled Adjustments, Weights, and Ratios in Data Analyses. This certainly has some bearing on the committee on processing, it perhaps has more bearing on carcass evaluation, however. As we worked out the time schedule we felt that this was the best slot to put this particular subject in. So without additional information we will ask Charles Henderson, Professor of Animal Science with a specialization in animal breeding and population genetics, to present this information. We have Ralph Boulware from Louisiana State University to lead the discussion.

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