Oct 25, 2024

The effect of climate change on lactating mammalian milk: a systematic review protocol

DOI
dx.doi.org/10.17504/protocols.io.4r3l2qxxxl1y/v1

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OPEN ACCESS

DOI: https://dx.doi.org/10.17504/protocols.io.4r3l2qxxxl1y/v1

Protocol Citation: Artur Nogueira de São José, Zilma Reis, Maria Cândida Ferrarez Bouzada, Márcia Gomes Penido Machado, Ursula do Carmo Resende, Hilton de Oliveira Mota, Adson Ferreira da Rocha, Marcelo Lopes Pereira Júnior, Paulo de Jesus Hartmann Nader 2024. The effect of climate change on lactating mammalian milk: a systematic review protocol. **protocols.io** **https://dx.doi.org/10.17504/protocols.io.4r3l2qxxxl1y/v1**

Protocol status: In development
We are still developing and optimizing this protocol

Created: October 23, 2024

Last Modified: October 25, 2024

Protocol Integer ID: 110591

Keywords: Climate change, Breastfeeding, Breast milk, Sensing technologies, Non-invasive sensing, Real-time sensing, systematic review protocol the search, database for this systematic review, lactating mammalian milk, systematic review, systematic review protocol, mammalian milk, cochrane library, included study, study, databases medline, pubmed, abstract, relevant study, excluded article, bibliographical reference, independent reviewer, search strategy, web of science, following database

Funders Acknowledgements:
National Council for Scientific and Technological Development (CNPq)
Grant ID: Bolsista de Produtividade Desen. Tec. e Extensão Inovadora do CNPq - Nível 2. Grant number: CNPq 305837/2021-4
National Council for Scientific and Technological Development (CNPq)
Grant ID: Bolsista de Produtividade em Pesquisa do CNPq - Nível 1C. Grant number: CNPq 315331/2023-2

Abstract

The search will be carried out in the following databases: MEDLINE (PubMed), Cochrane Library, Embase-Elsevier, Scopus-Elsevier, Web of Science, LILACS-BVS, IEEE. To define the search strategies, we will have support from the library of the Faculty of Medicine of the Univesidade Federal de Minas Gerais (one of the institutions that are part of this project). Furthermore, we will use the software StaRt® to manage all the bibliographical references and to centralize all information necessary to build a database for this systematic review. References retrieved from search strategies will be exported to the software StaRt®, and duplicates will be removed. After this procedure, two independent reviewers will select potential titles and abstracts, assessed for the inclusion criteria outlined above. Potentially relevant studies will have their full-text versions then independently assessed by two reviewers to determine if they meet the inclusion criteria. Discrepancies will be resolved by a third investigator. Excluded articles will be documented along with the reasons for exclusion. A total of nine reviewers is involved in this process. The final selection of included studies will be carried out for qualitative and quantitative analysis. Subsequently, data will be extracted, and the characteristics of the included studies will be detailed.

Troubleshooting

1 **1. Review title. Give the working title of the review, for example the one used for obtaining funding. Ideally the title should state succinctly the interventions or exposures being reviewed and the associated health or social problems. Where appropriate, the title should use the PI(E)COS.**

T*he effect of climate change on lactating mammalian milk: a systematic review protocol*

2. Original language title.

The present review will be written in English.

3. Anticipated or actual start date. Give the date when the systematic review commenced, or is expected to commence.

September 1st, 2024

4. Anticipated completion date. Give the date by which the review is expected to be completed.

Dezember 1st, 2024

5. Stage of review at time of this submission.

Formal screening of search results against eligibility criteria is in progress.

6. Named contact.

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9. Named contact phone number.

+55 (61) 3107-5510 (Office)

10. Organisational affiliation of the review. Full title of the organisational affiliations for this review and website address if available. This field may be completed as 'None' if the review is not affiliated to any organisation.

Institution #1
Universidade de Brasília
Faculdade de Tecnologia, Departamento de Engenharia Elétrica
Website: http://www.ene.unb.br/
Location: Brasilia, Brazil

Institution #2
Universidade Federal de Minas Gerais
Faculdade de Medicina, Departamento de Ginecologia e Obstetrícia
Website:
https://www.medicina.ufmg.br/
Faculdade de Medicina, Departamento de Pediatria
Website:
https://www.medicina.ufmg.br/ped/
Escola de Engenharia, Departamento de Engenharia Elétrica
Website: https://dee.ufmg.br/
Location: Belo Horizonte, Brazil

Institution #3 Centro Federal de Educação Tecnológica de Minas Gerais
Departamento de Engenharia Elétrica
Website: https://www.dee.cefetmg.br/
Location: Belo Horizonte, Brazil

Institution #4
Hospital Universitário de Canoas (HU CANOAS)
Location: Canoas, Brazil

11. Review team members and their organisational affiliations. Give the personal details and the organisational affiliations of each member of the review team. Affiliation refers to groups or organisations to which review team members belong. NOTE: email and country are now mandatory fields for each person.

Member #1
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Member #9
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Role: Medical Director
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Location: Canoas, Brazil

12. Funding sources/sponsors. Give details of the individuals, organizations, groups or other legal entities who take responsibility for initiating, managing, sponsoring and/or financing the review. Include any unique identification numbers assigned to the review by the individuals or bodies listed.

Zilma Silveira Nogueira Reis received a grant from the National Council for Scientific and Technological Development (CNPq). Grant category in Portuguese: Bolsista de Produtividade Desen. Tec. e Extensão Inovadora do CNPq - Nível 2. Grant number: CNPq 305837/2021-4.

Adson Ferreira da Rocha received a grant from the National Council for Scientific and Technological Development (CNPq). Grant category in Portuguese: Bolsista de Produtividade em Pesquisa do CNPq - Nível 1C. Grant number: CNPq 315331/2023-2.

13. Conflicts of interest. List any conditions that could lead to actual or perceived

undue influence on judgements concerning the main topic investigated in the review.

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this study.

14. Collaborators. Give the name and affiliation of any individuals or organisations who are working on the review but who are not listed as review team members. NOTE: email and country are now mandatory fields for each person.

Not applicable.

15. Review question. State the question(s) to be addressed by the review, clearly and precisely. Review questions may be specific or broad. It may be appropriate to break very broad questions down into a series of related more specific questions. Questions may be framed or refined using PI(E)COS where relevant.

Main research question
Are there any effects of climate change on nursing mammals that alter the composition or properties of raw milk?

Secondary questions:
1 - If so, what are the components or properties of the raw milk that change?
2 - What techniques are used to identify these changes?
3 - Is there evidence of climate change effects on human raw milk?

(P) Lactating mammals under climatic effects
(E) The exposure consists of a set of environmental conditions (temperature, humidity, rainfall indices, solar radiation etc) of a given geographical area that have been changed due to climate change
(C) Non-exposure refers to environmental conditions unaffected by climate change
(O)The main result is the comparison of raw milk components or biological properties under the effect of climate change against the natural state of the climate. Additional results are techniques and methods to assess climate change affecting raw milk; and any other evidence of climate change effects on human milk.

16. Searches. State the sources that will be searched. Give the search dates, and any restrictions (e.g. language or publication period). Do

NOT enter the full search strategy (it may be provided as a link or attachment.)

Sources: MEDLINE (PubMed), Cochrane Library, Embase-Elsevier, Scopus-Elsevier, Web of Science, LILACS-BVS, IEEE.

Search date:
September 19th, 2024.

Restriction:
no language restriction except that the articles must have their title and abstract available in English; no restriction regarding the publication date.

17. URL to search strategy. Give a link to a published pdf/word document detailing either the search strategy or an example of a search strategy for a specific database if available (including the keywords that will be used in the search strategies), or upload your search strategy.

Database:
MEDLINE (PubMed)
Search strategy: ((Milk[Title/Abstract] OR "Human Milk"[Title/Abstract] OR Lactation[Title/Abstract] OR "Breastfeeding Women"[Title/Abstract] OR "Breast Feeding"[Title/Abstract] OR "Suckling Animals"[Title/Abstract])) AND ((("Climate Change"[Title/Abstract] OR "Global Warming"[Title/Abstract] OR "Sea Level Rise"[Title/Abstract] OR "Air Pollutants"[Title/Abstract]))

Database:
Cochrane Library
Search strategy: (Milk OR "Human Milk" OR Lactation OR "Breastfeeding Women" OR "Breast Feeding" OR "Suckling Animals") AND ("Climate Change" OR "Global Warming" OR "Sea Level Rise" OR "Air Pollutants")

Database:
Embase-Elsevier

Search
strategy: (milk:ab,ti OR 'breast milk':ab,ti OR lactation:ab,ti OR 'breastfeeding women':ab,ti OR 'breast feeding':ab,ti OR 'suckling animal':ab,ti) AND ('climate change':ab,ti OR 'greenhouse effect':ab,ti OR 'sea level rise':ab,ti OR 'air pollutant':ab,ti)

Database:
Scopus-Elsevier
Seach
strategy: (Milk OR "Human Milk" OR Lactation OR "Breastfeeding Women" OR "Breast Feeding" OR "Suckling Animals") AND ("Climate Change" OR "Global Warming" OR "Sea Level Rise" OR "Air Pollutants")

Database:
Web of Science
Search
strategy: (Milk OR "Human Milk" OR Lactation OR "Breastfeeding Women" OR "Breast Feeding" OR "Suckling Animals") AND ("Climate Change" OR "Global Warming" OR "Sea Level Rise" OR "Air Pollutants")

Database:
LILACS-BVS
Search
strategy: (("Mudança Climática" OR "Climate Change" OR "Cambio Climático" OR "Changement climatique" OR "Alterações Climáticas" OR "Aquecimento Global" OR "Global Warming" OR "Calentamiento Global" OR "Réchauffement de la planète" OR "Elevação do Nível do Mar" OR "Sea Level Rise" OR "Elevación del Nivel del Mar" OR "Élévation du niveau de la mer" OR "Impactos da Poluição na Saúde" OR "Impacts of Polution on Health" OR "Impactos de la Polución en la Salud" OR "Impacts sur la Santé" OR "Poluentes Atmosféricos" OR "Air Pollutants" OR "Contaminantes Atmosféricos" OR "Polluants atmosphériques")) AND (("Mulheres Lactantes" OR "Breastfeeding Women" OR "Madres Lactantes" OR "Femmes allaitantes" OR "Animais Lactentes" OR "Animals, Suckling" OR "Animales Lactantes" OR "Animaux allaités" OR

"Aleitamento Materno" OR "Breast Feeding" OR "Lactancia Materna" OR "Allaitement naturel" OR "Animais Lactentes" OR "Animals, Suckling" OR "Animales Lactantes" OR "Animaux allaités" OR leite OR milk OR leche OR lait OR "Leite Humano" OR "Milk, Human" OR "Leche Humana" OR "Lait humain" OR lactação OR lactation OR lactancia OR lactation)) AND (db:("LILACS" OR "WPRIM" OR "BINACIS" OR "CUMED" OR "IBECS" OR "LIPECS"))

Database:
IEEE
Search strategy: ("All Metadata":("All Metadata":Milk) OR "All Metadata":("All Metadata":Human Milk) OR "All Metadata":("All Metadata":Lactation) OR "All Metadata":("All Metadata":Breastfeeding Women) OR "All Metadata":("All Metadata":Breast Feeding) OR "All Metadata":("All Metadata":Suckling Animals)) AND ("All Metadata":("All Metadata":Climate Change) OR "All Metadata":("All Metadata":Global Warming) OR "All Metadata":("All Metadata":Sea Level Rise) OR "All Metadata":("All Metadata":Air Pollutants))

18. Condition or domain being studied. Give a short description of the disease, condition or healthcare domain being studied. This could include health and wellbeing outcomes.

We seek to find evidence in the scientific literature regarding possible effects of climate change on the health of female mammals. More specifically, we will investigate scenarios where such effects affect the nutritional quality of raw breast milk produced by these mammals during the breastfeeding phase. Processed milk is out of the scope of this investigation. Our research will consider various environmental variables, such as temperature, humidity, altitude, rainfall levels, presence of tsunamis etc. Any environmental conditions not attributed to climate changes will be ignored, even if they are abnormal.

19. Participants/population. Give summary criteria for the participants or populations being studied by the review. The preferred format includes details of both inclusion and exclusion criteria.

Participant: Studies of Mammalian milk`s composition

Inclusion criteria:

- *Presence of adverse environmental effects that have been attributed to climate change*
- *Studies on female lactating mammals (human or not)*
- *Studies that analyze fresh milk (collected during breastfeeding)*
- *Studies with a clear definition of climate change.*

Exclusion criteria:

- *Presence of adverse environmental effects that have not been attributed to climate change*
- *Effects on processed milk (freeze-dried, refrigerated, stored in a milk bank etc)*
- *Study does not assess the effects of climate change on milk*

20. Intervention(s), exposure(s). Give full and clear descriptions or definitions of the nature of the interventions or the exposures to be reviewed.

The exposure consists of a set of environmental conditions (temperature, humidity, rainfall indices, solar radiation etc) of a given geographical area that have been changed due to climate change. Any abnormal environmental condition not attributed to climate changes will not be considered.

21. Comparator(s)/control. Where relevant, give details of the alternatives against which the main subject/topic of the review will be compared (e.g. another intervention or a non-exposed control group). The preferred format includes details of both inclusion and exclusion criteria.

Non-exposure refers to environmental conditions unaffected by climate change. Even if the environmental conditions are abnormal, they will be ignored if there is no known link with climate change.

22. Types of study to be included. Give details of the types of study (study designs) eligible for inclusion in the review. If there are no restrictions on the types of study design eligible for inclusion, or certain study types are excluded, this should be stated. The preferred format includes details of both inclusion and exclusion criteria.

There are no restrictions on the types of study design eligible for inclusion.

23. Context. Give summary details of the setting and other relevant characteristics which help define the inclusion or exclusion criteria.

According to the United Nations, "climate change refers to long-term shifts in temperatures and weather patterns". These phenomena "can be natural, such as changes in the sun's activity or significant volcanic eruptions." However, "human activities have been the main driver of climate change, primarily due to burning fossil fuels like coal, oil, and gas". Negative effects on human health may be associated with extreme climate changes, including people suffering from floods, storm catastrophes, and significant temperature variations throughout the year. In such a scenario, the effect of climatic stress on the milk produced by mammals during their breastfeeding phase has still not been deeply investigated. This review intends to assess whether climate change affects lactating females with any repercussions on the milk in terms of quality and amount.

24. Main outcome(s).
Give the pre-specified main (most important) outcomes of the review, including details of how the outcome is defined and measured and when

these measurements are made, if these are part of the review inclusion criteria.

Main
outcome: any reported change in the nutritional quality of milk of animal or human origin due to abnormal environmental conditions.
Measures
of effect: any reported disparity between the typical concentration levels of milk nutrients and the concentration levels of the same nutrients under an abnormal environmental condition.

25.
Additional outcome(s). List the pre-specified additional outcomes of the review, with a similar level of detail to that required for main outcomes. Where there are no additional outcomes please state 'None' or 'Not applicable' as appropriate to the review.

Additional
outcome #1: any list of milk properties or nutrients whose concentrations or any other physicochemical properties were affected by climate change.
Measure
of effect: any quantitative and comparative analysis of the milk nutrients' physicochemical
properties in both normal and harsh environmental conditions.
Additional
outcome #2: any reported measurement technique with a demonstrated efficiency to detect abnormalities in the nutritional status of any type of milk.
Measure
of effect: high correlation between the measured concentration of milk nutrients and a reference value.

26. Data extraction (selection and coding).
Describe how studies will be selected for inclusion. State what data will be extracted or obtained. State how this will be done and recorded.

The search will be carried out in the following databases: MEDLINE (PubMed), Cochrane Library, Embase-Elsevier, Scopus-Elsevier, Web of Science, LILACS-BVS, IEEE. To define the search strategies, we will have support from the library of the Faculty of Medicine of the Univesidade Federal de Minas Gerais (one of the institutions that are part of this project). Furthermore, we

will use the software StaRt® to manage all the bibliographical references and to centralize all information necessary to build a database for this systematic review.
References
retrieved from search strategies will be exported to the software StaRt®, and duplicates will be removed. After this procedure, two independent reviewers will select potential titles and abstracts, assessed for the inclusion criteria outlined above. Potentially relevant studies will have their full-text versions then independently assessed by two reviewers to determine if they meet the inclusion criteria. Discrepancies will be resolved by a third investigator. Excluded articles will be documented along with the reasons for exclusion.
The
final selection of included studies will be carried out for qualitative and quantitative analysis. Subsequently, data will be extracted, and the characteristics of the included studies will be detailed.

27. Risk of bias
(quality) assessment. Describe the method of assessing risk of bias or quality assessment. State which characteristics of the studies will be assessed and any formal risk of bias tools that will be used.

Once
the search is performed in the seven mentioned databases, the team is divided into pairs of reviewers. Both reviewers will have access to the same articles. Each of them will independently perform each step of the selection and extraction process. Independence is necessary to ensure that one reviewer will not influence his peer's analysis.
Then, they will meet to compare their individual decisions on acceptance or rejection of the papers. Any disagreements will be resolved by discussion or by involving a third author. The risk of bias of the individual studies will be assessed using the Prediction Model Risk of Bias Assessment Tool (PROBAST) for each article.

28. Strategy for data synthesis. Provide details of the planned synthesis including a rationale for the methods selected. This must not be generic text but should be specific to your review and describe how the proposed analysis will be applied to your data.

The data extraction and synthesis processes will be assisted by the software StArt. This software will be used to manage articles, identify duplicates and facilitate the selection based on inclusion and exclusion criteria. In summary, useful data will be finely extracted from the initial database by peer reviewers with the aid of StArt software.
After extraction, data will be summarized in tables according to the following criteria:

1. *Country where data was collected*

2. *Geographical coverage of the study – Possible Answers: Local (restricted to a city), Regional (more than one city), National (several regions/states of a country), Multicenter (more than one country)*

3. *Main goal of the study*

4. *Species of mammals analyzed*

5. *Study design – Possible Answers: Observational (bench), Observational (real scenario), Observational (cohort), Experimental (humans or animals exposed to climate change and monitored over time), Experimental (clinical trial), Simulation, Cross-sectional study*

6. *Milk sample collection technique*

7. *Milk sample storage technique*

8. *Milk sample processing technique*

9. *Milk features (substances or properties) analyzed*

10. *Sensing technology employed to detect changes in milk properties*

11. *Have the effects of climate change on lactating mammals been proven in raw milk composition or properties? – Possible Answers: Yes, No, Inconclusive; For the case where the answer is 'Yes': Which effect was observed?*

Apart from questions B, E, and K, free answers will be allowed.

29.
Analysis of subgroups or subsets. State any planned investigation of 'subgroups'. Be clear and specific about which type of study or participant will be included in each group or covariate investigated. State the planned analytic approach.
Not applicable.

30. Type and method of review. Select the type of review and the review method from the lists below. Select the health area(s) of interest for your review.

	A	B
	Type of	

	A	B
	review	
	Cost effectiveness	*No*
	Diagnostic	*No*
	Epidemiologic	*No*
	Individual patient data (IPD) meta-analysis	*No*
	Intervention	*No*
	Meta-analysis	*No*
	Methodology	*No*
	Narrative synthesis	*No*
	Network meta-analysis	*No*
	Pre-clinical	*No*
	Prevention	*No*

	A	B
	Prognostic	*No*
	Prospective meta-analysis (PMA)	*No*
	Review of reviews	*No*
	Service delivery	*No*
	Synthesis of qualitative studies	*No*
	Systematic review	*Yes*
	Other	*No*

	Health area of the review	
	Alcohol/substance misuse/abuse	*No*
	Blood and immune system	*No*
	Cancer	*No*
	Cardiovascular	*No*

	Care of the elderly	*No*
	Child health	*Yes*
	Complementary therapies	*No*
	COVID-19	*No*
	Crime and justice	*No*
	Dental	*No*
	Digestive system	*No*
	Ear, nose and throat	*No*
	Education	*No*
	Endocrine and metabolic disorders	*No*
	Eye disorders	*No*
	General interest	*Yes*
	Genetics	*No*
	Health inequalities/health equity	*No*
	Infections and infestations	*No*

	International development	*No*
	Mental health and behavioural conditions	*No*
	Musculoskeletal	*No*
	Neurological	*No*
	Nursing	*No*
	Obstetrics and gynaecology	*Yes*
	Oral health	*No*
	Palliative care	*No*
	Perioperative care	*No*
	Physiotherapy	*No*
	Pregnancy and childbirth	*Yes*
	Public health (including social determinants of health)	*Yes*
	Rehabilitation	*No*
	Respiratory disorders	*No*
	Service delivery	*No*

	Skin disorders	*No*
	Social care	*No*
	Surgery	*No*
	Tropical Medicine	*No*
	Urological Wounds, injuries and accidents	*No*
	Violence and abuse	*No*

31. Language. Select each language individually to add it to the list below, use the bin icon to remove any added in error.

English

32. Country. Select the country in which the review is being carried out from the drop down list. For multi-national collaborations select all the countries involved.

Brazil

33. Other registration details. Give the name of any organisation where the systematic review title or protocol is registered (such as with The Campbell Collaboration, or The Joanna Briggs Institute) together with any unique identification number assigned. (N.B. Registration details for Cochrane protocols will be automatically entered). If extracted

data will be stored and made available through a repository such as the Systematic Review Data Repository (SRDR), details and a link should be included here. If none, leave blank.

Not applicable.

34.
Reference and/or URL for published protocol. Give the citation and link for the published protocol, if there is one.

No
I do not make this file publicly available until the review is complete.

35. Dissemination
plans. Give brief details of plans for communicating essential messages from the review to the appropriate audiences.

Scientific articles.

Do you intend to
publish the review on completion? *Yes.*

36. Keywords. Give
words or phrases that best describe the review. Separate keywords with a semicolon or new line. Keywords will help users find the review in the Register (the words do not appear in the public record but are included in searches). Be as specific and precise as

possible. Avoid acronyms and abbreviations unless these are in wide use.

Climate change; breastfeeding; breast milk; sensing technologies; non-invasive sensing; real-time sensing.

37. Details of any existing review of the same topic by the same authors. Give details of earlier versions of the systematic review if an update of an existing review is being registered, including full bibliographic reference if possible.

Not applicable.

38. Current review status. Review status should be updated when the review is completed and when it is published. For new registrations the review must be Ongoing.

Paper will be submitted for review soon.

39. Any additional information. Provide any other information the review team feel is relevant to the registration of the review.

Not applicable.

40. Details of final report/publication(s). This field should be left empty until details of the completed review are available

Not applicable.