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A SYSTEMATIC MAPPING REVIEW: EXPLORING FACTORS ASSOCIATED WITH DARK CUTTING, PH, COLOR, AND GLYCOGEN CONTENT IN BEEF FROM FED CATTLE

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I. INTRODUCTION

Dark-cutting beef, characterized by a high pH and an abnormally dark color, results primarily from pre-harvest stress depleting muscle glycogen stores [1-3]. This defect leads to discounted prices and consumer rejection due to perceived low quality [4]. It is estimated that the beef industry in the United States loses over $3 billion annually in retail beef sales due to meat discoloration [5]; while in Australia, the grading penalties due to dark cutting results in AU $36 million [6] due to discounts. The occurrence of dark-cutting beef is a multifactorial issue, with contributing factors ranging from animal genetics and handling practices to environmental conditions and transportation stress [6-7]. The objective of this study was to identify trends, knowledge clusters, and knowledge gaps in research exploring antemortem factors that impact dark cutting and associated measurements in fed beef cattle (i.e., pH, meat color, and glycogen content of meat).

II. MATERIALS AND METHODS

The Center for Environmental Evidence methodology guideline [8] was followed to conduct this systematic mapping review, and the ROSES (RepOrting standards for Systematic Evidence Syntheses) reporting guidelines [9] were used to report the conduct of the review. Four databases (Agricola, CAB Abstracts, Medline, and Web of Science) were searched using tested search strings focusing on peer-reviewed, English-language studies of antemortem factors affecting dark cutting, pH, meat color, or glycogen content in fed cattle. The search was conducted on December 17, 2024. Two independent reviewers screened titles and abstracts, followed by full-text screening by three reviewers. Data extraction was conducted using a pre-tested tool. Extracted data were synthesized and visualized using EPPI-Reviewer, EPPI-Mapper, and EPPI-Vis (EPPI Centre, London, England) to screen, create summaries, and develop an interactive map of the research landscape.

III. RESULTS AND DISCUSSION

The search produced 16,506 citations, and of these, 6,440 were identified as duplicates and removed. The remaining 10,066 were screened using their title and abstract, after which 9,375 were removed as they did not meet the inclusion criteria. Six hundred eighty-eight articles were full-text screened and a total of two-hundred thirty one articles were excluded as they did not meet inclusion criteria. Four hundred sixty articles were included in the final sample. Figure 1 shows a screen shot of the interactive evidence gap map created from this project. The interactive map can be downloaded from this link: https://mountainscholar.org/items/f6e8713b-4234-41e6-94f6-4d618a98328f.

The majority of studies (n = 281, 61.1%) involved 21 to 150 animals with few studies over 1,500 animals (n = 33, 7.2%). The majority of studies were conducted in Europe (n = 131, 28.5%), and bulls (n = 160, 34.8%) and steers (n = 153, 33.3%) were the most common sex classes included in studies. pH (n = 337, 73.3%) and meat color (n = 355, 77.2%) were the most frequently measured outcomes, while glycogen content (n = 25, 5.4%) and dark cutting frequency (n = 50, 10.9%) were less common. Feeding was the most studied intervention (n = 245, 53.3%).



Figure 1. This is a screenshot of the living evidence gap map created from this project. The interactive map can be downloaded from this link: https://mountainscholar.org/items/f6e8713b-4234-41e6-94f6-4d618a98328f.

IV. CONCLUSION

This research provides a framework for identifying future research potential to address meat quality concerns in fed cattle. Dark cutting was infrequently represented in the literature base. Therefore, if reducing dark cutters is to be a priority area, from the standpoint of reducing economic losses in certain regions of the world, there should be an intentional effort to fund, request, or identify future research needs. A deeper exploration and critical appraisal of studies associated with interventions of interest should be conducted.

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