Supplemental Figure for: Mini-Review: System-level considerations associated with cow-calf contact in seasonal-calving pasture-based dairy systems

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Structured Search Process for Quantifying Cow-Calf Contact Research Trends

The primary focus of the review titled ‘Mini-Review: System-level considerations associated with cow-calf contact in seasonal-calving pasture-based dairy systems’ by Hendriks et al. (2026) was to highlight research gaps in understanding cow-calf contact in the context of predominantly pasture-based dairy farm systems. As a complement to the main narrative, we also undertook a structured literature search to quantify research activity on cow-calf contact. The objective was to provide readers with an overview of the scope of published work on cow-calf contact across global dairy systems.

Search Strategy

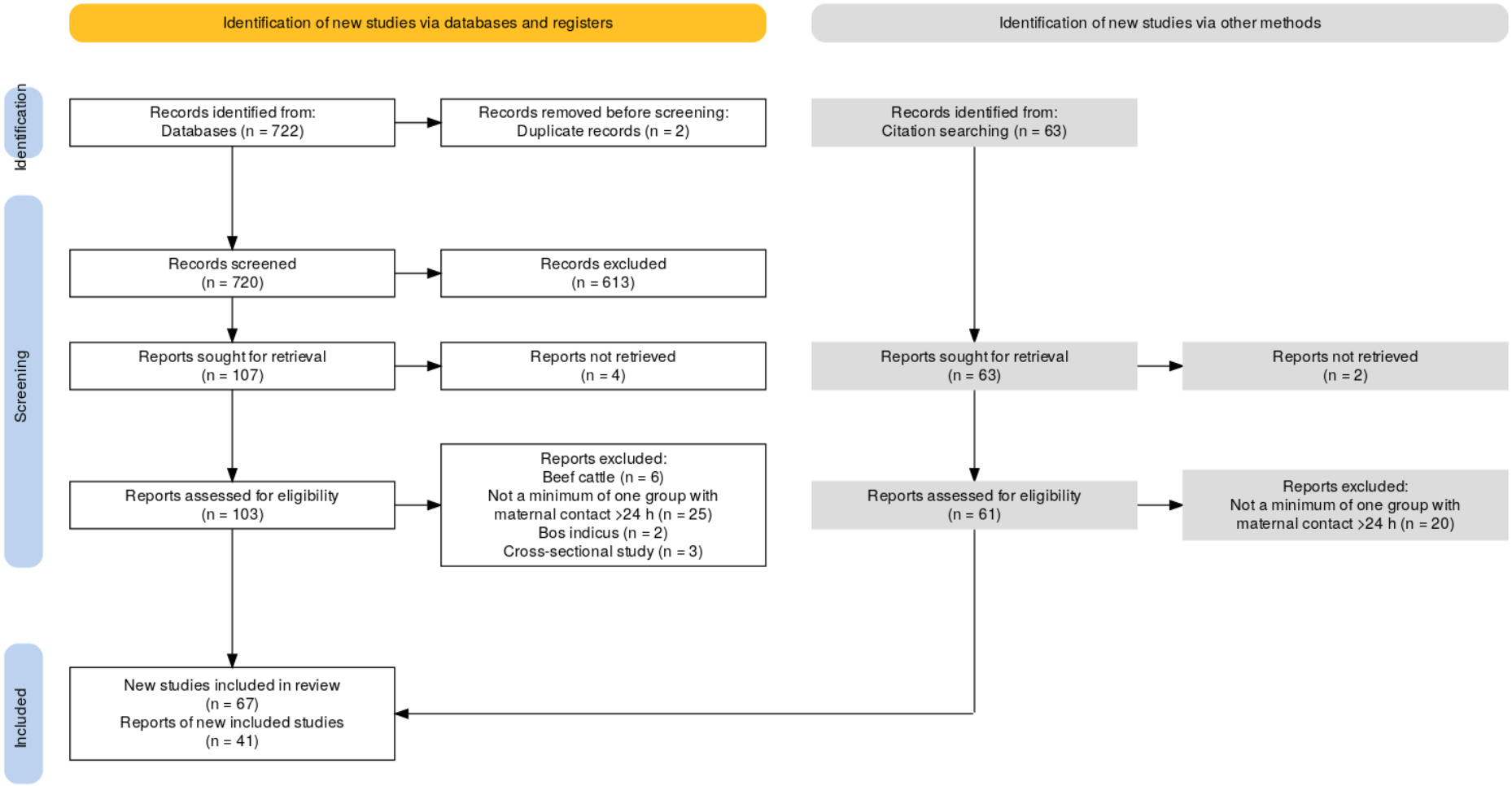
A systematic search was undertaken to search for, screen and extract journal articles that investigated the cow-calf contact or suckling on aspects of health, nutrition, behavioural interactions, physical environment, or affective state on the dairy cow or calf. A targeted search was undertaken using the PRISMA 2020 framework (Page et al., 2021). The search strategy combined terms using Boolean operators (i.e. AND, OR) and wildcard truncations (denoted as *). The search strategy contained the following keywords ("cow-calf" OR "cow/calf" OR "dam-calf" OR "dam/calf" OR "dam rearing" OR "reared by the dam" OR "reared by cows" OR "suckling system*" OR "mother rearing" OR "reared by the mother" OR "contact of calves with adult*" OR "leav* calves with dam*" OR "stay* with the dam" OR "remain* with the dam" OR "kept with the dam") AND (nurs* OR suckl* OR separation OR contact OR "risk factor*") AND (calf OR calves). A search of the open-access database PubMed was undertaken on the 27th August 2025 and only studies in peer-reviewed scientific journal articles published in English prior to 27 August 2025 were included, yielding 722 results.

Inclusion and Exclusion Criteria

We first screened all articles titles and abstracts to ensure relevance by applying clear inclusion and exclusion criteria. Articles were included if they focused on *Bos taurus* cattle and reported outcomes relating to health, nutrition, behavioral interactions, physical environment, or affective state in the dairy cow or calf with a minimum of one 'contact' group reported as having the opportunity to nurse or with maternal contact through a 'controlled study'. We included articles examining all forms of CCC where calves had more than 24 hours of contact with a dam or foster cow after birth. We define "controlled studies" as those with a comparator 'contact' group, including randomized and non-randomized trials, cohort studies, case–control studies, and other analytic epidemiological designs. We exclude purely descriptive designs such as case reports, case series, cross-sectional surveys without a comparator, and studies reporting only population characteristics. Non-English and review articles as well as articles in *Bos indicus* and beef cattle and other species were excluded. Following title and abstract screening, full article texts were retrieved via online searching (e.g. ResearchGate, personal contacts, Open-Access databases). Full text screening was undertaken and data extracted from each article regarding the production system (where adult cattle were ordinarily pasture-based and the predominant feed type is pasture or pasture feed (i.e. grass silage) or housed where the predominant feed type was total mixed ration or concentrate), and country of study. Further, key data of interest were the outcomes reported on dairy animals described as either calves and heifers (nulliparous) or cows (primi- and multi-parous) classified according to four predefined areas of interest 1) health and physiology, 2) behavior 3) performance, and 4) affective state. A table describing the studies included and related classifying data are presented in Supplemental Table S1. The associated bibliography is provided at the end of this document.

Results

The literature search resulted in 722 results, but after duplicate removal (n = 2) and exclusion criteria applied including reports not retrieved (n = 653) throughout the title and abstract screening and full text screening process, 67 papers remained. An additional 63 articles were identified through citation searching and of those, 22 articles were either not retrieved or excluded. A total of 41 articles remained, resulting in 108 articles for the extraction of relevant data of interest. A PRISMA flow diagram providing the full breakdown of papers excluded and reasons for exclusion is presented in Supplemental Figure S1.



Supplemental Figure S1. PRISMA 2020 flow diagram reporting the article searching and screening process for a structured review process for quantifying cow-calf contact research trends including the search of the PubMed database.

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