

# Meat

No. 2023/02He, The Hague, February 7, 2023

Background document to the advisory report:

Dutch dietary guidelines for people with atherosclerotic cardiovascular disease

No. 2023/02e, The Hague, February 7, 2023



## Contents

<b>1</b>	<b>Introduction</b> .....	<b>3</b>
1.1	Definition of meat .....	3
1.2	Meat recommendation and intake in the Netherlands.....	3
<b>2</b>	<b>Methodology</b> .....	<b>4</b>
2.1	Questions .....	4
2.2	Target group.....	4
2.3	Nutritional topics.....	4
2.4	Health outcomes .....	5
2.5	Selection and evaluation of the literature and drawing conclusions .....	5
<b>3</b>	<b>Effects and associations of meat consumption</b> .....	<b>7</b>
3.1	RCTs.....	7
3.2	Prospective cohort studies.....	7
3.3	Summary of conclusions .....	8
	<b>References</b> .....	<b>9</b>
	<b>Annexes</b> .....	<b>10</b>
	Annex A Search strategy.....	11

# 1 Introduction

This background document belongs to the advisory report *Dutch dietary guidelines for people with atherosclerotic cardiovascular disease (ASCVD)*.<sup>1</sup> It describes the methodology for the search, selection and evaluation of the literature regarding the relationship between meat consumption and health outcomes in people with ASCVD. It also describes the scientific evidence on this topic and the conclusions that have been drawn by the council's Committee on Nutrition.

## 1.1 Definition of meat

This background document describes the scientific evidence regarding meat intake. A distinction can be made between red meat and white meat, and between unprocessed and processed meat.<sup>2</sup> Red meat is meat from mammals, such as cattle, calves, pigs, goats, sheep and horses. White meat is meat from poultry, such as chickens, turkeys, ducks and geese and from domestic rabbits. The distinction between unprocessed and processed meat relates to the preservation method used. Meat is regarded as unprocessed if it is merely sliced or minced for domestic food preparation, possibly after being chilled or frozen. Meat is considered to be processed if it is smoked or salted for preservation or if preservatives such as nitrate or nitrite have been added. Processed meat, therefore, covers all meat products, including ham, bacon, sausage and the small proportion of minced meat that is sold as a ready-to-eat cooked product. Most processed meat is red meat.

## 1.2 Meat recommendation and intake in the Netherlands

The Health Council of the Netherlands included a guideline for meat consumption in the *Dutch dietary guidelines 2015*, which is as follows: 'limit the consumption of red meat, and particularly processed meat'.<sup>3</sup>

The average daily meat intake of the Dutch adult population is 123 grammes for men and 85 grammes for women. Almost half of the consumed meat by the Dutch population is processed according to the most recent *Dutch National Food Consumption Survey*.<sup>4</sup>

## 2 Methodology

### 2.1 Questions

The Committee aimed to answer the following question: What is the relationship (effect or association) of relatively higher meat consumption compared to no or relatively lower meat consumption with health outcomes in people with ASCVD?

### 2.2 Target group

The target group of the current advisory report is people with ASCVD. The Committee defines this group as people with clinically established coronary heart disease (CHD, consisting of acute coronary syndromes [myocardial infarction and unstable angina], stable angina and revascularisation procedures such as percutaneous coronary intervention [PCI] and coronary artery bypass grafting [CABG]), peripheral arterial disease (PAD) or cerebrovascular disease (consisting of stroke and transient ischemic attack). In the target population, atherosclerosis in the coronary arteries, aorta, iliac and femoral arteries, and cerebral arteries is the main underlying pathological process. Groups with a high risk (but no manifestation) of ASCVD, such as people with hypertension or elevated LDL cholesterol levels, fall outside this definition. Also, the target group of this advice does not include people with heart failure (except when those people also suffer from ASCVD). A detailed description of the target group of this advisory report is provided in the background document *Methodology for the evaluation of the evidence*.<sup>5</sup>

In the present background document, the Committee also considered studies performed in people with cardiovascular disease (CVD) in general (not further specified) because it assumes that the majority of this population will have ASCVD.

### 2.3 Nutritional topics

The Committee searched for studies into the effect or association of meat consumption on or with health outcomes. The Committee aimed to distinguish red meat and white meat, and processed and unprocessed meat, but this turned out to be impossible based on the available literature.

In addition, the Committee preferred to include studies in which meat consumption was measured after the occurrence of the ASCVD event, and preferably at least 6 months after the event in order to capture the habitual post-event intake and long-term effects of this exposure, since people may change their meat consumption habits because of an ASCVD event.

## 2.4 Health outcomes

The Committee selected the following health outcomes for this advisory report (further explained in the background document *Methodology for the evaluation of the evidence*<sup>5</sup>):

- short-term surrogate outcomes:
  - body weight
  - systolic blood pressure
  - low-density lipoprotein (LDL) cholesterol
  - estimated glomerular filtration rate (eGFR)
  - glycated haemoglobin (HbA1c) and fasting blood glucose
- long-term health outcomes:
  - all-cause mortality
  - morbidity and/or mortality from total CVD, CHD, stroke (cerebrovascular disease), heart failure, atrial fibrillation, type 2 diabetes, chronic obstructive pulmonary diseases (COPD), total cancer, breast cancer, colorectal cancer, lung cancer, dementia, depression
  - subtypes of CHD, such as myocardial infarction, angina pectoris and revascularisation procedures (i.e., coronary artery bypass surgery and percutaneous coronary intervention)

For cohort studies, the Committee included only studies in the above-described category named long-term health outcomes.

## 2.5 Selection and evaluation of the literature and drawing conclusions

### 2.5.1 Search and selection of studies

A detailed description of the approach used by the Committee for selecting and evaluating the scientific literature is provided in the background document *Methodology for the evaluation of the evidence*.<sup>5</sup> In short, the Committee aimed to base its evaluation of scientific literature on systematic reviews (SRs), including meta-analyses (MAs) and pooled analyses, of randomised controlled trials (RCTs) and/or prospective cohort studies examining the relationship of meat intake with the above-mentioned health outcomes in people with ASCVD. To identify such publications, the Committee searched PubMed and Scopus in January 2022. This search did not yield any publications relevant for the Committee's evaluation. The search strategy is provided in Annex A. The Committee was aware of two publications via the searches for literature on other nutritional topics for the current advisory report (fish, alcohol).<sup>6,7</sup> Both prospective cohort studies addressed the association between the Mediterranean diet and all-cause mortality (Iestra et al.<sup>6</sup>) and total CVD (Stewart et al.<sup>7</sup>) among people who survived a myocardial infarction (MI) or have stable CHD. Additional analyses were

performed by the authors to investigate the association of meat, as component of the Mediterranean diet. The reference lists of the publications and articles that cited these publications were checked, which yielded one more relevant study. This prospective cohort study by Trichopoulou et al.<sup>8</sup> also addressed the association between the Mediterranean diet and all-cause mortality. An additional analysis was done for the association between meat consumption and all-cause mortality. Additionally, the Committee was aware of one small-scaled RCT (31 participants) of Djekic et al.<sup>9</sup> via the search for literature on another nutritional topic for the current advisory report (substitution of saturated fat). The reference list of this RCT and articles that cited the RCT were checked, which yielded one more relevant study. This publication was again of Djekic et al.<sup>10</sup> and included the same study population. Both publications addressed the effect of meat consumption on LDL cholesterol among people with CHD.

### **2.5.2 Drawing conclusions**

A detailed description of the approach used for drawing conclusions is provided in the background document *Methodology for the evaluation of the evidence*.<sup>5</sup> In short, the Committee drew conclusions on (the certainty of) the evidence regarding the relationships between meat intake and health outcomes in people with (prior) ASCVD, based on the number of studies, number of participants and number of cases that contributed to the evaluation. Also, it took the quality of the studies, in particular the risk of bias, and the heterogeneity between studies into account. The Committee used the decision tree (presented in the in the background document *Methodology for the evaluation of the evidence*<sup>5</sup>) as a tool to support consistency in drawing conclusions.

### **3 Effects and associations of meat consumption**

In this chapter, the Committee describes the conclusions for the effects and associations of meat consumption with health outcomes in people with ASCVD. All conclusions apply to total meat consumption. Because two or less studies were found per health outcome, these studies were not further described below, since two or less studies provide too little evidence to base conclusions on.

#### **3.1 RCTs**

**Conclusion:**

**There is too little evidence to draw conclusions regarding the effect of total meat consumption on LDL cholesterol among people with ASCVD.**

The following considerations were made by the Committee, following the steps of the decision tree, to come to this conclusion:

There is one RCT that investigated the effect of total meat consumption and LDL cholesterol among people with CHD<sup>9,10</sup>, which provides too little evidence to base conclusions on.

#### **3.2 Prospective cohort studies**

**Conclusion:**

**There is too little evidence to draw conclusions regarding the association between total meat consumption and the risk of all-cause mortality among people with ASCVD.**

The following considerations were made by the Committee, following the steps of the decision tree, to come to this conclusion:

There are two prospective cohort studies that addressed the association between total meat consumption and the risk of all-cause mortality among people who survived a MI<sup>6,8</sup>, which provide too little evidence to base conclusions on.

**There is too little evidence to draw conclusions regarding the association between total meat consumption and the risk of total CVD among people with ASCVD.**

The following considerations were made by the Committee, following the steps of the decision tree, to come to this conclusion:

There is one prospective cohort study that addressed the association between total meat consumption and total CVD among people with CHD<sup>7</sup>, which provides too little evidence to base conclusions on.

### 3.3 Summary of conclusions

The Committee's conclusions regarding effects and associations of meat consumption with health outcomes in people with ASCVD are summarised in Table 1.

**Table 1** Overview of conclusions regarding the effects and associations of meat consumption with health outcomes in people with ASCVD

Type of meat	Health outcome <sup>a</sup>	Study design	Conclusion
Total meat	LDL cholesterol	RCT	Too little research
Total meat	All-cause mortality	Cohort studies	Too little research
Total meat	Total CVD	Cohort study	Too little research

Abbreviations: CVD: cardiovascular disease; LDL: low-density lipoprotein; RCT: randomised controlled trial.

<sup>a</sup> The table contains the health outcomes for which (relevant) studies were found. For the health outcomes that are not listed in the table, no (relevant) studies were found.



## References

- 1 Health Council of the Netherlands. *Dutch dietary guidelines for people with atherosclerotic cardiovascular disease*. The Hague: Health Council of the Netherlands, 2023.
- 2 Gezondheidsraad. *Vlees - Achtergronddocument bij Richtlijnen goede voeding 2015*. Den Haag: Gezondheidsraad, 2015; publicatie nr. A15/27.
- 3 Health Council of the Netherlands. *Dutch dietary guidelines 2015*. The Hague: Health Council of the Netherlands, 2015; publication no. 2015/26E.
- 4 van Rossum CTM, Buurma-Rethans EJM, Dinnissen CS, Beukers MH, Brants HAM, Dekkers ALM, et al. *The diet of the Dutch. Results of the Dutch National Food Consumption Survey 2012-2016*. Bilthoven: National Institute for Public Health and the Environment (RIVM), 2020; report no. 2020-0083.
- 5 Health Council of the Netherlands. *Methodology for the evaluation of evidence. Background document to Dutch dietary guidelines for people with atherosclerotic cardiovascular disease*. The Hague: Health Council of the Netherlands, 2023.
- 6 Iestra J, Knoops K, Kromhout D, de Groot L, Grobbee D, van Staveren W. *Lifestyle, Mediterranean diet and survival in European post-myocardial infarction patients*. Eur J Cardiovasc Prev Rehabil 2006; 13(6): 894-900.
- 7 Stewart RA, Wallentin L, Benatar J, Danchin N, Hagstrom E, Held C, et al. *Dietary patterns and the risk of major adverse cardiovascular events in a global study of high-risk patients with stable coronary heart disease*. Eur Heart J 2016; 37(25): 1993-2001.
- 8 Trichopoulou A, Bamia C, Norat T, Overvad K, Schmidt EB, Tjonneland A, et al. *Modified Mediterranean diet and survival after myocardial infarction: the EPIC-Elderly study*. Eur J Epidemiol 2007; 22(12): 871-881.
- 9 Djekic D, Shi L, Brolin H, Carlsson F, Sarnqvist C, Savolainen O, et al. *Effects of a Vegetarian Diet on Cardiometabolic Risk Factors, Gut Microbiota, and Plasma Metabolome in Subjects With Ischemic Heart Disease: A Randomized, Crossover Study*. J Am Heart Assoc 2020; 9(18): e016518.
- 10 Djekic D, Shi L, Calais F, Carlsson F, Landberg R, Hyotylainen T, et al. *Effects of a Lacto-Ovo-Vegetarian Diet on the Plasma Lipidome and Its Association with Atherosclerotic Burden in Patients with Coronary Artery Disease-A Randomized, Open-Label, Cross-over Study*. Nutrients 2020; 12(11): 3586.

# Annexes

## Annex A Search strategy

### PubMed

(Coronary disease [MeSH] OR Acute coronary syndrome [MeSH] OR Angina pectoris [MeSH] OR Coronary artery disease [MeSH] OR Myocardial infarction [MeSH] OR Peripheral arterial disease [MeSH] OR Intermittent claudication [MeSH] OR Stroke [MeSH] OR Brain ischemia [MeSH] OR Cerebrovascular disorders [MeSH] OR Percutaneous coronary intervention [MeSH] OR Coronary artery bypass [MeSH] OR Coronary disease [TIAB] OR Coronary heart disease [TIAB] OR Acute coronary syndrome [TIAB] OR Angina pectoris [TIAB] OR Angina [TIAB] OR Ischemic heart disease [TIAB] OR Ischaemic heart disease [TIAB] OR Coronary artery disease [TIAB] OR Coronary Arteriosclerosis [TIAB] OR Myocardial infarction [TIAB] OR Heart attack [TIAB] OR Peripheral arterial disease [TIAB] OR Peripheral vascular disease [TIAB] OR Intermittent claudication [TIAB] OR Stroke [TIAB] OR Acute stroke [TIAB] OR Cerebrovascular Apoplexy [TIAB] OR Apoplexy [TIAB] OR Ischemic stroke [TIAB] OR Ischaemic stroke [TIAB] OR Hemorrhagic stroke [TIAB] OR Haemorrhagic stroke [TIAB] OR Cerebrovascular accident [TIAB] OR Acute cerebrovascular accident [TIAB] OR Cerebrovascular stroke [TIAB] OR Brain vascular accident [TIAB] OR Brain ischemia [TIAB] OR Cerebral ischemia [TIAB] OR Cerebral stroke [TIAB] OR Brain accident [TIAB] OR Brain infarction [TIAB] OR Cerebral infarction [TIAB] OR Transient ischemic attack [TIAB] OR TIA [TIAB] OR Cerebrovascular\* [TIAB] OR Subarachnoid haemorrhage [TIAB] OR Intracerebral hemorrhage [TIAB] OR Intracranial hemorrhages [TIAB] OR Coronary revascularization [TIAB] OR Percutaneous coronary intervention [TIAB] OR Coronary artery bypass graft surgery [TIAB] OR Percutaneous transluminal coronary angioplasty [TIAB] OR Percutaneous transluminal angioplasty [TIAB] OR Coronary angioplasty [TIAB] OR Atherosclerotic cardiovascular disease [TIAB] OR Carotid artery disease [TIAB] OR CHD [TIAB] OR ACS [TIAB] OR IHD [TIAB] OR CAD [TIAB] OR MI [TIAB] OR AMI [TIAB] OR PAD [TIAB] OR CVA [TIAB] OR CVAs [TIAB] OR TIA [TIAB] OR PCI [TIAB] OR CABG [TIAB] OR PTCA [TIAB] OR PTA [TIAB] OR ASCVD [TIAB])

AND

("meat"[MeSH Terms] OR "meat"[tiab] OR "poultry"[tiab] OR "pork"[tiab] OR "beef"[tiab])

AND

("Systematic review"[publication type] OR "Meta-analysis"[publication type] OR "Review Literature as Topic"[MeSH] OR "review"[TIAB] OR "meta-analysis"[TIAB] OR "meta analysis"[TIAB] OR "metaanalysis"[TIAB] OR "quantitative review"[TIAB] OR

“quantitative overview”[TIAB] OR “Systematic Reviews as Topic”[MeSH] OR “systematic review”[TIAB] OR “systematic overview”[TIAB] OR “methodologic review”[TIAB] OR “methodologic overview”[TIAB] OR “individual participant data”[TIAB] OR “individual patient data”[TIAB] OR “IPD”[TIAB] OR “individual-level data”[TIAB] OR “pooled analysis”[TIAB] OR “pooled analyses”[TIAB] OR “multi-center study”[TIAB] OR “multi-cohort study”[TIAB])

Limit: from 2000

### **Scopus**

TITLE-ABS("Coronary disease") OR TITLE-ABS("Acute coronary syndrome") OR TITLE-ABS("Angina pectoris") OR TITLE-ABS("Coronary artery disease") OR TITLE-ABS("Myocardial infarction") OR TITLE-ABS("Peripheral arterial disease") OR TITLE-ABS("Intermittent claudication") OR TITLE-ABS(Stroke) OR TITLE-ABS("Brain ischemia") OR TITLE-ABS("Cerebrovascular disorders") OR TITLE-ABS("Percutaneous coronary intervention") OR TITLE-ABS("Coronary artery bypass") OR TITLE-ABS("Coronary heart disease") OR TITLE-ABS(Angina) OR TITLE-ABS("Ischemic heart disease") OR TITLE-ABS("Ischaemic heart disease") OR TITLE-ABS("Coronary Arteriosclerosis") OR TITLE-ABS("Heart attack") OR TITLE-ABS("Peripheral vascular disease") OR TITLE-ABS("Acute stroke") OR TITLE-ABS("Cerebrovascular Apoplexy") OR TITLE-ABS(Apoplexy) OR TITLE-ABS("Ischemic stroke") OR TITLE-ABS("Ischaemic stroke") OR TITLE-ABS("Hemorrhagic stroke") OR TITLE-ABS("Haemorrhagic stroke") OR TITLE-ABS("Cerebrovascular accident") OR TITLE-ABS("Acute cerebrovascular accident") OR TITLE-ABS("Cerebrovascular stroke") OR TITLE-ABS("Brain vascular accident") OR TITLE-ABS("Brain ischemia") OR TITLE-ABS("Cerebral ischemia") OR TITLE-ABS("Cerebral stroke") OR TITLE-ABS("Brain accident") OR TITLE-ABS("Brain infarction") OR TITLE-ABS("Cerebral infarction") OR TITLE-ABS("Transient ischemic attack") OR TITLE-ABS(TIA) OR TITLE-ABS(Cerebrovascular\*) OR TITLE-ABS("Subarachnoid haemorrhage") OR TITLE-ABS("Intracerebral hemorrhage") OR TITLE-ABS("Intracranial hemorrhages") OR TITLE-ABS("Coronary revascularization") OR TITLE-ABS("Percutaneous coronary intervention") OR TITLE-ABS("Coronary artery bypass graft surgery") OR TITLE-ABS("Percutaneous transluminal coronary angioplasty") OR TITLE-ABS("Percutaneous transluminal angioplasty") OR TITLE-ABS("Coronary angioplasty") OR TITLE-ABS("Atherosclerotic cardiovascular disease") OR TITLE-ABS("Carotid artery disease") OR TITLE-ABS(CHD) OR TITLE-ABS(ACS) OR TITLE-ABS(IHD) OR TITLE-ABS(CAD) OR TITLE-ABS(MI) OR TITLE-ABS(AMI) OR TITLE-ABS(PAD) OR TITLE-ABS(CVA) OR TITLE-ABS(CVAs) OR TITLE-ABS(TIA) OR TITLE-ABS(PCI) OR TITLE-ABS(CABG) OR TITLE-ABS(PTCA) OR TITLE-ABS(PTA) OR TITLE-ABS(ASCVD)

AND

TITLE-ABS(meat) OR TITLE-ABS("meat product\*") OR TITLE-ABS("processed meat")  
OR TITLE-ABS("red meat") OR TITLE-ABS(poultry) OR TITLE-ABS(pork) OR TITLE-  
ABS(beef)

AND

TITLE-ABS-KEY ("Systematic review") OR TITLE-ABS-KEY ("Meta analysis") OR  
TITLE-ABS (review) OR TITLE-ABS (meta-analysis) OR TITLE-ABS (metaanalysis)  
OR TITLE-ABS ("quantitative review") OR TITLE-ABS ("quantitative overview") OR  
TITLE-ABS ("systematic overview") OR TITLE-ABS ("methodologic review") OR TITLE-  
ABS ("methodologic overview") OR TITLE-ABS("pooled analyses") OR TITLE-  
ABS("pooled analysis") OR TITLE-ABS("multi-center study") OR TITLE-ABS("multi-  
cohort study")

Limit: from 2000

The Health Council of the Netherlands, established in 1902, is an independent scientific advisory body. Its remit is “to advise the government and Parliament on the current level of knowledge with respect to public health issues and health (services) research...” (Section 22, Health Act).

The Health Council receives most requests for advice from the Ministers of Health, Welfare and Sport, Infrastructure and Water Management, Social Affairs and Employment, and Agriculture, Nature and Food Quality. The Council can publish advisory reports on its own initiative. It usually does this in order to ask attention for developments or trends that are thought to be relevant to government policy.

Most Health Council reports are prepared by multidisciplinary committees of Dutch or, sometimes, foreign experts, appointed in a personal capacity. The reports are available to the public.

This publication can be downloaded from [www.healthcouncil.nl](http://www.healthcouncil.nl).

Preferred citation:

Health Council of the Netherlands. Meat. Background document to Dutch dietary guidelines for people with atherosclerotic cardiovascular disease.

The Hague: Health Council of the Netherlands, 2023; publication no. 2023/02He.

All rights reserved

