

1 ***Salmonella* in animal feeds: A scoping review protocol**

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19 **Abstract**

20 *Background:* *Salmonella* spp. cause enteric illness in humans and animals. Animal feeds are a
21 potential source of *Salmonella* spp. for livestock and poultry. A formal scoping review of the
22 literature relevant to *Salmonella* in animal feed would help to identify areas for evidence
23 synthesis and also gaps in the literature to target future research.

24 *Objectives:* This protocol describes the methods for a scoping review to address the question
25 "What is the nature and volume of the primary research literature on *Salmonella* in livestock and
26 poultry feeds or feed manufacturing?".

27 *Eligibility criteria:* Primary research studies published in English since 1995 that investigate
28 *Salmonella* spp. of any serotype in feeds intended for livestock or poultry, or that investigate any
29 serotype of *Salmonella* spp. in facilities, environments, or equipment related to manufacturing,
30 transporting, storing, or administering of feed intended for consumption by livestock or poultry.

31 *Sources of evidence:* Searches will be conducted in MEDLINE® (Web of Science™), Agricola
32 (ProQuest), CAB Direct (CABI), and Scopus.

33 *Charting methods:* Data charting will include study characteristics, setting or sector of the feed
34 production system, serotypes of *Salmonella* investigated, and study purpose (including
35 frequency, molecular characteristics, diagnostic test or surveillance system development or
36 validation, risk factor identification, and intervention evaluation).

37

38 **1. Introduction**

39 *1.1. Rationale*

40 Salmonellosis is an important public health issue; in the US, there are over a million cases of
41 salmonellosis per year, with foodborne transmission being a common route of exposure (Scallan

42 et al., 2011). *Salmonella* spp. may be present in the faeces of a variety of food animal species,
43 symptomatically or asymptotically (Rukambile et al., 2019). One potential source of
44 *Salmonella* for food animals is through the consumption of contaminated feed (Jones, 2011). To
45 date, there has not been a published scoping review describing the literature related to
46 *Salmonella* in animal feeds. A scoping review on this topic could be useful for identifying
47 specific topics with a sufficient depth of literature to support a systematic review and also to
48 identify research gaps.

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50 *1.2. Objectives*

51 The objective of this protocol is to describe the methods that will be used to conduct a scoping
52 review to address the following research question: "What is the nature and volume of the primary
53 research literature on *Salmonella* in livestock and poultry feeds or feed manufacturing?" For the
54 purposes of this review, "animal feed" will include feed intended for consumption by livestock
55 or poultry. The scoping review will follow the methodological framework outlined by Arksey
56 and O'Malley (1995).

57

58 **2. Methods**

59 *2.1. Protocol and registration*

60 This protocol was prepared using the Preferred Reporting Items for Systematic Reviews and
61 Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR) reporting guidelines (Tricco et
62 al., 2018) and will be published on the University of Guelph Atrium
63 (<https://atrium.lib.uoguelph.ca/xmlui/handle/10214/10046>). The protocol also will be available at
64 SYREAF (www.syreaf.org).

65 2.2. Eligibility criteria

66 To be eligible for inclusion in this review, studies must be:

- 67 1) Available in English (although studies published in English from any country are eligible);
- 68 2) Available in full-text of at least 500 words, to allow sufficient detail for data characterization;
- 69 3) Published during or after 1995;
- 70 4) A primary research design, including descriptive study designs, experimental designs, and
- 71 analytical observational designs. At full-text screening, the number of studies conducted as *in*
- 72 *silico* models, risk assessments, formal guideline documents, systematic reviews, meta-
- 73 analyses, or scoping reviews will be quantified, but these studies will not be further
- 74 characterized.
- 75 5) Investigating any serotype of *Salmonella* spp. in feed intended for consumption by livestock
- 76 or poultry, or
- 77 6) Investigating any serotype of *Salmonella* spp. in facilities, environments, or equipment related
- 78 to manufacturing, transporting, storing, or administering of feed intended for consumption by
- 79 livestock or poultry.

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81 2.3. Information sources

82 Four electronic databases will be search for eligible studies from January 1, 1995 to the date of

83 the search: MEDLINE® (Web of Science™), Agricola (ProQuest), CAB Direct (CABI), and

84 Scopus. Given the anticipated size of the literature, a grey literature search will not be conducted.

85 The citations resulting from the database searches will be uploaded into Endnote® X9 Desktop

86 and de-duplicated using internal algorithms. De-duplicated citations then will be imported into

87 DistillerSR® (Evidence Partners, Ottawa, ON, Canada) review management software, where

88 addition de-duplication will be conducted prior to eligibility screening. Following full-text
 89 screening, an additional manual de-duplication will be conducted.

90

91 *2.4. Search*

92 The proposed search strategy is included in the Table below, restricted to publications from 1995
 93 to present. The search will not include language or study design restrictions. The search will be
 94 formatted for implementation in other databases, including the use of MeSH terms where
 95 possible.

1	(Salmonella OR “bacterial contamination” OR “microbiological assessment” OR “microbiological quality”)	
2	(“Animal feed*” OR “in-feed” OR “feeding stuffs” OR “poultry feed*” OR “Hog feed*” OR “swine feed*” OR corn OR grain* OR barley OR silage OR “crops” OR meal* OR pelleted OR pellet OR pelleting OR “dry feed*” OR “wet feed*” OR “fermented feed*” OR “feed mill*” OR feedmill* OR manufacturing OR factory OR factories OR feedstuff* OR feedingstuff* OR feed* or ration* or TMR or “total mixed ration*” or diet* or ingredient*)	
3	#1 AND #2	11,869 citations (Aug. 12, 2020)

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98 *2.5. Selection of sources of evidence*

99 Study selection will be conducted in DistillerSR® (Evidence Partners, Ottawa, Canada).

100 Eligibility will be assessed by two reviewers working independently, first based on the
 101 title/abstract and then, for studies identified as potentially eligible, based on the full text. For the
 102 title/abstract screening, agreement will be at the form level, whereas agreement will be at the
 103 question level for the full-text screening. For both levels, any disagreements will be resolved by
 104 consensus or in consultation with a third reviewer if consensus cannot be reached. Due to the
 105 anticipated large number of citations that will be included for the title/abstract screening,

106 Distiller's internal AI ranking program will be used. An initial training set of 1000 references
107 will be used, after which the remaining references will be ranked by likelihood of being eligible.
108 The program will re-rank citations after every 1000 citations that are screened. At the point
109 where no additional eligible citations have been identified for 500 consecutively ranked
110 references (as agreed by consensus of 2 reviewers), further screening will not be conducted and it
111 will be assumed that all eligible references have been identified.

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113 The title/abstract screening form will be pre-tested by all reviewers on 100 records and revised as
114 needed for clarity and consistency, before screening begins. This form will comprise the
115 following question:

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117 1) Does the title or abstract describe a study investigating *Salmonella* (any serotype) in feed
118 intended for consumption by livestock or poultry, or in facilities, environments, or
119 equipment used for animal feeds?

120 a. YES (neutral response)

121 b. NO (exclude)

122 c. UNCLEAR (neutral response)

123 2) Based on the title or abstract, is the study a primary research study?

124 a. YES (neutral response)

125 b. NO, but is an *in silico* model, risk assessment, guideline document, systematic
126 review, meta-analysis, or scoping study (neutral response)

127 c. NO (exclude)

128 d. UNCLEAR (neutral response)

- 129 3) Is the article published in English?
- 130 a. YES (acquire full text and move to full text screening)
- 131 b. NO (exclude)
- 132 c. UNCLEAR (acquire full text and move to full text screening)

133 The full-text screening form will be pre-tested by all reviewers on five records and revised for
134 clarity and consistency prior to the beginning of screening. This form comprises the following
135 questions:

- 136 1) Is the study available as full text of at least 500 words?
- 137 a. YES (neutral response)
- 138 b. NO (exclude)
- 139 2) Is the full text of the study published in English?
- 140 a. YES (neutral response)
- 141 b. NO (exclude)
- 142 3) Does the full text describe a study investigating *Salmonella* (any serotype) in feed
143 intended for consumption by livestock or poultry, or in facilities, environments, or
144 equipment used for animal feeds?
- 145 a. YES (neutral response)
- 146 b. NO (exclude)
- 147 4) Based on the full text, is the study a primary research study?
- 148 a. YES (advance article to data characterization stage)
- 149 b. NO, but is an *in silico* model (exclude)
- 150 c. NO, but is a risk assessment (exclude)
- 151 d. NO, but is a guideline document (exclude)

152 e. NO, but is a systematic review and / or meta-analysis (exclude)

153 f. NO, but is a scoping study (exclude)

154 g. NO (exclude)

155 The total number of articles originating from each database searched, the number of unique
156 citations following de-duplication, the number of studies assessed for eligibility based on the
157 titles and abstracts, and number of studies assessed for eligibility based on review of the full-text
158 screening (with reasons for exclusions at this stage) will be reported in a PRISMA Flow Diagram
159 (Moher et al., 2009).

160

161 *2.6. Data charting process*

162 Data charting will be conducted in DistillerSR® by two reviewers working independently. The
163 data charting form will be pre-tested by all reviewers on five studies, following which
164 modifications will be made, if necessary, for question clarity . Conflicts will be resolved by
165 consensus or, if consensus cannot be reached, a third reviewer will be consulted. Authors will not
166 be contacted for clarification or to obtain additional information on eligible studies. If an article
167 describes more than one study, the data will be charted at the article level (i.e., information from
168 all studies within an article will be extracted into a single DistillerSR® form).

169

170 *2.7. Data items*

171 The proposed information that will be extracted from each eligible article for data charting is
172 summarized as follows, noting that additional response options for the charting questions may be
173 included as the review evolves:

- 174 • Country(ies) where study was conducted

- 175 • Study design
- 176 • Month(s) and year(s) when study was conducted
- 177 • Study setting where feed contamination was investigated
- 178 • For each setting reported in the study:
 - 179 ▪ Type(s) of feedstuffs evaluated
 - 180 ▪ Species for which the feedstuff is intended
 - 181 ▪ Sources tested for *Salmonella*
 - 182 ▪ *Salmonella* serotypes investigated
 - 183 ▪ *Salmonella* outcomes reported
- 184 • Purpose of the study (check all that apply)
 - 185 ▪ Development or validation of methods for detecting *Salmonella* in feeds,
 - 186 ▪ Development or validation of surveillance methods for monitoring *Salmonella* in
 - 187 feeds,
 - 188 ▪ Estimating prevalence of *Salmonella*
 - 189 ▪ Estimating concentration of *Salmonella*
 - 190 ▪ Estimating survival times for *Salmonella*
 - 191 ▪ Molecular epidemiology of *Salmonella*
 - 192 ▪ Identification of risk factors for prevalence, concentration, or survival of *Salmonella*
 - 193 ▪ Evaluation of interventions
 - 194 ▪ Evaluation of linkages between *Salmonella* in animal feed and illness in humans.

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196 The study results from eligible studies will not be extracted, as this is a scoping review.

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198 2.8. *Critical appraisal of individual sources of evidence*

199 A critical appraisal of the literature will not be conducted, as this is a scoping review.

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201 2.9. *Synthesis of results*

202 Descriptive statistics will be used to summarize the results of the data charting. The summaries
203 will be presented using a combination of tables, figures, and narrative text. Research gaps will be
204 identified if present, and a narrative summary of research areas with potentially sufficient bodies
205 of evidence to support systematic reviews will be provided.

206

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209

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