Q fever risk to human health from the consumption of contaminated, unpasteurised milk and milk products

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Background

Q fever is a widespread zoonotic disease caused by the bacterium Coxiella burnetii and is present in cattle, sheep and goats. In most cases clinical illness is not seen, but occasional large outbreaks or clinical cases of Q fever are reported in animals. The clinical manifestations of Q fever in humans are variable, ranging from asymptomatic to serious. The main route of transmission to humans is via the inhalation of aerosols from the parturient (birth) products of infected animals. It is known that meat, milk and milk products can be contaminated. However, the link to clinical disease in humans is unclear.

The original aim of this work was to undertake a quantitative risk assessment for C. burnetii in unpasteurised milk and milk products from UK cattle, goats and sheep. However, in part due to the problems in culturing this pathogen, much of the data required for the risk assessment are missing. It was therefore agreed with the Food Standards Agency to develop a risk profile for C. burnetii through unpasteurised milk and milk products and, instead of developing a full risk assessment, to conduct an exposure assessment for consumption of unpasteurised cows' milk.

This will allow our organisation to make consistent, evidence-based risk management decisions in relation to Q fever risks from unpasteurised milk and milk products.

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Research Approach

The original proposal to our organisation specified a full farm-to-consumption quantitative microbiological risk assessment to assess the risk to humans from the consumption of unpasteurised milk and milk products made from unpasteurised milk of UK cattle, sheep and goat origin. The risk assessment was to follow the main steps of the Codex risk assessment framework (CAC, 1999), which is most commonly used for food safety risk assessments. Using the Codex framework, a risk assessment is split into the following components; Hazard identification, exposure assessment, hazard characterisation and risk characterisation. However, during the hazard identification stage of the risk assessment it became clear that there were significant data gaps in the level of knowledge of C. burnetii. In particular there was little or no information on:

- levels and viability of C. burnetii in sheep and goats' milk

- survival of C. burnetii in unpasteurised milk and milk products
- survival and fate of C. burnetii during the cheese-making processes and manufacture of other milk products
- dose-response data for humans through the oral route
- current farm prevalence and within herd/flock prevalence of C. burnetii (ELISA and PCR data are available but will overestimate the prevalence); and
- Qualitative or quantitative studies on consumption patterns of unpasteurised milk and milk products

Those data gaps in part reflect the difficulties in routine culture of C. burnetii and also the lack of data on the viability of the organisms when DNA is detected by PCR methods. It was therefore agreed that an alternative approach was required as there were insufficient data for a full quantitative or qualitative risk assessment. Overall, the revised work programme included four deliverables:

- the hazard identification
- the development of a risk profile for C. burnetii through consumption of unpasteurised milk and milk products
- the identification of the risk pathways to humans through consumption of unpasteurised milk and unpasteurised cheeses; and
- the development of an exposure assessment model, together with a sensitivity analysis, for humans consuming unpasteurised cows' milk

Of additional interest was the risk to humans due to consumption of unpasteurised milk/milk products during an abortion storm* at a goat farm. In the absence of sufficient data for goats, a scenario analysis was undertaken for cows' milk to represent an outbreak within a cattle herd. The risk assessment was reviewed by the Advisory Committee on the Microbiological Safety of Food (ACMSF meeting of 27/6/13).

*A large number of abortions typically caused by infectious disease

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Results

The main conclusion of the risk profile is that unpasteurised milk and milk products may contain viable C. burnetii. Therefore the risks of human infection from C. burnetii through consumption of unpasteurised milk and milk products are not negligible. However, current knowledge suggests a low risk to human health from ingestion through milk particularly when compared to aerosols from parturient products and livestock contact. This reflects not only the more efficient transmission via inhalation of contaminated aerosols in which inhalation of just a few organisms may be sufficient to initiate infection but also the much higher loadings in birth products compared to milk, potentially giving higher exposures across the population through aerosols. C. burnetii infectivity, however, persists in milk and milk products over long periods.

Information gathered on the methods used to produce unpasteurised milk products such as cheese (hard and soft), butter and cream suggest that no manufacturing/process steps (other than pasteurisation) would result in a significant reduction in C. burnetii present in unpasteurised milk, although long maturation at low pHs may give some inactivation in hard cheese. This is consistent with viable C. burnetii rarely being detected in unpasteurised cheese compared to unpasteurised milk and with stronger epidemiological evidence for human cases through unpasteurised milk compared to unpasteurised cheese.

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