DEVELOPMENT OF GENERIC MODEL FOR FOOD SAFETY IN FARM BREEDING OF DAIRY COWS

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Communication

Abstract: In order to prevent or reduce the risk of food-borne illness, it is necessary to introduce pertinent control measures at all stages of the food chain. Following the scientific opinions presented in the documents of main international organizations for food safety, this paper was prepared to deal with milk safety hazards at the farm level. In this paper characteristics, development and procedures for implementation of prerequisite programs in farm breeding of dairy cows are presented in order to ensure production of safe milk suitable for further processing. The scope and use of pre-requisite programs for dairy farms were defined and requirements for control of work as a part of pre-requisite programs were established. The flow diagram was made for primary production of milk and activities related to process step. Feeding of milking cows was described. Hazard analysis was made by following selected criterions. Then Program of milk safety at farm level was made. This program has identified relevant hazards for process step Feeding of milking cows, criteria for hazard assessment, suggested control measures, monitoring and corrective actions and necessary records. Control measures based on the scientific analysis and GMP, GHP principles were suggested by this paper, with the scope to ensure problem prevention rather than to solve it after it has occurred.

Key words: food safety, primary production, milk

Introduction

Milk is food with high nutritional value, which is widely used in Serbian retail. Milk is frequently used by risky categories of population: children, old and sick people. In order to prevent or reduce the risk of food-borne illness, it is necessary to introduce pertinent control measures at all stages of the milk production chain, including the primary production – dairy farm. Dairy farmers are in the business of producing food. They aim to ensure that the safety and quality of their raw milk will satisfy the highest expectations of the food industry and consumers. On-farm practices should also ensure that milk is produced by healthy
animals under acceptable conditions for the animals and in balance with the local environment (Kljajić et al., 2005a; Kljajić et al., 2005b). Farmers should have a chance to enlarge value of their end product – raw milk by acceptance of production methods which satisfy requests of consumers and dairies. The role of dairy farmers is to ensure that good agricultural, hygienic and animal husbandry practices (GAP, GHP, GMP) are employed at the farm level. The focus should be on preventing a problem (including animal diseases) rather than solving it after it has occurred.

GMP/GHP presents general rules (scientifically established “best practices”) for hygienic production, handling and preparation of different foods. Although GMP/GHP rules are not specific for process or product, they contain instructions how to produce certain food in hygienic manner and represents fundament (pre-requisite) on which further control level can be built: HACCP and recommendations for safe production of certain foods. HACCP is widely accepted as the most effective means of producing safe, acceptable food. FAO/WHO and other relevant institutions in the world consider that HACCP plans are not applicable in farm breeding of food producing animals. This consideration is noticed in „Regulation (EC) No 852/2004 on the hygiene of foodstuffs”. Nevertheless, HACCP principles are valuable and they have been used in this paper in hazard analysis and recommendation of potential corrective actions.

The basic scope of this paper is to make generic model of work control in dairy farm, related to GMP/GHP pre-requisite programs. The aim of this paper is application of recommendations of General principles of food hygiene (CAC/RCP 1-1969, Rev 4-2003), Code of hygienic practice for milk and milk products (CAC/RCP 57-2004), EU directives, national legislative (Pravilnik 26/2002 and 81/2006) and scientifically based principles in development of generic model for work control in pre-requisite programs for farm breeding of dairy cows in order to produce safe milk suitable for further processing.


- milk should not contain any contaminant at a level that jeopardizes the appropriate level of public health protection, when presented to the consumer;
- contamination of milk from animal and environmental sources during primary production should be minimized;
- the microbial load of milk should be as low as achievable, using good milk production practices, taking into account the technological requirements for subsequent processing.
I DEMANDS OF PRE-REQUISITE PROGRAMS GMP/GHP SPECIFIC FOR DAIRY FARMS – WORK CONTROL

Farmers should apply measures for:
- control of contamination from air, soil, feed, pesticides, veterinary drugs and other things which are used in primary production (Regulations 90/2377, 852/2004, 853/2004; Directives 80/778, 48/2005; CAC/RCP 38-1993 i 49-2001);
- control animal health to eliminate human health risks after milk consumption and to eliminate risks for suitability of milk for further processing (Regulations 853/2004, 854/2004, 2377/90, Directives 96/23, 64/432, 91/68, 98/58);

Milk must originate from animals which are under official control in order to verify implementation of adequate management measures to prevent animal diseases and to control drug treatment of diseased animals or herds in an appropriate way (Regulations 853/2004, 854/2004, 2377/90; Directives 96/23, 64/432, 91/68, 98/58).

Measures for disease prevention. These measures include animals of unknown health status which shall be separated before being introduced in the herd, until the time their health status is established. During that separation period, milk from those animals should not be used for the production of milk for the manufacture of raw milk products and the owner should keep a record of relevant information, e.g., results of tests carried out to establish the status of an animal just being introduced, and the identity for each animal either coming or leaving the herd.

Animal health protection. Effective program for herd health management should be established. This program also should obligate animal identification. Raw milk quality must be in accordance with the law regulations (Regulation 853/2004; Directive 98/58).


Feed. When using feed, it is necessary that the feed is prepared, stored and used in a manner that will minimize microbial contamination of milk. Feed must have appropriate nutritive value. Usage of meals with animal proteins (meat, bones) in feeding of milking cows is banned (Directive 98/58).

Milkking should be carried out in such a manner that minimizes contamination of the milk being produced. Animals must be identified, clean and well maintained.
Milking should not injure cows and contamination must be avoided. Animals showing clinical symptoms of disease should be segregated and/or milked last, or milked by using separate milking equipment or by hand, and such milk should not be used for human consumption. This milk must not be delivered with milk from healthy cows. All milk should be filtered before entering the tank. Filter socks should be fitted at all times during milking and washing of the plant. Filter socks should be used as per the manufacturer instructions. Udder disinfection process must be approved by competent authority and must be applied after milking. Disinfectants must be approved for this purpose. Milking personnel must wear suitable, clean cloth (Regulative 853/2004; Directive 80/778).

**Milking equipment** should not be the source of contamination. Equipment must be clean, accurate and in good condition. After cleaning and disinfection equipment should be washed with clean potable water. Design of the equipment should be in such a manner to avoid dead ends. Milk cans must be covered when personnel carry them through a farm.

**Health and personal hygiene of milking staff.** Staff must not be the source of milk contamination. The milker should wear suitable and clean working clothes, keep hands and arms clean especially when milking, cover cuts or wounds, not have any infectious disease.

**Handling, storage and transport.** With consideration given to the end use of the milk, handling, storage and transport of milk should be conducted in a manner that will avoid contamination and minimize any increase in the microbiological load of milk. Ensure proper handling with milk after milking. Immediately after milking, the milk should be stored in properly designed and maintained tanks or cans in a clean place. Milk should be stored under $8^\circ$C (Regulative 853/2004; Codex stan 206-1999).

**Storage equipment.** Prevent milk contamination from storage equipment. Cans and tanks which are used for milk transport to collecting points and which are in direct contact with milk, must be clean and disinfected after each usage, or after serial usage (if those usages are in near time interval) at least once a day. After cleaning and disinfection equipment should be washed with potable water. Equipment and brushes should be stored in hygienic (Regulative 852/2004, 853/2004; Directive 80/778).

**Training.** The staff at farm should be sufficiently trained, aware and responsible for their jobs.

### II HACCP BASED APPROACH TO FOOD SAFETY AT THE DAIRY FARM LEVEL

1. **Flow diagram of raw milk primary production**

After defining the basic demands for pre-requisite programs flow diagram of raw milk primary production was made (Scheme 1) and activities related to process
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step Feeding of milking cows were described. Hazard analysis were made according to HACCP principles on the basis of analysis for selected hazards, according to selected criteria (Table 2). After these steps Program for milk safety at farm level was made where for process step Feeding of milking cows relevant hazards and criteria for hazard analysis were identified, control measures and monitoring programs were suggested and corrective actions and records were defined.

Schema 1. Flow diagram of raw milk primary production

<table>
<thead>
<tr>
<th>1. Calves calved on farm</th>
<th>2. Animals bought on other farms</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Milk production process</td>
<td></td>
</tr>
<tr>
<td>5. Pasture</td>
<td>4. Breeding of animals</td>
</tr>
<tr>
<td>6. Feeding of animals</td>
<td></td>
</tr>
<tr>
<td>(feed and feed additives)</td>
<td></td>
</tr>
</tbody>
</table>

2. DESCRIPTION OF ACTIVITIES RELATED TO PROCESS STEPS

As example process step **Feeding of milking cows (feed and feed additives)** were selected. Following activities were defined for this process step:
- making of formulations according to breeding demands
- feed selection
- feed supply
- reception of feed
- identification of feed
• feed storage
• feed medication
• preparation of formulation
• feeding
• program of supplement incorporation in feed
• feed removal

3. **Hazard analysis based on HACCP principles**

<table>
<thead>
<tr>
<th>Hazard analysis criteria</th>
<th>Biological hazard</th>
<th>Physical hazard</th>
<th>Chemical hazard</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>\textit{Staphylococcus aureus}</td>
<td>\textit{Animal hair}</td>
<td>\textit{Veterinary drugs}</td>
</tr>
<tr>
<td>Is it hazard for food safety?</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Is it problem for milk safety in retail?</td>
<td>YES</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>Primary source are \ A - animals \ P - production process</td>
<td>A</td>
<td>AP</td>
<td>A</td>
</tr>
<tr>
<td>Is it possible to apply effective control measures at farm?</td>
<td>YES - udder control, animal health control, cooling of milk</td>
<td>YES -milk filtration</td>
<td>YES -approved application and withdrawal of drugs</td>
</tr>
<tr>
<td>Is it possible to apply effective control measures during processing?</td>
<td>YES</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>Is this hazard relevant for further ex-farm hazard analysis?</td>
<td>YES</td>
<td>NO</td>
<td>YES</td>
</tr>
</tbody>
</table>

4. **Program for milk safety at farm level**

Program for milk safety at farm level was made in which for each process step relevant hazards and criteria for hazard analysis were identified, control measures and monitoring programs were suggested and corrective actions and records were defined.

Description of part Program for milk safety at farm level related to process step

**Feeding of dairy cows (feed and feed additives)**

**Process step title:** Feeding of dairy cows

**Hazards** which can appear during this process step are: presence of banned substances (banned additives, banned veterinary drugs, growth promoters), biological hazards (\textit{Salmonella} spp., \textit{Listeria} spp.), chemical hazards (mycotoxins), banned feed for food producing animals (BSE)
Criteria for hazard analysis: Safe feed

Control measures (GMP): Purchase from reputable supplier with feed safety system in place; usage of feed according to manufacturers instructions; proper storage; taking of measures to ensure good fermentation conditions, essential for good quality silage; where on farm produced cereal crops are feed to animals, ensure that crop pesticide withdrawal times are adhered to; for medicated feed follow veterinarians instructions

Monitoring/corrective actions: Rejection of inappropriate feed (certificate, laboratory results, banned feed), control of storage facility, rejection of contaminated feed, vermin control, laboratory examinations of feed (nutritional value, microelements, detection of fermentation etc.), control of fermentation (immediately close silage to ensure proper fermentation), records on pesticide application (date, dose, withdrawal).

Records: certificates from feed producers, laboratory records, records related to pesticides.

Conclusion

In this paper control measures made on scientific analysis and GMP and GHP principles were suggested. These measures aim to ensure prevention of problems and can be applied by farmers as a guide for development of their own activities on GMP/GHP pre-requisite programs but this paper may be useful also to competent authorities as a guide to assessment of fulfillment of pre-requisite programs and measures which ensure production of safe milk in dairy cow farms.

Razvoj generičkog modela za bezbednost hrane u farmskom uzgoju muznih goveda

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Rezime

U radu je definisan obim i osnovna upotreba preduslovnih programa za farme muznih krava i postavljeni su zahtevi za kontrolu rada u okviru preduslovnih programa, zatim je definisan dijagram toka primarne proizvodnje mleka i opisane su aktivnosti vezane za proizvodni korak Ishrana muznih krava. Analiza hazarda je izvršena na osnovu procene svakog hazarda prema više odabranih kriterijuma. Zatim je napravljen Program bezbednosti mleka na nivou farme u kom su za procesni korak Ishrana muznih krava identifikovani relevantni hazardi, kriterijumi za procenu hazarda, predložen je niz kontrolnih mera, način sprovоdenja
monitoringa, definisane su jasne korektivne akcije i zapisi koje treba voditi. U radu su sugerisane kontrolne mere zasnovane na naučnoj analizi i principima GMP i GHP a koje imaju za kranji cilj obezbeđenje prevencije nastanka problema.

References

64/432/EEC: Directive on animal health problems affecting intra-community trade in bovine animals and swine.
90/237/EEC Council Regulation (EEC): Community procedure for the establishment of maximum residue limits of veterinary medicinal products in foodstuffs of animal origin (9), and in particular Annexes I and III there to, is applicable as regards the maximum residue levels for pharmacologically active substances in milk;
91/68/EEC: Directive belonging to a sheep and goat holding officially free or free of brucellosis (Brucella melitensis).
98/58/EC: Directive concerning the protection of animals kept for farming purposes.
48/2005: Directive maximum residue levels for certain pesticides in and on cereals and certain products of animal and plant origin.
CAC/RCP 38-1993: Recommended international code of practice for control of the use of veterinary drugs.
CAC/RCP 49-2001: Code of practice for source directed measures to reduce contamination of food with chemicals.
CAC/RCP 54-2001: Codex Code of Practice on Good Animal Feeding.
CODEX STAN 206-1999: Codex general standard for the use of dairy terms.
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