the manufacturer's directions, as both underfeeding or overfeeding can be equally harmful.

In conclusion, what is the future of the milk replacer industry? It is very obvious that our future is very closely allied to the future of the dairy industry. We feel that we have a very viable future because the milk replacer industry will continue to free whole milk for human consumption. At the same time, we can provide a successful product for less cost than whole milk. In the future, the milk replacer industry will continue to investigate for use, and use ingredients that cannot be used for human consumption. The milk replacer industry will be in existence as long as there is a dairy industry.

Panel Discussion

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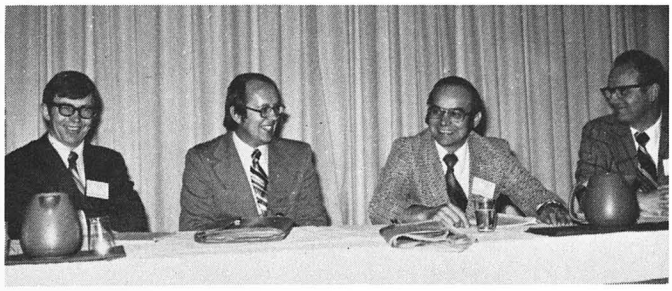

Moderator: This particular subject, as many of you know, interests me. I've been a disciple of Dr. Huber's for a long time. I have been quoting his work for some time now since he did some very fundamental work in digestive enzymes in calves. Perhaps I could start the discussion off by asking Dr. Schugel, how does the veterinarian in the field assess the quality of the milk replacer that is being fed to calves that may be suffering a variety of diseases? Let's say persistent intractable diarrhea in a veal calf operation or in a large dairy herd where the man is using milk replacers? How does the veterinarian say yes, this is a high quality milk replacer; I'm confident that it is. Therefore, I can tentatively remove it as a factor in making my diagnosis or investigating why these calves have diarrhea. This has been one of my chief problems in trying to investigate why these calves are scouring. Is it salmonella? Is it BVD? Is it reovirus? Is it a wet barn? What is it?

He took some aim at the Canadian government for government intervention on milk replacers. I don't want to get into politics. I just wish, personally, that we had a Ralph Nader in our country, and I hope he doesn't choke on a seat belt! I happen to be a consumer and I'm interested in the quality of my cars, my drugs and the foods I eat. I don't want to say anymore about that. As far as we're concerned, our veterinarians, our producers, and particularly our veterinary students in veterinary cults are saying, "Why isn't someone doing something about quality control in milk replacers?" If I look at a label on a milk replacer bag and it says protein, fiber, fat and then it lists all the ingredients, that does not help me assess its quality one bit. Now I'd like to open some discussion on how the veterinarian decides on quality? Does he take blind faith in the company?

Answer: That's an excellent question; a very valid question, and I wish I could give you a blanket answer. There is no secret way of looking at a tag because you can do a lot of things with tags and come up with many, many different results. There are large variations in quality. It is phenomenal! You just wouldn't believe it. I guess without regulations your next best bet is probably the integrity of the people you are working with. I don't know what better method you could have. Sure, there are some broad outlines you could make, such as the fat level being high. As far as the protein quality, there is no way you can put that on the tag. I do not have a good answer for it really.

Question: What is the significance in knowing the protein–energy ratio in a milk replacer or in any feed? How do we use that information in the field?

Answer: An overage of protein is not going to hurt; it is just going to cost more! Here, I think this 30:40 protein ratio - what we're trying to achieve - will give you a milk replacer which will do you the best job for the amount of money you put into it. You go higher in protein and it is the protein ingredients that are the more expensive ones. You're just throwing your money away. I guess that would be my primary response.

Question: What is the importance, based on today's information, of the milk clot in the abomasum of calves fed either whole milk or more particularly milk replacers? There was some work done some time ago which suggests that maybe the milk clot was not that important in the abomasum. What is the current state of information?

Answer: I don't know. You're quoting Foster Allen who completely eliminated the milk clot. He had very high quality ration though. In that case you didn't need the clot to slow down the passage of that milk. Now, I presume over a heated milk replacer you probably benefit from a milk clot. Over a milk solid you'd benefit from a milk clot. You'd benefit with less digestible protein, too, because you would slow down the passage and increase the digestibility of that particular material. High quality products, and these are the ones where we can be assured of the clot. I'm not sure we really need it that much if we believe the work done at Iowa years ago.

Question: How does pre-milking affect the com-

position of colostrum?

Answer: It essentially eliminates the amino-globulin. I guess that first milk that you get will be similar to colostrum, but after that when the cow calves you've got to find material other than from the mother to give it. You won't find the very high solid content and the high amino-globulin level.

Question: If glucose is not digested by the calf, why is sugar included in oral fluids for calves with scours?

Answer: Glucose is digested. Dextrose, the same as glucose, is one of the two carbohydrates which the calf can use–the other being lactose.

Moderator: I think you're using the term sugar, here, very broadly to mean sucrose, and we say that they can't utilize that. I hope you're not putting sucrose in your oral fluids.

Question: Can a calf three-six weeks of age, weaned, do well on starter without milk added to it?

Answer: The study in Nebraska had no milk. You lose a little efficiency of that high quality material when you put it through the rumen.

Question: How do you handle frozen colostrum? What size container? Any effort to feed same calf from same cow at every feeding?

Answer: In answer to the second part of that - no. We do not always try to feed a calf its mother's milk. In fact, I really don't see a lot of reason for that. The first part - if the dairyman is buying milk for his family in these large plastic gallon containers, they are the right size. He can take his "pool" colostrum and what I would do is pool colostrum from several cows, freeze it, and then thaw it out. This would be about the right size for one calf or a couple of calves for a feeding. Be sure you dilute the colostrum by two to one. In South Dakota they did it one to one, and they had poor results.

Question: What is the percentage of different grades of milk replacers marketed in the U.S.?

Answer: I would say that we have about 50% or close to it - in that optimum range with another 25% in that next range and 25% in those lower two, but unfortunately, that's about 25% too much in those lower two categories. They cause more problems than all the rest of them put together, for sure.

Question: Would you comment on once a day feeding and cold vs. warm feeding?

Answer: I've been very familiar with once a day feedings over the years. If I were raising calves, I'm sure this is the way I would feed calves. The performance has been excellent with once a day feeding. In fact, in some cases, it has been better than twice a day. This is field experience. It only allows you to feed that flame once a day with a perfect media for the coliforms to grow on, I guess! Also, it encourages that calf to go on a dry feed a little faster, and he weans a little bit easier because of it. If we go on once a day feeding we must be sure that we provide fresh water because we do not get enough water into them in one feeding, and secondly, we can not overlook observations with once a day. Cold feeding - there have been some good reports. My own experience has been negative. I don't know why. We have used it in lambs very successfully, but in our research we just haven't been able to make it work. Nebraska has reported excellent reports with cold feeding so I guess I'm open on that one. Oklahoma also had good results with 43° milk - as good as the other. If I were a calf, I'd want it a little warmer!

Question: Is it true some reputable companies may market a less desirable milk replacer just for the sake of meeting the competition?

Answer: I'm afraid that might be true. We've seen that. People go in, and they've got two grades of milk replacers. One is a top quality product, and one is to meet competition. It is unfortunate when we do things like this. In fact I was with one producer last week who had two grades. One they sold through their dealers. The other they sold directly to the dairymen. The good one they sold to the dairymen. Where they were not such good salesmen, they'd go on price! That's strictly a case of education. I'm afraid there's a lot of truth in that.

Question: Two hundred forty veal calves. No death loss till 15 weeks. Then fantastic losses - usually salmonella. When feed was changed, death losses stopped dramatically. Fat and protein was okay. Where do I go from here?

Answer: I think that's a little difficult to analyze unless we had a little more information. Perhaps I could suggest that questioner discuss that with us later.

Question: What is your opinion of fish protein concentrates as a protein source in milk replacers?

Answer: My experience with it has been quite limited. We did a little work a few years ago, and the results were not that great. At that time the economics were certainly not in favor of it so we didn't continue working with it. I understand that there is a fair amount of it being used in Europe.

Second Answer: Our results were not that great, either. The Swedish have had pretty good success. But their protein levels are way up there, too, and I think that might explain why. They're around 26% compared to ours at around 20%.

Question: Have you any experience feeding acid-preserved hay or grains to pre-ruminant calves? This is hay or grain preserved with acetic or proprionic acid.

Answer: No, I haven't had experience. Some of our dairymen have fed the proprionic treated material, and they say the calves really like it. We fed acid preserved hay to three or four month old heifers. We haven't tried any younger ones.

Question: How do you account for less diarrhea with higher fat diets? Isn't fat traditionally associated as an aggravating factor in scours?

Answer: I think the first reaction of most people would be that the fat is an adjunct of scours, but actually, the opposite is true. This is quite well documented in the literature. We've certainly seen this in the field. Apparently, it has a caustic effect. It

slows the digestive tract allowing the material to be there for a longer period of time so it is more readily absorbed. It does have this effect. We've seen this many times. I know, merchandising a product a number of years ago that had a 20% fat content with a high level of antibiotics. For some time, I was giving the credit to the antibiotics, and I found out how wrong I was. It really was the fat level that was doing the job for us!

Question: What is the maximum ash level acceptable in a good milk replacer?

Answer: If you have an all milk product, and you're using good quality ingredients with 10% fat you won't run above 8%. Nine percent would be a high level. With 20% fat this would drop down to a high level of 7½%. Many times the 10% fat level will run in the neighborhood of 7-7½%; the 20% level - 5½%. Anything over 10% would be detrimental.

Question: Can a milk replacer be fermented? Is there any advantage in doing this to control harmful elements such as salmonella which is a problem in veal calf operations.

Answer: This question has been brought up. I realize salmonella is a problem in veal calf operations. It's a problem any time you assemble calves. But if you have a product that is salmonella-free to begin with why ferment it or do anything with it?

Moderator: I think the person may have been wondering whether or not the increased acidity in fermented milk replacer, perhaps extrapolating from fermented colostrum, might not control the salmonella organisms. I don't know. There is some interesting British work that has been published. Maybe Dr. Huber or Dr. Schugel can comment on it. Recently, two or three reports from England studied the survival and proliferation of salmonella species in fermented colostrum. I think my memory serves me correctly when I state that the salmonella survive, but they don't proliferate for very long once the fermented colostrum reaches a certain acidity. But it can survive up to a certain point. There are some hazards associated with fermented colostrum. Do you wish to comment?

We had a pH drop within a day down to 4.42, and as long as it stays there, I think you're pretty safe. But after you hold it a while it'll go back up, and you may get more proliferation.

Question: Is there any hope of predigestion of non-milk ingredients by the use of enzymes prior to feeding or chemical treatment?

Answer: I think there's hope. They have digested sorghum products.

Question: What is the desirable level of molasses in a calf starter?

Answer: 10%.

Question: Can the quality of colostrum be influenced by prepartum feeding of the cow?

Answer: I think, generally, no. If you subscribe to the idea that prepartum feeding is going to increase the size of the udder and such, perhaps.

It's a very interesting topic. We've been interested in this in connection with calf scours in beef calves. So many people have told me through the years that the incidence of calf scours is higher in calves born to cows which have not been fed throughout the winter properly. Two years ago we ran an experiment with 48 cows. We fed 24 of them a ration designed to lose body weight. They were in terrible shape through the winter months. The other 24 according to accepted requirements. Neither the incidence of scours nor the quality of colostrum differed. The quantity of the colostrum was probably lower in the poorly fed cows.

In prepartum feeding of cows, if you feed a large amount I think you can run the cows into problems. But say, starting a couple of weeks before they calve, build up to 10 pounds a day. I think this would be a desirable thing.

Question: Is there a danger of milk protein being denatured in the preparation of milk powders?

Answer: The possibility exists if you use extremely high temperature water. It's a combination of temperature and time, but if you use high temperature you still have to cool it down. You won't have it at high temperature for very long. The calf isn't going to be drinking it at that high temperature. I usually tell people to mix it as near body temperature as possible. Maybe a little higher because it will cool down some anyway, but at 120° at the tops, though. There'd be no problem there.

Question: Does the percentage of fiber in milk replacers effect or cause scours?

Answer: No, I don't think the fiber causes the problem. It's the product providing the fiber that is the culprit, and you can have some of these proteins that are quite acceptable today that contain some fiber. On the other hand, you can have some proteins that are not very well accepted that contain no fiber. Unfortunately, there was a time when we judged milk replacer quality by fiber level. This could be just a little bit misleading.

Question: Do you suggest mixing several milkings from several cows? Other workers have said to feed only from one cow. In other words, do not mix several cows' colostrum. Would you discuss this?

Answer: In fermented colostrum that you feed the calf after this first day until weaning, you have about only 25% the antibody action there anyway. Fermented colostrum loses this much. Arizona work showed this. They only had about 25% of the immunoglobulins in the blood after they fed fermented colostrum compared to fresh colostrum to newborn calves. So I guess with respect to the material you feed to weaning, I don't see any problem as to mixing different cows. With respect to what you feed the first day, again it may be that if you buy a calf - move it from the premises where if it's not going to be raised from where it was born - you'd want to feed it from a cow that had lived on those premises where it is to be raised other than its mother.

Question: Do you think that the listing of all the in-

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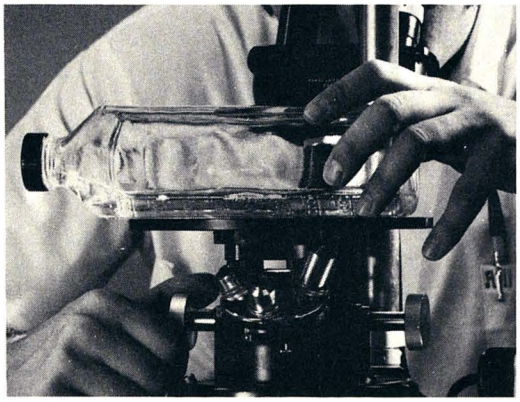

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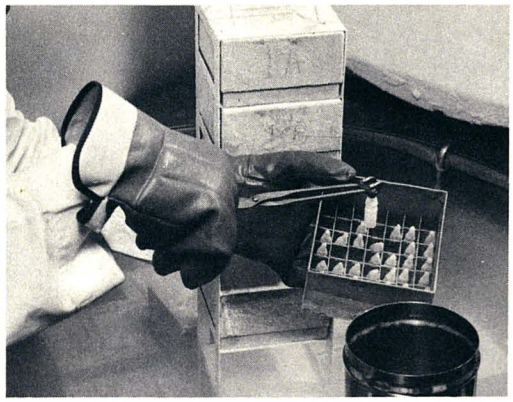

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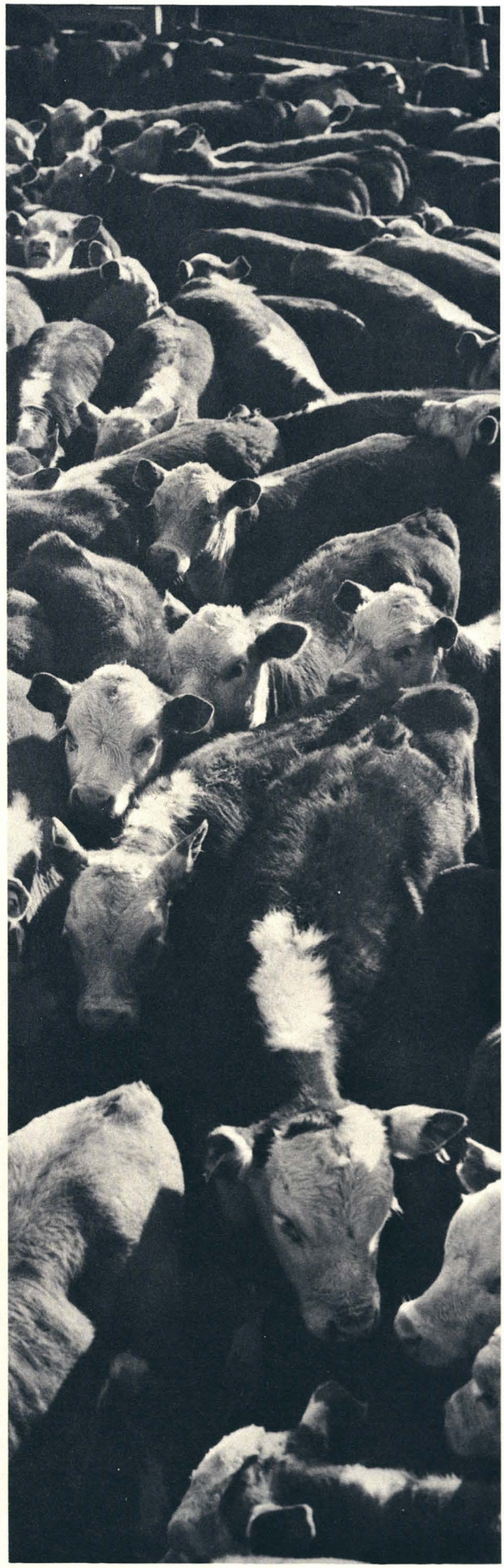

gredients and their percentages would be a good way to give us all the information necessary to assess a milk replacer?

Answer: I am afraid that still would not be the answer because that still would not tell you what the quality was. I have mentioned whey many times. How do we judge quality of whey? One of the best ways we have is a combination of pH and ash. If the pH of sweet whey is pretty much near neutral - if we have a low pH, then we know it has been soured, but if the pH has been raised by neutralization then the ash level has been raised so you have one or the other in a poor quality whey. Either a low pH or a high ash level. It's a pretty good gauge on the quality of whey, but just listing it wouldn't really mean anything.

Question: Please comment on the frequency and amount of feeding milk replacer. 1. Automatic feeding, once a day, and cold vs. warm, assuming a two week old calf; 2. Why can't you put all milk protein on the milk replacer tag?

Answer: As far as the automatic feeding is concerned, I have certainly not been a disciple of those type of devices because usually the people who use those are the ones trying to short-cut management, and with the automatic feeding devices usually your management has to be better than any other method. The reason for using the automatic feeding device is to cut costs. This doesn't happen if you use an automatic feeding device because you end up feeding about twice as much milk product as when you hand feed. So you're defeating some of your purpose, and I think hand feeding is still desirable.

The last question - I guess there's no reason why you can't. Many of them do talk about having all milk protein.

Question: Your slides showed weight gains on fermented colostrum about ½ that of whole milk, and that experiment was low compared to other fermented colostrum trials. Was there a reason for this?

Answer: This did concern us. Probably we were holding the fermented colostrum a little longer than did the Kansas work. However, the reason is not obvious.

Question: I'd like a comment on quality product vs. feeding management.

Moderator: That's a good question. I could rephrase that question a bit and ask these people to discuss the known economics of calf mortality taking into consideration the management that we presently deal with, given reality, and feeding whole milk vs. milk replacers up to two weeks of age.

Answer: It is very dangerous to generalize, but I was impressed when I visited California last year and talking to veterinarians from California, how many of those large dairy herds used cow's whole milk for the first two weeks of life then start considering milk replacers. Perhaps there are some veterinarians from California who can give us more specific information on that. I say, it's very dangerous to generalize, but I went down there and I thought, these big herds–300-600–cows would be using milk replacers. They are not, and if you ask the dairyman why, he says, "Because given our management these milk replacers just are not doing the job probably because quality is a question. Now, I'll be the first one to agree with Dr. Schugel that there are many other factors involved in calf mortality and calf diarrhea, but I still have a problem in removing that as a factor in trying to diagnose the condition. I wonder if I could ask the person who submitted the question if I was fair in rephrasing the question?

It seems to me that we've been concentrating on quality of milk replacer products, and I'd like to share with you a perspective that I have developed. That is that more often than the diet *per se* or the quality of the diet, it is feeding management that is at fault. This goes for virtually any class of livestock, and it has to be with the sort of things that come to me as a nutrition man, an academic clinic and from practitioners. More often than not, things that are delivered to me as nutritional problems turn out to be problems of feeding management. If they can talk me into it at all, I say that I want to go out and see the calves' feed. I tell that to the owners. It gives me a chance to see what the feeders are doing with them, thinking I'm watching the calves, but I'm watching them! In the case of milk replacers, they very often feed too much, or not enough, or don't mix it right, or mix it with dirty equipment, and then they blame the product when it is really the feeding management! I think that is the very first thing that we should look at - the feeding management, - before we start looking at the diet. When it comes to milk replacers, I am afraid we are in a position where, in the first instance, we have to trust the company. We have to trust them for the proportion of ingredients, the quality of ingredients, and the processing. The processing is just as crucially important. Until you have some experience, you really have no alternative but to go along with the manufacturer.

Second Answer: I would like to comment on your comment. I think we can live in pretty good accord. I agree with you on this - ideally - to go this two week period on whole milk or colostrum. Then switch over to the milk replacer. I know exactly what you're talking about because I've seen these operations work. It might be the answer.

Question: What are the names of acceptable brands of milk replacers?

Answer: No comment.

Question: Why add antibiotics to milk replacers?

Answer: Good question. I'd rather not put any in at all. I made this comment at this meeting a year ago. Our marketing people seem to think we have to have some in there because everybody else does, but we market products in some areas without antibiotics. I like this way because if we have a problem a veterinarian can go in there and treat it. The response is going to be better, and everybody is going to be

much better off because of it. Especially with high levels. I have seen too many adverse problems with high levels of antibiotics.

Question: Can colostrum from cows that have been dry-treated be fermented?

Answer: We have done this quite successfully. Generally we leave the calf with the cow for that first milking, and then take the six milkings from then on and ferment it. It has worked out well.

Question: Do you need to feed water when you begin grain feedings? Secondly, are there any problems in giving calves free choice water from the day they are born?

Answer: If you can feed water to the individual calf, yes, but where you have common waters there are problems. I guess I'm a proponent of all free choice water.

Question: Do you have any information on the economics of feeding calves milk replacers vs cow's whole milk when you consider calf mortality under conventional management systems?

Most of the work that is presented talked about the amounts of whole milk we used, the amounts of milk replacers up to 28 days of age, but have we incorporated into that, calf mortality?

Answer: The Michigan Cow Farm study I referred to did compare whole milk and milk replacers and got essentially no difference in calf mortality between those particular systems.