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Protocol for systematic map of reproductive performance of male cattle in Africa

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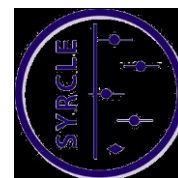
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Peer reviewed version

Systematic Review Protocol for Animal Intervention Studies

Item #	Section/Subsection/Item	Description	Check for approval
	A. General		
1.	Title of the review	Systematic map of reproductive performance of male cattle in Africa	
2.	Authors (names, affiliations, contributions)	Isla MacVicar[1], Fiona K Allan[1], Andrew R Peters[1] and Christian Schnier[1] [1]Supporting Evidence Based Interventions in Livestock (SEBI-Livestock), The Royal (Dick) School of Veterinary Studies, The University of Edinburgh, Easter Bush Campus, Midlothian, EH25 9RG, UK	
3.	Other contributors (names, affiliations, contributions)	-	
4.	Contact person + e-mail address	Fiona K Allan: fiona.allan@ed.ac.uk	
5.	Funding sources/sponsors	SEBI-L is funded by the Bill & Melinda Gates Foundation	
6.	Conflicts of interest	No conflicts of interest	
7.	Date and location of protocol registration	-	
8.	Registration number (if applicable)	-	
9.	Stage of review at time of registration	Formulating search terms/strings, including outcome measures	
	B. Objectives		
	Background		
10.	What is already known about this disease/model/intervention? Why is it important to do this review?	Optimizing cattle reproductive performance is a crucial pillar in the strategy to achieve sustainable development goals. In high income countries, with mostly intensive production, there is reasonable agreement about optimum reproduction. In lower- and middle-income countries (LMICs), however, wide variation in production systems and environments mean that optimal reproductive performance is complex. Fertility of male cattle (bulls) is a crucial factor in determining the reproductive performance of female cattle (cows). However, bull fertility is rarely studied, which can lead to costly delays in discovering fertility problems. A systematic evidence map of bull reproduction will help to define the current state of cattle reproduction evidence bases in different production systems and ecosystems, and will identify current trends, barriers to improvements, and highlight potential solutions. Solutions can then be developed into sustainable and targeted actions.	

	Research question		
11.	Specify the disease/health problem of interest	Male cattle (bull) fertility	
12.	Specify the population/species studied	Cattle	
13.	Specify the intervention/exposure	-	
14.	Specify the control population	-	
15.	Specify the outcome measures	Measures of reproductive performance	
16.	State your research question (based on items 11-15)	What is the available evidence of male cattle fertility in Eritrea, Ethiopia, Kenya, Nigeria, Tanzania, South Sudan, Sudan, Somalia and Uganda	
	C. Methods		
	Search and study identification		
17.	Identify literature databases to search (*e.g.* Pubmed, Embase, Web of science)	X MEDLINE via PubMed X Web of Science X SCOPUS ☐EMBASE X Other, namely: Google Scholar, CAB Direct, Global ETD, Research4life X Specific journal(s), namely: CGIAR, Gates Open Research	
18.	Define electronic search strategies (*e.g.* use the step by step search guide[15] and animal search filters[20, 21])	When available, please add a supplementary file containing your search strategy: [will be included in manuscript]	
19.	Identify other sources for study identification	X Reference lists of included studies x Books X Reference lists of relevant reviews X Conference proceedings, namely: X Contacting authors/ organisations, namely: X Other, namely: theses and reports	
20.	Define search strategy for these other sources	Screening the sources for relevant titles and screening the abstracts of relevant titles	
	Study selection		
21.	Define screening phases (*e.g.* pre-screening based on title/abstract, full text screening, both)	1) Screening based on title and abstract 2) Full-text screening of eligible articles	
22.	Specify (a) the number of reviewers per screening phase and (b) how discrepancies will be resolved	3 reviewers (IM, FA and CS) will screen a sample (10%) of title/abstract and a Kappa test will be used to measure inter-rater reliability to ensure consistency. Differences will be resolved through discussion or by consulting a fourth reviewer. After the consistency check, the criteria will be applied and three reviewers (IM, FA and CS) will screen the title/abstract phase and the full text phase and differences will be resolved through discussion.	
	Define all inclusion and exclusion criteria based on:		
23.	Type of study (design)	Inclusion criteria: observational, experimental (clinical trials)[†] Exclusion criteria: modelling studies and reviews	
24.	Type of animals/population (*e.g.* age, gender, disease model)	Inclusion criteria: Male cattle (bulls), any age Exclusion criteria: Female cattle. Camel, buffalo, bison, elephant, whale, walrus, crocodile, elk, giraffe, hippopotamus, dogs	
25.	Type of intervention (*e.g.* dosage, timing, frequency)	Inclusion criteria: NA Exclusion criteria: NA	

26.	Outcome measures	Inclusion criteria: bull fertility, bull reproduction, testicle, scrotal circumference, sperm (count, morphology, motility), semen, non-return rate, culling due to infertility, successful conception rate, number of services per conception, breeding soundness exam (BSE), libido. Potentially other (quantitative) measures of fertility. Exclusion criteria: any other measure of fertility	
27.	Language restrictions	Inclusion criteria: English Exclusion criteria: all other non-English languages	
28.	Publication date restrictions	Inclusion criteria: 2012-2022 inclusive Exclusion criteria: all other dates	
29.	Other	Inclusion criteria: study country: Eritrea, Ethiopia, Kenya, Nigeria, Somalia, South Sudan, Sudan, Tanzania, Uganda Exclusion criteria: any other country	
30.	Sort and prioritize your exclusion criteria per selection phase	Selection phase: 1. Abstract only 2. Duplicated data 3. Country 4. Experimental or modelling study	
Study characteristics to be extracted (for assessment of external validity, reporting quality)			
31.	Study ID (*e.g.* authors, year)	Author, title, year	
32.	Study design characteristics (*e.g.* experimental groups, number of animals)	Country of study, locality, agroecological zone, season, farming system, sampling method, study direction (prospective/retrospective), study type (cross-sectional, longitudinal, cohort), data source, cover (AI, natural, both), number of cattle, number of herds	
33.	Animal model characteristics (*e.g.* species, gender, disease induction)	Breed, age	
34.	Intervention characteristics (*e.g.* intervention, timing, duration)	NA	
35.	Outcome measures	Bull fertility, bull reproduction, testicle, scrotal circumference, sperm (count, morphology, motility), semen, non-return rate, culling due to infertility, successful conception rate, number of services per conception, breeding soundness exam (BSE), libido. Potentially other (quantitative) measures of fertility.	
36.	Other (*e.g.* drop-outs)	Data source (survey, records), publication type (journal, thesis)	
Assessment risk of bias (internal validity) or study quality			
37.	Specify (a) the number of reviewers assessing the risk of bias/study quality in each study and (b) how discrepancies will be resolved	Quality of included studies not typically appraised in systematic mapping, according to methodological guidance (James *et al.*, 2016[*])	

38.	Define criteria to assess (a) the internal validity of included studies (*e.g.* selection, performance, detection and attrition bias) and/or (b) other study quality measures (*e.g.* reporting quality, power)	☐By use of SYRCLE's Risk of Bias tool[4] ☐By use of SYRCLE's Risk of Bias tool, adapted as follows: ☐By use of CAMARADES' study quality checklist, e.g [22] ☐By use of CAMARADES' study quality checklist, adapted as follows: ☐Other criteria, namely:	
	Collection of outcome data		
39.	For each outcome measure, define the type of data to be extracted (*e.g.* continuous/dichotomous, unit of measurement)	Testicle/Scrotal circumference: continuous (cm) Sperm count: % or continuous Sperm morphology: % Sperm motility: % Semen: volume, sperm concentration (% or continuous), sperm motility (%), sperm morphology (%) Non-return rate: % Culling due to infertility: % Successful conception rate: proportion Number of services per conception: continuous Breeding soundness exam (BSE): categorical Libido: observational (behaviour)	
40.	Methods for data extraction/retrieval (*e.g.* first extraction from graphs using a digital screen ruler, then contacting authors)	Extraction from text and tables Contacting authors by email where any confusion	
41.	Specify (a) the number of reviewers extracting data and (b) how discrepancies will be resolved	a) Two reviewers (FA and IM) will extract all data b) Discrepancies will be resolved by discussion between all 3 reviewers	
	Data analysis/synthesis		
42.	Specify (per outcome measure) how you are planning to combine/compare the data (*e.g.* descriptive summary, meta-analysis)	Descriptive analysis of all outcome measures, including associations with study design variables	
43.	Specify (per outcome measure) how it will be decided whether a meta-analysis will be performed	Systematic mapping reviews do not typically involve quantitative synthesis i.e. meta-analysis (Dicks *et al*., 2014[**])	
	If a meta-analysis seems feasible/sensible, specify (for each outcome measure):		
44.	The effect measure to be used (*e.g.* mean difference, standardized mean difference, risk ratio, odds ratio)	-	
45.	The statistical model of analysis (*e.g.* random or fixed effects model)	-	
46.	The statistical methods to assess heterogeneity (*e.g.* I^2, Q)	-	
47.	Which study characteristics will be examined as potential source of heterogeneity (subgroup analysis)	-	
48.	Any sensitivity analyses you propose to perform	-	

49.	Other details meta-analysis (*e.g.* correction for multiple testing, correction for multiple use of control group)	-	
50.	The method for assessment of publication bias	-	

Final approval by (names, affiliations):
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Livestock (SEBI-Livestock),
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Date: 08/05/2023

* James KL, Randall NP, Haddaway NR (2016). Methodology for systematic mapping in environmental sciences. Environmental Evidence 5:7.

** Dicks LV, Walsh JC and Sutherland WJ (2014). Organising evidence for 747 environmental management decisions: a '4S' hierarchy. Trends in Ecology and 748 Evolution 29: 607–613.

† Included but flagged.