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### Title

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### Publication Date

2023-06-07

### Supplemental Material

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## **Clay and clay mineral supplementation in newborn calves: A protocol for a scoping review**

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### **Author Contributions:**

- MH: Perform screening process, design data extraction sheets, data extraction, data analysis, review protocol, manuscript preparation.
- RBL: Review data extraction, data analysis, review protocol and manuscript.
- CBC: Design screening strategy, perform screening process, design data extraction sheets, review protocol and manuscript.
- AV: Review data extraction, review protocol and manuscript.
- EDF: Develop search strategy and literature search, edit protocol.
- NSR: Prepare protocol manuscript, review data extraction and data analysis, assist with manuscript preparation.

Amendments: Any amendments to this protocol will be documented and justified in the final review

**Keywords:** clay, clay minerals, calf, serum IgG, immunity, diarrhea, mortality, growth, feed efficiency

## INTRODUCTION

### Rationale:

According to national statistics, preweaned calf morbidity in the US exceeds 34%, with respiratory and gastrointestinal problems being the most prevalent ailments (Urie et al., 2018;). Nearly 74% of the sick preweaned calves receive antimicrobial therapy, which raises concerns considering the antimicrobial resistance (AMR) global health crisis. Under this scenario, there is a growing interest in complementary and alternative therapies to manage calf health, including the oral supplementation of medicinal clays (Williams and Haydel, 2010; Subramaniam et al., 2015). Clays and clay minerals are cost-effective supplements that might be easily incorporated into daily calf management practices. However, different types of clays exhibit diverse physical and chemical compositions (Williams and Haydel, 2010). This diversity raises the necessity of conducting a systematic review and a meta-analysis on the efficacy and safety of clays and clays' minerals in newborn calves before industry recommendations can be made.

The volume of scientific literature investigating clay and clay mineral supplementation in calves might be limited, which could render a systematic review and meta-analysis unfeasible. Scoping reviews (ScRs) could offer alternative options to address this challenge as they map the existing literature in terms of volume, nature, and characteristics of primary research (Tricco et al., 2018). This approach is useful for several purposes: (1) clarifying key concepts and definitions in the literature, (2) examining how research is conducted on a particular topic, (3) identifying knowledge gaps, and (4) evaluating the feasibility of pursuing a systematic review and a meta-analysis.

### Objectives:

The objective of this protocol for a ScR is to identify, summarize, appraise, and discuss the current literature on the clay and clay mineral supplementation for dairy calves.

## METHODS

**Eligibility criteria:** As the research question, the eligibility criteria were defined based on the PICO elements:

- a) Population: newborn calves (< 3wk old) from organic or conventional veal, beef, or dairy production systems.
- b) Intervention: clay or clay mineral supplementation starting within the first three weeks of life.
- c) Comparator: placebo or no clay or clay mineral supplementation.
- d) Outcomes: immunity (e.g., IgG), health (e.g., morbidity, mortality, fecal score), productive performance (e.g., feed intake, growth, feed efficiency).

**Study design.** The ScR will include primary research studies, including non-randomized and randomized controlled trials, which are available in English. Observational studies and reviews will be excluded. Eligible studies must have investigated clay or clay mineral supplementation in newborn calves. Only peer reviewed studies will be considered. Publications will be restricted to those after year 2000.

**Intervention and comparator groups.** Eligible studies must have evaluated clay or clay mineral supplementation starting during the first three weeks of life, with no restriction for type of clay or clay mineral, dose, or duration of supplementation. The clay or clay mineral supplementation must have been compared to no intervention or placebo. Studies evaluating clay or clay mineral supplementation in combination with other molecules (e.g., glucose, vitamins) will be excluded.

**Outcome measures.** Studies must include at least one main immunity (e.g., IgG), health (e.g., morbidity, mortality, health score), or productive performance outcome (e.g., feed intake, feed efficiency, growth).

**Information sources:** After consultation with an experienced health and veterinary science academic librarian (EDF), the following electronic databases will be searched: Biosis (Web of Science, 1926 to present), CAB Abstracts (CAB Direct, 1973 to present), Medline (PubMed, 1966 to present), and Scopus (Scopus, 1996 to present). The bibliography of relevant studies will be hand-searched by the first author following the snowballing approach, to identify additional studies.

**Search strategy:** For the preliminary search described in Appendix 1 and conducted in April 2023, the first author selected key words from relevant literature with the assistance of an academic librarian (EDF). Eight papers were used to calibrate the search (Appendix 2). Subject headings or keywords were mined by finding these references in PubMed and Cab Direct. Keywords were collected and compared with keywords already utilized. Yale MeSH analyzer was utilized to compare common Medical Subject Headings across articles.

**Screening:** Two independent researchers will screen all the titles and abstracts retrieved from the two proposed search approaches by answering the following questions:

- a) Does the study include calves either veal, beef, or dairy?
- b) Does the study describe the supplementation of clay or clay minerals to calves in milk or grain?
- c) Does the study evaluate immunity (e.g., IgG, leukocytes, neutrophiles), health (e.g., clinical signs, blood outcomes), or productive outcomes (e.g., feed efficiency, growth, intake)?
- d) Did the clay supplementation start within three weeks of age? If age no reported, do not include studies with calves > 100 kg at enrollment.

In the title and abstract screening, the available answers will be “no”, “maybe”, and “yes”. Citations will be excluded if the two reviewers answer “no” to one of the questions. Citations

with “yes” and/or “maybe” answers to all questions will be retained for full-text screening. Additional questions during the full manuscript screening will be:

- e) Is the study a controlled trial with a negative control group (placebo or non-treated)?
- f) Is the clay or clay mineral supplemented as a prophylactic or metaphylactic approach (not for treatment)?
- g) Is the clay or clay mineral supplemented alone (e.g., without combination with other molecules such as glucose or vitamins)?

During the full-text screening, the title and abstract screening questions will be answered for a second time. The available answers will be “no” and “yes”. Only citations with “yes” answers for the questions e-g will be included in the scoping review. The aforementioned screening questions will be beta-tested by MH and CBC with 40 records, and if deemed necessary, the screening strategy will be calibrated. Conflicts between the two reviewers will be solved through discussion and, if necessary, consulted with a third researcher (NSR). All reviewers will be trained on ScR methods and have domain-specific knowledge in the veterinary and animal science field. Journal and author names will not be blinded to the reviewers.

**Data management:** The Systematic Review Accelerator (Institute for Evidence-Based Healthcare, Bond University, AU) will be used for deduplication, Covidence for title/abstract and full-text screening, and Zotero for full-text retrieval in Covidence.

**Data Extraction:** The data extraction will be done using predesigned Microsoft Excel forms (Microsoft Office Excel 2010, Microsoft, Redmond, WA) and pre-tested using three manuscripts. The most relevant information that will be extracted relates to:

- General study characteristics (e.g., year of publication, country where the study was conducted, type of study design, funding).
- Population: (e.g., breed, sex, age, housing, production system, assessment of passive transfer, and herd type).
- Intervention and comparator (e.g., type of clay, dose, form of administration, duration of supplementation).
- Outcomes:
  - o Continuous outcomes characteristics (e.g., average daily gain): number of experimental units for each treatment group, least square or contrast means for each treatment group, mean differences from control, unit of results, lower and upper 95% confidence intervals (CI), standard error, standard deviation, *P*-value, and the time point of each measurement.
  - o Dichotomous outcomes characteristics (e.g., occurrence of diarrhea): number and proportion of positive experimental units per treatment group, total number of experimental units per treatment group, unit of results, odds ratio, relative risk, lower and upper 95% CI, *P*-value, and the time point of each measurement.

The accuracy and completeness of full manuscript data extraction will be evaluated by a secondary reviewer extracting 25% of the manuscripts; if a 100% of accuracy is not achieved the secondary reviewer will extract all the data.

## Data Charting Process

Data will be presented using descriptive methods. A PRISMA Preferred Reporting Items for Scoping Reviews (PRISMA-ScR; Tricco et al., 2018.) flow diagram will be generated to report the screening and selection results. A narrative description of the eligible studies will be included in the results section of the future scoping review manuscript. The data will be plotted using GraphPad (GraphPad Software, La Jolla, California, USA). The following graphing methods will be considered: frequency bar graphs, scatter plots, box plots, pie charts, or heat maps. Tables reporting means, ranges, and coefficients of variation will be prepared in Microsoft Excel.

## REFERENCES:

Tricco, A. C., Lillie, E., Zarin, W., O'Brien, K. K., Colquhoun, H., Levac, D., Moher, D., Peters, M. D. J., Horsley, T., Weeks, L., Hempel, S., Akl, E. A., Chang, C., McGowan, J., Stewart, L., Hartling, L., Aldcroft, A., Wilson, M. G., Garritty, C., Lewin, S., ... Straus, S. E. (2018). PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Annals of internal medicine*, 169(7), 467–473. <https://doi.org/10.7326/M18-0850>

Urie, N. J., Lombard, J. E., Shivley, C. B., Koprak, C. A., Adams, A. E., Earleywine, T. J., Olson, J. D., & Garry, F. B. (2018). Preweaned heifer management on US dairy operations: Part V. Factors associated with morbidity and mortality in preweaned dairy heifer calves. *Journal of dairy science*, 101(10), 9229–9244. <https://doi.org/10.3168/jds.2017-14019>

Williams, L. B., & Haydel, S. E. (2010). Evaluation of the medicinal use of clay minerals as antibacterial agents. *International geology review*, 52(7/8), 745–770. <https://doi.org/10.1080/00206811003679737>

## APPENDIX 1 – Preliminary Search Strategy:

PRISMA-S Template (based on v1.0 retrieved from <https://osf.io/2ybwn/>)

### (Literature and information being sought)

EX. represents examples for reference.

### Databases and Interfaces Searched:

Database	Interface	Date Coverage	Date Searched
CAB Abstracts (included products: CAB ABSTRACTS, VetMed Resource, CABI Full Text, Global Health, Animal Health and Production Compendium (AHPC))	CABDirect	1973 to Present	24 April 2023
Medline (Included products: Medline, in process citations, "ahead of print" citations, out-of-scope citations, journals indexing prior to medline inclusion, pre-1966 citations, PubMed Central, author manuscripts NIH funding, NCBI Bookshelf )	PubMed	1966 to Present	24 April 2023
Scopus	Scopus	1996 to Present	24 April 2023
Biosis	Web of Science	1926 to Present	24 April 2023

### Simultaneous Searches:

Not Applicable

Item 2: Other Online Resources (As Needed): Not planned at this time

### Manual Searching (searching relevant journals Table of Contents):

Not Planned at this time

### Citation Searching And Text Analysis:

Article Citation:
Fratrić, Natalija, et al. "The effect of a clinoptilolite based mineral adsorber on concentrations of immunoglobulin G in the serum of newborn calves fed different amounts of colostrum." <i>Acta Veterinaria-Beograd</i> 55.1 (2005): 11-21.
Fratrić, Natalija, et al. "The effect of mineral adsorbent in calf diet colostrum on the levels of serum immunoglobulin G, protein and glucose." <i>Acta Veterinaria-Beograd</i> 57.2-3 (2007): 169-180.

Marc, Simona, et al. "Serum protein electrophoretic pattern in neonatal calves treated with clinoptilolite." *Molecules* 23.6 (2018): 1278.

Mohri, Mehrdad, Hesam A. Seifi, and F. Daraei. "Effects of short-term supplementation of clinoptilolite in colostrum and milk on hematology, serum proteins, performance, and health in neonatal dairy calves." *Food and chemical toxicology* 46.6 (2008): 2112-2117.

Mohri, Mehrdad, Hesam A. Seifi, and M. O. H. S. E. N. Maleki. "Effects of short-term supplementation of clinoptilolite in colostrum and milk on the concentration of some serum minerals in neonatal dairy calves." *Biological trace element research* 123 (2008): 116-123.

**Process:** Key articles were identified by Principal Investigator and keywords were mined by finding references in PubMed and CAB Abstracts. Keywords were collected and compared with keywords already utilized.

**Contacts (Researchers contacted for additional information):**

Not planned at this time.

**Additional Methodologies Not Listed Above: Citation tracking (“snowball”)**

**Process:** Articles that were included for extraction after title/abstract and full text screening were utilized for forward and backward citation searching in Scopus.

**Limits and Restrictions**

*Date and Time Period:* 2000 to current

*Language:* English

*Publication status:* Peer reviewed

*Species Included:* Calves

*Study Design:* clinical trials

*Database Subset:*

*Pre-specified cut-off or saturation point for results:*

*Other Restrictions:*



**Search Filters:**

Database	Interface	Search Filters Applied
CAB Abstracts	CAB Direct	Limit to English Language, year limits (2000 to current), and Article Document Type
Medline	PubMed	English Language and year limits (2000 to current)
Scopus	Scopus	English Language, year limits (2000 to current) and Article Document Type
Biosis	Web of Science	English Language, year limits (2000 to current) and Article Document Type

**Full Search Strategy:**

Search Database:CABDirect

Search ID	Terms (copy and paste)	Results
#1	calves	103,502
#2	ti:(“adsorbent*” or “clinoptilolite” or “Zeolite*” or “clinosorb” or “sepiolite” or “Halloysite” OR “zeolite” OR “clinoptilolite” OR “sepiolite” OR “smectite” OR “diosmectite” OR “montmorillonite” OR “bentonite” OR “kaolin” OR “palygorskite” OR “attapulgitite” OR “perlite” OR “sepiolite” OR “Clay” OR “clay minerals” OR “aluminum silicate” OR “allophane” OR “bauxite” OR “beidellite” OR “bentonite” OR “chlorite” OR “dickite” OR “glaucosite” OR “halloysite” OR “hectorite” OR “illite” OR “imogolite” OR “intergrade minerals” OR “interstratified minerals” OR “kaolinite” OR “montmorillonite” OR “nontronite” OR “palygorskite” OR “sepiolite” OR “smectites” OR “vermiculite” ) or ab:(“adsorbent*” or “clinoptilolite” or “Zeolite*” or “clinosorb” or “sepiolite” or “Halloysite” OR “zeolite” OR “clinoptilolite” OR “sepiolite” OR “smectite” OR “diosmectite” OR “montmorillonite” OR “bentonite” OR “kaolin” OR “palygorskite” OR “attapulgitite” OR “perlite” OR “sepiolite” OR “Clay” OR “clay minerals” OR “aluminum silicate” OR “allophane” OR “bauxite” OR “beidellite” OR “bentonite” OR “chlorite” OR “dickite” OR “glaucosite” OR “halloysite” OR “hectorite” OR “illite” OR “imogolite” OR “intergrade minerals” OR “interstratified minerals” OR “kaolinite” OR “montmorillonite” OR “nontronite” OR “palygorskite” OR “sepiolite” OR “smectites” OR “vermiculite”) or de:(“clinoptilolite” or “adsorbents” or “clay minerals” or “allophane” OR “bauxite” OR “beidellite” OR “bentonite” OR “chlorite” OR “dickite” OR “glaucosite” OR “halloysite” OR “hectorite” OR “illite” OR “imogolite” OR “intergrade minerals” OR “interstratified minerals” OR “kaolinite” OR “montmorillonite” OR “nontronite” OR “palygorskite” OR “sepiolite” OR “smectites” OR “vermiculite”)	156,893

#3	#1 AND #2	240
#4	<u>Limit to English and articles</u>	136
#5	<u>Limit to 2000 to current</u>	68
Copy and Paste	<p>(((ti:(("adsorbent*" or "clinoptilolite" or "Zeolite*" or "clinosorb" or "sepiolite" or "Halloysite" OR "zeolite" OR "clinoptilolite" OR "sepiolite" OR "smectite" OR "diosmectite" OR "montmorillonite" OR "bentonite" OR "kaolin" OR "palygorskite" OR "attapulgitite" OR "perlite" OR "sepiolite" OR "Clay" OR "clay minerals" OR "aluminum silicate" OR "allophane" OR "bauxite" OR "beidellite" OR "bentonite" OR "chlorite" OR "dickite" OR "glaucanite" OR "halloysite" OR "hectorite" OR "illite" OR "imogolite" OR "intergrade minerals" OR "interstratified minerals" OR "kaolinite" OR "montmorillonite" OR "nontronite" OR "palygorskite" OR "sepiolite" OR "smectites" OR "vermiculite" ) or ab:(("adsorbent*" or "clinoptilolite" or "Zeolite*" or "clinosorb" or "sepiolite" or "Halloysite" OR "zeolite" OR "clinoptilolite" OR "sepiolite" OR "smectite" OR "diosmectite" OR "montmorillonite" OR "bentonite" OR "kaolin" OR "palygorskite" OR "attapulgitite" OR "perlite" OR "sepiolite" OR "Clay" OR "clay minerals" OR "aluminum silicate" OR "allophane" OR "bauxite" OR "beidellite" OR "bentonite" OR "chlorite" OR "dickite" OR "glaucanite" OR "halloysite" OR "hectorite" OR "illite" OR "imogolite" OR "intergrade minerals" OR "interstratified minerals" OR "kaolinite" OR "montmorillonite" OR "nontronite" OR "palygorskite" OR "sepiolite" OR "smectites" OR "vermiculite") or de:(("clinoptilolite" or "adsorbents" or "clay minerals" or "allophane" OR "bauxite" OR "beidellite" OR "bentonite" OR "chlorite" OR "dickite" OR "glaucanite" OR "halloysite" OR "hectorite" OR "illite" OR "imogolite" OR "intergrade minerals" OR "interstratified minerals" OR "kaolinite" OR "montmorillonite" OR "nontronite" OR "palygorskite" OR "sepiolite" OR "smectites" OR "vermiculite")) AND (Ti:(calf OR calves) OR ab:(calf OR calves) OR de:(("calves" or "calf diseases")))) AND ( (item-type:(("Journal article" ) ) ) (language:(("English" ) ) ) ) ) AND yr:[2000 TO 2023])</p>	

Search Database: PubMed

Search ID	Terms (copy and paste)	Results
#1 species	"Calf"[tiab] OR "calves"[tiab]	69,475
#2	"Zeolites"[Mesh] OR "zeolite*"[tiab] OR "clinoptilolite" [Supplementary Concept] OR "clinoptilolite"[tiab] OR "Klinosorb"[tiab] OR "adsorbent"[tiab] OR "sepiolite"[tiab] OR "Calcium Aluminosilicate/therapeutic use"[Mesh] OR "adsorbent*"[tiab] or "clinoptilolite"[tiab] or "Zeolite*"[tiab] or "clinosorb"[tiab] or "sepiolite"[tiab] or "Halloysite"[tiab] OR "smectite"[tiab] OR "diosmectite"[tiab] OR "montmorillonite"[tiab] OR "bentonite"[tiab] OR "kaolin"[tiab] OR "palygorskite"[tiab] OR "attapulgitite"[tiab] OR "perlite"[tiab] OR "sepiolite"[tiab]	68,042

	OR "Clay"[tiab] OR "clay minerals"[tiab] OR "aluminum silicate"[tiab] OR "allophane"[tiab] OR "bauxite"[tiab] OR "beidellite"[tiab] OR "bentonite"[tiab] OR "chlorite"[tiab] OR "dickite"[tiab] OR "glaucosite"[tiab] OR "halloysite"[tiab] OR "hectorite"[tiab] OR "illite"[tiab] OR "imogolite"[tiab] OR "intergrade minerals"[tiab] OR "interstratified minerals"[tiab] OR "kaolinite"[tiab] OR "montmorillonite"[tiab] OR "nontronite"[tiab] OR "palygorskite"[tiab] OR "sepiolite"[tiab] OR "smectites"[tiab] OR "vermiculite"[tiab]	
#3	#1 AND #2	90
#4	#3 AND (english[Filter])	83
#5	#4 AND (2000:2023[pdat])	38
Copy and paste	((("Zeolites"[MeSH Terms] OR "zeolite*" [Title/Abstract] OR "clinoptilolite" [Supplementary Concept] OR "clinoptilolite" [Title/Abstract] OR "adsorbent" [Title/Abstract] OR "sepiolite" [Title/Abstract] OR "calcium aluminosilicate/therapeutic use" [MeSH Terms] OR "adsorbent*" [Title/Abstract] OR "clinoptilolite" [Title/Abstract] OR "zeolite*" [Title/Abstract] OR "sepiolite" [Title/Abstract] OR "Halloysite" [Title/Abstract] OR "smectite" [Title/Abstract] OR "diosmectite" [Title/Abstract] OR "montmorillonite" [Title/Abstract] OR "bentonite" [Title/Abstract] OR "kaolin" [Title/Abstract] OR "palygorskite" [Title/Abstract] OR "attapulgitite" [Title/Abstract] OR "perlite" [Title/Abstract] OR "sepiolite" [Title/Abstract] OR "Clay" [Title/Abstract] OR "clay minerals" [Title/Abstract] OR "aluminum silicate" [Title/Abstract] OR "allophane" [Title/Abstract] OR "bauxite" [Title/Abstract] OR "beidellite" [Title/Abstract] OR "bentonite" [Title/Abstract] OR "chlorite" [Title/Abstract] OR "dickite" [Title/Abstract] OR "glaucosite" [Title/Abstract] OR "Halloysite" [Title/Abstract] OR "hectorite" [Title/Abstract] OR "illite" [Title/Abstract] OR "imogolite" [Title/Abstract] OR "kaolinite" [Title/Abstract] OR "montmorillonite" [Title/Abstract] OR "nontronite" [Title/Abstract] OR "palygorskite" [Title/Abstract] OR "sepiolite" [Title/Abstract] OR "smectites" [Title/Abstract] OR "vermiculite" [Title/Abstract]) AND ("Calf" [Title/Abstract] OR "calves" [Title/Abstract]) AND "english" [Language]) AND (2000:2023[pdat])	

Search Database: Scopus

Search	Terms (copy and paste)	Results
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I D		
#1 sp ec ie s	TITLE-ABS-KEY ( "calf" OR "calves" )	1 0 4, 6 3 9
#2 cl ay m lonite in er al s	TITLE-ABS-KEY ( "adsorbent*" OR "clinoptilolite" OR "Zeolite*" OR "clinosorb" OR "sepiolite" OR "Halloysite" OR "zeolite" OR "clinoptilolite" OR "sepiolite" OR "smectite" OR "diosmectite" OR "montmorillonite" OR "bentonite" OR "kaolin" OR "palygorskite" OR "attapulgate" OR "perlite" OR "sepiolite" OR "Clay" OR "clay minerals" OR "aluminum silicate" OR "allophane" OR "bauxite" OR "beidellite" OR "bentonite" OR "chlorite" OR "dickite" OR "glaucosite" OR "halloysite" OR "hectorite" OR "illite" OR "imogolite" OR "intergrade minerals" OR "interstratified minerals" OR "kaolinite" OR "montmorillonite" OR "nontronite" OR "palygorskite" OR "sepiolite" OR "smectites" OR "vermiculite" )	5 5 7, 9 1 3
#3	#1 AND #2	2 0 1
#4	#3 AAND PUBYEAR > 1999 AND PUBYEAR < 2024 AND ( LIMIT-TO ( DOCTYPE,"ar" ) ) AND ( LIMIT-TO ( LANGUAGE,"English" ) )	9 2
C op y an d pa st e	TITLE-ABS-KEY("adsorbent*" OR "clinoptilolite" OR "Zeolite*" OR "clinosorb" OR "sepiolite" OR "Halloysite" OR "zeolite" OR "clinoptilolite" OR "sepiolite" OR "smectite" OR "diosmectite" OR "montmorillonite" OR "bentonite" OR "kaolin" OR "palygorskite" OR "attapulgate" OR "perlite" OR "sepiolite" OR "Clay" OR "clay minerals" OR "aluminum silicate" OR "allophane" OR "bauxite" OR "beidellite" OR "bentonite" OR "chlorite" OR "dickite" OR "glaucosite" OR "halloysite" OR "hectorite" OR "illite" OR "imogolite" OR "intergrade minerals" OR "interstratified minerals" OR "kaolinite" OR "montmorillonite" OR "nontronite" OR "palygorskite" OR "sepiolite" OR "smectites" OR "vermiculite") AND TITLE-ABS-KEY(calf or calves) AND PUBYEAR > 1999 AND PUBYEAR < 2024 AND ( LIMIT-TO ( DOCTYPE,"ar" ) ) AND ( LIMIT-TO ( LANGUAGE,"English" ) )	

Search Database: Biosis

Se ar ch I D	Terms (copy and paste)	R es ul ts
#1 sp ec	TS=(calf or calves)	1 1 5, 3

ies		85
#2	TS=("adsorbent*" OR "clinoptilolite" OR "Zeolite*" OR "clinosorb" OR "sepiolite" OR "Halloysite" OR "zeolite" OR "clinoptilolite" OR "sepiolite" OR "smectite" OR "diosmectite" OR "montmorillonite" OR "bentonite" OR "kaolin" OR "palygorskite" OR "attapulgitite" OR "perlite" OR "sepiolite" OR "Clay" OR "clay minerals" OR "aluminum silicate" OR "allophane" OR "bauxite" OR "beidellite" OR "bentonite" OR "chlorite" OR "dickite" OR "glaucanite" OR "halloysite" OR "hectorite" OR "illite" OR "imogolite" OR "intergrade minerals" OR "interstratified minerals" OR "kaolinite" OR "montmorillonite" OR "nontronite" OR "palygorskite" OR "sepiolite" OR "smectites" OR "vermiculite")	124680
#3	#1 AND #2	239
#4	#3 AND English AND articles AND AND PY=(2000 OR 2001 OR 2002 OR 2003 OR 2004 OR 2005 OR 2006 OR 2007 OR 2008 OR 2009 OR 2010 OR 2011 OR 2012 OR 2013 OR 2014 OR 2015 OR 2016 OR 2017 OR 2018 OR 2019 OR 2020 OR 2021 OR 2022 OR 2023)	100
COPY AND PASTE (article file)	(TS=("adsorbent*" OR "clinoptilolite" OR "Zeolite*" OR "clinosorb" OR "sepiolite" OR "Halloysite" OR "zeolite" OR "clinoptilolite" OR "sepiolite" OR "smectite" OR "diosmectite" OR "montmorillonite" OR "bentonite" OR "kaolin" OR "palygorskite" OR "attapulgitite" OR "perlite" OR "sepiolite" OR "Clay" OR "clay minerals" OR "aluminum silicate" OR "allophane" OR "bauxite" OR "beidellite" OR "bentonite" OR "chlorite" OR "dickite" OR "glaucanite" OR "halloysite" OR "hectorite" OR "illite" OR "imogolite" OR "intergrade minerals" OR "interstratified minerals" OR "kaolinite" OR "montmorillonite" OR "nontronite" OR "palygorskite" OR "sepiolite" OR "smectites" OR "vermiculite") AND TS=(calf or calves)) AND (DT=("ARTICLE") AND LA=("ENGLISH")) AND PY=(2000 OR 2001 OR 2002 OR 2003 OR 2004 OR 2005 OR 2006 OR 2007 OR 2008 OR 2009 OR 2010 OR 2011 OR 2012 OR 2013 OR 2014 OR 2015 OR 2016 OR 2017 OR 2018 OR 2019 OR 2020 OR 2021 OR 2022 OR 2023)	

**Updates:** No updates at this time

**Search Designers:**

Information Specialists or Librarians involved in process were: EDF  
 Additional input from content experts in project: NSdR, CB-C & MH

**Peer Review:**

Librarian had their search strategy checked by content expert (MH) for sensitivity in results. Calibration studies that could be identified in CAB Abstracts (CAB Direct) and PubMed were used to validate search strategy.

Total Records	Total Records after deduplication	Deduplication software/methodology
260	170	SR Accelerator
170	170	Covidence

## APPENDIX 2 – Calibration Papers:

Fratrić, Natalija, et al. "The effect of a clinoptilolite based mineral adsorber on concentrations of immunoglobulin G in the serum of newborn calves fed different amounts of colostrum." *Acta Veterinaria-Beograd* 55.1 (2005): 11-21.

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