



IJSRM

INTERNATIONAL JOURNAL OF SCIENCE AND RESEARCH METHODOLOGY

An Official Publication of Human Journals



Human Journals

Review Article

October 2020 Vol.:16, Issue:4

© All rights are reserved by Márcia Aparecida Andreazzi et al.

Analysis of Scientific Production on Chemical Residue in Bovine Milk



Camila Schubert Marques dos Reis¹, Rafaela Carvalho Alves², Márcia Aparecida Andreazzi^{*3}, José Maurício Gonçalves dos Santos⁴, Fábio Luiz Bim Cavalieri⁵, José Eduardo Gonçalves⁶

¹Student of the Veterinary Medicine Course, Cesumar University, Maringá, Paraná, Brazil. ²Student of the Veterinary Medicine Course, Cesumar University, Maringá, Paraná, Brazil. ³PhD, full professor in the Veterinary Medicine Course and the Master in Clean Technologies at Cesumar University, Paraná, Brazil. ⁴PhD, full professor in Veterinary Medicine Course at Unicesumar University, Paraná, Brazil. ⁵PhD, full professor in Veterinary Medicine Course and the Master in Clean Technologies at Cesumar University, Paraná, Brazil. ⁶PhD, full professor in the Master in Clean Technologies at Cesumar University, Paraná, Brazil.

Submission: 23 September 2020

Accepted: 30 September 2020

Published: 30 October 2020



HUMAN JOURNALS

www.ijsrm.humanjournals.com

Keywords: Antibiotics; Hormones; Milk Production; Milk Quality; Dairy Cows

ABSTRACT

Milk is a universal food and several countries stand out in its production, among them Brazil. In fact, production has expanded, in order to increase both the quantity and the quality of the milk produced, which must present an appropriate composition to the legislation. However, in some situations, milk may present chemical residues, compromising its quality. Considering the importance of studies that evaluate and discuss the presence of chemical residues in bovine milk, the objective of this work was to carry out a historical and quantitative analytical approach to the scientific literature on residues in bovine milk. Data were collected between 2000 and 2016 in journals indexed in different databases. The results showed, despite the reduced number of publications, an increasing behavior in the amount of scientific articles on the subject. The publications dealt with different residues, but residues of antibiotics and pesticides were the most studied. It is suggested that more research be conducted encouraging actions to reduce these residues through improvements in the management of the dairy herd, in order to guarantee a better milk yield in the industry and greater safety in the consumption of bovine milk.

INTRODUCTION

Brazilian milk production is constantly developing, reflecting an increase in the number of milked cows and in production capacity, placing the country in the 4th position in the world ranking of milk production (1).

However, major transformations have marked the production of Brazilian milk, especially those related to its quality. Stated that, as milk is produced by a living organism, its characteristics in quantity and composition can be influenced by several factors (2). Thus, the composition of milk may vary, but it is considered that, on average, milk has 3.2% protein, 3.5% fat, around 4.6% lactose and 0.7% of salts, totaling 12% of total solids (3).

However, the occurrence of problems inherent to the general, sanitary and reproductive management of cows must be considered and therefore, in certain situations, the use of veterinary drugs in the herd is necessary.

Thus, some factors may result in the presence of these drugs or their metabolites in milk, for example, not respecting the withdrawal period, using doses different from those recommended (4), errors in the identification of treated animals, use of products for dry cows in the treatment of lactating cows, accidental milking of dry cows or in the treatment process and the mixing of milk with residues to milk without residues.

Another point to be considered is the use of the lactation induction protocol. The protocol aims to stimulate milk production, regardless of whether the cow has a pregnancy, and the use of hormones and other drugs are common in these protocols (5), however, if the veterinary instructions are not respected, these products can be transferred to milk, compromising its quality and the food safety of consumers.

Considering the importance of studies that evaluate and discuss the presence of chemical residues in bovine milk, the objective of this work was to evaluate, in a qualitative and quantitative way, the scientific publications that dealt with the topic “chemical residue in bovine milk”.

MATERIALS AND METHODS

The object of analysis was the scientific production published in journals indexed in the databases of the Scientific Electronic Library Online (SciELO), Latin American and Caribbean Literature in Health Sciences (LILACS), Latin American and Caribbean Center for Information in Health Sciences (BIREME) and National Library of Medicine (PubMed). The research was conducted following the methodological recommendations of Braun and Schubert (1988) (6).

The search for scientific articles was carried out in 2017, using the following descriptors: residue in milk, chemical residue in milk, agrochemical in milk, agrochemical in milk, antibiotic in milk, hormone in milk and chemical contaminant in milk, in Portuguese and English and in singular and plural.

The survey resulted in 64 scientific articles, from which the year of publication information and the central thematic axis of the research were identified and separated. The data were tabulated and organized in an electronic spreadsheet and descriptive analysis was used.

RESULTS AND DISCUSSION

The data referring to historical evolution during the period from 2000 to 2016 showed an increase in the number of publications until 2012, followed by a decrease in the following years (Figure 1). Part of this continuous increase in publications on the topic of residue in milk is attributed to the greatest concern with the food safety of consumers.

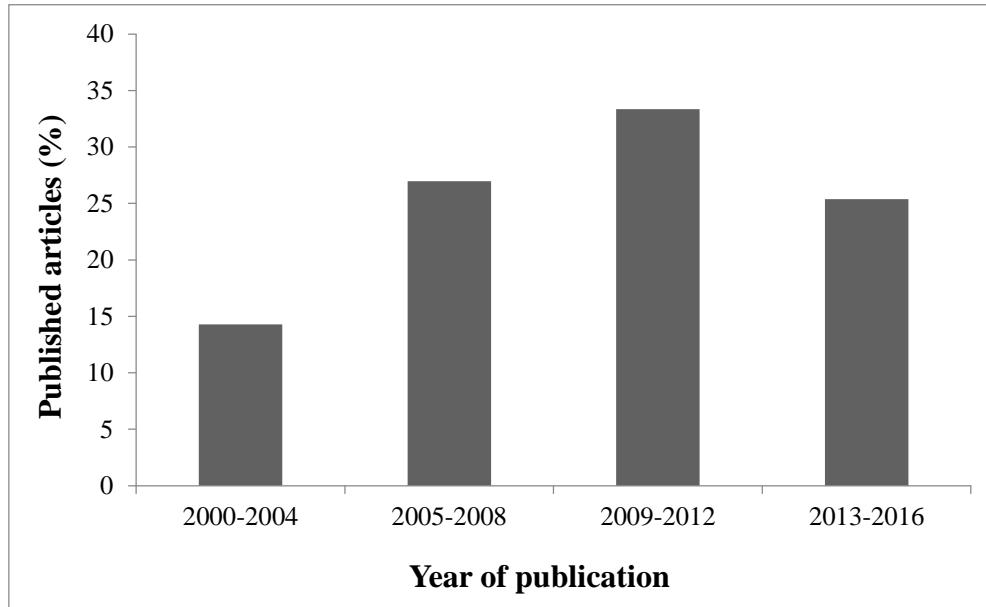


Figure No. 1: Percentage of articles published, every 4 years, related to the presence of residues in bovine milk, according to the year of publication (2000 to 2016) (n:64).

In fact, this concern has become more accentuated in the new millennium, as can be seen from the notes on the Millennium Development Goals (MDG, 2000 to 2015) and the Sustainable Development Goals (SDG, 2015-2030) (7). The SDG, defined by the United Nations, comprise a global agenda that involves actions to end poverty, promote prosperity and well-being for all, protect the environment and face climate change. Among the 17 SDG, Objective 2 addresses, among other goals, the global need to improve nutrition and achieve food security and Objective 12, which discusses the need to ensure sustainable production and consumption patterns (7). Thus, it is considered that more researchers have conducted studies and published articles on this topic in this period.

Regarding the thematic axis, the survey showed a great variation in the research objectives (Figure 2), but in general, the vast majority of works (58%) discussed antibiotic residues in milk, followed by pesticide residues (25%).

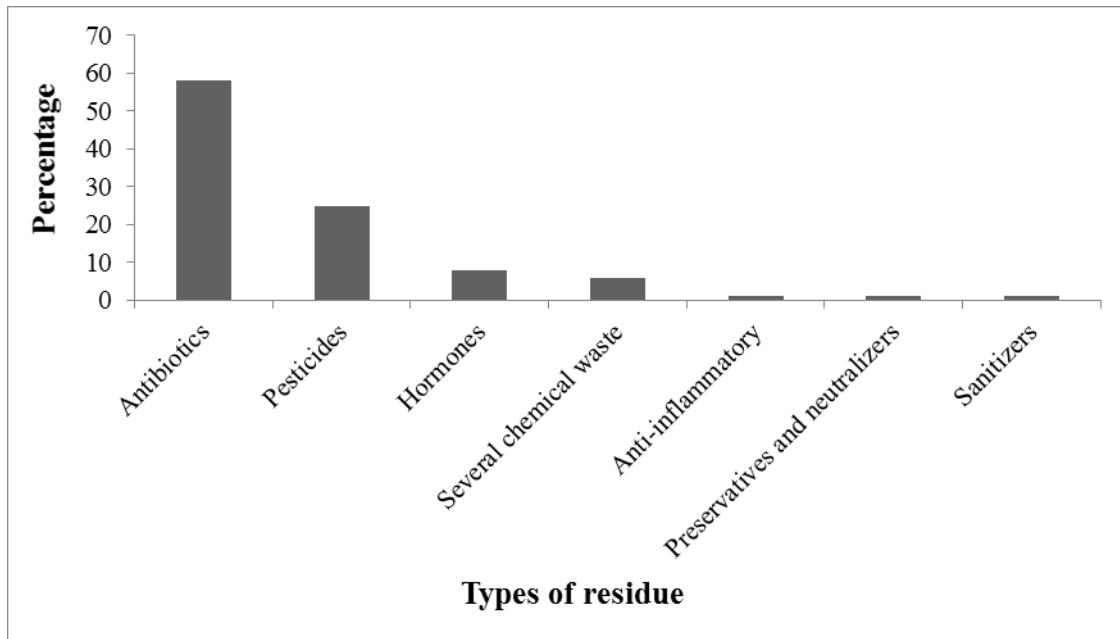


Figure No. 2: Percentage of scientific articles published on “Residue in milk”, according to the thematic axis of the research (n:64).

Regarding antibiotics, it is known that dairy production must overcome some barriers, such as the reduction of excessive consumption of antibiotics in production. To ensure the productivity and competitiveness of the chain, the use of medicines for therapeutic purposes is a very common practice and, among the medicines used, antibiotics are the most prescribed (8; 9). Changes in the environment, in general management, in food and, especially, cases of mastitis result in the use of antibiotics, which are natural or synthetic compounds capable of causing death or inhibition of bacterial growth, and which are used routinely in the plantations.

Antibiotics are an important tool to improve the efficiency of the production of meat and other products of animal origin, such as milk. However, its indiscriminate use, the need to maintain food security for consumers (10; 11) and the increased resistance of bacteria to antibiotics (12), led the World Health Organization (WHO) to emphasize the need to reduce their consumption in livestock (13). In fact, especially in low- and middle-income countries, several actions must be implemented in order to stimulate the use of antimicrobials in an effective, optimized and rational manner (14). According to Brazilian legislation, antimicrobials should be used only when necessary and in accordance with Good Agricultural Practices (15).

Concerning pesticides, it is known that there are consolidated management practices so that milk does not contain residues of veterinary drugs at levels harmful to human health, such as respect to the grace period, detailed instructions on the dose and form of use on labels, in addition to necessary disposal of milk produced by cows under treatment (4). However, in some situations these practices are not used in their entirety, resulting in the presence of residues in the milk, which are not eliminated by treatment processes such as boiling, pasteurization and sterilization, causing concern for public health and problems for the industry (16; 17), thus being a subject that generates many investigations among researchers.

One of the biggest concerns nowadays regarding food safety is the production of food free from contaminants, so it is essential that the production of food that does not pose a health risk to consumers is guaranteed (18). Food and Nutritional Security consists of everyone's right to regular and permanent access to quality food, from a biological, health, nutritional and technological point of view (19). Therefore, in order to produce milk, which is a product of animal origin quite susceptible to contamination by chemical residues, the recommendations of international organizations and national legislation must be carefully respected in all stages of the production chain (18).

It is also pointed out as another problem caused by the presence of residues in milk, especially antimicrobials, the undesirable effects in the production of dairy products, since these residues can inhibit fermentation, causing serious economic problems for the dairy industry (20; 21). Finally, we report that, in addition to putting consumers' health at risk, generating losses in dairy products, food residues can compromise international commercial relations (22). Therefore, research that seeks to evaluate the quality of milk is imperative in the scenario of food production today.

CONCLUSIONS

Based on the results obtained, it is concluded that, despite the growing behavior, there is an insignificant number of publications on the theme "Residue in milk" between the years 2000 to 2016 and the publications dealt with different themes, however broad axes such as antibiotic and pesticide residues were the most relevant.

In view of the reduced number of publications, it is suggested that researchers study and publish more work on the presence of chemical residues in milk, so that, based on the results, actions for improvements in the management of dairy herds are more intensified and that safety in milk consumption is guaranteed.

ACKNOWLEDGEMENTS

Araucária Foundation, for the grant of the scientific initiation scholarship that made this research possible and the Cesumar Institute of Science, Technology and Innovation - ICETI / Unicesumar, Maringá, Paraná, Brazil.

REFERENCES

1. MILK YEARBOOK. 2019. Anuário leite - **Indicadores, tendências e oportunidades para quem vive no setor leiteiro**. Texto Comunicação Corporativa - concessão Embrapa Gado de Leite. 116 p. Available in <http://www.infoteca.cnptia.embrapa.br/infoteca/handle/doc/1109959> accessed on June 10, 2020.
2. BELOTI, V.; TAMANINI, R.; NERO, L. A.; MOREIRA, M. A. S.; SILVA, L. C. C.; FAGNANI, R.; REIS, K. T. M. G. **Leite: Obtenção, Inspeção e Qualidade**. Londrina: Planta, 2015. 417 p.
3. BRAZIL. Ministério da Agricultura, Pecuária e Abastecimento. **Instrução Normativa Nº 76**, de 26 de novembro de 2018. Aprova os Regulamentos Técnicos que fixam a identidade e as características de qualidade que devem apresentar o leite cru refrigerado, o leite pasteurizado e o leite pasteurizado tipo A. 2018a. Available in http://www.in.gov.br/materia/-/asset_publisher/Kujrw0TZC2Mb/content/id/52750137/, accessed on June 10, 2020.
4. BANDEIRA, D. D.; MUNARETTO, J.S.; RIZZETTI, T. M.; FERRONATO, G.; PRESTES, O. D.; MARTINS, MANOEL L.; ZANELLA, R.; ADAIME, M.B. Determinação de resíduos de agrotóxicos em leite bovino empregando método QuEChERS modificado e GC-MS/MS. **Química Nova**, v.37.n.5, p.900-907, 2014.
5. PESTANO, H.S.; HAAS, C.S.; SANTOS, M.Q.; OLIVEIRA, F.C.; GASPERIN, B.G. Indução artificial da lactação em bovinos: história e evolução. **Brazilian Journal of Animal Reproduction**. v.39, p.315-21, 2015.
6. BRAUN, T.; SCHUBERT, A. Scientometric *versus* socio-economic indicators. Scatter plots for 51 countries, 1978-1980. **Scientometrics**, v.13, n. 1/2, p. 3-9, 1988.
7. UNESCO - UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANIZATION- **Post-2015 Development Agenda - UNESCO and the Sustainable Development Goals**. Available in <https://sustainabledevelopment.un.org/post2015>, accessed on September 17, 2020.
8. THIELE-BRUHN, S. Pharmaceutical antibiotic compounds in soils – a review. **Journal of Plant Nutrition and Soil Science**, v.166, p.145-167, 2003.
9. REGITANO, J. B.; LEAL, R.M.P. Comportamento e impacto ambiental de antibióticos usados na produção animal brasileira. **Revista Brasileira de Ciência do Solo**, v.34, n.3, p.601-616, 2010.
10. PRESTES, O.D.; MARTINS, M.L.; FRIGGI, C.A.; MUNARETTO, J.S.; ADAIME, M.B.; ZANELLA, R. O estado da arte na determinação de resíduos de medicamentos veterinários em alimentos de origem animal empregando técnicas cromatográficas acopladas à espectrometria de massas. **Química Nova**, v.36, n.5, p.697-710, 2013.
11. MACHADO, G.B.; MOURA, S.V; FORTES, T.P.; FELIX, S. R.; TIMM, C. D.; SILVA, É.F. Impacto da salmonelose na suinocultura e suas implicações em saúde pública. **Arquivos do Instituto Biológico**, v.83, n.1, 2016.

12. WHO - WORLD HEALTH ORGANIZATION. **Critically important antimicrobials for human medicine**, 2017. Available in <http://apps.who.int/iris/bitstream/handle/10665/255027/9789241512220-eng.pdf>, accessed on September 17, 2020.
13. ZANGARO, C. **Antibiotic use in swine production**. Michigan State University Extension. Maio de 15, 2019. Available in <https://www.canr.msu.edu/news/antibiotic-use-in-swine-production>, accessed on September 17, 2020.
14. LEKAGUL, A.; TANGCHAROENSATHIEN, V.; MILLS, A.; RUSHTON, J.; YEUNG, S. How antibiotics are used in pig farming: a mixed-methods study of pig farmers, feed mills and veterinarians in Thailand. **BMJ Global Health**. v.5, e001918, 2020.
15. BRAZIL. Ministério da Agricultura, Pecuária e Abastecimento. **Instrução Normativa Nº 77**, de 26 de novembro de 2018. Estabelece os critérios e procedimentos para a produção, acondicionamento, conservação, transporte, seleção e recepção do leite cru em estabelecimentos registrados no serviço de inspeção oficial. 2018b. Available in http://www.in.gov.br/materia/-/asset_publisher/Kujrw0TZC2Mb/content/id/52750141/do1-2018-11-30-instrucao-normativa-n-77-de-26-de-novembro-de-2018-52749887, accessed on June 10, 2020.
16. BRITTO, L.G.; ROCHA, R.B.; SILVA NETTO, F.G.; BARBIERI, F.S.; OLIVEIRA, M.C.S.; GONÇALES, M.A.R.; CARVALHO, G.L.O. **Eficácia de carrapaticidas em rebanhos leiteiros de Rondônia**. Porto Velho: Embrapa Rondônia, 2010. 4 p. (Circular Técnica 113).
17. MORAIS, C. M. Q. J.; DURÃES, T. S.; NÓBREGA, A. W.; JACOB, S. C. Presença de resíduos de antibióticos em leite bovino pasteurizado. **Ciência e Tecnologia de Alimentos**, v. 30, p. 33-35, 2010.
18. MARTIN, J.G.P. Resíduos de antimicrobianos em leite - Uma revisão. **Segurança Alimentar e Nutricional**, v.18, p. 80-87, 2011.
19. BRAZIL. **Lei nº 11.346**, de 15 de setembro de 2006. Cria o Sistema Nacional de Segurança Alimentar e Nutricional – SISAN, com vistas a assegurar o direito humano à alimentação adequada e dá outras providências. Diário Oficial da União, Brasília, 18 set. 2006. Seção 1, p. 1. Available in <http://www4.planalto.gov.br/consea/conferencia/documentos/lei-de-seguranca-alimentar-e-nutricional>, accessed on September 10, 2020.
20. BOZO, J.; ANDEL, S. Segurança e fermentabilidade de produtos lácteos. **Food Feed**, v68, p77-80, 2011.
21. TROMBETE, F. M.; SANTOS, R.R.; SOUZA, A.L.R. Antibiotic residues in Brazilian milk: a review of studies published in recent years. **Revista Chilena de Nutrición**. v.41, n. 2, p.191-197, 2014.
22. LERAYER, A.L.S.; MIGUEL, A.M.R.O; GUEDES, A.L.A; CARVALHO, A.F.; ITAJDENWURCEL, J.R.; FONSECA, L.M. **Nova legislação de produtos lácteos: Revisada, Ampliada e Comentada**. São Paulo: Editora Revista Indústria de Laticínios; 2002.

 <p>Author -1</p>	<p>Camila Schubert Marques dos Reis <i>Student of the Veterinary Medicine Course, Cesumar University, Maringá, Paraná, Brazil.</i></p>
 <p>Author -2</p>	<p>Rafaela Carvalho Alves <i>Student of the Veterinary Medicine Course, Cesumar University, Maringá, Paraná, Brazil.</i></p>
 <p>Author -3</p>	<p>Márcia Aparecida Andreazzi – Corresponding Author <i>PhD, full professor in the Veterinary Medicine Course and the Master in Clean Technologies at Cesumar University, Paraná, Brazil.</i></p>
 <p>Author -4</p>	<p>José Maurício Gonçalves dos Santos <i>PhD, full professor in Veterinary Medicine Course at Unicesumar University, Paraná, Brazil.</i></p>
 <p>Author -5</p>	<p>Fábio Luiz Bim Cavaliere <i>PhD, full professor in Veterinary Medicine Course and the Master in Clean Technologies at Cesumar University, Paraná, Brazil.</i></p>
 <p>Author -6</p>	<p>José Eduardo Gonçalves <i>PhD, full professor in the Master in Clean Technologies at Cesumar University, Paraná, Brazil.</i></p>