

**Uses of Sodium Bicarbonate, Calcium Carbonate and Calcium Gluconate in relation to childbirth: a scoping review protocol**

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**ADMINISTRATIVE INFORMATION****Support** - The Danish Health Foundation.**Review Stage at time of this submission** - Data extraction.**Conflicts of interest** - None declared.**INPLASY registration number:** INPLASY202630069**Amendments** - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 19 March 2026 and was last updated on 19 March 2026.**INTRODUCTION**

**Review question / Objective** To identify and map existing studies examining the use of sodium bicarbonate, calcium carbonate or calcium gluconate as an intervention in relation to childbirth, including its clinical indications, timing and route of administration, dosage, treatment duration and reported maternal and perinatal outcomes (including benefits and harm).

**Background** Bicarbonate is a natural buffer essential for maintaining the body's acid-base balance. Its therapeutic effects have been extensively studied in various tissues, particularly skeletal muscle of male athletes, where it mitigates the intracellular accumulation of lactate by neutralizing hydrogen ions produced during anaerobic metabolism. This process enhances contractile function and delays the onset of fatigue. However, it is important to note that current research in this field is conducted almost exclusively on male athletes, leaving a significant gap in the comprehensive data regarding the physiological benefits for women.

Similarly, calcium compounds - such as calcium carbonate and calcium gluconate - play a dual role in muscle function. They provide the essential ions required for excitation-contraction coupling of the smooth muscle, while also functioning as an acid-buffer, through the same mechanisms as sodium bicarbonate.

During childbirth, the smooth muscle cells of the uterus make strong, intermittent contractions. With each contraction, uterine blood flow is temporarily reduced, causing a brief shift to anaerobic metabolism. This leads to an accumulation of hypoxia-associated metabolites, such as lactic acid. Under normal physiological conditions, mechanisms are in place to continuously clear lactate from the tissue. Yet, in cases of prolonged labour, removal may be insufficient or ongoing anaerobic production may surpass the body's ability to eliminate lactate, resulting in progressively rising concentrations of lactate and other metabolic by-products. It is suspected that the resulting acidification inhibits the contractility of myometrial cells, leading to weaker and less effective uterine contractions.

Prolonged labour is common, estimated to affect up to 10–15% of nulliparous women, and is associated with maternal fatigue, increased rates of assisted delivery, and higher risk of postpartum haemorrhage (PPH). These obstetric complications contribute to maternal morbidity and mortality worldwide, highlighting the clinical importance of optimizing uterine contractility. Labour induction and augmentation with pharmacological agents, such as oxytocin, are frequently employed; yet these interventions do not directly address the underlying metabolic or biomechanical limitations of the uterus.

While sporadic studies have explored sodium bicarbonate or calcium compounds in relation to labour onset and childbirth outcomes, these are limited in number, heterogeneous, and rarely focus on female-specific physiology. Despite decades of research on muscle function in male athletes, our understanding of human uterine smooth muscle in labour remains incomplete.

**Rationale** Despite the physiological plausibility, the use of sodium bicarbonate, calcium carbonate, or calcium gluconate, to support uterine contraction during labour, has not been systematically synthesized. While a number of studies have examined buffering and calcium supplementation in male athletic populations, comparable data for women during childbirth are scarce, reflecting a broader gender gap in biomedical research.

Clinically, labour induction, prolonged labour, and postpartum haemorrhage (PPH) are frequent challenges, carrying significant maternal and neonatal risks. Adverse neonatal outcomes may include fetal distress, low Apgar scores, umbilical cord acidemia, and increased need for neonatal intensive care. Interventions that enhance uterine contractility could reduce the incidence of prolonged labour, decrease the need for assisted deliveries, and mitigate PPH, while potentially improving neonatal outcomes by promoting more efficient labour and reducing fetal compromise. However, current obstetric practice relies predominantly on pharmacological stimulation, which may not fully address metabolic or mechanical limitations of the myometrium.

Existing studies on bicarbonate and calcium compounds in relation to labour are scattered across populations, outcomes, doses, and timing. There is a notable gap when it comes to understanding the physiological responses of uterine smooth muscle under stress conditions, particularly in women with prolonged labour. Furthermore, the potential impact of these interventions on neonatal outcomes remains

insufficiently explored. A scoping review is warranted to systematically identify and map existing evidence, clarify knowledge gaps, and inform both future research and potential clinical strategies aimed at optimizing maternal uterine performance while ensuring neonatal safety.

## METHODS

**Strategy of data synthesis** A systematic search will be conducted in PubMed and Embase to identify relevant studies. The search will be conducted around two conceptual blocks: the population (women in labour) and interventions of interest (sodium bicarbonate, calcium carbonate and calcium gluconate).

For each block, a combination of controlled vocabulary terms (e.g. MeSH terms in PubMed) and free text terms will be used including synonyms, spelling variations and/or relevant abbreviations. Terms within each block will be combined using the Boolean operator “OR”, and the population and intervention blocks will then be combined using “AND”.

In PubMed, the population block includes the main terms: ‘Labor, Obstetrics’, ‘Delivery, Obstetrics’, and ‘Parturition’. Synonyms and related terms combined with the Boolean operator “OR” includes: labour, labor, birth, parturition, intrapartum, and uterus. As there are three interventions of interest, a block for each is appropriate. For the 1st intervention the main term is ‘Bicarbonates’ (with synonyms: bicarbonate, NaHCO<sub>3</sub>, baking soda, sodium bicarbonate). For the 2nd intervention: ‘Calcium carbonate’ (with synonyms: CaCO<sub>3</sub>, chalk), and for the 3rd intervention: ‘Calcium gluconate’ (with synonyms: calcium gluc, calcium D-gluconate, CaGlu, Ca gluconate, calcium bis(D-gluconate)).

In Embase, the population block includes: ‘Labor’, ‘Birth’, and ‘Obstetric delivery’ (with synonyms labour, labor, birth, parturition, intrapartum, and uterus). The intervention blocks includes: ‘Bicarbonate’ (with synonyms: bicarbonate, NaHCO<sub>3</sub>, baking soda, sodium bicarbonate), ‘Calcium carbonate’ (with synonyms: calcium carbonate, CaCO<sub>3</sub>, chalk) and ‘Calcium gluconate’ (with synonyms: calcium gluconate, calcium D-gluconate, CaGlu, Ca gluconate).

**Eligibility criteria** The population consists of women who are administered sodium bicarbonate, calcium carbonate and calcium gluconate in relation to childbirth, defined as interventions from the third trimester until 24 hours postpartum. ‘In relation to childbirth’ refers to women in the third trimester, during labour and birth, or within 24

hours postpartum, regardless of parity, obstetric risk status, plurality or mode of birth.

#### Inclusion criteria

**Intervention:** Use of sodium bicarbonate, calcium carbonate and calcium gluconate, including preventive, therapeutic, diagnostic, or adjunctive purposes.

**Study designs:** Randomized clinical trials (RCTs), non-randomized interventional studies, observational studies (cohort and case-control studies), case series and case-report studies.

**Year:** No publication date limits will be imposed, allowing for the inclusion of all relevant literature.

#### Exclusion criteria

**Study designs:** Narrative reviews, systematic reviews, meta-analyses, scoping reviews, editorials, commentaries, expert opinions, conference abstracts without fully accessible data, case reports describing incidental intervention exposure. Studies conducted at the cellular or molecular level, that do not involve whole-organism physiological responses, such as in vitro or ex vivo studies.

Articles in which sodium bicarbonate, calcium carbonate or calcium gluconate is administered exclusively in the context of obstetric anesthetics management.

#### Source of evidence screening and selection

Articles identified through searches will be imported into Covidence, a web-based software platform for conducting systematic reviews, where duplicates will be automatically removed. Study selection will be conducted in two stages. First, titles and abstracts will be independently screened by two independent reviewers. Second, remaining full-text articles will be assessed for eligibility with the predefined inclusion and exclusion criteria. Any disagreements at either stage will be resolved through discussion or, if needed, consultation with a third reviewer. The study selection process will be documented using the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews abbreviated PRISMA-ScR flow diagram.

**Data management** A structured data chart will be developed prior to data extraction to systematically chart relevant information from all included studies. Data to be extracted will include, but is not limited to: first author, title, country, intervention, timing and routes of administration, dosage, treatment duration and outcomes.

#### Reporting results / Analysis of the evidence

Findings will be presented, using a combination of

narrative description, tables, and appropriate visualizations such as forest plots when applicable, to illustrate patterns across studies. Studies may be grouped by outcome, intervention type or study design, and visualization will be used to enhance clarity.

**Language restriction** Studies in languages mastered by the research team (English, Arabic, Danish, Swedish, and Norwegian) will be included. Articles in other languages will be excluded as no AI-translation will be utilized.

**Country(ies) involved** Denmark and England.

**Keywords** Labour; childbirth; parturition; sodium bicarbonate; NaHCO<sub>3</sub>; calcium carbonate; CaCO<sub>3</sub>; calcium gluconate; prolonged labour; cesarean section; postpartum haemorrhage; labour induction; Uterus.

**Dissemination plans** The results will be submitted for publication upon completion, following relevant reporting guidelines (e.g. PRISMA-ScR). Authorship order reflects contribution and ICMJE guidelines.

#### Contributions of each author

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