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INPLASY

Barriers to Nitrite-Free Cured Meat Adoption in EU and UK Markets: A Systematic Review of the Technical, Regulato-ry, Consumer, and Commercial Constraints

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ADMINISTRATIVE INFORMATION

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Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 22 April 2026 and was last updated on 22 April 2026.

INTRODUCTION

Review question / Objective The overall aim of this systematic review is to synthesise the available scientific evidence on barriers to nitrite-free adoption in the EU/UK cured meat sector. The specific objectives are to examine: (i) technical and scientific barriers to reformulation; (ii) regulatory barriers in the EU/UK legislative context, including the post-Brexit divergence between UK and EU frameworks; (iii) commercial and economic barriers faced by manufacturers considering reformulation; and (iv) consumer perception barriers and the role of demand signals in the EU/UK market. A final objective is to derive, from the above four syntheses, a practitioner questionnaire enabling manufacturers to assess both their internal readiness for nitrite-free product development, and their supplier due-diligence requirements.

Rationale There clearly is a problem with the market availability for nitrite-free bacon and ham products. Consumer demand is real and well-documented. A decade of survey evidence across European markets shows that when people are asked whether they want fewer chemical preservatives in their cured meat, the answer is consistently yes. The products available on supermarket shelves tell a different story: the vast majority of bacon rashers and of cooked ham slice sold in EU and UK are still cured with sodium nitrite salt. This review questions why manufacturing practices are not changing with consumer demand.

Condition being studied The 2015 IARC reclassification of processed meat as a Group 1 carcinogen accelerated consumer con-cerns considerably. IARC's clear statement that eating processed meat is associated with colorectal cancer received widespread media coverage and

prompted a wave of demand for clean-label alternatives.

METHODS

Search strategy Searches were performed on 10 March 2026 in two databases: PubMed/MEDLINE (National Library of Medicine) and Web of Science Core Collection (Clarivate). PubMed/MEDLINE returned 400 records, and a further 208 came from Web of Science, giving 608 records before deduplication. The approach taken enabled cross-disciplinary coverage through Web of Science with PubMed providing good biomedical coverage. Food Science and Technology Abstracts (FSTA) was also excluded, which was partly a pragmatic decision given that institutional access was unavailable. Both omissions are declared here in line with PRISMA 2020.
Search strings were built around three concepts: A. Product terms, (nitrite-free, no added nitrite, uncured, vegetable-extract-cured, celery powder); B. product type terms (bacon, ham, cured meat, processed meat); and C. covering barrier and adoption terms like barrier, regulation, consumer, label, adoption, and market. Concept C. was kept deliberately broad. There was a risk of over-retrieval, but the tighter criteria for C would have meant missing relevant regulatory or consumer literature at the search stage. Over-retrieval was managed at the screening stage. No date limits were set, and the search was restricted to English-language publications.

Participant or population Sytsematic Review: No human participants.

Intervention Sytsematic Review: No intervention.

Comparator Sytsematic Review: No comparative intervention.

Study designs to be included Systematic review: A PRISMA 2020-compliant systematic search of PubMed/MEDLINE and Web of Science, screened records and retained studies for narrative synthesis organised across four barrier domains: technical and scientific , regulatory, consumer perception, and commercial and economic.

Eligibility criteria The key definitional problem identified during this review is that 'nitrite-free' is not a stable category. It serves as an umbrella term covering different product types that should be kept distinct because their regulatory and safety situations are quite different.
The clearest types are those we refer to as genuinely uncured products: i.e. no added nitrite or nitrate from any source, relying instead on alternative antimicrobial strategies or simply operating without a curing function. More complicated are vegetable-extract-cured products: those processed with celery powder, celery juice concentrate, or similar vegetable-source nitrite precursors. These have been marketed as 'no added nitrites' or 'nitrite-free', despite the fact that residual nitrite concentrations after fermentation or thermal processing may be comparable to conventionally cured equivalents. The third product types are the conventionally cured products, made with sodium nitrite or sodium nitrate, included here as comparators and are not treated as nitrite-free.
The above definition distinctions were held consistent throughout screening and extraction. Without it, products with meaningfully different safety profiles could be conflated and could distort findings about regulatory classification or consumer labelling. Geographically, the review prioritised EU and UK evidence. Studies from other regions were not counted as primary evidence in the consumer perception domain, since national regulatory contexts make direct comparisons difficult.

Information sources Two databases:
PubMed/MEDLINE (National Library of Medicine)
Web of Science Core Collection (Clarivate).

Main outcome(s) The database search retrieved 608 records from two databases (PubMed/MEDLINE and Web of Science) on 10 March 2026. After removing 111 duplicates, 497 records were screened at title and abstract level. Of these, 134 were excluded, leaving 363 studies meeting the inclusion criteria. Screening was conducted at title and abstract level only; full-text retrieval was not required.
Studies were assigned to four barrier domains. Of the 363 included articles, 346 were coded to a single domain and 17 carried a secondary domain tag. Technical and Scientific was by far the largest, with 335 pri-mary-tagged studies and a further 9 carrying Technical as a secondary tag. Such dominance reflects decades of food-science research on curing chemistry and food safety. Regulatory studies were considerably fewer (16 primary-tagged, none appearing as a secondary domain). This is consistent with the grey-literature exclusion applied in this review, since much of the most current regulatory evidence sits in policy documents rather than peer-reviewed journals. Consumer Perception studies numbered 11 primary-tagged, with 3 appearing as a secondary tag (14 total appearances); Commercial and Economic studies were the fewest in number , with just 1 primary-tagged article and 5 secondary tags

(6 total appearances). Quality ratings were high across the corpus: 334 studies (92%) were rated high quality and 29 (8%) medium quality; none were rated low quality. Full quality assessment scores were reported. The four domains were synthesized narratively. Each identified barrier was mapped to its supporting evidence and a questionnaire was devised.

Data management Data Availability: No new data were created or analysed in this study. Data sharing is not applicable.

Quality assessment / Risk of bias analysis Following screening, all 363 included records were placed in a standardised table. For each study the following were recorded: author(s) and year; study type; geographic scope; EU/UK relevance; barrier domains (Technical and Scientific; Regulatory; Consumer Perception; Commercial and Economic); barriers to adoption; and specific barriers identified. The full extraction data are provided.

Strategy of data synthesis Given the range of study designs, outcome measures, and evidence types across the four barrier domains, quantitative pooling was not possible. Evidence was organised by barrier domain, with findings summarised descriptively and the EU/UK context kept as the primary frame throughout. Where non-EU/UK evidence is drawn on for comparison, this is flagged explicitly in the text. A synthesis table mapping barriers to supporting sources was developed.
Each of the 363 included studies was assessed against three criteria. The first was relevance to the domain: does the study directly address one or more of the four barrier domains, with meaningful EU/UK bearing? The second was methodological transparency: is the method described clearly enough to be reproducible? Third, source credibility i.e. is the source peer-reviewed or an official regulatory document, rather than trade or grey literature? Each criterion was scored High, Medium, or Low, and an overall score derived by a majority rule: two or more Highs gave a High overall; two or more Lows gave Low; everything else was Medium.
Of the 363 studies, 334 scored High overall (92%) and the remaining 29 scored Medium (8%). None scored Low. This reflects how predominantly peer-reviewed the selected paper were. Quality scores were used only to characterise the evidence base but played no role in weighting or excluding findings, and all included studies are treated as contributing equally to the synthesis.

Subgroup analysis See 'Strategy of data synthesis' section: Each study was considered as to whether it addressed one or more of the four barrier domains.

Sensitivity analysis Systematic Review: not possible to undertake sensitivity analysis.

Language restriction Restricted to English-languge publications.

Country(ies) involved United Kingdom.

Keywords nitrites; meat; nitrite-free; barriers; manufacture; systematic review; food safety; EU regulation; consumer per-ception; questionnaire.

Dissemination plans Submission to a leading international Food Science peer-reviewed Journal.

Contributions of each author
Author 1 - BRIAN GREEN - Conceptualization, methodology, investigation, data curation, writing original manuscript draft, writing, review and editing.
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