*The Control of Mastitis: An IDF Seminar

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On April 7-10, 1975, approximately 150 scientists from 23 different countries engaged in a seminar on the control of mastitis sponsored by the International Dairy Federation (IDF). The conference was hosted by the University of Reading, Berkshire, England, and organized jointly by the United Kingdom Dairy Association and the National Institute for Research in Dairying, Reading. The IDF is basically a European organization including Canada, Australia, New Zealand, and South Africa. For the first time American participation in the IDF was invited through the National Mastitis Council. Although formal membership for the U.S. does not appear to be feasible now, arrangements are underway for American participation or representation on working committees and councils. This is important for rapid communication of knowledge on the practical control of mastitis, for standardization of criteria and methods, and for diagnosis, treatment and quality control procedures such as bacteria counts, cell counts, other methods of detection of products of inflammation or antibiotics in milk and for exchange of basic ideas and information by scientists engaged in mastitis research.

The seminar itself consisted of six sequential sessions during which at least 29 main papers and 32 short papers were presented, plus 45 spontaneous contributions from the floor and extended discussions. This report will attempt only to present an overall summation, particularly of those points of most interest to American dairy practitioners.

Session I - Diagnosis of Mastitis

Considerable attention was given to the problem of diagnosis of mastitis, particularly bacteriological diagnosis. Teat dipping for at least a week before sampling was stressed as was the necessity for thorough cleaning of the teat end to assure clean samples. Errors of false positive and false negative results were discussed, especially as they referred to research observations.

The validity of properly used gel-viscosity (CMT, etc.) tests was confirmed for screening and cowside use as were their limitations for refined work.

Two other measures for inflammation of the udder were discussed. One method, referred to as the Monomastest (MMT) was a radial immune assay for bovine serum albumin. The second test involved a threshold for lactose in the milk, below which there was a high correlation with mastitis.

Attention was called to the increasing incidence of Group B (*Str. agalactiae*) infections in humans, and especially to the sepsis and meningitis occurring in newborns, presumably as a consequence of passage through an infected genital tract of the mother. Observations from Germany indicate that Group B streptococci were detected 40 times more frequently in consumers of raw milk than in consumers of pasteurized milk and the minor difference (loss of ability to hydrolyze lactose) between the human and bovine strains was thought to occur by adaptation within the human.

It was agreed that further standardization was needed in definition and methodology for diagnosis of mastitis but that some variations in methodology were necessary for different purposes such as field diagnosis, research and for milk quality control. The IDF in conjunction with the NMC will work on this problem.

Session II - Determination of Somatic Cells in Milk

Two factors stood out immediately from this session: (1) Permissible cell counts in most IDF countries are lower than in the United States, (2) Electronic methods for counting cells are widely used in contrast to our less accurate screening tests based on gel viscosity. Coulter Counter and Auto-Analyzer results were considered good and three papers were presented on a method in which cells stained with ethidium bromide would emit nuclear fluorescence evoked by UV light to be picked up by a photomultiplier and counted. The latter method (Fossomatic) was considered by the authors as equivalent to Coulter Counter and Auto-Analyzer methods in accuracy but possibly more advantageous from the standpoint of numbers of samples handled and practical operation.

A most interesting paper discussed use of the Coulter Counter Model TA, which has made it possible to count cells by means of size (volume) for counting normal milk, mastitic milk, colostrum and milk

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from bulk tanks. The resulting histogram patterns differ for infected and normal milk. From this it was concluded that not all bulk tank milk with high somatic cell counts comes from infected mammary glands, nor does that with counts under 500,000 per ml necessarily come from uninfected quarters. More work obviously is indicated along these lines.

Although electronic methods of counting cells is accepted as the best, there is still the possibility that improved chemical methods, such as the Filter DNA assay, may prove to be very useful.

Great emphasis was placed upon standardization of methods and frequent within-laboratory and between-laboratory tests to ensure that errors in counting did not creep in. Furthermore, it was emphasized that trends or consistent elevations or decreases in counts on tank milk were of greatest significance since day to day variation can be high. Use of six-month moving averages can therefore be very useful and substantial or continuing departure therefrom can be significant.

Again it was proposed that the IDF and the NMC should join in standardization efforts and that each country should have one reference laboratory to participate in international standardization programs and to serve as the standard reference laboratory for that country. It was considered important that the dairymen always receive notice of cell counts observed on his milk, preferably together with his moving average and the current mean count of all dairies in his area. Research must be continued on the reasons for variation in cell counts in milk.

Session III - Prevention of Infection

This session began with a discussion of value, safety and effectiveness of hygiene practices and especially of teat dipping. Teat dipping with an effective dip will reduce new infection rate by about 50% but the effect on level of infection in a herd is modest in the short term because of the long duration of infections already present. Care should be taken to select products proven to be both safe and effective. Available data indicate that oils should not be used as a primary vehicle for a teat dip unless there is conclusive evidence of efficacy for the specific product in question.

The role of the milking machine in preventing mastitis received appropriate attention and it was noted that the combination of regular and irregular vacuum fluctuations will produce impacts which can penetrate the streak canal. Experimentally this has been shown to cause infection which could be prevented by putting shields in the milk tubes. However, a field trial showed that the shields were helpful in only a small minority of problem herds.

Overmilking is still considered dangerous both from the standpoint of teat injury and opportunity for bacterial colonization. Automated cluster removal may be of help in this regard but further research and observation are needed.

Two research workers are investigating pulsationless milking, one by means of a jacketed airflow cushion and one based on the use of a swinging vacuum in a single chambered teat cup. These developments must be watched with interest.

The role of psychological and physiological stress in the dairy cow and its influence on mastitis and on cell counts continues to demand attention. The reports in the literature are contradictory; however, it is at least known that phagocytic abilities are reduced by high levels of cortisol.

Attention was called to a cationic polypeptide called "Ubiquitin" and found in many cells including those of Furstenberg's rosette. Perhaps this "Ubiquitin" is an important defense substance and more work is proceeding.

The possibility of milk-protein phenotyping as a means of genetically augmenting mastitis resistance was noted by two researchers but the value of this approach remains to be demonstrated.

The general consensus from this session was that hygiene is of extreme importance and must be brought to bear at as many foci as possible, that teat dips must be proven safe and effective, that environmental hygiene needs more attention, that more milking machine research is in order, and that specific and non-specific bovine defense mechanisms need further elucidation. Differences in susceptibility between the dry and lactating status are very important, i.e., coliform infection is generally not possible during the dry period. A better understanding of the cow's defense mechanisms at all stages of lactation may enable their optimal utilization in mastitis prevention and control.

Session IV - Elimination of Infection

Because most mastitis infections tend to be of long duration a system of eliminating existing infections was considered to be necessary in most herds. Lactation treatment of clinical cases generally speeds return of the cow to the milking string but is not highly efficient for removal of the infection, especially staphylococcal infections. Treatment of subclinical infections can be useful in rapidly reducing or eliminating *Streptococcus agalactiae* from the herd but is less effective against staphylococci. If there is no urgency it is more economical to defer treatment until drying off, except for clinical infections, especially those discovered early in the lactation. It was emphasized that treatment benefits would be short-lived unless appropriate measures of hygiene have first been taken to avoid reinfection.

Treatment during the dry period is most effective in eliminating existing infection and also prevents the new infections which normally occur, especially during the first 2-3 weeks after drying. Because antibiotics normally disappear even faster from a dry udder than a lactating udder, special bases are required for the persistence necessary, especially for staphylocci. The importance of eliminating infections present at or acquired during the dry period is emphasized by the drop in production in the

succeeding lactation for quarters infected at calving.

Dry cow therapy reduces infections due to all primary pathogens, and such secondary pathogens as *Corynebacterium bovis* and micrococci. The response of staphylococcal infections is generally good (70-80%) but wide variations in response between herds, unrelated to sensitivities, can be expected.

One paper dealt with the problems of formulating antibiotic preparations. Many factors enter into maintenance of levels, diffusibility, persistence, effectiveness, etc. Because the requirements for high efficacy and no residue are usually conflicting, compromises must be made in formulation. Another paper dealt extensively with the pharmacokinetics for systemic and intramammary antibiotic therapy. For those really interested in the intramammary action of drugs purchase of the *Proceedings* for this article alone would be well worthwhile. Unfortunately it does not lend itself to a short summation.

There was considerable discussion of the merits for treating all quarters at drying or treating only known infected quarters or quarters selected by CMT or clinical histories during lactation. There was no consensus on this point. Certainly the need for treating all quarters at drying will need continued examination, especially in herds with little or no streptococcal and staphylococcal infection.

Finally an examination of the role of culling in eliminating infection in the three-year Cornell project on hygiene and dry cow treatment was presented. Culling did serve some function in reducing infection levels, the number of clinical infections and duration of infection. However, the impact of culling on mastitis was less than is frequently assumed and it could not be recommended as a major factor in mastitis control programs. It was concluded that the maximum financial gain can be made by first introducing a hygiene dry cow therapy (HDCT) regime and then culling solely on the basis of milk production, as far as mastitis is concerned.

In summary, it was concluded that continued research is needed to improve therapy, especially against staphlococci, that the results of long-term dry cow and possible alternatives thereto, need much research and that improved methods of utilizing therapy in conjunction with other management practices were needed.

Session V - Control of Mastitis

At this point attention was directed first to coliform mastitis and other secondary pathogens. In particular the association of sawdust bedding with high populations of *Klebsiella pneumonia* and outbreaks of Klebsiella mastitis was discussed. High populations of *Escherichia coli* have also been observed in bedding materials and present information indicates a relationship between high bedding bacterial populations, high teat skin populations and increased coliform infections. Teat dipping does not appear to protect against these infections originating in the environment as contrasted to those originating from infected quarters. Much more research is needed on control of mastitis from coliform and other environmental organisms.

Quarters infected with secondary pathogens such as *C. bovis* and micrococci have increased cell counts and thus exert a protective effect against invasion by primary pathogens. This is not an important consideration from the standpoint of control since HDCT programs tend to control these secondary pathogens as well as streptococcal and staphylococcal infections. At least one report indicates that reduction in milk yield from these infections is substantial and therefore, such infections are to be discouraged on economic grounds.

There was considerable discussion of control philosophies. Should programs be directed toward all herds or only certain "problem" herds or should programs be directed at all pathogens or specific pathogens. The major reason for control was considered to be economic benefit to the farmers and to the general public. Therefore, the concept of endeavoring to reduce mastitis prevalence by efforts concentrating on herds with high cell counts or high infection levels could be seen to be counterproductive since the largest proportion of overall economic benefit will come from herds clustered around the mean, not those relatively few herds at each end of the distribution.

In a similar vein there was strong opinion that a system of control must be directed at all cows and be applicable in such a way that expensive and bothersome dependence upon laboratory and administrative services is not necessary. The HDCT approach satisfies these criteria and tends also in the long run to eliminate *Streptococcus agalactiae* and staphylococcal infections from the herd. At the same time many questions regarding this approach were raised including the medical and economic desirability of treating all cows at drying, especially in relatively mastitis free herds, the effects of such programs upon coliform infections, and some reports of lesser effectiveness than that reported by the NIRD and Cornell University. An economic study of mastitis control by the HDCT method in England revealed benefit/cost ratios from 1.87:1 to 3.43:1 depending upon details of the program.

Evidence favoring eradication programs of specific pathogens was also presented along with examples of successful and long-standing eradication of *Streptococcus agalactiae*. *Staphylococcus aureus* can also be effectively eliminated from herds by specific programs and some hope is also held for *Streptococcus dysgalactiae*. *Streptococcus uberis* has many characteristics of environmental organisms and may not be so susceptible to eradication.

Scandinavian countries have generally been successful in streptococcal eradication programs which are dependent upon a widely available state diagnostic service and veterinary service officers, small dairies (i.e., 20 cow average) and a high ratio of

veterinarians to cows (1/1333 in Denmark). Veterinarians do all treatment in Denmark and thus have substantially greater control of mastitis situation in the herds. This reporter does not think this system is appropriate to North American dairies. The general consensus was that campaigns directed toward eradication of specific pathogens were not needed, rather than management programs directed broadly at all cows and control of most pathogens were more fruitful under most circumstances. This does not negate the frequent desirability of eradicating certain pathogens from specific herds. A laboratory facility is always important to provide guidance in control programs.

The California Mastitis Monitoring System (CMMS) was presented as a practical way to monitor the mastitis status in dairy herds. A CMT is run on the monthly DHI test milk and a bacteriological examination is made on frozen samples saved from all clinical mastitis cases before treatment. This system provides continued monitoring of both clinical and sub-clinical mastitis and a continuing record on bacteriological causes of clinical mastitis at minimal cost and trouble to the dairyman and his veterinarian. Mastitis is considered to be reasonably well under control if 90% of the cows score CMT negative and trace and the clinical mastitis rate is less than 2% of the cows per month.

The role of the veterinarian was defined as supplying the best in technical service and advice based upon monthly observations and graphing of cell count results in the herd, appropriate culturing of clinical cases, antibiotic sensitivity testing and assurance of properly operating and operated milking equipment. Since mastitis control is ultimately dependent upon the owner-herdsman, the veterinarian has a special responsibility to provide constant supervision of the management practices on each dairy he serves. The rising standards of husbandry must be matched by rising competence of advice and service from the veterinary practitioner.

Economic incentives are practical in some areas for production of low cell count milk. Most common was a penalty for high cell count milk but some systems provided incentive payments for low cell count milk. Economic incentives are justified on the basis of improved nutritional quality of normal milk and reduced dangers from antibiotic residues and the possible dangers to public health, especially from the Group B streptococci.

Whatever mechanisms are used to assure farmer participation in mastitis control, one of the essential requirements for successful programs is assurance of good and informed cooperation and support from all organizations and persons directly or indirectly involved in the problem and all must work together. This is essential on the local basis but it should operate on a national basis as well. The National Mastitis Council of the USA was cited as a shining example of the latter.

The Symposium must be regarded as an outstanding success, in part because of valuable information imparted, but more so because the major workers in mastitis research from much of the world were brought together where they could exchange ideas and become acquainted as friends. The natural consequence is a much more rapid and free exchange of information in the future which will be to the advantage of the dairy industry throughout the world.

The complete Proceedings will be published by the IDF; those wishing to order copies of the complete paper should write to Mr. P. Staal, Secretary General, International Dairy Federation, Square Vergote 41, Bruxelles, Belgium. Approximate cost $15.00.

NDHIA CONVENTION

BOVINE BRIGADE-Mythical dairy cattle family leads the way to Baltimore in this artist's rendering of an informational poster for the 1976 convention of the National Dairy Herd Improvement Association. Occasion will mark 70 years of cow-testing activity in the U.S. and 65 years for Maryland. Host states, as indicated on the poster signboard, will be Maryland, Delaware and West Virginia. The first two states were part of the Thirteen Original Colonies, an appropriate fact for the Bicentennial Year.