QUALITY OF THE MILK SUPPLY: EUROPEAN REGULATIONS VERSUS PRACTICE

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Introduction

The European Union comprises fifteen member countries adhering to a common agricultural policy to manage output and provide an even spread of opportunity. Raw milk offered for sale within and into the European Union has to be produced according to the requirements of Commission Directive 89/362/EEC (1) and to meet quality standards described in Council Directive 92/46/EEC (2, 3). These should have been fully implemented in member countries since 1998. However, compliance is very variable between countries inspected as shown in a series of evaluations summarized previously (4, 5).

Together the regulations say many things about the quality of milk and the hygienic means of production including guidance and requirements for

- The means of production, farm specifications etc
- Processes, milk handling
- Animal health, milk composition related to quality - especially antibiotics, cell count and bacterial content

Council directive 92/46/EEC (2) also lays down the health rules for the production and placing on the market of raw milk and milk-based products. In many ways the directives are comparable to the US "Grade A" Pasteurized Milk Ordinance.

Requirements

A comparison between the basic requirements in the EU and in the Pasteurized Milk Ordinance is shown in Table 1.

Table 1. Basic milk hygiene requirement in the EU and USA

	EU	PMO
Drugs/ml	<0.004µg	None detectable
Somatic cells/ml	400 000	750 000
Bacteria/ml	100 000	100 000

Antibiotics

Fairly rigorous standards on β-lactams in milk are applied to the limits of the tests available. Generally the inhibitory substance testing has used the Delvo P although the Delvo SP, giving greater sensitivity and breadth of spectrum, has superseded this in many laboratories. Some

concern exists that the sensitivity of this test, for some antimicrobials, allows detection of presence at levels below the agreed Maximum Residue Level and that this is not understood.

Milk sample testing is carried out on supplies delivered to the dairies such that all tankers are tested using a rapid method before discharge and a Delvo SP test also carried out. All farm supplies are sampled at each collection to allow tracing of any tanker failures if necessary. Each farm supply is tested each week using one of the collection samples at random. In addition there are small scale statutory surveillance programs. All countries currently have a low rate of antibiotic contamination of the milk supplied from farms, usually much less than 0.5% of farm supplies. However, some countries test very few samples.

Interest in more sensitive, broad-spectrum tests is growing, but not included in regulatory provisions, to cope with unlabelled use of other actives including un-licensed products, and persisting components of polypharmacy such as streptomycin.

Somatic cell count

The limit on milk cell count, a three-monthly rolling geometric average, is 400 000 cells/ml. In most EU countries the market usually demands a much lower level for a premium product with a common threshold around 200 000 cells/ml. Milk buyers pay a premium of 3-5% of milk price below the premium threshold, a neutral price above that threshold and then introduce price reductions of 5-10% from a higher threshold, often 250 000 cells/ml, up to the regulatory level. Milk with a persistently high cell count is relatively worthless, even if some form of market can be found, with penalties of 30-60% of regular price and special collection costs often applied.

The achievement of somatic cell count limits appears extremely variable between EU countries. The national annual geometric averages, where available, suggest that there is generally good quality milk. Austria appears to produce the best milk in this aspect from its small herds, with a cell count a little greater than 100,000 cells/ml. Many other countries reporting (e.g. Germany, Netherlands, Sweden, and UK) achieve an average cell count less than 200,000 cells/ml.

Of more strategic importance are those farms that fail to meet the regulatory threshold. In northern Europe this is usually no more than 1% producers and usually only for a short period. Local problems occur in less traditional, cow's milk, producing countries where little more than 50% of the milk supply meets the regulatory threshold of fewer than 400,000 cells/ml, despite 8 years to achieve compliance since introduction of the limit.

A number of problems and challenges to meeting cell count standards can be identified.
First, a proportion of farmers supplying the organic market have suffered a considerable reduction in the quality of their production over the 2 to 3 years after conversion. A doubling of cell count is not unusual. These farmers have to produce milk under restrictions preventing the use of routine dry cow treatment, severe limitations on therapeutic use of antibiotics, adherence to philosophies on use of herbal and homoeopathic products and limitations of general chemical use that preclude use of some teat disinfectants and most pesticides.

Occasionally extreme seasonality in production can cause short-term problems in meeting the cell count regulations. Ireland, with a largely spring-calving herd, has a special dispensation to cope with the low production period. Individual producers elsewhere have to cope otherwise with this problem. Reports increase on a growing seasonality problem related to summer months when the balance of calving is September to December. Whether this is entirely stage of lactation related or other environmental factors have an influence is a matter of debate in some parts of the EU, as it is in some parts of the USA.

Cell counts are determined by relatively sophisticated instruments operated to defined laboratory methods enshrined in international standards. It is recognized that the standards and especially their application is less than desirable hence the current review of the standards by a Joint Action Team of ISO/IDF/AOAC. Most laboratories should work to standard methods but considerable variability can and does exist within and between laboratories in the cell counts produced (6). The quality of data is also affected by sampling methods, sample storage and transport and sample handling. The use in the EU of geometric averages is extremely beneficial in 'smoothing' data, taking account of erroneous values. The effect is better the more frequent the sampling regimen in use. Errors on individual counts of 20% can be reduced to less than 5% for monthly values (6).

Bacteria

The milk quality directives specify that bacteria in milk be measured as a plate count. However, there is growing use of the Bactoscan-type technology although there is no agreed calibration. The IDF has a working group whose aim is to recommend a calibration standard. In many countries all buyers now only use Bactoscan. However, some individual countries use their own conversion factors with Bactoscan values varying from 3-5 times plate count and often changing seasonally. In others, e.g. UK, only Bactoscan data are reported to the producer. To meet regulatory needs monthly plate counting data will be provided.

It is clear that there is no significant problem in the majority of EU countries of farms failing to supply milk with fewer than 100,000 cfu/ml. National average bacterial contents are frequently less than 10,000 cfu/ml. The UK monthly Bactoscan averages 28 000 to 35 000 impulses/s in 2003 with best milk in the summer months.

The level of control of milk bacterial content varies. With competing buyers and large cooperatives, especially for liquid milk, it is driven by 'market forces' such that test results go only to the producers and acceptability or rejection of the supply is a contractual arrangement. In other countries enforcement of quality is by central or local, competent authorities. Increasingly there are farm inspections by regulatory authorities to apply the full provisions of the EU directives on farm suitability, staff capability and implementation of methods to meet the regulations. It is not unknown for enforcement notices to be applied to farms easily meeting the bacterial limit in milk but still required to achieve further improvements in milking-time hygiene. Contractual requirements from milk buyer add a layer of enforcement often with their own inspectorate to enforce farm assurance schemes. In many case farm unions, dairy associations and cooperatives are paid-up members of self-regulatory systems. Many have contributed to the impending IDF Guidelines for Good Dairy Farming Practice.

<u>Specific requirements</u>

Food safety is the primary concern of most of the regulations with growing pressure to control zoonoses in milk production, therefore a need to know about specific bacteria.

The EU directives mention specific animal health requirements and specific limits for some bacteria in raw milk and milk for processing.

Milk may only come from herds that are officially tuberculosis-free and brucellosis-free. Many EU countries are fully brucellosis-free although in a few countries some herds are under restriction. An official tuberculosis-free scheme applies with regular testing of milk and individual animals. The frequency of testing is increased significantly in areas where tuberculosis is endemic. Herds with tuberculosis-reactor-cows are compelled to have all milk pasteurized – they cannot supply milk for non heat-treated product.

Table 2. Limits on bacterial levels in milk (cfu/ml)

	PMO	**EU**
<u>Raw milk for drinking</u>		
- bacteria	-	<20 000
- *S. aureus*	-	<500
- Salmonella	-	0
- Coliforms	-	<100
<u>Pasteurized milk</u>		
- Bacteria	<20 000	5 000/50 000
- Coliforms	<10	<5
<u>Raw milk for production</u>		
- bacteria	<100 000	<100 000
- *S. aureus*	-	<2000

Drinking of raw milk, by direct purchase from the farm or distributed for local sale, is allowed in some areas of the EU but in many it is prohibited. The regulations on the bacterial content are more specific for liquid raw milk to be consumed (Table 2) such that salmonella are specifically mentioned and much be shown to be absent. The limit of 500 cfu/ml of *Staphylococcus aureus* allows a little and low grade infection of perhaps 2 quarters per 100 cows. The amount of *S. aureus* is checked only by random sampling although no more than 2 of every 5 samples may exceed the limit. The limit on coliforms relates largely to contamination of the milk rather than a limit to udder health. A level of 100 coliforms/ml would be sufficient to warrant an investigation into farm hygiene let alone trigger an alert about milk quality.

The requirements for pasteurized milk essentially require that it is fully effective with any coliform content being a control on post pasteurization contamination, nothing to do with milk harvesting.

The third category in the regulations specifies limits on the bacteria in milk for production as raw-milk products. The only specific limit is on *S. aureus* and that is more tolerant (Table 2). No mention is made of other bacteria based on the historical perception that they do not survive the maturation process of the product. Given that at a bulk milk cell count of 400 000 cells/ml some 12% of quarters would be infected (7) then if all were *S. aureus* infections a concentration in milk of 2400 cfu/ml could easily be expected. This suggests very little margin for error unless the bulk milk cell count level is much lower than the regulatory threshold.

Despite the regulations it appears that buyers carry out these tests infrequently. No data appear in the public domain, other than for total bacterial content. The few buyers still using plate counts are more likely to carry out coliform counting and, if buying milk for cheese production, determine psychrotrophs too. Otherwise specific counting is only applied as diagnostic methods to indicate the type and frequency of specific bacteria when problem solving.

This seems quite perverse when the emphasis in so much of food production standards is based on making food safe(r). The directives include words in their aims such as '..(public) health and animal health…' A number of examples of problems, especially related to zoonoses can be considered immediate and relevant yet only receive cursory attention.

Consideration of the relative importance of sources for zoonotic bacteria in milk (Table 3) suggests good mastitis control, bacterial and cell count limits applying, is necessary. The means to minimize bacteria in milk are well developed and NMC promotes all of the techniques required to limit bacteria entering milk from intra mammary infection, contaminated teat skin and from less than clean plant.

Intra mammary infections of the dairy cow by salmonella or listeria species are relatively uncommon so environmental management is most important in limiting their presence in milk from post harvesting contamination. No detectable amount is tolerable but examination for presence appear reactive to problems either of human or animal health.

The regulations say that teats must be clean and dry before milking, both are essential to limit coliforms in milk. It is obvious that they are a risk to the milk supply, although very few strains from cattle are pathogenic in man, that they can be controlled and that simple methods exist to measure them in milk. It may be that the milk supply system is defaulting to accepting that good practices are in place and that pasteurization is the failsafe back-up.

Mycobacterial infections and the potential presence of such zoonoses in milk and raw milk products is of growing importance as the distribution of Johne's disease and the local spread of bovine tuberculosis in many countries becomes more problematic.

Table 3. Relative importance of sources for important bacteria in milk

Source	Bacteria				
	S. aureus	Listeria/ Salmonella	*E. coli*	*M. bovis*	*M. paraTB*
Teats – skin colonization	+	-	-	-	-
Teats – fecal contamination	-	+	+++	-	++
Housing/food	-	+	+++	-	++
Milk handling – machine	+	-	++	-	-
Milk handling – tanks	-	-	++	-	-
Water supply	-	+	++	-	++
Intra mammary infection – milk	+++	(+)	+	+	+
Intra mammary infection – cells	+++	-	-	++	++
Post production	-	++	+++	-	-

The likelihood of *Mycobacterium bovis* in milk is limited at one level by the requirement for milk to come from an officially tuberculosis-free herd. Yet this status is only confirmed by testing of animals and not milk. In the period between routine tests a significant exposure to bacteria could occur especially when unpasteurized products are manufactured. Mycobacteria may survive for a long time in some types of product (8).   Recent conversations suggest a lack of appreciation of how mycobacteria might enter milk with general belief that a tuberculis udder is required ignoring that any secondary dissemination of infection would lead to systemic distribution of infected leukocytes. The occurrence of *Mycobacterium avium paratuberculosis* in

milk is proposed to arise from fecal contamination of milk but little consideration appears to have been given to cellular dissemination into milk. High cell count milk may pose a higher risk.

The EU regulations on the hygienic production of milk are strong on intention and require milk to be produced to defined quality standards based on traditional methodology. The requirements tend to be easy to meet and generally few problems exist in most EU countries on meeting bacterial content and cell content limits. Identification of the responsibility for determining and enforcing bulk bacterial and cell count requirements is clear and has been ensured following inspections by EU officials of EU and external, supplier countries (4, 5). The diligence and achievement gets less precise for more specific objectives such as individual bacterial types in milk. Testing appears to be less frequent and often more likely to be reactive. No transparent mechanism to confirm the quality of the milk, or responsibility, is obvious. Where the industry has been progressively deregulated then this situation is more likely. It is only when specific problems arise or become more prominent that significant effort is likely. Overall, control or even recognition of a potential problem in milk can be tardy and usually lax.

Summary

The EU regulations on milk quality were prepared with good intent. The main aims of producing safe milk from healthy animals are largely achieved with dairy farmers easily meeting the targets for bacterial and cell content. The requirements become less precise when specific objectives are required and there is less convincing appearance of attempts to meet the regulations. It may be they get close to farm achievements on udder health. The regulations have to be seen by dairy farmers to be relevant, achievable, effective and enforced. After nearly a decade of effort some of these are reality but consistency thru the regulations is lacking and detracts from the progress made. A local farmer commented bitterly ' *I sold my cows because I was caught by the need to invest in equipment to conform to the new standards for milk hygiene and cow welfare and a falling milk price due to ……. Many of these standards are cosmetic.*'

Various gaps in the application of the requirements of hygienic milk production, the quality of the supply and ensuring that milk is safe are apparent. The intention to remedy is not consistently obvious.

References

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