Editors: dr H. Hogeveen (NL) and dr P. Winter (AT)

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Report of the IDF Group of Experts on Mastitis

As members of A2 prepare Mastitis Newsletter 23, we are anxious to know the fate of Commission A and the A2 Group of Experts on Bovine Mastitis given the major restructuring efforts now taking place within IDF. By the time Newsletter 23 is published our fate will be known, and A2 members are hopeful that the Group will continue in some format. A2 has had a long history of productivity for IDF and is still the only international organization attempting to address the dairy industry’s number one disease problem – mastitis. Despite progress on control of various aspects of the disease, mastitis remains a significant problem in all IDF member countries and mastitis not only reduces milk yield and producers’ profits but also negatively affects the quality and safety of the product shipped to processors and, ultimately, consumers. While other diseases can and do affect the dairy industry, their impact varies greatly from country to country and they are likely to be of greater significance to other food industries rather than the dairy business. The impact of bovine mastitis is almost exclusively limited to the dairy industry and, as such, a strong international effort through IDF A2 would seem to be justified.

The Mastitis Newsletter is undergoing major change with this issue. Prof. Dr Mel Schällbaum (CH) has been editor of the Mastitis Newsletter for many years and has largely been responsible for its success. Dr Schällbaum has indicated that it is time to allow some of the younger A2 members to experience the joys of editorship. Members of A2 wish to express their sincere thanks to Mel for all his efforts to drag material from reluctant members and the production of a Newsletter that is literally read world wide. Editorship of the Newsletter has been passed to Dr Henk Hogeweij (NL) and Dr Petra Winter (AT). We appreciate their willingness to accept this major responsibility and we are confident that IDF can continue to expect good things from the Newsletter. Publication of the Newsletter for the next 3 years has been guaranteed by a financial gift from Boehringer Ingelheim and Group A2 wishes to thank Boehringer Ingelheim and Prof. Dr Jörn Hamann (DE) for arranging the sponsorship.

The A2 Group has met on two occasions since the publication of Edition 22 of the Mastitis Newsletter. Meetings were held in Brussels on 18 and 19 November 1997 and in Oslo, Norway, on 4, 5 and 6 June 1998. Highlights of the November meeting included a presentation by G. Kalantzopoulos (GR) describing the problems of mastitis in small ruminants, especially breed differences and length of lactation. Kalantzopoulos chairs the Group A7 and expressed the need for collaboration between A2 and A7. Other actions included reports of the Action Groups and a major discussion of the future of the Mastitis Newsletter.

The Norway meeting in June 1998 was organized by Olaf Østerås (NO) and Kerstin Plym Forsnell (NO) and included 3 days of scientific discussion interspersed with several delightful social functions, concluding with visits to some typical Norwegian dairy farms. Work accomplishments in Norway included a lively session on the terminology and definitions used in mastitis research that is being prepared for publication as a Mastitis Glossary, and a 1-day session during which member countries presented the mastitis situation and the control schemes currently employed in their countries. All found this to be a very useful exercise and the results will be organized into a report for publication in the Bulletin. A highlight of the Norway meeting was the presence of Dr James Booth who attended and contributed to all sessions, including a report on the current status of milk production and mastitis control in Chile. James is the former Chairman of Group A2 and we hope to see him at future meetings.

New publications from A2 include "Mastitis Therapy is Necessary for Animal Welfare" by Dr Eric Hillerton (UK) and was published in the Bulletin No.330/1998. A document entitled "Evaluation of the electrical conductivity of milk as a mastitis indicator" was prepared by Prof. Dr Alfonso Zecconi and Prof. Dr Jörn Hamann and appears in IDF Bull. No 334/1998. Details continue to develop for the year 2000 seminar in Stresa, Italy. The topic is "Immunology of the Mammary Gland", and Prof. Dr Alfonzo Zecconi is leading the planning process for this seminar.

There has been a change in membership during the past year. Dr Kerstin Plym Forsnell (SE), Technical Secretary to A2, has taken a job in Norway and will now leave A2. All members of the Group are very appreciative of the hard work and dedication Kerstin gave to Group A2. We wish Kerstin the best in her new endeavors. The new Swedish representative is Dr Torkel Ekman from the Swedish University of Agricultural Sciences, Uppsala, Sweden.

A future meeting of A2 is planned for Cork, Ireland, 17-19 June 1999.

Prof. K. Larry Smith, Chairman
Department of Animal Sciences, The Ohio Agricultural Research and Development Center/The Ohio State University, 1680 Madison Ave., Wooster, OH 44691, USA
smith.149@osu.edu
Research Communications

STATE OF PROFICIENCY IN COUNTING OF SOMATIC CELLS – RESULTS OF LATEST INTERCOMPARISONS

IDF Standard 148A: 1995 describes in appendix 1 collaborative trials for SCC (Somatic Cell Counting) in milk. In accordance with these rules the Dairy Research Center in Kiel (DE) carries out intercomparisons factually as a reference laboratory once a year.

In March 1998 laboratories from 21 countries participated with a total of 66 instruments. The number per country (car plate abbr.) was 6xA, 1xAUS, 4xB, 1xCH, 2xD, 4xDK, 1xE, 4xF, 4xFIN, 3xGB, 1xH, 6xI, 2xIRL, 3xJ, 4xN, 3xNL, 1xPL, 1xRA, 11xS, 1xSK, 3xSZ. The instruments’ types were 1xSomoscope, 15x Somacount, 10xFM5000, 8xFM400, 25xFM360, 7xFM90 in general groups.

Two vials of reference material attached to the ring test had a shelf life of several months, when stored below 6°C. Under conditions with temperatures increasing to about 20°C the shelf life should be sufficient for even the latest examinations. Four counts should have been done from each vial. Some laboratories only managed two or three counts; 62 participants conveyed these counts. All cell counts in this communication will be given in 1000/million (=1/microliter), denoted as c/µl.

The lower reference sample gave an average of 192 c/µl, a standard deviation of 29.3 c/µl, which is a relative deviation of 15%. Three labs had counts higher than 192+20 c/µl, 7 labs had counts lower than 192-20 c/µl. Maximum was 381 c/µl (second highest was 234 c/µl), minimum was 138 c/µl.

The higher reference sample gave an average of 460 c/µl with a standard deviation of 49.1 c/µl, which is a relative deviation of 11%. Six labs had counts higher than 460+50 c/µl, 6 labs had counts lower than 460-50 c/µl. Maximum was 634 c/µl, minimum was 252 c/µl (second lowest was 364 c/µl).

The result of this pretest shows that 2/3 of the instruments work with a sufficient calibration but 1/3 of the participants have some or even substantial difficulties in setting or keeping their instruments on the true measuring level.

The 10 milk samples for the intercomparison have been chosen carefully from our herd to cover the relevant measuring range. They were divided into 4 vials per participant, each receiving 10 x 4 plus 6 blinds, giving 46 vials, which were randomly numbered. As this biological material from lactating cows can not be determined perfectly before sampling, two desired levels (150 to 200 c/µl and 500 c/µl) have not been met sufficiently. The well insulated packaging made it possible to gain reliable counts within about 2 weeks after the samples left our institute. For two participants delivery was delayed by customs officers. Under conditions with temperatures increasing to about 20°C the shelf life of the potassium dichromate preserved samples should safely be 1 week. For the latest examinations, done up to 18 days after preparation, the cell contents decrease by 5–8%.

All the laboratories’ counts were examined in a statistical procedure according to IDF Standard 148A. Six participants have been excluded from all calculations because of shipping conditions, giving 60 formally reliable instruments. The statistical procedure excluded a further 9 participants (15% of 60) because of their poor repeatability and/or 9 participants because of high bias, iteratively. Only the statistically faultless instruments contributed to the "reference mean", all instruments contributed to the "grand mean". Table 1 shows that the statistically reliable participants do find the "true level".

A statistical analysis of variance has been calculated for the population of those labs with no formal deficiencies (for example from transport condition) and was carried out by the SAS procedure "varcomp" estimating variance components by the restricted maximum likelihood method.

The effects are:
- participant (lab or instrument),
- splitting (partitioning from bulk into vials, part of sampling), and
- error.

The effect "splitting" contributed 3% on average to the total variation, and ranged from 1% to 9%. This means that partitioning has been done from

<table>
<thead>
<tr>
<th>Table 1: Means and standard deviations in c/µl</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk</td>
</tr>
<tr>
<td>------</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
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<tr>
<td>6</td>
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<tr>
<td>7</td>
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<td>8</td>
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<tr>
<td>9</td>
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<tr>
<td>10</td>
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</table>
Table 2: Repeatability and reproducibility

<table>
<thead>
<tr>
<th>Milk</th>
<th>Level</th>
<th>r</th>
<th>sr</th>
<th>CVr (%)</th>
<th>R</th>
<th>S_R</th>
<th>CV_R (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>46</td>
<td>13</td>
<td>4.6</td>
<td>10.0</td>
<td>22</td>
<td>7.7</td>
<td>16.6</td>
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<tr>
<td>2</td>
<td>69</td>
<td>15</td>
<td>5.3</td>
<td>7.7</td>
<td>25</td>
<td>8.9</td>
<td>12.8</td>
</tr>
<tr>
<td>3</td>
<td>108</td>
<td>19</td>
<td>6.7</td>
<td>6.2</td>
<td>36</td>
<td>12.8</td>
<td>11.9</td>
</tr>
<tr>
<td>4</td>
<td>233</td>
<td>29</td>
<td>10.1</td>
<td>4.4</td>
<td>68</td>
<td>23.9</td>
<td>10.3</td>
</tr>
<tr>
<td>5</td>
<td>285</td>
<td>32</td>
<td>11.2</td>
<td>3.9</td>
<td>76</td>
<td>26.9</td>
<td>9.4</td>
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<tr>
<td>6</td>
<td>399</td>
<td>50</td>
<td>17.6</td>
<td>4.4</td>
<td>111</td>
<td>39.2</td>
<td>9.8</td>
</tr>
<tr>
<td>7</td>
<td>464</td>
<td>46</td>
<td>16.4</td>
<td>3.5</td>
<td>122</td>
<td>43.1</td>
<td>9.3</td>
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<tr>
<td>8</td>
<td>615</td>
<td>59</td>
<td>20.8</td>
<td>3.4</td>
<td>162</td>
<td>57.1</td>
<td>9.3</td>
</tr>
<tr>
<td>9</td>
<td>751</td>
<td>70</td>
<td>24.9</td>
<td>3.3</td>
<td>192</td>
<td>68.0</td>
<td>9.0</td>
</tr>
<tr>
<td>10</td>
<td>892</td>
<td>79</td>
<td>28.0</td>
<td>3.1</td>
<td>231</td>
<td>81.6</td>
<td>9.1</td>
</tr>
</tbody>
</table>

well stirred bulk milk and that no other factors affected the content in the single vial.

The effect *instrument* contributed 79% on average to the total variation, and ranged from 64% to 88%. This indicates that counting results of different laboratories have too poor coincidence with the measuring level of other labs. The extent of this deviation means that agreement between laboratories has to be improved.

The effect *error* is caused by inhomogeneity within repeated countings from each single vial plus a random statistical effect. The *error* contributed 18% on average to the total variation, and ranged from 10% to 31%.

Laboratories are required to improve their measuring, so the laboratory-
effect in the analysis of variance is reduced to the amount of error-effect. Simply said: There is not sufficient agreement between different laboratories for the countings of one milk sample.

sr is the standard deviation corresponding to r (= repeatability) as defined in IDF Standard 148A. sr is calculated as the square root of var(error) + var(splintering). sr is the standard deviation corresponding to R (= reproducibility). sr is calculated as the square root of var(error) + var(splintering) + var(lab). Table 2 shows the values for the different milk samples (SCC levels).

IDF Standard 148A sets a target for repeatability for SCC levels between 400 and 500 c/µl. The CV (= coefficient of variation) shall be lower than 4–5%. For SCC levels between 100 and 200 c/µl the target is set to 5–10%. Although the single milk on the 396 c/µl level shows 4.4% we can state that the 60 participants have a laboratory practice where demands for repeatability are easily fulfilled.

The target for reproducibility, for SCC levels between 400 and 500 c/µl states that the CV shall be lower than 10–12%. For SCC levels between 100 and 200 c/µl the target is set to 10–20%. Here we can state that the 60 participants have a laboratory practice where demands for reproducibility are fulfilled. Smoothing ideal curves on the numerical dependency of level and CV gives the last line of Table 3 (*1996*). Doing so for the 1996-figures, you find the results for the intercomparisons of 2 years. While laboratory quality shows an excellent status for repeatability, the situation for reproducibility needs a special comment. Though the (anti-)quated targets of IDF Standard 148A can be certified, modern requirements will not allow routine laboratories permanently to produce SCCs lying on the extremes (that is, far away from the true value) of the interlaboratory distribution. Efforts must be made in most laboratories to keep the instruments' calibration such that even single counts do not differ much from the true values.

E.-H. Ubbe & Dr J. Reichmuth
Institute for Hygiene and Product Safety,
Federal Dairy Research Center,
Hermann-Weigmann-Str. 1,
D-24103 Kiel, Germany

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Table 3: Comparison between 2 years

<table>
<thead>
<tr>
<th>Level</th>
<th>Repeatability</th>
<th></th>
<th>Reproducibility</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>150</td>
<td>450</td>
<td>750</td>
<td>150</td>
</tr>
<tr>
<td>1996</td>
<td>7.5</td>
<td>3.7</td>
<td>3.1</td>
<td>12.1</td>
</tr>
<tr>
<td>1998</td>
<td>5.9</td>
<td>3.6</td>
<td>3.3</td>
<td>11.3</td>
</tr>
</tbody>
</table>

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**DYNAMICS OF MASTITIS IN NORWAY**

The Norwegian Animal Recording Scheme organized by the Norwegian Dairies Association analyses samples from lactating cows every second month for cow (composite) somatic cell counts (CMSCC). In the Norwegian Cattle Health Services every treatment for disease is recorded on a cow health card and reported periodically into the same mainframe database as production and quality data. This reporting system is now used to produce periodicals for farmers after each somatic cell count test. The periodical summarizes the dynamics of mastitis in the herd reported from date of the last 12 periods (months), and reports to each farmer four epidemiological key measures for mastitis. These measures are:

1. The frequency of somatic cell count analyses above 200 000 CMSCC.
2. The number of new animals having above 200 000 or new case of clinical mastitis when the last analyses on that particular cow had a value below 200 000 in CMSCC, all divided by number of cows.
3. The estimated mean duration of CMSCC above 200 000 in the herd by dividing the figure in (1) by the figure in (2) adjusting for the period of observation.
4. The incidence of cases of clinical mastitis treatments per cow/year in the herd with a restriction of 4 days from the first treatment before allowing a count for a new case in the same cow.

The report is illustrated in Table 1.
Table 1: Example of report from the Norwegian Cattle Health Service on mastitis dynamics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Herd</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. &quot;Prevalence&quot; of high CMSCC (%)</td>
<td>26</td>
<td>21.8</td>
</tr>
<tr>
<td>2. Incidence of &quot;new inflammation&quot; (%)</td>
<td>50</td>
<td>60.0</td>
</tr>
<tr>
<td>3. Estimated mean duration (in months)</td>
<td>6.2</td>
<td>4.0</td>
</tr>
<tr>
<td>4. True incidence of clinical mastitis (per cow-year)</td>
<td>0.23</td>
<td>0.42</td>
</tr>
</tbody>
</table>

The number under (1) will reflect the approximate prevalence of infectious mastitis in the herd according to Dohoo & Leslie [1].

In the calculation of (2) there is an approximation that all recorded treatments of clinical mastitis are supposed to be with cows having above 200 000 CMSCC at the time of treatment. This figure will therefore be an approximation of the "new inflammation" rate in the herd where inflammation is defined as a CMSCC above 200 000 (200 000 is chosen according to the paper of Dohoo & Leslie [1]).

The calculation under (3) (duration) is based on the very simple formula from Dodd [2] stating that the prevalence (A) = the incidence (B) x the duration (C) x 1/100 (all in percentage). When A and B are known from the calculations under (1) and (2), C can be easily estimated for each herd. This is done under (3).

The estimated incidence of treatment for clinical mastitis is according to the definition in the Bulletin of IDF [3] where the restriction time is set to 4 days from the first treatment before a new case in the same cow can be allowed.

Despite the fact that all these figures are rough approximations, they are a practical and pragmatic way to illustrate to the farmers and his/hers advisers the dynamics of mastitis in the herd. This presentation as a rolling 12 month mean every second month is a good tool to evaluate the mastitis dynamics in the herds and it makes it very convenient to interfere with the herd's general management when figures are too high according to the standard set or the figures are suddenly changing to an unacceptable level.

These measures started with the rolling mean from 1 July 1995 to 1 July 1996 (first) and the last figures for the country are from 1 July 1997 to 1 July 1998 (last). All members of the animal recording scheme run by the Norwegian Dairies Association is offered this service. The distributions of the figures for the first (1996) and last (1998) services are presented in Figures 1–4. The data presented are restricted to farmers being members of animal recordings both in 1996 and 1998, otherwise no exclusions done.

Total number of farms is 20 642 and the mean number of cow-years is 13.6 ± 6.1.

![Figure 1: Distribution of prevalence of CMSCC values above 200 000 in 1996 and 1998.](image)

![Figure 2: Distribution of incidence rate of "new inflammation" according to CMSCC values above 200 000 or new treatment of clinical mastitis cases in cows with CMSCC values below 200 000 at previous sampling.](image)

RESULTS

The proportion of analyses above 200 000 in 1996 was 22.5 and in 1998 this figure was 21.8 in weighted mean by cow-years in the herd; a reduction of 3.1%.

The proportion of new analyses above 200 000 in 1996 was 64.9 and in 1998 60.0 in weighted mean by cow-years in the herd; a reduction of 7.6% in 2 years.

The mean duration was estimated as 3.8 months in 1996 and 4.0 months in 1998. This is an increase of 0.1%.

The true incidence of treatments of clinical mastitis was recorded as 0.54 in 1996 and 0.42 in 1998, an overall reduction of 22.2%. The different farmers' associations within meat and milk production in Norway have set a goal that the use of antibiotics as well as the health should be improved by 25% in 5
years from 1995. In fact this goal has already been met by the use of antibiotics in mastitis within 2–3 years. It proves to be harder to improve the general udder health. However, using the objective criterion of "new inflammation" illustrates that also udder health in general is improved during the same period of time.

CONCLUSION

This practical approach to use CMSCC figures to calculate the dynamics of mastitis in the Norwegian herds seemed to have solved the problems of having good parameters to describe the mastitis situation in the herd. The very best parameter seemed to be the "new inflammation rate". This parameter is less reflecting the farmers and the advisers attitude to use therapies or culling to meet certain quality goals in somatic cell counts. The goal in the future mastitis work in Norway would be to decrease the "new inflammation rate" as far as possible with as little use of antibiotics as possible and without an increase in the already low bulk tank somatic cell count (level of 130 000).

As clinical mastitis and bulk tank somatic cell count reflect more the attitude of the farmers and advisors to use therapies or culling to meet certain quality goals in SCC, the "new inflammation rate" is more an indication of the "true udder health status" in the herd.

Literature

O. Østeraas
Norwegian Dairies Association, P.O. Box 58, N-1430 ÅS, Norway

C-REACTIVE PROTEIN AS INDICATOR FOR SUBCLINICAL BOVINE MASTITIS

The early and most precise detection of mastitis has a marked influence on the success of mastitis control measures. The combination of identification of mastitis pathogens and detection of inflammatory changes in quarter foremilk samples is the basis of mastitis diagnosis.

The number of available and sensitive parameters to detect very early inflammatory signs in milk is limited. Based on a recent publication showing a marked increase in C-reactive protein (CRP) in milk from bovine udder quarters clinically diseased, a study was initiated to compare the somatic cell count with CRP in milk from subclinically diseased quarters.

CRP is produced mainly in the liver and may increase to levels 100–1000 times higher than its normal concentration during the initial phase of diseases. Whether CRP is also produced in the bovine mammary gland is not known.

Concentrations of the C-reactive protein (enzyme-immunoassay), the somatic cells (Fossomatic), and the presence of mastitis pathogens were determined in healthy and subclinically diseased udder quarters from 47 cows. Foremilk sampling was done 3 times at weekly intervals.

The categories of udder health (normal secretion, mastitis, latent infection and non-specific mastitis) were defined on the basis of bacteriological findings and a cell count threshold of 100 000 cells/ml milk. The mean values of the somatic cells were significantly different between all health categories (range: normal secretion, 16 595 cells/ml; mastitis, 971 535 cells/ml), whereas the corresponding means of the CRP concentration had a comparable level (range: normal secretion, 81.28 ng/ml; mastitis, 114.82 ng/ml).

The overall correlation coefficient between CRP and somatic cells in milk was \( r = 0.32 \). The threshold of the CRP concentration for quarters with normal secretion was determined as 123 ng/ml. The application of this threshold instead of 100 000 somatic
cells/ml as the criterion to define mastitis resulted in a classification of "mastitis" with a poor level conformity of 55%.

The low correlation of CRP concentration and cell counts in milk of subclinically diseased udder quarters \( (r = 0.32) \) seems to indicate that under these inflammatory circumstances the CRP system is not markedly activated.

The potential use of CRP concentration measurements in milk during the initial stage of intrammary infections not only to obtain information on the local, intramammary situation but also on the systemic status of the cow, makes a more detailed look at the interaction between somatic cells and CRP during the acute phase of clinical mastitis appear worthwhile.

J. Hamann  
Department for Hygiene and Technology of Milk, School of Veterinary Medicine,  
30173 Hannover, Germany

THE EFFECT OF AUTOMATIC MILKING ON BULK MILK SOMATIC CELL COUNT

The first publications on automatic milking were made a little more than a decade ago. Since then, much has changed. In the past year, the number of farms milking with an automatic milking system has increased rapidly. Currently, an estimated 250 farms are using a milking robot. These farms are mainly located in European countries. With the increase in number of used milking robots, questions regarding the effects of automatic milking on the udder health arise.

Compared to a conventional milking parlour, a number of differences may influence the udder health. Cows will be milked more than twice a day. A higher milking frequency is believed to be beneficial for the udder health. Also, because cows come to the milking robot voluntarily, milking frequency will vary from cow to cow. It may happen that, although the average milking frequency of a herd is increased, individual cows have milking intervals longer than 14 h. The construction of the milking equipment of a milking robot differs from conventional milking equipment. For instance, the milking cluster of a milking robot has a different layout to a conventional milking cluster. Infections from cluster to cluster are not possible with the current milking robots. Since there is no milker present during the milking process, direct control for clinical mastitis cannot be carried out. Udder health control must be carried out using information on electrical conductivity, temperature of the milk and milk production. Also the cleaning of the udder prior to milking cannot be carried out by a milker. The different types of milking robots currently on the market each have equipment to clean the teats prior to milking, but this equipment does not differentiate between dirty and clean udders.

The introduction of a milking robot may have positive as well as negative effects on the udder health. However, hardly any information on the effects of automatic milking on udder health have been published.

CHARACTERISTICS OF BOVINE MASTITIS CAUSED BY LISTERIA MONOCYTOGENES AND A NEW ELISA METHOD FOR DIAGNOSIS

Contaminated raw milk and milk products have been involved in several outbreaks of human listeriosis. Although the cow's environment is the main source of the contamination of the bulk milk in the farm, several cases of bovine mastitis caused by L. monocytogenes have been reported. Naturally occurring cases of mastitis and experimental infections enabled us to specify some characteristics of bovine Listeria mastitis [1]. Infected quarters developed chronic subclinical mastitis with occasional clinical episodes and a great variation in the number of colony forming units isolated from milk was recorded. Bacteriological examinations performed after slaughtering of cows were negative for liver, spleen and mesenteric lymph nodes.

L. monocytogenes strains were isolated from the supramammary lymph nodes and occasionally from iliac lymph nodes. Treatments in lactation (combination gentamicin/claxacillin) or at dry-off (claxacillin) were inefficient. Consequently the identification of the infected cow responsible for the persistent contamination of the bulk milk by L. monocytogenes is crucial. The bacteriological methods used are expensive and time consuming, and milk samples should be taken aseptically. Because the level of L. monocytogenes excretion in milk is variable, with less than 10 CFU/ml of milk [1], in some cases identification of infected animals by direct plating is difficult or even impossible and an enrichment step is necessary.

We reported [2] a significant increase and persistent titer of specific antibodies in milk from 5 days post-infection in cows with Listeria mastitis.

With purified proteins obtained from culture supernatant of L. monocytogenes we developed an ELISA based on the detection of antibodies in composite milk sample [3]. The test can be used with similar conditions for cow, ewe and goat. A commercial prototype kit is currently under evaluation. It has recently been evaluated by comparison with bacteriological examination of 7860 composite milk samples collected from ewe. Sensitivity and specificity were 92% and 86%, respectively.

This method, rapid and less expensive than the bacteriological methods, could be recommended in herds of which bulk milk is contaminated persistently by L. monocytogenes and applied to animals having a somatic cell count above 300 000/ml.

Literature

B. Poutril  
INRA - Laboratoire de Pathologie Infectieuse et Immunologie, 37380 Nouzilly, France
MATERIAL AND METHODS
All farms in the Netherlands know to be using milking robots for at least a year were asked to cooperate in this study. Data from the Dutch system for control of quality of farm milk from these farms before and after the introduction of the milking robot were generously provided by MCS Nederland. Moreover, data from control farms milking twice a day and three times per day were also provided. In the Dutch milk quality control programme, bulk milk somatic cell count (BMSCC) is measured every 4 weeks. Data were collected from 28 farms with a milking robot, 58 farms milking twice a day and 28 farms milking 3 times per day. Calculations were carried out with a geometric average of the somatic cell count.

RESULTS AND DISCUSSION
The best average BMSCC, 169 000 cells/ml, was obtained at the farms milking 3 times per day (Figure 1). In general, in the Netherlands these farms may be regarded as very well managed. The average BMSCC on the farms milking twice per day was slightly higher, 178 000 cells/ml.

The average BMSCC on the robot farms before introduction of the milking robot was 233 000 cells/ml. This was higher than the BMSCC on the farms milking twice per day. This indicates that the population of farms who were the first with a milking robot differed from the average farm. These farms were pioneers, probably strongly technology driven. In the first year after the introduction of the milking robot on these farms, the BMSCC did not change and was on average 237 000 cells/ml.

The conclusion can be drawn that the introduction of the milking robot did not affect the BMSCC positively or negatively.

H. Hogewezen, G.H. Klungel and B.A. Slaghuis
Research Station for Cattle, Sheep and Horse Husbandry (PR), Lelystad, the Netherlands

INVESTIGATION ON HYGIENIC IMPORTANT AND POTENTIAL PATHOGENS OF RAW MILK OF SHEEP AND GOATS DURING ONE LACTATION PERIOD

SUMMARY
The aim of this study was to investigate raw bulk milk of sheep and goat concerning total bacterial counts, counts of coliforms and Staphylococcus aureus, Streptococcus B. and Salmonella spp. and also new emerging pathogens (Campylobacter jejuni, Listeria monocytogenes, Yersinia enterocolitica and verotoxin producing E. coli O157 (EHEC)).

This study was carried out on 13 sheep and 2 mixed sheep and goat farms. Sampling was done fortnightly over one lactation period.

Bulk milk samples turned out negative regarding Sc. B., Salmonella spp., L. monocytogenes, C. jejuni and E. coli O157.

Y. enterocolitica was detected in sheep and goat milk of one farm.

INTRODUCTION
Due to the increasing market demand for sheep and goat milk and their products, since January 1998 these products are controlled according to the milk hygiene regulations. Farmers are forced to produce milk according to the "good hygiene practice" as part of the HACCP concept. Nevertheless, it is possible that raw sheep and goat milk and their products are contaminated with potential pathogens. Azadian et al. [1] and Harris et al. [2] reported foodborne outbreaks of Listeria and Campylobacter infections caused by consumption of raw sheep and goat milk products. Later, authors reported on outbreaks caused by new emerging pathogens in raw milk and products [3–7]. Based on this concept the hygiene quality of bulk milk is in accordance with the milk hygiene regulations.

MATERIAL AND METHODS
Fifteen sheep farms, two of them containing goats, were examined. Milk sampling was carried out fortnightly over the 1996 lactation period.

The milk samples were examined as follows:
(a) total bacterial count (according to the milk hygiene regulation)
(b) evidence of hem. streptococci of sero-groups A, B and G, salmonella spp. and new emerging pathogens (Campylobacter jejuni, E. coli O157, Listeria monocytogenes, Yersinia enterocolitica).

RESULTS AND DISCUSSION
Bulk milk of 12 of 15 sheep farms corresponded with the quality required of the milk hygiene regulations for milk desired with heat treatment.
The quality of bulk milk of 11 farms was in accordance with the threshold level of the milk hygiene regulations for milk desired with no heat treatment.

Bulk milk of three farms exceeded the threshold level of the milk hygiene regulation for milk desired with heat treatment.

On one farm, goat milk was under the threshold level of unheated milk (500,000 cfu/ml) over the whole lactation period; milk of the second farm exceeded the threshold level of 1,000,000 cfu/ml for heated milk.

Pathogens causing foodborne diseases could not be detected in bulk milk samples of 15 farms neither in sheep nor goat bulk milk. Yersinia enterocolitica was not detected in one farm producing sheep and goat milk, but further examination by PCR identified this strain as not pathogenic for humans.

In conclusion, the bulk milk examined was of high quality, but it should be mentioned that raw milk consumption can be a minor health risk factor for children, pregnant women and persons with immune deficiency. Finally, a low total bacterial count does not mean the absence of human pathogens.

**Literature**


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**EFFECT OF MILKING INTERVAL ON MILK YIELD AND COMPOSITION**

There are conflicting reports in the literature on the effect of milking interval on milk production, composition and somatic cell count (SCC). The issue of milking interval may become more evident as cow production potential increases due to improvement in both genetic merit and overall herd management. A study was undertaken to investigate the effect of unequal and equal milking intervals on milk yield, composition, SCC and free fatty acid (FFA) content in milk from cows producing in excess of 5000 kg in a lactation.

Sixty-six cows with a mean calving date of 16 February were assigned to two treatments for a 4-week period (16 April to 14 May). Cows on treatments 1 and 2 were milked at intervals of 16:8 h and 12:12 h, respectively. The results are presented in Table 1.

The daily yield of milk, protein and lactose and protein and lactose concentrations were not affected by a 16:8 h compared to a 12:12 h interval at peak lactation. Daily fat yield and concentration were reduced with the 12:12 h interval. SCC levels in the total daily milk yield were unaffected by milking interval. There was no consistent relationship between interval length and FFA level; however, all FFA levels were relatively low even after storage for 24 h. In conclusion, milking intervals of 16:8 h and 12:12 h do not adversely affect milk production in cows yielding ~5000 kg. Changes in milking interval, however, may offer a mechanism to manipulate milkfat concentration (if necessary) in the future and milk sampling consistently from a balanced number of a.m. and p.m. milkings is the preferred option.

**Literature**


B. O'Brien, J. O'Connell & W. Meaney
Teagasc Research Centre, Moorepark, Fermoy, Co.Cork, Ireland

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| Table 1: The effects of milking at two different interval regimes in a 24-h period on milk yield, composition and SCC level of milk |
|---|---|---|---|
| **Week 1–4** | **16:8 h** | **12:12 h** | **s.e.d.** |
| **Milk yield (kg/cow)** | 25.1 | 25.0 | 0.52 |
| **Fat yield (kg/cow)** | 0.867 | 0.825 | 0.0184 |
| **Fat conc. (g/kg)** | 34.72 | 32.98 | 0.673 |
| **Protein conc. (g/kg)** | 32.90 | 32.76 | 0.347 |
| **Lactose conc. (g/kg)** | 45.24 | 45.63 | 0.352 |
MILK QUALITY AND AUTOMATIC MILKING SYSTEMS (AMS)

INTRODUCTION
At present there are around 250 automatic milking systems operating in Europe. It has been estimated that during the next 10 years a marked proportion of dairy farmers at least in Europe will install AMS. The potential advantages are obvious in offering more cow-friendly conditions and more flexible time management and less social exclusion for farmers. Yet, the actual status of the technical development of AMS is not able to meet the legal requirements for milk production laid down in the Commission Directive (89/362/EEC) and the Council Directive (92/46/EEC). This short paper deals with some of the most open questions concerning the application of AMS and the legal requirements for milk quality and some general aspects of dairying under AMS conditions.

MILK QUALITY ASPECTS

Cowshed hygiene and cow cleanliness
The cowsheds must at all times be sufficiently clean, tidy and in a good condition. Before the milking of a cow is started the teats, udder and, if necessary, adjacent parts of the groin, thigh and abdomen of the cow must be clean.

These general conditions for the upkeep of premises for milk production defined by the Commission Directive 89/362/EEC (1989) cannot be fulfilled at present by AMS because there is no yet a technique available to detect automatically dirty or contaminated udder and/or teats and to perform the necessary cleanings.

Milking hygiene
Under hygienic aspects the foremilking should be done before measures to clean the udder are applied. AMS, in contrast, start with cleaning procedures and may therefore include a potential risk to distribute pathogens within the udder during automatic cleaning.

The Commission Directive (89/362) describes that before the milking of the individual cow the milker must inspect the appearance of the milk. If any physical abnormality is detected milk from the cow must be withheld from delivery. Cows with clinical udder diseases must be milked last or by a separate machine or handstripped and the milk must be withheld from delivery.

There is no AMS on the market which can fulfil these requirements. The interpretation of these hygienic requirements has initiated a very controversial discussion. The authorities in Sweden and in Denmark have decided that also in connection with the AMS a person has to perform foremilking and inspection of the appearance of milk before the automatic system is attached to the cluster. Obviously, other countries have not definitely decided what should be done to meet the "Directive" requirements. Concerning the legal situation it seems clear that only by the EU Commission modifications of the hygienic requirements for milking can be performed.

Animal health requirements for raw milk
Raw milk must originate from cows:
- incapable of giving the milk abnormal organoleptic characteristics;
- whose general state of health is not impaired by any visible disorder and which are not suffering from any infection of the genital tract with discharge, enteritis tract with diarrhoea and fever, or a recognizable inflammation of the udder,
- which do not show any wound likely to affect the milk.

Due to the fact that at present the AMS are not able to consider these aspects, the risk for an impairment of the hygienic quality of the milk is increased under automatic milking conditions.

Milk definition
Milk is defined as the secretion of the mammary gland, which means four quarters per gland. Therefore, if the AMS, for whatever reason, is not milking all teats, this secretion is not milk in the sense of the law.

Treatment and residues
The definition and determination of the withholding periods is based on regular milking intervals. Therefore, it is not clear what may happen with, for example, antibiotic residue concentration in milk under AMS conditions.

Bacterial counts
Based on the available information there does not appear to be any great problem in keeping the total bacterial counts in the milk in a range < 100 000/ml.

MASTITIS CONTROL

Under AMS conditions it is very often rather complicated to obtain quarter milk samples for mastitis diagnostics. Furthermore, there is no reference system available to interpret the data (for example cell counts) from milk samples stemming from quarters milked at irregular intervals. Without a diagnostic reference system it is nearly impossible to perform a necessary and justified mastitis control.

CONCLUSION
No doubt the application of AMS may offer a lot of potential advantages. However, before these positive aspects should be used, the hygienic quality of the milk must be principally ensured under the AMS conditions. During the IDF Annual Meeting in Aarhus, Denmark, September 24–27 1998, IDF Group of Experts A32 proposed that IDF request a temporary derogation pending the development of sensing systems which will fully meet the requirements of the current Hygiene Directives to the benefit of food quality and consumer safety.

Additionally, there seems to be a need for new guidelines for mastitis control in connection with AMS. In any case it must be ensured that by further improvement of the AMS the present problems can be solved.

Jörn Hamann
Department for Hygiene and Technology of Milk, School of Veterinary Medicine Hannover, Germany
VACCINATION WITH FERRIC ENTEROBACTIN RECEPTOR (FepA) TO CONTROL COLIFORM MASTITIS
(Summary of a recent PhD Tesis)

The area of coliform mastitis control with the greatest advances in recent years is vaccination. The commercial sale of Escherichia coli JS (O111:B4) vaccines provides dairy producers with a management tool to reduce the severity and duration of clinical signs following a coliform intra-mammary infection (IMI). However, E. coli JS vaccines do not prevent IMI. Therefore, the need still exists for an effective vaccine to prevent IMI and control the growth of coliform bacteria in the bovine mammary gland, especially during the nonlactating period when the rate of new coliform IMI is four-fold higher than that during lactation.

This study was a unique approach to achieve potential control of coliform mastitis during the nonlactating period. Iron is an essential element for survival and multiplication of many bacteria. However, most iron in mammary secretions of nonlactating cows is bound to lactoferrin; concentrations of which may reach 20–30 mg/ml. Consequently, the amount of free iron is too low to support the growth of bacteria. Coliform bacteria can overcome this limitation by utilizing high affinity iron acquisition systems. The systems are involved in the synthesis of efficient iron chelators (siderophores), iron-regulated outer membrane proteins (IROMP) and some enzymes for the utilization of iron. Among these high affinity iron acquisition systems, the enterobactin iron acquisition system is of particular interest in bacterial pathogenicity, because enterobactin has the highest affinity among all siderophores and the enterobactin system is common in coliforms isolated from a variety of clinical sources. The ferric enterobactin receptor FepA plays an important role in iron assimilation. The surface-exposed region of FepA is responsible for the binding of ferric enterobactin. Molecular mass and antigenic properties of FepA were highly conserved in different genera of Gram-negative bacteria. Previous research indicated that antibodies against IROMP, some of which are siderophore receptors, could prevent infections in animal models or inhibit the growth of bacteria in vitro. These findings make FepA a possible vaccine candidate for controlling coliform mastitis during the nonlactating period. The general goal of this study was to determine the role of FepA in the pathogenesis of bovine mastitis caused by coliform bacteria.

Expression of siderophore and the ferric enterobactin receptor FepA by E. coli, Klebsiella pneumoniae, and Serratia marcescens was investigated. Bacterial isolates from bovine IMI in five herds were tested by the chromo azurol sulfonate assay to detect siderophore production. All isolates of E. coli (n = 25), K. pneumoniae (n = 25), and S. marcescens (n = 5) produced positive siderophore production. Each isolate expressed IROMP when grown in tryptic soy broth plus iron chelator, "mph"-dipyridyl. Rabbit polyclonal antisera against E. coli K12 FepA was used in conjunction with the immunoblot technique to examine frequency distribution of FepA expression and the degree of antigenic homology of FepA among the 53 coliform isolates. All isolates expressed FepA that reacted with the polyclonal antisera under iron-restricted conditions. Both the molecular mass and the antigenic properties of FepA were highly conserved among Gram-negative bacteria isolated from bovine IMI.

The ability of a murine monoclonal antibody (MAb35) to block the enterobactin ligand binding site of FepA and to inhibit the growth of coliform bacteria derived from bovine IMI was determined in an iron-restricted medium. Immunoblot revealed that MAb35 recognized FepA on whole cell lysates of E. coli isolates (n = 25). Only 4 of 25 K. pneumoniae isolates produced FepA that reacted with MAb35. This result coincided with the results of an in vitro growth assay. Growth of all E. coli isolates was significantly inhibited by the addition of MAb35 to synthetic medium containing apolactoferrin. Antigenic variation in the enterobactin binding site resulted in a low percentage of K. pneumoniae isolates that were inhibited by MAb35. As little as 50 μg/ml of purified MAb35 had an inhibitory effect on bacterial growth in the synthetic iron-restricted medium.

The anti-FepA antibodies used in previous experiments were from lab animals. Antigenicity of FepA protein in cows was further investigated. FepA protein was successively extracted from E. coli 471 by N-lauroylsarcosine sodium salt and Triton X-100. Ion-exchange chromatography finally resulted in substantial purification of FepA. Immunization with FepA elicited an immunological response in serum and milk. Serum and whey IgG titers to FepA proteins from cows immunized with FepA were significantly higher than those from cows immunized with either E. coli JS or PBS. ELISA tests showed that purified IgG from cows immunized with FepA was cross-reactive to E. coli and K. pneumoniae isolates from naturally occurring bovine IMI.

The ability of purified bovine IgG from cows immunized with FepA to inhibit the growth of coliform bacteria isolated from bovine IMI was finally studied in iron-restricted media. All isolates of E. coli (n = 21) and K. pneumoniae (n = 21) were tested for growth in a chemically defined medium containing 0.5 mg/ml of apolactoferrin and in a pooled source of dry cow secretion. The addition of 4 mg/ml of purified bovine IgG directed against FepA in the synthetic medium resulted in significant growth inhibition for both E. coli and K. pneumoniae isolates. Growth reduction of E. coli was greater than that of K. pneumoniae. In the dry cow secretion, growth of each E. coli isolate, but less than half of K. pneumoniae isolates (43%) were inhibited by IgG from cows immunized with FepA. Purified bovine IgG from cows immunized with E. coli JS had a minimal inhibitory effect on the growth of both E. coli and K. pneumoniae isolates in the synthetic medium. In the dry cow secretion, IgG from cows immunized with E. coli JS had no inhibitory effect on the growth of E. coli and K. pneumoniae isolates. Supplementation of 50 μM of ferric chloride to the medium completely reversed the inhibitory effects of the antibodies and lactoferrin. Bovine IgG directed against FepA apparently inhibited the growth of coliform bacteria by interfering with the binding of the ferric enterobactin complex to the cell surface receptor FepA.

The results of these studies suggest that FepA protein may be used as an effective vaccine component to optimize current vaccination programs against coliform IMI. Clinical trials are needed to determine whether the FepA vaccine would prevent coliform IMI and further reduce the incidence and severity of clinical episodes of coliform mastitis during the nonlactating period compared with currently available whole-cell bacteria.

J. Lin, J.S. Hogan & K.L. Smith
Department of Animal Sciences,
Ohio Agricultural Research and Development Center,
The Ohio State University,
1680 Madison Ave, Wooster, OH
44691, USA
UDDER HEALTH ON DAIRY FARMS: A LONGITUDINAL STUDY (Summary of a recent PhD thesis)

Udder health management has been an important component of dairy farming for the last decades. Udder health is more than subclinical mastitis. Complete udder health also includes a low incidence of clinical mastitis, a low risk of residues, and absence of pathogenic microorganisms. However, clinical mastitis continues to be a significant problem. When designing a herd-specific mastitis control programme, bulk milk somatic cell count (BMSCC), and distribution of clinical and subclinical pathogens have to be taken into account. The scope of this thesis was to contribute to knowledge necessary for the design of herd-specific complete udder health programmes.

Based on mean annual BMSCC, three categories, each consisting of 100 dairy herds, were selected. Only herds that housed lactating cows in a free-stall barn during winter, that participated in a milk recording system in which the production of cows was measured three or four times weekly, that had annual production quota between 300 000 and 900 000 kg, and that had cows of the Holstein-Friesian or Dutch Friesian breeds were selected. The mean herd size was 75 adult cows (SD = 21.1) and varied from 40 to 143. The BMSCC was determined 13 times/year by a milk quality laboratory using a Fossomatic cell counter. The farmers collected milk samples from every quarter with visible signs of clinical mastitis before treatment. During the study, the farmers were questioned on relevant aspects of mastitis control and prevention. A number of housing items (for example size of the cubicles, diameter of ventilation openings) were measured by the interviewer.

Mean incidence rate of clinical mastitis (IRCM) was 0.278, 0.257, and 0.252 per 365 cow-days at risk in herds with low (150 000), middle (150 000–250 000), and high (250 000–400 000 cells/ml) BMSCC, respectively. The IRCM was not different among the three categories. Clinical mastitis caused by Gram-negative pathogens, such as Escherichia coli, Klebsiella spp. or Pseudomonas spp., occurred more often in herds with a low BMSCC. Clinical mastitis caused by Staphylococcus aureus, Streptococcus dysgalactiae, and Streptococcus agalactiae occurred more often in herds with a high BMSCC. However, Streptococcus uberis IRCM was not different among the three BMSCC cohorts. Clinical mastitis with systemic signs of illness occurred more often in herds with a low BMSCC. Both overall culling rate and culling rate for clinical mastitis were not different among groups categorized by BMSCC. In herds with a high BMSCC, however, more cows producing milk with a high somatic cell count (SCC) were culled.

The differences in BMSCC between the categories could well be explained by the management practices studied. This was not only true for the difference between the high and low BMSCC category, but also for middle and low, and high and middle categories. Management practices known to be important in high BMSCC herds, such as dry cow treatment, milking technique, post-milking teat disinfection, and antibiotic treatment of clinical mastitis cases, were found to be also important to explain the difference between the middle and low BMSCC categories. On low BMSCC herds more attention was paid to hygiene than on middle or high BMSCC herds. Supplementation with minerals occurred more frequently on low compared to middle and high BMSCC herds.

Management practices associated with overall IRCM can be divided into three groups. Associated with resistance of the cow were: feeding corn silage to lactating cows (preventive), size of the air inlet (increased risk with increased size), and milk vacuum (increasing risk with increasing level). Variables that were associated with exposure to pathogens were: lactating cows not pastured at night (increased risk), dry cows and pregnant heifers housed in the same group (increased risk), and hygiene variables like straw always removed from calving parlour after calving (preventive), thickness of straw bedding in calving parlour >5 cm (preventive), and the use of a well as drinking water source (increased risk).

Post-milking teat disinfection (in low BMSCC herds), and years of practising dry cow therapy were positively associated with IRCM. After correction for use of post-milking teat disinfection, low BMSCC herds had lower IRCM compared to other herds. Lower IRCM was found in herds where clinical mastitis cases were milked out frequently. Also associated with a higher IRCM was the frequency of checking pregnant heifers for clinical mastitis.

Incidence rate of clinical E. coli mastitis was mostly related to housing conditions, hygiene, and milking machine. Staph. aureus IRCM was associated with factors that were associated with bulk milk somatic cell count level, and factors that might be due to cause-and-effect reversal. There was a strong positive correlation between Str. dysgalactiae and Staph. aureus IRCM. Incidence rate of clinical Str. dysgalactiae mastitis was related to nutrition, milking technique and milking machine. Streptococcus uberis IRCM was associated with housing, nutrition, and milking machine related factors.

The effect of farmers’ management style on udder health was studied to evaluate how mastitis control programmes should be offered to farmers. Two groups of farmers could be differentiated. The first group was identified as ‘Clean and Accurate’, the second group as ‘Quick and Dirty’. The relationship between clusters and BMSCC category was high. The relationship between clusters and IRCM was weak. Compared to high BMSCC herds, herds with a low BMSCC were managed by farmers who were younger, had children with a higher education, and were more eager to invest. Low BMSCC herds had better record keeping, and knew the cows better. The most striking difference between farmers of low and high BMSCC herds was that the first group worked precisely rather than fast, and the last group fast rather than precise. As a result, hygienic conditions of a low BMSCC farm were better than on a high BMSCC farm.

H. Barkema
Animal Health Service, P.O. Box 361, 9200 AJ Drachten, the Netherlands
A STUDY OF DAIRY HERDS WITH CONSTANTLY LOW OR CONSTANTLY HIGH BULK MILK SOMATIC CELL COUNT, WITH SPECIAL EMPHASIS ON MANAGEMENT

(Summary of a recent PhD thesis)

Swedish dairy farms with low bulk milk somatic cell counts (LC) for at least 7 years and farms with high cell counts (HC) for the same period were studied. Herds had to produce >100 tons of milk and be enrolled in the official milk recording scheme to be eligible for inclusion. LC herds had to have an average arithmetic cell count over the observation period of less than 137 000 cells/ml and HC herds had to have an average arithmetic cell count of 325 000–525 000 cells/ml. There was complete separation, as regards BMSCC, between the two types of farms. The sampled farms were studied via (1) data available in Swedish databases on dairy farms (250 LC and 202 HC), and (2) through an in-depth field study (52 LC and 30 HC). The farms were located in seven different regions in the southern half of the country, Skåne and Halland excluded. Variables were first screened with conventional univariable methods. Variables with P ≤ 0.2 were then analysed using multivariable statistical methods – logistic and linear regression – to elucidate differences between farm types.

The LC farms were smaller, 29 versus 37 cows, respectively, and generally had higher incidences of treatments of cattle diseases than the HC farms. The incidence of mastitis treatments on LC farms was not higher than the national average. The LC farms produced more milk/cow and had better fertility than the HC farms (Table 1). This indicates better management on the LC farms. A statistically significantly higher proportion of LC farms with SRB (Swedish Red and White breed) compared to HC farms, 68% and 14%, respectively. Only 4% of the LC herds were purebred SLB (Swedish Holstein) herds.

The results of the in-depth field study also indicated better management and better care of the livestock on LC farms. Thus, the cows on LC farms were cleaner, better sheared, had better trimmed claws and were of the SRB-breed. The LC farmers used rubber mats and more straw of better quality more often in the stalls. The milking lines had greater diameters, the milking technique was much better, and teat dipping was practised more frequently. The farmers on LC farms milked their high cell count cows last, that is, statistically significantly more often than the HC farmers, they had a strict milking order, so preventing transmission of bacteria during milking. In the presence of the two management related variables “Milking order” and “Teat dipping” all variables concerning dry cow therapy were evicted from the logistic regression models.

The calves on LC farms were more often tended by a female (generally the farmer's wife), the calves were cleaner, received whole milk for a longer period of time and were dewormed more often than calves on HC farms. The spouses worked together more often on LC farms and they liked cows and liked to milk cows more than was the case with the HC farmers. There were more children in the LC households although there was no difference in age between the two types of farmers. The farmers/milkers on LC farms were judged to be more patient than their counterparts on HC farms, where there was more employed personnel. The LC farmers had a more information seeking behaviour and were more verbally mobile. The study indicates the need for a new holistic approach for control of udder health.

Torkel Ekman,
Department of Obstetrics and Gynecology, Veterinary Faculty, Swedish University of Agricultural Sciences, P.O. Box 7039, S-750 07 Uppsala, Sweden

| Table 1: Medians of some disease treatments and means of fertility parameters and some demographic variables that were statistically significantly different between LC and HC farms |
| --- | --- | --- |
| Variable | Type of farm | |
|  | LC (250) | HC (202) |
| Mastitis, AID<sup>a</sup> | 17.6 | 12.3 |
| Teat-treads, AID | 0 | 2.5 |
| Cystic ovaries, AID | 2.7 | 0 |
| Feet disorders, AID | 3.5 | 2.0 |
| Other diseases<sup>b</sup>, AID | 7.7 | 5.1 |
| Calf-to-call interval, days | 381 | 393 |
| Calving to 1st AI, days | 81 | 90 |
| Calving to last AI, days | 107 | 118 |
| Milk production, kg | 7432 | 6634 |
| Mean no. of cows/herd | 29 | 37 |

<sup>a</sup>AID: annual incidence density – number of cases/100 cow years at risk.
<sup>b</sup>Several diseases not listed separately in the Swedish animal health records and lumped together as "other".
Mastitis Notes from Member Countries

SWITZERLAND

MASTITIS PATHOGENS ISOLATED IN SWITZERLAND 1987 – 1996

Samples taken by Udder-Health-Service Extension Workers from Cows with Subclinical Mastitis

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<tbody>
<tr>
<td>Bact. negative</td>
<td>24.5%</td>
<td>23.7%</td>
<td>28.8%</td>
<td>26.7%</td>
<td>26.4%</td>
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<td>15.4%</td>
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<td>9.4%</td>
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<td>Bact. positive (= 100%)</td>
<td>75.5%</td>
<td>76.3%</td>
<td>71.2%</td>
<td>73.3%</td>
<td>73.6%</td>
<td>80.9%</td>
<td>82.0%</td>
<td>84.6%</td>
<td>91.0%</td>
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<tr>
<td>Streptococcus agalactiae</td>
<td>7.3%</td>
<td>7.2%</td>
<td>5.7%</td>
<td>5.0%</td>
<td>5.6%</td>
<td>3.8%</td>
<td>3.6%</td>
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<tr>
<td>&quot;Other streptococci&quot;</td>
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<tr>
<td>(S. uberis, S. dysgalactiae, enterococci)</td>
<td>27.6%</td>
<td>25.1%</td>
<td>23.8%</td>
<td>24.0%</td>
<td>21.9%</td>
<td>25.8%</td>
<td>27.6%</td>
<td>28.4%</td>
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<tr>
<td>Staphylococcus aureus</td>
<td>41.2%</td>
<td>43.3%</td>
<td>41.4%</td>
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<td>41.4%</td>
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<td>45.2%</td>
<td>41.5%</td>
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<td>39.8%</td>
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<td>&quot;Other staphylococci&quot;</td>
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<tr>
<td>(S. epidermidis, S. xylosus, S. hyicus, Micrococcus sp.)</td>
<td>16.6%</td>
<td>16.2%</td>
<td>19.0%</td>
<td>20.4%</td>
<td>16.4%</td>
<td>16.5%</td>
<td>14.2%</td>
<td>18.4%</td>
<td>16.2%</td>
<td>18.8%</td>
</tr>
<tr>
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</tr>
<tr>
<td>(e.g. C. bovis, coliforms, A. pyogenes)</td>
<td>7.3%</td>
<td>8.2%</td>
<td>10.1%</td>
<td>8.4%</td>
<td>14.7%</td>
<td>8.5%</td>
<td>9.4%</td>
<td>8.9%</td>
<td>7.3%</td>
<td>15.8%</td>
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29.01.1998 MSCH/WIWO/MASTPAF1

Samples taken by Veterinarians from Cows with Clinical Mastitis

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<tr>
<td>Bact. negative</td>
<td>21.8%</td>
<td>22.3%</td>
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<tr>
<td>Streptococcus agalactiae</td>
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<td>2.6%</td>
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<td>1.9%</td>
<td>1.6%</td>
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<td>1.3%</td>
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<tr>
<td>&quot;Other streptococci&quot;</td>
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<td></td>
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<tr>
<td>(S. uberis, S. dysgalactiae, enterococci)</td>
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<td>32.9%</td>
<td>32.4%</td>
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<tr>
<td>(S. epidermidis, S. xylosus, S. hyicus, Micrococcus sp.)</td>
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<td>12.9%</td>
<td>17.5%</td>
<td>17.9%</td>
<td>14.8%</td>
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<tr>
<td>Actinomyces pyogenes</td>
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<td>2.6%</td>
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<td>2.0%</td>
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<tr>
<td>Yeasts</td>
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<td>1.6%</td>
<td>1.6%</td>
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<td>1.9%</td>
<td>1.7%</td>
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<tr>
<td>(Nocardia spp., Pseudomonas spp., Bacillus spp., C. bovis)</td>
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<td>8.5%</td>
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<td>6.0%</td>
<td>5.8%</td>
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20.01.1998 MSCH/WIWO/MASTPAF2

Prof. D.M. Schällibaum, Federal Dairy Research Institute, Milk Production Section, CH-3097 Liebefeld-Berne, Switzerland.
THE HEALTH PLANNER: A NEW CONCEPT IN MASTITIS CONTROL

Much knowledge on mastitis is available and can be applied in mastitis management. Besides preventive measures and application of knowledge when problems occur, monitoring of the mastitis status of a farm is an important aspect in mastitis management. With a good monitoring system effective measures may be taken as fast and effective as possible. Monitoring mastitis on an individual cow basis is becoming fairly common on dairy farms using individual somatic cell counts (SCC) as part of a dairy herd information programme. Monitoring mastitis on a farm level is also important and may help the dairy farmer to take preventive measures before the problem grows out of hand.

In the Netherlands a project has been initiated to develop a health planner, which can support the dairy farmer in mastitis management. This mastitis planner is based upon a common management planning circle (Figure 1).

The management planning circle starts with the definition of goals, represented by target values. Target values are set by the farmer and his consultants based on the specific situation on the farm and the personal goals of the farmer. Given the goals, a management strategy is planned and executed. From that point on, the monitoring circle starts, consisting of the recording, calculation and evaluation of monitoring parameters. Based upon a pre-set decision criterion, the monitoring circle will be continued or the problem circle will be entered. The decision criterion is set in such a way that the probability of entering the problem circle unnecessarily is small. Standard, a 95% confidence interval is used. In the problem circle, an analysis protocol has to be carried out in order to find possible causes for the inability to meet the pre-set targets and, if necessary, adjust the planning. If necessary these can be adapted in time.

The health planner for mastitis control consists of tools to obtain the current mastitis prevention status of a farm, tools to register preventive measures that were planned, a tool to monitor the mastitis status of a farm and a scheme to analyse occurring herd mastitis problems. For the monitoring of the mastitis status of a farm, new parameters were developed and tested. All tools are extensively described and much background knowledge on mastitis is given.

The health planner for mastitis control has been tested on 250 Dutch dairy farms and is now implemented in a project of the Dutch farmers organization (LTO) to increase the health status of Dutch dairy farms.

H. Hogeveen  
Research Station for Cattle Sheep and Horse Husbandry, Lelystad, the Netherlands

T.J.G.M. Lam  
Department of Herd Health and Reproduction, Utrecht University, Utrecht, the Netherlands

E.G. Grijzen  
Agricultural Telematics Centre, Wageningen, the Netherlands

Y.H. Schukken  
Department of Herd Health and Reproduction, Utrecht University, Utrecht, the Netherlands
DUTCH MASTITIS PLATFORM

Mastitis research within the Netherlands is scattered among a number of research institutes. There is a relative large interest in mastitis, and a large number of smaller and bigger projects with regard to udder health are underway at any given moment. To be able to inform all interested mastitis research workers a Mastitis Platform was initiated approximately 7 years ago. In this platform, researchers and extension specialists from the Animal Health Service, the Research Station for Horses, Cattle and Sheep, the Faculty of Veterinary Medicine, the Institute for Agricultural Mechanisation (Imag-DLO), and the Institute for Animal Health (ID-DLO) are participating. There are currently approximately 20 participants.

The Platform meets twice a year, and ongoing research is presented and discussed. All members participate in presentation of results. A preference is given to relatively large projects leading to a PhD dissertation. Often discussions take place that lead to further investigations, or further analysis of the data.

The Platform is also the sounding board of the Dutch representative in the IDF - A2 committee. Finally, the Platform discusses important developments in the field of udder health. For example, the platform has taken initiatives to discuss with the national DHIA system (NRS) about presentation of cell count data, and also the development of that udder health planner was closely followed and evaluated in the Platform.

The advantage of the Platform is especially the increased communication between representatives of different institutes. The interest in udder health binds all members. The open discussions on research projects also improve the transfer of research results directly into the field. The distance between discovery and application is therefore as small as possible.

The Platform appears to be a necessary component of contemporary udder health research in the Netherlands. When udder health promotion is an important issue for the dairy farmer and the dairy industry, it is especially important that researchers at different sites throughout the country participate in scientific discussions. This leads to better understanding, fruitful discussions, and eventually to a better extension message to the dairy farmer.

Y.H. Schukken
Department of Herd Health and Reproduction, Utrecht University, the Netherlands

Events & Meetings

US NATIONAL MASTITIS COUNCIL – UPDATE

The 1998 Annual Meeting was held 25–28 January in St Louis, Missouri, in conjunction with the American Society of Agricultural Engineers 4th International Dairy Housing Conference. Keynote speaker was Dr K. Larry Smith, The Ohio State University, who opened the general sessions with a somewhat controversial presentation on milk quality from a worldwide perspective, focusing on the issue of how somatic cell count limits may impact the ability of the US to export dairy products on the world market. Currently, the US has the highest upper limit for SCC (750 000) compared to other major milk producing countries. While acknowledging that most producers in the US already produce milk with SCC less than 400 000, Smith argued that the US should lower the SCC limit so that the US would appear more competitive on a milk quality basis for marketing dairy products internationally. Smith also argued that lowering the SCC limit would increase US consumer perception of safety and wholesomeness of US milk and milk products. The major argument against lowering the SCC regulatory limit in the US is that milk somatic cells do not represent a direct human health risk. Smith argued that NMC was an appropriate forum to debate the issue of what the SCC limit should be in the US, and strongly suggested that NMC take a greater leadership role in this regard.

The milk quality session continued with speakers from three countries (US, Canada, and New Zealand) describing quality milk production, followed by speakers giving perspectives on regulatory, consumer and export issues surrounding international marketing of milk. The final speaker described how the US pork industry has tackled the international market. The session wrapped up with a panel discussion which was lively at times, particularly when the SCC limit issue was debated.

The second day of the program was held jointly with the 4th International Dairy Housing Conference and drew large crowds. Sessions covered test and interactions with bacteria and milking machines; management challenges for the future dairy farm; housing and facility design; and robotics and automation of the dairy farm. The meeting also included four specialty short courses and the annual Technology Transfer Session which featured 54 poster presentations on mastitis control, milk quality and milk safety. All papers, including the poster presentations, are in
Three new educational offerings are available from NMC. A video entitled "Procedures for Evaluating Milking Systems" was produced by the Milking Machine Committee and is meant to be a companion piece to the publication "Procedures for Evaluating Vacuum Level and Airflow in Milking Systems". The second new publication is a revised edition of the former "Laboratory and Field Handbook on Bovine Mastitis" now called the "Laboratory Handbook on Bovine Mastitis". The new edition has been updated and improved significantly by a subcommittee of the Research Committee headed by Dr. J. S. Hogan, The Ohio State University, Wooster, Ohio. The third publication available is "Recommended Protocol for Determining Efficacy of a Postmilking Barrier Teat Dip Based on Reduction of Naturally Occurring New Intramammary Infections". This document was developed by the NMC Research Committee in response to the need for a separate protocol for the type of teat dips commonly referred to as "barrier" teat dips. The protocol does not include any definition or description of a barrier dip, however, since there currently is no industry-wide standard or consensus as to what constitutes a "barrier" dip.

NMC has had numerous requests over the years to provide many of the publications in languages other than English. NMC has put together an action group to investigate the feasibility of translating key NMC publications and is making progress in that direction. First efforts are likely to be English into Spanish but translation to other languages is being considered.

Future meeting dates and venues include: NMC Regional Meeting, 20 August 1998 at the Hyatt Regency Bellevue, Bellevue, Washington; NMC 38th Annual Meeting, 14–17 February 1998 at the Hyatt Regency Crystal City, Arlington, Virginia. Consideration is currently being given to holding the Regional Meeting in 1999 at some venue in Canada. For all of the latest information regarding meetings and registration visit the NMC web site <www.nmconline.org>. The web site also has the latest information on publications and how to order.

Prof. K. Larry Smith
The Ohio Agicultural Research and Development Center, 1680 Madison Ave, Wooster, OH 44691, USA
smith.149@osu.edu
Anne Saeman
National Mastitis Council, 2820 Walton Commons West Suite 131, Madison, WI 53718, USA
anne@nmconline.org

BRITISH MASTITIS CONFERENCE 1998

The 11th British Mastitis Conference on 7 October 1998, attended by more than 200 delegates, included 10 papers presented by authors of six different nationalities. The main themes were mastitis therapy and the effect of machine milking on teat condition and udder health. The topic of "mastitis therapy" was introduced by Eric Hillerton. He discussed the strategies of treating the disease, the infection and the whole cow. Attitudes in the UK have changed, with the main objective now being to achieve the best milk quality possible. This has led to more concentration on eliminating infection. The IDF guidelines on therapy (Bulletin No. 320) are being recognized as important. Mastitis therapy is being regarded as a welfare issue.

A view from the US was presented by Ron Erskine from Michigan State University. He emphasized that decisions on therapy focus on efficacy, economics and evasion of drug residues. An important component in therapy is the success of dry cow treatment in resolving subclinical and chronic infections, and preventing new infections. This is related to the high incidence of clinical cases in early lactation when immune function is impaired. He believes in the need to enhance immune capability.

Andrew Biggs presented the view of the practising vet in treating mastitis cows. He was concerned with reducing the duration of infection by achieving bacteriological cure. Success from using aggressive treatment, often an extended treatment period or combination of intramammary and parenteral antibiotics, was reported, especially for quarters persistently infected by Staphylococcus aureus or Streptococcus uberis. He supported the need for early detection to allow effective treatment and that treatment was always necessary for clinical mastitis on welfare grounds alone.
Alternative treatments to antimicrobials were considered in two papers. John Egan from Dublin summarized a series of trials conducted in Ireland on the use of proprietary homeopathic remedies to treat clinical mastitis. These were singularly unsuccessful in controlled trials yet still achieve significant sales, with 43% of users claiming field success. Malla Hovi (University of Reading) reported preliminary results on the attitudes to mastitis treatment and the effects on mastitis prevalence from a number of farms converting to organic status. The main alternative to antibiotics was homeopathy on 52% of organic farms. Antibiotic treatment of clinical mastitis in lactation is allowed on organic farms and was used on 40% cases on 15 organic farms compared to 100% cases on 7 conventional farms. Dry cow therapy is not usually allowed on organic farms and 25% of the clinical cases on the organic farms occurred in the dry period. The duration of treatment was longer with homeopathy but milk withdrawal period shorter. There was no overall difference in the incidence of clinical mastitis between organic and conventional farms studied but the organic farms reported a much higher bulk tank cell count.

The final paper on therapy, from Julie Fitzpatrick of Glasgow Vet. School, described the importance of pain in clinical mastitis. Pain has been shown to be real during the clinical episode and there is also an increased sensitivity to pain for some time afterwards. Treatment of the cows during mild or moderate mastitis with the non-steroidal anti-inflammatory drug, flunixin meglamine, reduced sensitivity to pain but only for 1 day. The effect was not seen in severe cases. It was concluded that pain is a significant component of clinical mastitis, that pain relief is possible and should become a significant contribution to animal welfare.

In a short update on summer mastitis, Elizabeth Berry reported no significant changes in incidence or cost over 10 years. Risk factors remain the same and hence the main preventive measures of dry cow therapy and good fly control, now mostly by pour-ons, remain essential. Brian McGuirk of Genus gave an informal update on use of bull proofs in selecting for lower cell count and possibly incidence of clinical mastitis. He showed clearly, using UK, US and Swedish data, the potential benefits whilst criticizing the claims that lowering cell count will lead to more clinical mastitis. He considered that farmers and cows could benefit but that an increase in enthusiasm from breeding companies is necessary.

The final session was on the milking machine. Ian Ohnstad (ADAS) presented data on the effects of recently installed milking machines on cow behaviour, teat condition and milking performance. Important lessons on cow and cluster position need to be learnt. Poor milking performance, especially overmilking from a poor routine or lack of cluster removers can lead to significant teat trauma and discomfort to the cow. The drive to increase parlour efficiency measured as a higher throughput of cows is at a cost of poor milking conditions and poorer cow welfare.

Graeme Mein from the University of Wisconsin concluded the meeting with a most lucid presentation on the changing appreciation of how to milk cows properly. He showed clearly the need for good teat preparation, achieving and maintaining good milk flow and the need to remove the milking cluster earlier than often appreciated. Earlier removal does not increase strip yield or lead to more mastitis and does improve parlour performance and teat condition. Good milking conditions can be assessed roughly by observing how evenly and completely cows milk, the amount of liner slip, checking teat condition on cluster removal and by observing cow behavioural responses to the milking action.

The first poster award went to Trevor Jones for his work on toxins from Staphylococcus aureus mastitis. The proceedings are available, priced £18, from Trish Agnew, Novartis Animal Health, Whittlesford, Cambridge CB2 4XW, UK.

J.E. Hillerton
Great Britain

The IDF – A2 meeting in Oslo

The IDF Group of Experts on mastitis (Group A2) had its summer meeting in Oslo, 4–7 June 1998, hosted by Olav Østeras and Kerstin Plym Forshall from the Norwegian Dairies Association in cooperation with the National Veterinary Institute, the Norwegian College of Veterinary Medicine, Department of Food Production and Plant and Animal Health at the Royal Ministry of Agriculture and the Norwegian Animal Health Authority.

Twelve group members and three observers were served a programme covering information about the Dairy Industry in Norwegian Agriculture to the presentation of ongoing Norwegian research in the area of mastitis at the National Veterinary Institute and the Veterinary High School in Oslo.

The group members presented Mastitis Control Schemes from their member countries at a seminar in the old manor house owned by NRF (Norwegian Breeders Association). The seminar provided useful information about current principles for mastitis control in the member countries. The reports from the member countries will be organized into a single document for later publication.

The discussions in the A2 Group were time concentrated on the first draft of a "Mastitis Glossary" and the different principles for mastitis therapy in the member countries. The Nordic countries use selective dry cow therapy instead of blanket dry cow therapy as recommended in the five point plan. There are also different opinions on principles for clinical mastitis therapy, also between the Nordic countries. The action group for "Mastitis therapy" led by E. Hillerton (UK) will review the principles for different therapy methods used in order to continue the attempts to analyse further these differences and their consequences in different parts of the world.

The former chair of the Group A2, James Booth, gave a report from the last ring trial on somatic cell counts in Kiel, more than 25% of the labs were outside the range of acceptable results. Booth underlined the useful work done in this area and stated that more can be done in the future.

Booth also reported on the current status of milk production in Chile and the country's plans to increase the milk production in the region together with other countries in the same region to compete for world market.

Finally, the group attended a study tour to two typical Norwegian dairy farms and some social events together with the hosts for this year's A2 summer meeting.

Kerstin Plym Forshall
DVM, Norwegian Cattle Health Service, TINE Norwegian Dairies BA, Langbakken 20, Postboks 58, N-1430, Norway
UDDER HEALTH AT THE IPCD

The 10th International Conference on Production Diseases in Farm Animals (ICPD) was held in Utrecht (the Netherlands) from 24 to 28 August 1998.

There was a special session about “Milk production and diseases of the mammary gland”. The highlights of the oral presentation are listed below.

A keynote lecture titled “Somatic cell counts (SCC) measurements: a diagnostic tool to detect mastitis” was given by H. Leavens (Belgium). The sources of variation in SCC were discussed as well as methods to distinguish between infected and uninfected cows or quarters.

At 15 farms in Germany almost 10,000 milk flow curves were recorded during a 12-month period. Mrs. U. Wessels presented the results. In cows having a SCC < 100,000/ml 25% optimal curves were recorded; this number was reduced to 12% in animals having a SCC > 400,000/ml. In 62% of the foremilk samples no mastitis pathogens could be detected; only 22% of these cows exerted an optimal milk flow curve.

In contrast, only 10% of cows proved optimal curves when subclinical or clinical infections were present in every udder quarter.

In addition to previous research with subclinical mastitis, J. Sol (the Netherlands) presented the factors affecting the treatment of cows with clinical mastitis caused by Staphylococcus aureus (SAU). Data were obtained from 134 cases at 100 farms. Use of an interfering antibiotic therapy, susceptibility to penicillin and stage of lactation appeared to be the most important factors. These are not the same factors as for the treatment of subclinical infections.

The physiological variation of milk components as SCC, NAGase, electrical conductivity, fat, lactose and chloride was reported by J. Hamann (Germany). Special attention was given to milking frequency. Data from 13 healthy cows were sampled. There was great individual cow variation of the different parameters. Within-cow comparison of two versus four milkings per day applied to two quarters each evoked different changes in milk components. The application of varying milking intervals may require a new classification scheme for mastitis diagnosis.

Jánosi (Hungary) put forward the idea that hyper ketonaemia may predispose for early puerperal mastitis, but mastitis fails to cause long-lasting endocrine and metabolic alternations in herds producing low cell count milk. These results were based on data from 199 cows from 3 commercial herds.

From an observational study of intramammary SAU infection in 3 herds in the Netherlands, the relationship between SCC and bacterial shedding was examined. There was neither a single dominant pattern nor a consistent order of events in a time series of SCC and bacterial counts (BC). This is in contrast to the studies done using experimental infections, where a counteracting phasic pattern in the temporal relation between SCC and BC was observed. Mrs. R. Zadoks received an award for her presentation of this study.

Seven strains of Escherichia coli originating from clinical cases of bovine mastitis were tested for their adhesion to and invasion into udder epithelial cells in vitro. D. Dopfer concluded that the invasion of E. coli into udder epithelial cells is possible and that there are both strain and cow factors involved in the invasion.

Prevalence of mastitis in 308 dairy heifers at 15 farms in Schleswig-Holstein (Germany) was studied by H. Klaas. One-third of all heifers start lactation with an intra-mammary infection and increased SCC. During the first lactation about 50% of all cows suffered at least once from udder infections and half of them again during subsequent lactation.

Prevalence and etiology of subclinical mastitis were studied in 135 dairy herds managed under guidelines of controlled organic farming. The study involved a total of 1321 cows; subclinical mastitis was diagnosed in 34% of the cows. P. Trachslo noticed considerable effects of individual and farm management factors and preventive measures of milking.

T. Baars (the Netherlands) asked that attention be given to alternative minerals, vitamin and trace element supplements to increase the resistance to infections in the prevention of mastitis on organic farms.

The full papers of the invited presentations, and abstracts of all other presentations and posters will be published in the proceedings.

W.J.A. Hanekamp
Research Station for Cattle, Sheep and Horse Husbandry (PR), Lelystad, the Netherlands
Announcements

IDF SYMPOSIUM ON UDDER DEFENCES AND IMMUNOLOGY

IDF A2 groups recently agreed on the importance of organizing symposiums every 5 years on a "special topic" between the traditional "10 years" mastitis symposium. The topic for the first of these symposiums will be udder defences and immunology.

The general aim of the symposium is to cover the scientific and technical aspects of udder immune defences and to provide a large forum to discuss:
- the state-of-the-art on udder immunological defences
- the influences on udder immune system from physiological, nutritional, chemical and hormonal factors

- the most recent developments in vaccination and modulation of immune defences.

To fulfill these aims, the preliminary programme will include the following sessions (see table below).

For each of the main topics, and in a few cases the sub-topics, each session will start with a position paper presented by a leading scientist. This will be the basis for the subsequent presentations and discussions. Besides oral presentation, a poster session will be organized. Position papers, papers and posters will be included in the meeting proceedings, which will be ready at the beginning of the Symposium.

The Symposium will be held in Stresa, Italy, 11-14 June 2000 in connection with the IDF A2 group meeting. Stresa is a beautiful town on the shore of Lake Maggiore, famous for castles and monuments, and therefore will present an appropriate background for this meeting. The location of the Symposium, being close to Milan and Switzerland south border and to a major intercontinental airport (Milano Malpensa), is very convenient for attending scientists coming from different parts of the world.

Everyone interested in this field of dairy science is invited to come to the Symposium. Further information is available from the Scientific Secretariat:

Alfonso Zecconi, Istituto Malattie Infettive Veterinarie, Via Celoria 10, 20133 Milano, phone +39 02 70631720, fax +39 02 70635338 e-mail: azeconni@imiucca.csi.unimi.it

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<td>2. Prolactine</td>
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<td>ENVIRONMENT &amp; METABOLISM</td>
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<td>BACTERIA &amp; THERAPY</td>
<td>1. Bacterial factors</td>
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<td>HOW TO MODULATE IMMUNITY</td>
<td>VACCINES</td>
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<td>IMMUNOMODULATORS</td>
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<td>2. Citokines</td>
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SOMATIC CELLS IN MILK

Annual Meeting co-organized by the Société Nationale des Groupements Techniques Vétérinaires and the Institut National de la Recherche Agronomique NANTES (France), 26-28 May 1999

For the general meeting, the Scientific Committee has selected two topics: "Somatic cells in milk" and "Antibiotherapy ".

People (800-1200) attending this meeting are mostly veterinarians concerned by the pathology of ruminants and, on this particular occasion, executives involved in milk production and milk processing belonging to dairy plants.

The official language of the meeting will be French but translation will be provided for contributions given in English. A tentative programme for "Cells Session" included about 16 oral contributions, by invited speakers with recognized authority in the field.

B. Poutrel
INRA, Laboratoire de Pathologie Infectieuse et Immunologie, 37380 Nouzilly, France
Mastitis Newsletter 23

IDF Publications on Mastitis

All documents listed below can be obtained from IDF Brussels as per address on cover: prices are shown in Belgian Francs.

RECOMMENDATIONS FOR PRESENTATION OF MASTITIS-RELATED DATA
Part 1: Somatic Cell Count
Part 2: Records of Clinical Mastitis
By a sub-group of IDF Group A2 – Bovine Mastitis

Historically, somatic cell count data have been presented in a variety of ways, making comparisons of data from different sources difficult, if not impossible. Milk somatic cell counts are increasingly used to compare milk quality within regions or states of a country as well as among countries. The final number used to indicate the status of a country/region/milk cooperative can vary greatly depending upon the method used for calculation. As the demand for such comparisons increases, so does the need for a standardized method of calculation. A sub-group of A2 was organized under the leadership of Olav Østérås (Norway) with the charge to produce a document recommending standardized methods for presentation of somatic cell count data. A section on presentation of clinical mastitis data is included as these data also suffer from a lack of consistent method of presentation, and comparisons among studies or reports are very difficult.

The document is presented in the form of a condensed version for quick reading and introduction to the subject matter, and as the full text with complete detail. The document will be a useful reference for those publishing data involving somatic cell counts and/or incidence of clinical mastitis cases, and will help bring clarity to an area where it is needed.

GUIDELINES FOR THE EVALUATION OF THE MILKING PROCESS
By J. Hamann (Germany) (in conjunction with the IDF Machine Milking and Mastitis Subgroup A2D of Group A2)

The paper describes guidelines to evaluate the entire process of mechanical milking. Application of the guidelines will result in detailed information on interactions between machine, milker and dairy cows, and the related efficiency of milking, milk removal and any risk of new infection of the mammary gland. The guidelines are based mainly on the evaluation of the following criteria:

1. Operator action and behaviour;
2. Animal factors and behaviour;
3. Machine characteristics, and
4. General conditions of housing and management.

Bulletin No. 321/1997 – 1200 BEF

MASTITIS CONTROL
RESULTS OF QUESTIONNAIRE 1694/A
by IDF Group of Experts A2 – Bovine mastitis

The replies of 24 member countries to IDF mastitis control questionnaire 1694/A issued in February 1994 are tabulated. The survey shows a high degree of uniformity in recommended mastitis control measures and an increase in their application on-farm since the previous questionnaire 5 years before. There is little evidence in a reduction in infection levels, although cell counts are lower and there has been a big increase in cell count payment schemes in the countries replying to the questionnaire.

Bulletin No. 262/1991 – 1400 BEF

DESIGN OF CLINICAL TRIALS FOR MASTITIS THERAPY
by Margaret A. Thorburn, Dept of Population Medicine, Ontario Veterinary College

This 8-page report covers clinical trials of therapeutic treatments; causes of mastitis and its consequences.

It is part of a five-part Bulletin which also covers: radionuclides in dairy products; distribution systems for fresh dairy products; enzymes in cheesemaking; and teat and udder cleaning.

Bulletin No. 247/1991 – 1500 BEF

ENVIRONMENTAL INFLUENCES ON BOVINE MASTITIS
by a Group of Experts

Covers mastitis as a multifactorial disease, pathogenesis, sources & transmission of pathogens, environmental influences on animal health, external environment, internal environment, conclusions and recommendations.

Bulletin No. 217/1987 – 1000 BEF

MACHINE MILKING & MASTITIS
by a Group of Experts

Comprises (a) recommendations concerning the use of milking machines and the incidence of mastitis; (b) review of literature on milking machine factors affecting the rate of new infections; (c) review on the effect of machine milking on teat end condition.

Bulletin No. 215/1987 – 1000 BEF
**MASTITIS NEWSLETTER N°22**

**GENERAL**
- Report of the IDF Group of Experts on Mastitis – K.L. Smith, Chairman (USA)
- Erratum Mastitis Newsletter No. 21

**RESEARCH COMMUNICATIONS**
- Differential Somatic Cell Counts in Milk – A. Saran, G. Leitner & M. Chaffer (Israel)
- Effect of Undermilking and Overmilking on Teat Tissue Condition – E. O’Callaghan (Ireland), D. Gleeson (Ireland) & F. Neijenhuis (the Netherlands)
- The Use of Lacticin 3147 in Mastitis Control – M. Ryan, W.J. Meaney, C. Hill & P. Ross (Ireland)
- Decision-Making in Clinical Mastitis Therapy programmes – K. Leslie & G. Keefe (Canada)
- Vaccination Against Coliform Mastitis: A Historical Perspective – K.L. Smith & J. Hogan (USA)

**MASTITIS NOTES FROM MEMBER COUNTRIES**

**ITALY:** *Staph. aureus*: A Problem for Italian Dairy Herds – A. Zeconci & R. Piccinini

**NEW ZEALAND:** Daily Somatic Cell Count Testing – R. Franks

**SPAIN:** Milk Quality in Spain – E. Cifrian, J.A. Garcia, P. y. Casado & J.C. Marco

**SWITZERLAND:** Evolution of Somatic Cell Counts in Bulk Milk Samples: Switzerland 1983–1996 – M. Schällbaum

**EVENTS & MEETINGS**


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**PROGRESS IN MASTITIS CONTROL**

**GENERAL**
- Report of the IDF Group of Experts on Mastitis – K. L. Smith, Chairman (USA)
- Integrated Detection Systems for Antimicrobials in Milk: The IDF Approach – W.H. Heeschen (Germany)

**RESEARCH COMMUNICATIONS**
- Standards for Somatic Cells in Milk: Physiological and Regulatory* – K.L. Smith (USA)
- Somatic Cells: Factors of Influence and Practical Measures to Keep a Physiological Level* – J. Hamann (Germany)
- Somatic Cells and their Significance for Milk Processing (Technology) – A. Zeconci (Italy)
- Milk Quality Payment: Quality Assurance (QA) in Somatic cell Counting* – M. Schällbaum (Switzerland)
- Mastitis: The Disease under Aspects of Milk Quality and Hygiene* – W.H. Heeschen (Germany)
- New Systems for Somatic Cell Counts – J. Reichmuth (Germany)

**MASTITIS NOTES FROM MEMBER COUNTRIES**

**FINLAND:** Mastitis Prevention has Succeeded in Finland – T. Honkanen-Buzalski & V. Myllys

**ITALY:** Mastitis Control Programme and Breeders Association – A. Zeconci & M. Nocetti

**NORWAY:** Bulk Milk Somatic Cell Count in Goat Milk (A presentation according to new standard) – Ø. Østerås & T. Lunder

**SWEDEN, NORWAY, DENMARK & FINLAND:** Antimicrobial Drug Policy in Four Nordic Countries – K. Plym Forshell, O. Østerås, K. Aagaard & L. Kulkas

**IRELAND:** Antibiotic Resistance Testing of *Staphylococcus aureus* Isolates from Cases of Bovine Mastitis in Ireland – W.J. Meaney & J. Flynn

**IRELAND AND USA:** Analysis of diversity of *Staphylococcus aureus* isolates from bovine mastitis using
DNA restriction fragment length polymorphisms of rRNA genes – J.R. Fitzgerald, C.J. Smyth, P.J. Hartigan, W.J. Meaney & V. Kapur


EVENTS & MEETINGS
British Mastitis Conference

IDF PUBLICATIONS ON MASTITIS
* Summaries of papers presented at the conference on the occasion of the meeting of Commission A during the IDF Annual Sessions in Vienna, September 1995.

Ref. N°144 – Available on request – September 1996

MASTITIS NEWSLETTER N°20

GENERAL
- Report of the IDF Group of Experts on Mastitis – J.M. Booth (United Kingdom)
- Hygienic Requirements in International Trade and the Role of Codex Alimentarius and the International Dairy Federation – W.H. Heeschen (Germany)

RESEARCH COMMUNICATIONS
- Treatment of Mastitis with Homeopathic Remedies – W.J. Meaney (Ireland)
- Mastitis Cell Count Date – J.M. Booth (United Kingdom)
- Counting Somatic Cells in Milk: Reference material (“Kiel Standards”) – W.H. Heeschen & E.-H. Ubben (Germany)
- The Importance of Coagulase-Negative Staphylococci – K.L. Smith & J.S. Hogan (USA)
- Somatic Cell Counts in Milk of Goats – B. Poutrel (France)

Mastitis Notes from Member Countries
Finland: The Bovine Udder and Mastitis – M. Sandhol, T Honkanen-Buzalski, L. Kaartinen & S. Pyörälä (Editors)
Germany: New German Guidelines for Mastitis Control – J. Hamann

EVENTS & MEETINGS
The 3rd International Mastitis Seminar
British Mastitis Conference
Symposium “Udder Health” in the Netherlands

IDF PUBLICATIONS ON MASTITIS
Ref. N°142 – September 1995 – 500 BEF

MASTITIS NEWSLETTER N°19
Report of the IDF Group of Experts on Mastitis – J.M. Booth (United Kingdom)

RESEARCH COMMUNICATIONS
- Counting somatic cells in milk: results of IDF intercomparison trials – W.H. Heeschen (Germany)
- Studies on inflammation in the bovine teat with regard to its role in the defense against udder infections – K. Persson (Sweden)
- Cubicle designs for dairy cattle – J. O’Connell & B. Meaney (Ireland)
- Retarded Excretion of antibiotics in milk after drying-off therapy – M. Schällibaum (Switzerland)

Mastitis Notes from Member Countries
Czechoslovakia: Standardization in somatic cell counting – D. Rysánek, V. Babák & L. Slezhoferová (Czech Republic)
Finland: The status of mastitis in the Nordic countries – S. Pyörälä & T. Honkanen-Buzalski (Finland)
Israel: The national program for the control of mastitis and the improvement in milk quality – A. Saran (Israel)
Italy: Eradication and control programs – A. Zeconi & G. Vicenzoni (Italy)
New Zealand: S&M – A new mastitis control plan – M.W. Woolford (New Zealand)
Norway: Norwegian cow milk somatic cell count – O. Østerås (Norway)

EVENTS & MEETINGS
IDF PUBLICATIONS ON MASTITIS
Ref. N°140 – Available on request – August/Août 1994

Mastitis Notes from Member Countries
Italy: The prevention of mastitis in Italy – G. Ruffo & A. Zeconi (Italy)
Switzerland: Mastitis pathogens in Switzerland, 1988–1991 – Prof. Dr M. Schällibaum

EVENTS & MEETINGS
IDF PUBLICATIONS ON MASTITIS
Ref. N°134 – Available on request – April/Avril 1993

MASTITIS NEWSLETTER N°17
Antibiotics and sulfonamides in milk-risk evaluation of residues (Prof. W.H. Heeschen, Germany), Teat dipping before milking – summary of UK field trials (S.A. Langridge, UK), What future for conductivity? (A. Zeconi, Italy), Mastitis pathogens in Switzerland (M. Schällibaum, Switzerland), Mastitis events, Mastitis publications.

MASTITIS NEWSLETTER N°13
Questionnaire on national herd milk mastitis cell counts – Mastitis notes from member countries.
Ref. N°102 – March 1988

MILK – ENUMERATION OF SOMATIC CELLS