revista online de extensão e cultura
REALIZAÇÃO

CC BY NC SA

DOI 10.30612/realizacao.v8i15.15239
ISSN: 2358-3401

Submetido em 08 de Outubro de 2021
Aceito em 06 de Novembro de 2021
Publicado em 17 de Dezembro de 2021

PHYSICAL-CHEMICAL COMPOSITION OF RAW MILK PRODUCED BY FAMILY FARMERS OF THE ITAMARATI-MS SETTLEMENT

COMPOSIÇÃO FÍSICO-QUÍMICA DO LEITE CRU PRODUZIDOS POR AGRICULTORES FAMILIARES DO ASSENTAMENTO ITAMARATI- MS

COMPOSICIÓN FÍSICO-QUÍMICA DE LA LECHE CRUDA PRODUCIDA POR AGRICULTORES FAMILIARES DEL ASENTAMIENTO ITAMARATI-MS

Janaina Palermo Mendes*
Universidade Federal da Grande Dourados
Janaina Tayna Silva
Universidade Federal da Grande Dourados
Euclides Reuter de Oliveira
Universidade Federal da Grande Dourados
Alzira Salete Menegat
Universidade Federal da Grande Dourados
Andréa Maria de Araújo Gabriel
Universidade Federal da Grande Dourados
Eduardo Lucas Terra Peixoto
Universidade Federal da Grande Dourados
Jefferson Rodrigues Gandra
Universidade Federal do Sul e Sudeste do Pará
Hellén Felicidade Durães
Universidade Federal da Grande Dourados
Nathálie Ferreira Neves
Universidade Federal da Grande Dourados
Wagner da Paz Andrade
Universidade Federal da Grande Dourados
Rosilane Teixeira Alves
Universidade Federal da Grande Dourados
Hindyra Marihellym Folador
Universidade Federal da Grande Dourados

Abstract: This study aimed to evaluate the physicochemical characteristics of raw milk produced by family farmers in the Itamarati Settlement. The samples were collected in ten different rural properties, during the month of July 2021, by students and professors

* Autor para Correspondência: janapalermo@gmail.com

from the Faculty of Agricultural Sciences. The samples were placed in 1000 mL jars identified with numbers from one to ten and transported under refrigeration in isothermal boxes containing ice sheets to the Food Technology Laboratory -TPA, at the Federal University of Grande Dourados (UFGD). Physical-chemical analyzes were performed, such as: stability to alizarol, titratable acidity, relative density and cryoscopic index, fat, protein, defatted dry extract and defatted dry extract. After the analyses, a visit was made to the Itamarati Settlement, with the producers, respecting all safety measures due to Covid-19. The results found in relation to the physical-chemical quality of the collected samples were presented and later discussed about the influence on the quality of milk and consequently on the income of producers. Through the physical-chemical analysis, it was possible to identify that 90% of the analyzed samples were in accordance with the norms of IN 62, for all analyzed variables. Monitoring the quality of the producers' milk is of paramount importance because in many rural properties milk is the main source of income in some of them, it is even the only source of income for producers and their families.

Keywords: Physico-chemical constituents; Density; Extension; Quality.

Resumo: Objetivou-se avaliar as características físico-químicas do leite cru produzido por agricultores familiares no Assentamento Itamarati. As amostras foram coletadas em dez propriedades rurais diferentes, durante o mês de julho de 2021, por alunos e docentes da Faculdade de Ciências Agrárias. As amostras foram acondicionadas em potes de 1000 mL, identificas com numeração de um a dez e transportadas sob refrigeração em caixas isotérmicas contendo placas de gelo até o laboratório de Tecnologia de Alimentos -TPA, da Universidade Federal da Grande Dourados (UFGD). Realizou-se análises físico-químicas como: estabilidade ao alizarol, acidez titulável, densidade relativa e índice crioscópico, gordura, proteína, extrato seco desengordurado e extrato seco desengordurado. Após as análises feitas, realizou-se uma visita no Assentamento Itamarati, com os produtores, respeitando todas as medidas de segurança devido ao Covid-19. Os resultados encontrados em relação a qualidade físico química das amostras coletadas foram apresentados e posteriormente, discutido sobre a influência na qualidade do leite e consequentemente na renda dos produtores. Através das na análises físico-químicas foi possível identificar que 90% das amostras analisadas estavam de acordo com as normas da IN 62, para todos as variáveis analisadas. O acompanhamento em relação a qualidade do leite dos produtores é de suma importância pois em muitas propriedades

rurais o leite é a principal fonte de renda em algumas delas chega ser a única fonte de renda para os produtores e sua família.

Palavras-chave: Constituintes físico-químicos; Densidade; Extensão; Qualidade.

Resumen: El objetivo fue evaluar las características físico-químicas de la leche cruda producida por agricultores familiares en el Asentamiento Itamarati. Las muestras fueron recolectadas en diez propiedades rurales diferentes, durante el mes de julio de 2021, por alumnos y docentes de la Facultad de Ciencias Agrarias. Las muestras fueron acondicionadas en potes de 1000 mL, identificadas con numeración de uno a diez y transportadas bajo refrigeración en cajas isotérmicas conteniendo placas de hielo hasta el laboratorio de Tecnología de Alimentos -TPA, de la Universidad Federal de la Grande Dourados (UFGD). Se realizaron análisis físico-químicos como: estabilidad al alizarol, acidez titulable, densidad relativa e índice crioscópico, grasa, proteína, extracto seco desengrasado y extracto seco total. Después de los análisis realizados, se realizó una visita en el Asentamiento Itamarati, con los productores, respetando todas las medidas de seguridad debido al Covid-19. Los resultados encontrados en relación a la calidad físico-química de las muestras recolectadas fueron presentados y posteriormente, discutido sobre la influencia en la calidad de la leche y consecuentemente en la renta de los productores. A través de los análisis físico-químicos fue posible identificar que el 90% de las muestras analizadas estaban de acuerdo con las normas de la IN 62, para todas las variables analizadas. El acompañamiento en relación a la calidad de la leche de los productores es de suma importancia pues en muchas propiedades rurales la leche es la principal fuente de renta, en algunas de ellas llega a ser la única fuente de renta para los productores y su familia.

Palabras clave: Constituyentes físico-químicos; Densidad; Extensión; Calidad.

INTRODUCTION

Milk is a nutritional source, is considered one of the most complete feeds, presenting in its composition nutrients such as protein, carbohydrates, water, mineral salts, high calcium, and fatty acids such as oleic, linoleic, compounds with high digestibility (MARQUES et al., 2005).

Raw milk quality standards were regulated by Normative Instruction (IN) n 51 and updated by IN n 62 on December 29, 2011 (BRASIL, 2011). According to the Ministry of Agriculture, Livestock and Supply – BRAZIL, (2011) milk without any other specification is understood as a product from the complete, uninterrupted, hygienic milking of healthy, well-fed, and rested cows. Milk from other animal species must contain the name of the species from which it comes.

Cow's milk is the most produced in the country, which according to the Brazilian Institute of Geography and Statistics -BIGS, in 2019, Brazil 34.8 billion liters, an increase of 2.7% compared to last year, being the fifth largest milk producer in the world ranking, trailing countries like the United States, India, China and Russia (USDA, 2019).

In 2019, the state of Mato Grosso do Sul produced about 282.75 million liters of milk, a reduction of 8.6 % compared to 2018. The state was behind states such as Minas Gerais, responsible for producing 9.4 billion of milk liters for year, Paraná (4.3 billion), Rio Grande do Sul (4.3 billion), Goiás (3.2 billion), and Santa Catarina (3 billion), (IBGE, 2019).

Milk is evaluated against physical-chemical parameters such as stability to alizarol, titratable acidity, relative density, and cryoscopic index, composition: fat, protein, defatted dry extract and and for its microbiology and sanitary quality through analyzes such as: total bacterial count, cell count somatics, detection of antibiotic residues, (DIAS and ANTES 2014).

The quality of raw milk is important for safe consumption for consumers, in addition to being important to ensure adequate use in the manufacture of dairy products, whether fermented or not (SANDOBAL and FREITAS, 2021).

The physicochemical characteristics of raw milk can be manipulated by microorganisms, diet, environmental factors, genetics and stages of lactation. The lactation phase is one of the factors that most change the composition of milk, as during lactation the values of protein, lipids and lactose can significantly change (DE OLIVEIRA et al., 2010).

Furthermore, the quality of milk in people's diet, as a nutritious feed, milk can be considered an important product for income generation, especially on small properties, as in the case of family farming families in the Itamarati settlement. In this sense, the objective of this work was to develop a university extension action aimed at contributing to the productive potential of families, evaluating the physicochemical characteristics of raw milk produced by small rural producers in the Itamarati Settlement.

MATERIALS AND METHODS

The Itamarati Settlement is part of the municipality of Ponta Porã, state of Mato Grosso do Sul, specifically represented by the Novo Eldorado communities, seven falls belonging, respectively, to the Itamarati Settlement I, II and the Aba da Serra settlement.

This extension project is being developed in the Itamarati settlement, aiding the transition from traditional milk production to organic milk production, aiming at increasing milk production and quality through physicochemical analyses. With this project, we aim to exchange knowledge, as pointed out by Menegat, Nunes, Conceição and Oliveira (2019), by showing extension actions in the Areias/MS settlement.

In the Itamarati settlement, we followed the logic indicated by the authors, who recommend paying attention to the importance of exchanging knowledge, from those systematized at the university, with those from experiences in the making of production. With this joint effort, we seek to contribute to the milk production of Itamarati families, aiming at increasing production and improving the quality of milk, introducing physical-chemical evaluation of the product.

The samples were provided by 10 rural producers 3 times a week (Tuesday, Thursday and Saturday), during the month of July, and collected by students from the Faculty of Agricultural Sciences and packed in 1000 mL polyethylene pots and identified, numbered and transported under refrigeration in isothermal boxes containing ice sheets to the Food Technology Laboratory -TPA, at the Federal University of Grande Dourados. The results of the analyzes were made available to all producers and doubts about the results and their interpretations were clarified by the extensionists involved in the project.

The physicochemical analyzes such as acidity, density and fat were carried out following the methodology described in Normative Instruction No. 68 of December 12, 2006 of MAPA. Acidity was performed by transferring 10 mL of the sample to a tube and adding 4 drops of 1% neutralized phenolphthalein, subsequent titration with a 0.111 mol/L NaOH solution, until the appearance of pink color.

For density, 500 mL of milk was transferred to a beaker of corresponding capacity and then a thermoolactodensimeter was introduced in the samples, leaving it to rest for 3 minutes and reading the density with the correction to 15ºC.

The fat content was determined by the Gerber butyrometric method. To which 10 mL of sulfuric acid, 11 mL of milk were added and then 1 mL of isoamyl alcohol was

added. The butyrometer was centrifuged for 10 minutes at 1200 rpm. After centrifugation, the butyrometer was transferred to a water bath at 65ºC for 5 minutes. Reading the percentage of fat using the scale of the device.

The Total Dry Extract (TDE) was performed by the indirect Ackermann method using the Ackermann disk. The defatted dry extract (DDE) was calculated by the difference between the percentage of fat and the total dry extract.

Protein contents were determined by the Kjeldahl method, in which 5 mL of milk was pipetted and transferred to a Becker 100 mL and the volume was completed with distilled water. Then 5 mL of the solution was placed in a digestion tube, containing sulfuric acid and a catalyst mixture (potassium sulfate and copper sulfate). The mixture was then digested and the material was distilled by the drag method and subsequently titrated with a hydrochloric acid solution.

The alizarol test was carried out using a saturated alizarin solution prepared in 80% alcohol. 2 mL of alizarol and 2 mL of milk were mixed in a test tube and the test was read by visually observing the color of the mixture and by the presence or absence of clot or formation of lumps.

The test is read by visually observing the color of the mixture and by the presence or absence of coagulation or lump formation. The milk is considered normal to have a pink to lilac coloration and no coagulation formation, demonstrating that the milk has adequate acidity (pH from 6.8 to 6.6). If clots form along with the yellow color, this milk is considered acidic. The alkaline milk showed a mixture of purplish or violet color, tending towards blue.

The cryoscopic index was determined using a digital electronic (cryoscope), 2.5 mL of milk was placed in small tubes fitted to the equipment, which rapidly cooled the sample and stirred the milk by a rod in the device and with this the descent and ascent of the mercury column until its stabilization, and then the cryoscopy reading in Graus Hortvert was performed.

Table 1. Normative Instruction No. 62 of December 29, 2011.

Composition Item	Requirement
Fat (g/100 g)	min. 3,0
Acidity, in g of lactic acid /100 mL	0,14 a 0,18

Relative density, 15/15ºC, g/mL	1,028 a 1,034
Cryoscopic index	- 0,530ºH a -0,550ºH (equivalent to -0,512ºC e a -0,536 ºC)
Non-Greasy Solids (g/100g)	mín. 8,4
Total Protein (g/100 g)	mín. 2,9
Alizarol stability 80 % (v/v)	steady

Source: Brasil, 2011.

RESULTS AND DISCUSSION

After the analyzes were carried out, a visit was made to the Itamarati Settlement, with the producers, respecting all safety measures due to Covid-19, where the results were found in relation to the physical and chemical quality of the collected samples were presented and, subsequently, they discussed one can see how each altered variable can influence the quality of the milk and, consequently, the acceptance of the product in the consumer market, resulting in income generation for the producers.

The physical-chemical analyzes of the samples from the Itamarati Settlement producers are shown in table 2. The relation of densities only samples 4 presented an average value above (34.2 g/mL) than allowed by legislation (maximum 34 g/mL), which may indicate the occurrence of adulteration, however, the cryoscope index of this sample observes values higher (562 ºC) than those allowed by legislation (550 ºC), indicative of the presence of reconstituents, used to mask the presence of water.

Table 2. Mean physicochemical characteristics of fresh milk samples from producers in the Settlement of Itamarati.

Producer	MP	Density 15ºC	Fat %	TDE %	DDE %	Acidity ºD	CI ºC	Protein g
1	202	32.3	3.8	12.2	8.5	17	535	3.100
2	171	33.6	3.9	12.7	8.8	16	539	3.085
3	194	32.9	3.7	12.3	8.6	15	540	3.070

4	231	34.2	3.4	12.3	8.9	17	562	3.185
5	255	32.9	4.0	12.7	8.7	16	537	3.115
6	752	33.0	3.7	12.4	8.7	16	540	3.070
7	289	33.2	3.4	12.0	8.6	15	538	3.115
8	323	33.0	4.0	12.7	8.7	17	536	3.115
9	253	33.6	4.0	12.9	8.9	16	542	3.205
10	201	32.5	3.6	12.1	8.5	16	535	3.025

MP: milk production; TDE: Total Dry Extract; DDE: defatted dry extract; CI: Cryoscopic index

The producer of sample 4 was instructed on the importance of collecting and storing milk, in relation to the quality of the final product, in addition to being instructed to avoid adding any additive (water) that changes the characteristics of the milk as it is not allowed by the health legislation.

When adding water to the milk, the cryoscope index approaches the freezing temperature of the water, making it below what is allowed by legislation, to mask this change, salts are used to increase the cryoscope index, not being penalized by the dairy or the consumer (ZENEBON et al., 2008).

The fat content ranged from 3.6 to 4%, values considered adequate, as they are above the minimum allowed content of 3% for raw milk. The self-fat content found in the present work may have been influenced by the feeding of animals, as due to the dry period in the region, it influenced an increase in dry matter in the forage and, consequently, an increase in fiber, corroborating an increase in rumination and chewing, increasing the acetate production and propionate decrease (GANDRA et al., 2019).

The production of organic forage used by milk producers in the settlement increases the forage dry mass production, influencing the increase in rumination and chewing, corroborating the high-fat content found (SILVA et al., 2021).

All DDE samples are suitable, according to INº62. DDE is composed of minerals, proteins and lactose, being influenced by the cows' diet. According to Nascimento and Galvão (2020), when the energy level of the cows' feeding is increased, there is a significant increase in the percentage of DDE in the milk.

The protein content of the 10 samples analyzed has an average value of 3.1g, showing a stable value. The amount of protein can vary according to race, climate, season, feeding and management, the protein content directly influences the DDE, being the second component that most varies in milk (PAIVA et al., 2018).

Regarding the acidity content, even though all samples present values acceptable by law, the producers were advised on the importance of hygiene at the time of milking, such as keeping hands clean, pre-dipping, to remove dirt and microorganisms present in the cow's teats before milking, ensuring that the milk has a lower microbiological load and consequently has lower acidity and at the end of milking carry out the post-dipping, "closing" the cow's teat reducing the risk of mastitis, being another factor that can influence to increase acidity (DA SILVA et al., 2019).

Table 3. Alizarol and pH Test.

Producer	Alizarol	pH
1	Good	6.55
2	Good	6.64
3	Good	6.40
4	Good	6.60
5	Good	6.91
6	Good	6.56
7	Good	6.88
8	Good	6.33
9	Good	6.48
10	Good	6.77

The alizarol test is considered a qualitative analysis that indicates the state of conservation of the milk. With the alizarol test, it is possible to estimate the pH of the milk. the pH of normal milk should range from 6.6 to 6.9, values below are considered acidic milk and above are considered alkaline milk. Producers 1, 3, 8 and 9 had values below 6.6, however, the presence of clots or lumps in the milk was not observed, and Dornic acidity showed normal milk values, not characterizing the samples as sour milk (CARDOSO, 2014).

The alizarol test is a quick and easy analysis to be carried out, being possible to be carried out on the property. Due to the doubt of many producers about how to perform the test and how to interpret its results, the test was carried out together with the producers of some samples collected on the properties, thus helping to resolve doubts, and also sharing scientific techniques, in an exchange of knowledge, characteristic of university extension. With this exchange, producers will be able to carry out this control on the property themselves, being able to monitor the acidity of the milk, seeking to avoid losses, improve the product as food and make it viable for acceptance in the market and in the lives of consumers. A similar situation of interaction between the university and social groups is presented in the article by Oliveira et al (2020), when reporting dialogues and technology transfer between settlers involved in the production of organic products, with university professors and students, a situation that according to the authors "There was a positive socio-environmental and ecological impact for beekeepers with the use of technologies introduced in the transition process to the organic honey production system" (OLIVEIRA, et al, 2020).

Peres et al., (2019) performing technical monitoring of small producers in the Alto São Francisco region, in Minas Gerais, from 2015 to 2016, observed that producers who received technical assistance were able to improve the quality of the milk produced, meeting the requirements of the Ministry of Agriculture, Livestock and Supply, for the milk to be considered of good quality, confirming the importance of quality guidance for producers, aiming to increase production and improve the quality of the raw material.

This interaction was possible in the activity with milk in the Itamarati settlement, where there was an exchange of knowledge with the producers, in order to understand that the physicochemical quality of the milk can be influenced by factors, intrinsic and extrinsic and can be easily manipulated

Many producers who do not have access to information are unaware of the importance of producing quality milk, and that this can translate into an improvement in quantity, as in addition to ensuring a quality product for their family, they get a better sale price. The dialogue between the knowledge produced at the university and transferred to the daily practice of production is fundamental for the dialogical process of knowledge production that aims to provide benefits at the base of production and also in the academic training of students, as confirmed by Menegat, and Oliveira (2019).

In this sense, the possibility for UFGD students to see in the practice of dealing with animals in the small properties of the Itamarati settlement served to get to know the

reality of production in that place and also to take knowledge that they acquired during the course, showing the importance of technology transfer and information between academia and the field, spreading knowledge, in addition to allowing interaction between teachers, students and producers, strengthening means of production in the field.

CONCLUSION

With the completion of the extension project developed in the Itamarati settlement, we concluded several results, among which we highlight two: the first result concerns the physicochemical analyses, in which it was possible to identify that 90% of the analyzed milk samples came from the units of the production of the Itamarati settlement were in accordance with the norms of IN 62, for all variables analyzed. In this way, the milk that the families produce in the settlements' lots is of high quality, being able to consume it and contribute to food improvement.

Another result that we highlight concerns the reach of the extension project, which provided opportunities for interaction between universities and producers, bringing contributions to both, whether in the possibility of students knowing the dynamics of small properties, in the daily production, as well as bringing academic knowledge to improve the production processes in the small lots of the settlement. This link has its contribution in university extension, one of the axes of the university, fundamental in academic training and also in training as a social subject, the main objective of the production of knowledge and which only makes sense if it enhances the good life.

In this sense, we see that monitoring the quality of the producers' milk is of paramount importance, as in many rural properties milk is the main source of income and, in some of them, it is even the only source of income for producers and their families. In this way, producing quality milk guarantees food security for the settled families, increasing the value of the product in relation to dairy products, ensuring better development for the producers of the Itamarati settlement.

ACKNOWLEDGMENT

To the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) and a Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) for the granting of the scholarship. Support from the Federal University of Grande Dourados,

through the Dean of Extension and Culture (PROEX/UFGD); to the Technological Vocational Center in Agroecology and Organic Production in Mato Grosso do Sul and to UFGD's Participatory Knowledge Construction Center in Agroecology and Organic Production.

REFERENCES

BRASIL. **Ministério Da Agricultura, Pecuária E Abastecimento.** Instrução Normativa 62 De 29 De Dezembro De 2011. Dispõe Sobre Regulamentos Técnicos De Produção, Identidade, Qualidade, Coleta E Transporte Do Leite. Diário Oficial da União, Brasília, Seção 1, 30 Dez. 2011.

CARDOSO, GDSP **Avaliação físico-química e microbiológica do leite cru refrigerado e soros dos queijos minas frescal e muçarela estocados sob diferentes temperaturas** . Tese (Doutorado) – Universidade Federal de GPOÁS, Escola de Veterinária e Zootecnia (EVZ), Programa de Pós-Graduação em Ciências Animais, Goiânia, 2014.

DA SILVA, EMN, DE ASSIS SILVA, G., DE SOUZA, BB, DE ALCÂNTARA, MDB, DE CARVALHO, MDGX Influência da fase de lactação e do intervalo entre as ordens sobre a composição e produção de leite de cabras no semiárido. **Revista Brasileira de Ciência Veterinária** , v. 3. 2019.

SILVA, LHX, OKADA , ESM, SOARES, JPG, DE OLIVEIRA, ER, GANDRA, JR, MARQUES, OFC, DE ARAÚJO GABRIEL, AM Gestão orgânica de *Urocloa brizantha cv. Marandu* consorciado com leguminosa . **Orgânico Agricultura ,** v. 1, p. 1-14. 2021.

DE OLIVEIRA, ENA, DA COSTA SANTOS, D., DA SILVA OLIVEIRA, A., DE SOUSA, FC Composição físico-química de leites em diferentes fases de lactação. **Revista Acadêmica Ciência Animal,** v. 4, 409-415. 2010.

DIAS, JA, ANTES, FG Qualidade Físico-Química, Higiênico-Sanitária E Composicional Do Leite Cru: Indicadores E Aplicações Práticas Da Instrução Normativa 62. **Embrapa Rondônia- Documentos (Infoteca -E)** 2014.

GANDRA , JR, TAKIYA , CS, DEL VALLE, TA, ORBACH, ND, FERRAZ , IR, OLIVEIRA, ER, ESCOBAR, AZ Influência de um aditivo alimentar contendo vitamina B12 e extrato de levedura na produção de leite e temperatura corporal de vacas leiteiras em pastejo em ambiente com alto índice de temperatura e umidade. **Livestock Science** , 221, 28-32. 2019.

IBGE. **Instituto Brasileiro De Geografia E Estatística** . Indicadores IBGE: Estatística Da Produção Pecuária. 2019. Disponível em: <Https://Www.Ibge.Gov.Br/Busca.Html?Searchword=Pecuaria+2019> Acessado em: 22 de agosto de 2021

MARQUES, MS; COELHO JÚNIOR, LB; SOARES, PC Avaliação Da Qualidade Microbiológica Do Leite Pasteurizado Tipo "C" Processado No Estado De Goiás. **In:** Congresso Latino-Americano 7.; Brasileiro De Higienistas De Alimentos, 2., 2005, Búzios. Anais. Búzios, 2005. v.19, n.130. 2005.

MENEGAT , AS; NUNES, F.; CONCEIÇÃO, C.; OLIVEIRA, ER A extensão universitária no assentamento Areias/MS: diálogos mudando pessoas, saberes e processos de produção. **Realização,** v. 12, 2019.

NASCIMENTO, IAD; GALVÃO, EL **Análises Dos Parâmetros Físico-Químicos Do Leite Bovino Cru Refrigerado Dos Pequenos Agropecuaristas Do Sertão De Angicos Segundo A In76/2018** . Disponível Em: <Http://Repositorio.Ufersa.Edu.Br/Handle/Prefix/4878>.Acesso: 26 de agosto De 2021.

OLIVEIRA, ERD, MUNIZ, EB, SOARES, JPG, DE FÁTIMA LF, M., GANDRA, JR, DE ARAÚJO GABRIEL, AM, PEREIRA, TL Impactos ambientais da conversão para produção de mel orgânico em unidades familiares de pequenos agricultores no Brasil. In: **Organic Agriculture,** Revista oficial da The International, Society of Organic Agriculture Research. v. 10, n. 2, 2020.

PERES, FD, PARREIRA, DP, VALENTIM, JK, DE PAULA, KLC, PACIULLI , SDO D.,SILVA , DAL Avaliação da qualidade do leite de produtores de leite na região do Alto São Francisco. **Realização,** v. 12, pág. 108-120. 2019.

SANDOVAL, VL, RIBEIRO, LF Qualidade Do Leite: Sua Influência No Processamento, Requisitos Obrigatórios E Sua Importância Para O Produto Final. **Revista Getec ,** 10(28). 2021.

SOUZA, JV, PAIVA, BLF, FONTENELE, MA, DA SILVA ARAÚJO, KS, VIANA, DC Avaliação Dos Parâmetros Físico-Químicos Do Leite "In Natura" Comercializado Informalmente No Município De Imperatriz-Ma . **Revista Brasileira De Agropecuária Sustentável,** v. 4. 2018.

ZENEBON , O.; PASCUET , NS; TIGLEA , P. LEITE E DERIVADOS. EM: ZENEBON , O.; PASCUET , NS; TIGLEA , P. **Métodos Físico-Químicos Para Análise De Alimentos. São Paulo: Instituto Adolfo Lutz.** boné. 27, pág. 823-881. 2008.