

# A SYSTEMATIC REVIEW ASSESSING MUSCLE FOOD DEFINITIONS IN NUTRITION AND HEALTH-RELATED RESEARCH

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## I. INTRODUCTION

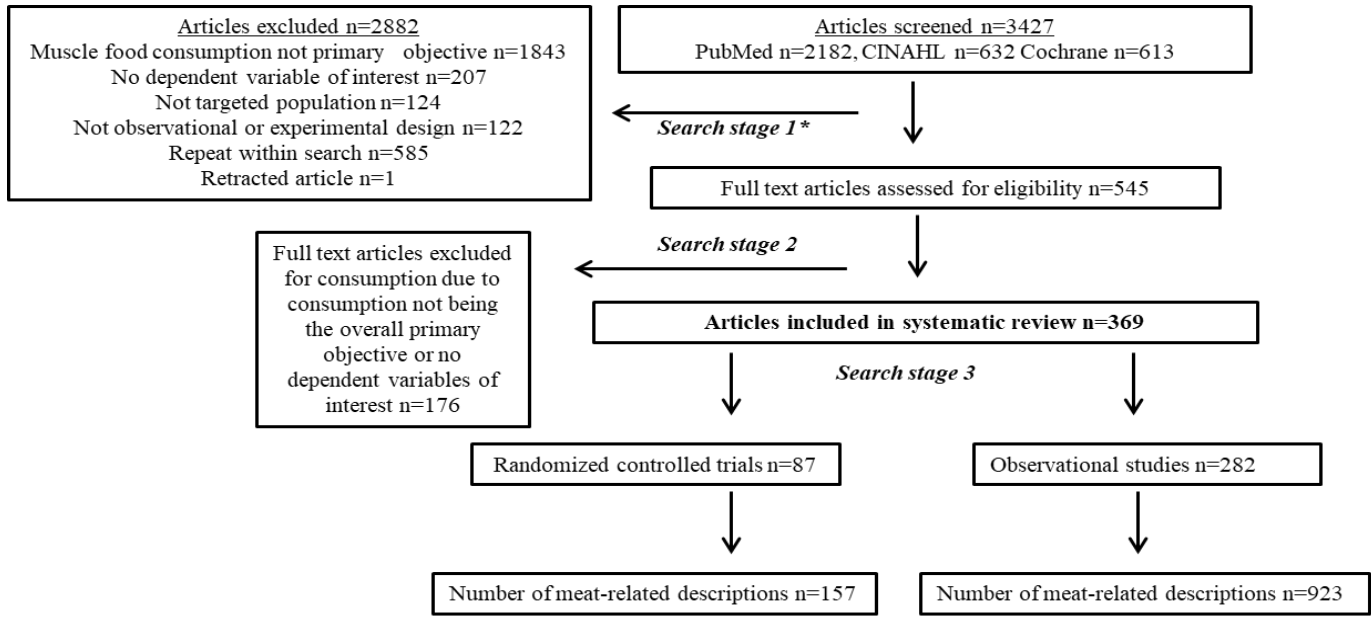
Muscle foods are commonly categorized into broad groups which can add variability into the definitions of these categories in human health research. Organizations, such as the World Cancer Research Fund [1], have attempted to list animal food products in simpler categories for consumers to understand and recognize. This complexity was highlighted further in the 2015 International Agency for Research on Cancer (IARC) which described that the processed meat category “refers to any meat that has been transformed through one or several of the following processes: salting, curing, fermentation, smoking, or other processes to enhance flavour or improve preservation”, additionally complicated by the difficulty in separating processing between food manufacture and meal preparation at home [2]. The objective of the current study was to review available scientific literature using standardized protocols for conducting systematic reviews to assess variability in definitions and categories of muscle foods (e.g., foods derived from animal tissue) included in diet and human health studies.

## II. MATERIALS AND METHODS

The PICOS criteria (Population, Intervention, Comparator, Outcome, Study design) was used to define our systematic search criteria. Inclusion criteria consisted of the following: 1) use of an observational or RCT study design, 2) subjects aged  $\geq 19$  y, 3) muscle food consumption as a primary objective, and primary prevention assessment of risk factors or incidence of CVD, T2DM, Cancer or Obesity. Studies were identified via a computerized search in 3 separate databases: 1) PubMed, 2) Cochrane Library, and 3) CINAHL. All database searches were conducted independently by three researchers. Following identification, inclusion criteria and extracted data were validated independently in the same manner as study identification. Authors independently extracted the following: 1) author name, 2) publication year, 3) type of study (observational or RCT, including empirical, systematic review or meta-analysis), 4) primary objective of the study 5) category of muscle food assessed (ex. red meat, processed meat, poultry, fish, etc.), 6) indication of definition provided, 7) definition of muscle food category if provided, 8) country or region where study was conducted, and 9) health outcome variables assessed. Briefly, muscle food categories and definitions were grouped according to specificity level of broadness, type, species, processing, leanness, cooking, origin, dish (e.g., mixed dishes), and specific cut or product designation included in categories and definitions from studies.

## III. RESULTS AND DISCUSSION

Figure 1 outlines the systematic process that was utilized to identify diet and health studies evaluating muscle foods. Among the computerized databases, 3,427 studies were identified from search criteria. To limit error from studies that included additional factors beyond intake of muscle foods that pertained to assessing health outcomes of interest, specific criteria were developed for excluding studies. A total of 369 studies met all criteria for this systematic review. A total of 1,080 muscle food categories resulted from this search, including those from both observational ( $n=923$ ) and randomized control trials ( $n=157$ ; Figure 1). Final descriptions of muscle foods were then used in statistical analyses. Frequencies of description groups from extracted definitions used in studies are reported in Table 1. Of 1,080 final category descriptions, 246 muscle food categories did not include a definition describing which foods were considered in a category (Table 1).



\*The search process and data extraction consisted of the following three stages: 1) potential eligibility based on information provided in the abstract, 2) confirmation of eligibility based on information provided in the full text if abstract qualified, 3) data extraction from full text articles once deemed qualified.

**Figure 1 Overview of systematic process of inclusion and exclusion criteria to identify observational and randomized control trials that evaluated muscle food intake related to human health outcomes\***

**Table 1 Frequencies of selected description groups of muscle food definitions from observational studies and randomized control trials.**

Description of Muscle Food Definitions	Frequencies from Observational Studies	Frequencies from Randomized Control Trials	Total Frequency <sup>1</sup>
No definition provided	219	27	246
Defined as deriving from a species only	83	26	109
Defined as a muscle cut or product only	65	2	67
'Ground' or 'minced' included in definition	48	19	67
Defined by $\geq 3$ specificity factors <sup>2</sup>	198	46	244

<sup>1</sup>Total frequency includes number of definitions of each description level from both observational studies and randomized control trials.

<sup>2</sup>Number of specificity factors refers to the number of specie, type (ex., red meat, white meat, etc.), processing, leanness, cooking, origin, dish (e.g., mixed dishes), and specific cut or product designations used in definitions extracted from published studies.

#### IV. CONCLUSIONS

This study is of global importance to clarify the level of specificity of muscle foods used in diet and human health studies by researchers. Variability, including lack of providing a definition, in the degree of specificity of muscle foods complicates the understanding of which foods are evaluated in diet and health research. This work will help inform future study designs assessing consumption of specific muscle foods and disease risk in human health research.

#### ACKNOWLEDGEMENTS

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