

Scholarly progression

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Comparison of nonlinear functions to describe lactation curves for cumulative milk production in buffalo

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Iran, Spain and Canada

Abstract

The aim of this study was to examine the suitability of different growth functions (linear, sinusoidal, Gompertz, Schumacher and Richards) to fit cumulative milk production data from buffalo cows. Cumulative milk production at each day in milk was calculated from two published data-sets reporting (i) fortnightly test-day milk yield records of the first lactation of Murrah buffalo that had calved during 1977-2012 and (ii) the first lactation records of Jaffarabadi buffalo collected from history-cum-pedigree registers for each quinquennium between 1991 and 2010. Each function was fitted to the lactation curves using nonlinear regression procedures. The Richards and sinusoidal equations provided the smallest root mean square error values, Akaike's and Bayesian information criteria and, therefore, the best fit for the cumulative lactation curves for milk yield. The Richards equation seemed to provide the most accurate estimate of the cumulative milk production at peak milk yield. Sinusoidal and flexible classical growth functions are appropriate to describe cumulative milk production curves and estimate lactation traits in buffalo.

Functional properties of cream and butter oil from milk of Holstein cows abomasally infused with increasing amounts of high-oleic sunflower fatty acids

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USA

Abstract

This research paper addresses the hypothesis that there is an optimal amount of intestinally available oleic acid (provided via abomasal infusion) to produce higher-oleic acid milk fat with satisfactory functional characteristics of cream and butter oil. A control and four increasing doses of free fatty acids from high oleic sunflower oil (HOSFA) were infused into the abomasum of four lactating dairy cows in a crossover experimental design with 7-d periods. Treatments were: 1) control (no HOSFA infused), 2) HOSFA (250 g/d), 3) HOSFA (500 g/d), 4) HOSFA (750 g/d), and 5) HOSFA (1000 g/d). All treatments included meat solubles and Tween 80 as emulsifiers. Viscosity, overrun and whipping time as well as foam firmness and stability

were evaluated in whipping creams (33% fat). Solid fat content (from 0 to 40°C), melting point and firmness were determined in butter oil. Whipping time of cream increased linearly and viscosity decreased linearly as infusion of HOSFA increased. Overrun displayed a quadratic response, decreasing when 500 g/d or more was infused. Foam firmness and stability were not affected significantly by HOSFA. For butter oil, melting point, firmness, and solid fat content decreased as HOSFA infusion increased. Changes in 21 TG fractions were statistically correlated to functional properties, with 6 to 10 fractions showing the highest correlations consistently. Decisions on the optimal amount of HOSFA were dependent on the dairy product to which milk fat is applied. For products handled at commercial refrigeration temperatures, such as whipping cream and butter oil, the 250 g/d level was the limit to maintain satisfactory functional qualities. Palmitic acid needed to be present in at least 20% in milk fat to keep the functional properties for the products.

Effect of calcium soaps from garlic (*Allium sativum*) and willow (*Salix babylonica*) extracts on nematode loads, nutrient intake and digestibility, nitrogen balance, and rumen fermentation kinetics in dairy goats

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UK, Iran, Mexico and Argentina

Abstract

The objective of this study was to determine the effect of dietary calcium soaps from garlic (*Allium sativum*) and willow (*Salix babylonica*) extracts on nematode loads, nutrient intake and digestibility, nitrogen balance and rumen fermentation kinetics in dairy goats. Nine adult non-lactating Saanen goats were grouped into a complete randomized block design with 3 treatments (n=3) over a period of 28 days. Animals were fed a diet based on alfalfa hay and a concentrate that was supplemented (65 g/kg DM) with calcium soaps of safflower (control), garlic or willow. Intake of dry matter (DM), organic matter (OM) and neutral detergent fiber (NDF) were not affected by dietary calcium soaps. However, the highest digestibility of DM and OM were observed in willow supplemented goats. *In vitro* gas kinetics and fermentation profile were not affected by diets. Results from fecal egg count indicated a reduction in total count, *Haemonchus* spp. and *Trychostrongylus* spp. for both garlic and willow compared to control. Our results suggest that calcium soaps of garlic or willow extracts can be used to reduce gastrointestinal parasites in goats without compromising productive traits or rumen function.

Ration particle size has different effects on digestive but not production parameters in higher-yielding (Holstein) compared to lower-yielding (Girolando) cows

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Brazil and Australia

Abstract

The aim of the study was to compare the effects of total mixed ration particle size on intake dynamics, animal performance and CH₄ emissions in high-yielding Holstein and lower-yielding Girolando cows. The experimental design was a 2×2 Latin Square arranged as a crossover factorial scheme with two diets (short particle size, SPS or long particle size, LPS) and the two breeds comprising two periods of 26 days each, where all data collection was performed at cow level. No influence of the particle size occurred for the passage rate, NDF digestibility, milk yield or milk composition, methane emissions or ruminal fermentation parameters ($P > 0.05$). However, Girolando cows had significantly greater dry matter intake when fed SPS, while Holsteins did not. Girolando cows had lower dry matter, crude protein and non-fibrous carbohydrate digestibility when fed LPS compared to SPS, while Holsteins had the opposite effect (dry matter) or no effect. Girolando had increased eating rate and CH₄ intensity when compared to Holstein. Reducing particle size increased CH₄ intensity in both breeds, but particle size did not influence eating time, eating rate, feed trough visits or visits with intake, regardless of the breed.

Study on proteomics difference between high-yielding and low-yielding Guanzhong dairy goats during peak lactation

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China

Abstract

The aim of this experiment was to investigate the differential proteomic characteristics of milk from high- and low-yielding Guanzhong dairy goats during the peak lactation period under the same feeding conditions. Nine Guanzhong dairy goats with high yield (H: 3.5 ± 0.17 kg/d) and nine with low yield (L: 1.2 ± 0.25 kg/d) were selected for milk proteomic analysis using tandem mass tag (TMT) technology. A total of 78 differentially expressed proteins were identified. Compared with L, 50 proteins including HK3, HSPB1 and ANXA2 were significantly upregulated in H milk, while 28 proteins including LALBA and XDH were significantly downregulated. Bioinformatics analysis of the differentially expressed proteins showed that galactose metabolism, purine metabolism, glycolysis/gluconeogenesis, MAPK signaling pathway, regulation of actin cytoskeleton and other pathways were closely related to milk

yield. HK3, HSPB1, ANXA2, LALBA and XDH were important candidate proteins associated with the milk production characteristics of Guanzhong dairy goats. Our data provide relevant biomarkers and a theoretical basis for improving milk production in Guanzhong dairy goats.

Relationship among thermal environment, stage of lactation, body characteristics, yield and milk constituents of dairy Gyr cows managed on pasture

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Brazil

Abstract

Our aims were to evaluate changes in body characteristics, milk yield and milk constituents as well as to determine the relationship between the thermal environment and production characteristics during the first lactation of dairy Gyr cows raised on pasture. Between 2013 and 2014, forty-five nulliparous dairy Gyr cows were evaluated from prepartum to 10 months of lactation in Southeast of Brazil. Body weight, body condition score (BCS), subcutaneous fat thickness (SFT), milk yield (305 d), and milk constituents were collected monthly and progesterone was collected weekly. Additionally, we determined the temperature humidity index (THI) based on microclimate data. Overall, the cows lost body weight until six months of lactation and there was a progressive decrease in BCS, SFT, milk yield and milk lactose as the months in lactation progressed. In contrast, there was an increase in milk fat, milk protein and milk solids. The thermal environment did not pose a consistent heat challenge, nevertheless, we found a positive correlation between the average THI two days before milk collection with milk yield, fat and lactose contents, but in contrast a negative correlation was found with total solids and protein. In conclusion, the THI and months of lactation affected the yield and constituents of milk. However, more studies are necessary to understand the impacts of body characteristics and thermal environment on yield and milk constituents throughout the productive life of Gyr dairy cows.

Non-*aureus* staphylococci and mammaliicocci (NASM): their role in bovine mastitis and One Health

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Abstract

Non-*aureus* staphylococci (NAS) are gaining importance in mastitis and public health, and some NAS have been reclassified as mammaliicocci (NASM). Bovine milk production has a major influence on the world economy, being an essential source of income for small, medium

and large producers, and bovine mastitis caused by NASM can cause an economic impact. Mastitis generates financial losses due to reduced revenue, increased veterinary costs and expenses associated with animal slaughter. However, it is also a public health issue involving animal health and welfare, human health and the ecosystem. Furthermore, it is an increasingly common infection caused by NASM, including antimicrobial-resistant strains. Despite all these adverse effects that NASM can cause, some studies also point to its protective role against mastitis. Therefore, this review article addresses the negative and positive aspects that NASM can cause in bovine mastitis, the virulence of the disease and resistance factors that make it difficult to treat and, through the One Health approach, presents a holistic view of how mastitis caused by NASM can affect both animal and human health at one and the same time.

Assessing teat canal morphology in the dry period and during lactation by high resolution ultrasound

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UK and Australia

Abstract

Our objectives were to quantify the dimensions of a fully 'closed' teat canal in dry cows and to describe recovery of the teat canal between milkings in lactating cows to assess whether and when full closure is attained, since this is an important determinant of udder health. Using an ultrasound scanner, teat canal length and diameter (proximal, midpoint and distal), teat cistern width, teat end width, whole teat width and teat wall thickness in 77 dry and 39 lactating dairy cows were measured. The dry cows represented a cross section of the dry population, with days since dry off ranging from 0 to 69 (median: 27). Data from lactating cows were recorded just before milking, and every 3 hours post-milking. To control for location a cross-over (parlour vs barn) study design was used. In dry cows, teat canal length and diameter did not vary by quarter or days since dry off, but multiparous cows had significantly wider teat canals than primiparous cows. The dry cow measurements can be used as baseline for dimensions for closed teats. In lactating cows, all teat dimensions except teat end width changed significantly during the 12-hour milking cycle. Location (parlour vs barn) did not affect the measurements, except teat end width and teat wall thickness. Teat canal length increased after milking and returned to pre-milking values by 9 hours. Proximal and midpoint teat canal diameters decreased slightly just after milking and then progressively increased to above the pre-milking values by 9 hours. Distal teat canal diameter increased after milking, partially contracting by 9 hours. We found that during the dry period the teat canal is in a steady state, but its diameter is not zero, while during the lactation, the teat canal is in a near constant state of remodeling.

Laboratory evaluation of a rapid diagnostic test for dairy mastitis

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The Netherlands and Denmark

Abstract

Rapid diagnostic tests that differentiate between Gram positive, Gram negative and the absence of aerobic bacteria in milk samples from dairy cows with clinical mastitis can support antimicrobial treatment decisions and contribute to a more prudent use of antimicrobials in the dairy industry. The objective of this study was to evaluate the test characteristics of the novel rapid BACT mastitis test in discriminating causes of clinical mastitis under laboratory conditions. Test outcomes of 155 milk samples from clinical mastitis cases were incubated for 14-16h in the BACT test and compared to results of bacteriological culture. The accuracy for detection of bacterial growth and Gram positive growth was 91% and 89% respectively. The BACT test could provide an accurate and relatively fast decision tool for farmers to aid in antimicrobial treatment decisions in cases of clinical mastitis.

Concentrations of antimicrobial components in milk at dry off and postpartum and their relationships to new high somatic cell counts at quarter level in dairy cows

Naoki Suzuki, Rika Harada, Yusaku Tsugami, Takahiro Nii and Naoki Isobe

Japan

Abstract

We investigated the antimicrobial components in cow milk at dry off and postpartum and their contribution in preventing new high SCC at quarter level. Milk samples from 72 quarters of 19 lactating cows were collected at last milking before dry off and at 7 d after parturition. Milk yield of each cow was recorded and SCC, IgG, IgA, lactoferrin, lingual antimicrobial peptide (LAP), and S100A7 concentrations in each quarter milk sample were measured. The postpartum milk yield was significantly higher than that at dry off. The IgG, IgA and lactoferrin concentrations in milk at dry off were significantly higher than those at postpartum, whereas the LAP concentration was lower. Quarters with SCC <300,000 cells/mL at both dry off and postpartum were classified as persistent low SCC (PL) whereas those that rose above that same threshold postpartum were classified as new high SCC (NH). At dry off, IgG and LAP concentrations in milk were significantly higher in PL than in NH. These results suggest that high LAP concentrations during the dry period may contribute toward the prevention of new high SCC.

Intramammary treatment of clinical mastitis quarters with ceftiofur does not cause antibiotic residues in adjacent untreated quarters

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Brazil

Abstract

The study was carried out in dairy cows to elucidate whether treatment of clinical mastitis quarters with Spectramast® LC (ceftiofur hydrochloride, 125 mg, Zoetis) created a reason for discarding milk from adjacent untreated healthy quarters. The antibiotic was infused once daily in the affected mammary quarter for four days. Forty-nine cows were evaluated after diagnosis of clinical mastitis in three or fewer udder quarters. In all cases, quarters that did not receive treatment had milk samples collected one day after the end of treatment. All milk samples were below the maximum permissible limit for the presence of antibiotic residues after analysis with the BetaStar S Combo test. Pharmacokinetic and pharmacodynamic characteristics may explain this finding. We conclude that it is feasible to use milk from untreated quarters of animals that have been treated with Spectramast® LC. We also reiterate the need to carry out tests with other pharmacological bases, and that the results found in this experiment cannot be extrapolated to other drugs.

Effects of feeding pasteurized waste milk or saleable milk to calves on weight, health, and fecal *Escherichia coli* antimicrobial resistance

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Argentina

Abstract

The aim of this study was to compare the effects of feeding pasteurized waste milk or saleable milk to calves on weight, health and emergence of antimicrobial resistance in *Escherichia coli* strains isolated from those calves. An experimental study under field conditions on a commercial pasture-based Argentinian dairy farm was carried out. Forty Holstein calves were assigned randomly to either pasteurized waste milk (PWM) or non-pasteurized saleable milk (SM). The antimicrobial agents (AM) used on the farm, both to treat or prevent diseases, were recorded. The passive immunity level, calf live weight, AM presence in milk, clinical examination of calves, and *E. coli* isolation and identification, were performed. A total of 258 *E. coli* strains were isolated from fecal samples (132 isolates from SM calves and 126 from PWM calves at six sampling times). All *E. coli* isolated were used to perform AM susceptibility tests (disc diffusion and agar dilution). No differences were observed between groups in health parameters, average daily gain or prevalence of resistant *E. coli* strains to any AM evaluated throughout the study. Peaks of trimethoprim, sulfamethoxazole and enrofloxacin

minimum inhibitory concentration (MIC) were observed at 30 d in *E. coli* from both groups of calves, whilst additional peaks to tetracyclin and ampicillin were observed only in SM calves. All MIC apart from gentamicin decreased at 75 and 90 d of age (during the weaning period). Gentamicin MIC behaved differently, having no peaks and increasing at 90 d only in PWM group. In conclusion, we found no evidence that emergence of antibiotic resistance is related to the consumption of pasteurized waste milk.

Whey protein dynamics in goat mammary secretions during colostrum and early lactation periods

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Brazil

Abstract

The protein composition in goat milk undergoes changes throughout the different lactation periods, displaying distinct characteristics that are influenced by the dynamic nature of protein composition and concentration during the transition from colostrum secretion to mature milk. To evaluate the dynamics of whey proteins of Saanen goats during the colostrum phase and the first month of lactation, 110 milk samples from 11 healthy mammary halves of seven Saanen goats were selected through a clinical evaluation. Whey was obtained by rennet coagulation of the mammary secretion. The biuret method determined total protein concentration, and their fractions were identified by 12% dodecyl sulfate-polyacrylamide gel electrophoresis. Maximum concentrations of all protein fractions were observed in the first 12 hours of lactation, reducing throughout the study. Modification of the protein predominance was also observed. The transition from colostrum secretion to milk occurred 5 or 7 days postpartum.

Characterization of variables related to high stability of raw cow milk

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Brazil

Abstract

This research paper analyzes the stability of raw cow milk in the alcohol test and seeks to understand to know the factors that influence milk stability and the occurrence of unstable non-acid milk. Milk samples were collected from the cooling tanks of rural farmers in the state of Paraná twice in summer and twice in winter. The farms were classified according to the production system: pasture with supplementation and feedlot. The following variables were analyzed: stability in the alcohol test, titratable acidity, ionized calcium concentration (iCa), chemical composition of milk, somatic cell count and standard plate count. The results showed that milk stability was greater in winter versus summer, when the milk contained

higher iCa, and in the feedlot versus pasture system. The Pearson Correlation between variables (ethanol stability, milk composition, iCa, cooling tank temperature, milk volume, number of milking, number of cows milked, fat/protein ratio, distance and travel time) were analyzed. Stability was negatively correlated with iCa concentration and positively with lactose content. Logistic regression of the risk of unstable non-acid milk at 72% alcohol (UNAM₇₂) showed that only iCa and lactose were determinants, while evaluation of the same risk at 78% alcohol revealed iCa, titratable acidity, lactose and milk urea nitrogen as risk factors. Under the dairy farming conditions of Paraná state, the frequency of UNAM₇₂ was low (12.16%) and was higher in summer and in pasture systems with supplementation. In conclusion, in dairy herds bred with high technological level, with adequate nutritional and health management, the frequency of UNAM is low and is related to nutritional management and, perhaps, heat stress, factors that alter iCa and lactose levels.

Whey protein concentrate and skimmed milk powder as encapsulation agents for coffee silverskin extracts processed by spray drying

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Brazil

Abstract

We tested the hypothesis that milk proteins, through microencapsulation, guarantee protection against bioactive substances in coffee silverskin extracts. Therefore, the aim of this study was to carry out technological, nutritional and physicochemical characterisation of a coffee silverskin extract microencapsulated using instant skim milk powder and whey protein concentrate as wall materials. The aqueous extract of coffee silverskin was spray-dried using 10 % (w/v) skim milk powder and whey protein concentrate. The samples were characterised by determining the water content, water activity, particle size distribution, colour analysis and total phenolic compound content as well as antioxidant activity using 2,2-diphenyl-radical 1-picrylhydrazyl scavenging methods, nitric oxide radical inhibition and morphological analysis. The product showed water activity within a range that ensured greater stability, and the reduced degradation of the dried coffee silverskin extract with whey protein concentrate resulted in better rehydration ability. The luminosity parameter was higher and the browning index was lower for the encapsulated samples than for the pure coffee silverskin extract. The phenolic compound content (29.23 ± 8.39 and 34.00 ± 8.38 mg gallic acid equivalents/g for the coffee silverskin extract using skimmed milk powder and whey protein concentrate, respectively) and the antioxidant activity of the new product confirmed its potential as a natural source of antioxidant phenolic compounds. We conclude that the dairy matrices associated with spray drying preserved the bioactive and antioxidant activities of coffee silverskin extracts.

Quality and antioxidant potential of goat's milk paneer prepared from different citrus juices and its whey

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USA and Pakistan

Abstract

The experiments reported in this research paper aimed to evaluate the physico-chemical and sensory characteristics, microbial quality and antioxidant potential of goat's milk paneer during storage (0-12 days, $4 \pm 1^\circ\text{C}$). The juices from five different citrus fruits were used as coagulant (treatments) to make goat's milk paneer. The pH of all paneer samples decreased during storage whereas titratable acidity increased. Ash (%) fat (%) and protein (%) of paneer increased slightly during storage, whereas sensory perception decreased. The juices from all the citrus fruit varieties showed high contents of total phenolics and total flavonoids which ultimately influenced ferric reducing antioxidant power, total antioxidant capacity and radical scavenging activities. As the contents of different juices were also retained in the paneer matrix, so paneer coagulated with citrus juices also showed encouraging results in terms of total phenolic and flavonoid contents, ferric reducing antioxidant power and radical scavenging activities. Amongst all the paneers, the most promising was that coagulated by kinnow juice. In addition, the whey obtained from paneer coagulated by citrus juices also showed appreciable quantities of total phenolic and flavonoid contents, thereby beneficially influencing ferric reducing antioxidant power and radical scavenging activities. It is concluded that citrus juices improve the sensorial quality and antioxidant potential of goat's milk paneer and its whey.

Fermentation of whey-derived matrices by *Kluyveromyces marxianus*: alcoholic beverage development from whey and fruit juice mixes

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Argentina

Abstract

This research paper addresses the hypotheses that *Kluyveromyces marxianus* can be cultured with good alcohol production on different whey-derived matrices, and that the fermented product can be used in order to develop alcoholic beverages with acceptable sensory characteristics by mixtures with yeast-fermented fruit-based matrices. Growth and fermentative characteristics of *Kluyveromyces marxianus* LFIQK1 in different whey-derived matrices were explored by culturing (24 hours, 30°C) on reconstituted whey, demineralized whey, heat-treated whey and milk permeate media. High lactose consumption, ethanol production and yield were observed. Reconstituted whey matrix was selected for mixing with orange or strawberry juices fermented using *Saccharomyces cerevisiae* to obtain alcoholic

beverages (W-OR and W-ST, respectively). Consumer evaluation of beverages was performed using acceptability and Check-All-That-Apply (CATA) questions. Good acceptance was observed, significantly higher for W-ST (than for W-OR). CATA questions gave formation about organoleptic characteristics of beverages. Penalty analysis showed W-R and W-ST were positively associated with smooth/refreshing and fruity/natural, respectively. Liking was represented, accordingly with penalty analysis, by natural/refreshing. A novel alternative for utilization of whey and whey-related matrices by alcoholic beverages production with natural ingredients is presented.

Milk processing systems of the Mongolian nomadic Khalkha groups in Eastern Mongolia and technique transmission from West Asia

Masahiro Hirata

Japan

Abstract

The purpose of this paper is to understand the milk processing system practiced in the Mongolian nomadic Khalkha groups of Su'qbaatar and Dornod Provinces in eastern Mongolia through a field survey, to compare it with surrounding areas of Qentiy and Dundgovi provinces, and then to analyze the transmission of processing techniques by further comparison with those of Syria, Jordan, Iran and Iraq in West Asia. The milk processing techniques of fermentation, cream separation and additive coagulation are all used in Su'qbaatar and Dornod Provinces. In fermentation processes, the technique of alcohol fermentation with churning is mainly used for cow milk to process alcoholic sour milk, followed by further processing to spirit, butter oil and non-matured dry cheese. In cream separation processes, the technique of heating/cream separation is used, in which cream is first separated from milk and non-matured dry cheese is processed from skim milk. In additive coagulation processes, the technique of fermented milk coagulation which utilizes lactic acid fermented whey as a coagulant is used to process non-matured dry cheese. These techniques are widely shared in the eastern part of Mongolia. It is characteristic of Su'qbaatar Province that the processing of cow milk is dominated by the technique of fermentation processes, mainly alcohol fermentation with churning. It is presumed that the technique of churning sour milk transmitted from West Asia to eastern Mongolia, and then the function of churning originally for butter processing was converted to allow for alcohol fermentation under the cooler environment in North Asia.

Implementation of hazard analysis and critical control point (HACCP) in yogurt production

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Iran and Turkey

Abstract

This study aimed to review hazard analysis and critical control points (HACCP) in the dairy industry for the production of yogurt. The food safety management system (FSMS) was implemented over the last several decades with several amendments. The need for practical and proactive procedures in the dairy industry was identified so that HACCP implementation could ensure that consumers would always have safe food. The concept of HACCP is a systemic and science-based method that can result in safe dairy products such as yogurt based on the complete analysis of manufacturing processes, recognition of hazards potentially present at all stages of production, and risk prevention. In yogurt production, raw milk receipt, pasteurization, packaging, and storage are the steps most susceptible to contamination and were considered as critical control points. Further steps also need to be implemented to achieve other related control measures, and these will be discussed.