Meer plantaardig voedingspatroon en chronische ziekten

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1 Introduction

This background document belongs to the advisory report *Dutch dietary guidelines: dietary protein sources and dietary patterns 2025 (DDG2025).*[1] It describes the methodology for the search, selection and evaluation of the literature regarding the effects and associations of more plant based dietary patterns with health outcomes. It also describes the scientific evidence on this topic. This background document has been prepared by the Health Council's committee on Nutrition. A list of the committee members can be found in the advisory report.[1]

1.1 More plant based dietary patterns: definition and rationale

Dietary patterns are defined as the amounts, proportions, variety and combination of different foods and beverages in diets and the frequency with which they are consumed.[2] The committee's evaluation focused on dietary patterns that are based on foods and beverages; dietary patterns based on specific nutrients are not considered for this background document. Also outside the scope of this background document (and advisory report) are meal or eating patterns, such as intermittent fasting, which describe the frequency, regularity and timing of eating meals (main meals and snacks).

In the *Dutch dietary guidelines* (DDG2015), it was concluded that various dietary patterns lower the risk of chronic diseases.[3] These dietary patterns were referred to as recommended dietary patterns by the 2015-committee. These recommended dietary patterns were all characterised by relatively higher amounts of plant based and lower amounts of animal based foods. In addition, these dietary patterns were generally characterised by a high consumption of vegetables, fruit, whole grains, nuts, legumes, oils rich in cis-unsaturated fatty acids, semi-skimmed and low-fat dairy, poultry and fish; they contained little or no red and processed meat, full-fat dairy, drinks (and other products) with added sugar, hard fats and table salt and they were moderate in alcohol. A Mediterranean diet, DASH diet and dietary pattern according to the guidelines are examples of recommended dietary patterns.[2] Based on the above-described, the DDG2015 included the following overarching guideline on dietary patterns: *Eat a more plant-based and less animal-based diet in accordance with the guidelines below.*[3]

More recent reports support the conclusions that were drawn in 2015 on dietary patterns and chronic disease risk (see section 2.3 for more details).[4-8] Therefore, the focus of this background document (and of the advisory report), is on dietary patterns that are characterised by a relatively higher amount of plant based and lower amount of animal based foods. These are referred to as more plant based dietary patterns in this background document. It does not mean that they consist solely of plant-based foods; vegan diets therefore fall outside the definition of more plant based dietary patterns for

this background document (although vegan diets are sometimes included in the scientific literature on this topic). In the evaluated studies, more plant based dietary patterns are compared to dietary patterns that contain less plant based and more animal foods.

1.2 Consumption in the Netherlands

The report describing the results of the most recent Dutch National Food Consumption Survey (DNFCS) from 2019-2021 does not expresses the ratio between plant-based and animal-based of the Dutch diet in terms of foods, but based on proteins. It was calculated that on average 42% of the protein intake of Dutch adults aged 18 to 79 years comes from plant sources. There is virtually no difference between men and women.[9]

2 Methodology

Below, the methodology used for the evaluation of the evidence on more plant based dietary patterns and chronic disease risk is described in short. Because previous reports already provided strong indications that more plant based dietary patterns have favourable associations with and effects on health outcomes,[2-8] the committee decided that a only a less extensive evaluation of the evidence was needed, as further explained below. In the background documents on food groups and risks of chronic diseases, the methodology is described in more detail.[10-17]

2.1 Health outcomes

The committee focused on the health outcomes listed below.

- *Chronic diseases*: CHD, stroke, heart failure, type 2 diabetes, cancer subtypes (colon cancer and breast cancer), obesity (in some evaluations combined with overweight), depression, chronic obstructive pulmonary disease (COPD), dementia – and in some cases – total cardiovascular disease (CVD) and total cancer;
- *Causal risk factors and other short-term outcomes*: blood pressure (systolic and diastolic), low-density lipoprotein (LDL) cholesterol, body weight, glycated haemoglobin (HbA1c) and estimated glomerular filtration rate (eGFR);
- *Other outcomes*: all-cause mortality, quality of life, perceived health and fertility.

2.2 Type of studies

The committee evaluated the evidence based on meta-analyses (MAs) and pooled analyses of:

- Randomised controlled trials (RCTs) into effects of dietary factors on the incidence of morbidity or mortality due to a disease;
- RCTs into effects of dietary factors on causal risk factors;
- Prospective cohort studies into associations of dietary factors with morbidity or mortality due to a disease.

2.3 Quick scans and consulted literature

For efficiency reasons, the committee decided to make use of recent reports of other organisations where possible. To this end, quick scans were performed. These quick scans were aimed at summarising the state of science in an efficient way and to identify aspects on which the dietary guidelines may need to be updated.

In the quick scan, the conclusions and findings regarding the relationships of dietary patterns with health outcomes reported in the DDG2015 were compared to the conclusions and findings reported in existing dietary guidelines reports or other relevant

advisory reports and associated background documents or scientific reports. For the topic of dietary patterns, the following reports were used:

- Background document *Plant-based diets* belonging to the Dutch Health Council's advisory report *A healthy protein transition (2023)*;[4]
- Advisory report *Nordic Nutrition Recommendations 2023 (NNR2023)* and NNR background paper *Dietary patterns*;[5,6]
- Scientific reports of the Dietary Guidelines Advisory Committee (DGAC) from 2020 and 2025, developed for the benefit of the *Dietary Guidelines for Americans (DGA)*.[7,8]

Based on the quick scans, the committee noted that all above listed reports reported beneficial associations or effects of more plant based dietary patterns on health outcomes. The committee also noted that the literature searches conducted for the above mentioned reports were quite recent, were mostly carried out systematically, and its results were very much in line with each other and with the conclusions drawn in the DDG2015 on this topic. Therefore, the committee judged that there was no need to search for more recent literature. There was one exception to this: the committee judged that a systematic literature search for recent MAs on health effects of the Planetary Health Diet of the EAT-Lancet Commission was necessary. This is because the Planetary Health Diet is relatively new (introduced in 2019[18]) and seemed to be limitedly presented in the above systematic reviews and reports. The committee performed systematic literature searches in PubMed, Scopus and Embase. See Annex A for more details on the search and section 3.4 for more information on the Planetary Health Diet of the EAT-Lancet Commission.

2.4 Evaluation of evidence

Since the DDG2015 guideline to eat according to a more plant-based and less animal-based diet was already strongly substantiated in 2015, and the current literature supports and strengthens these findings, the committee decided to not perform extensive evaluations with formal conclusions (based on the decision tree) for each dietary factor-health outcome combination. Instead, it describes in broad terms the findings from these reports and from the additional meta-analyses found via its own literature search on health effects of the Planetary Health Diet of the EAT-Lancet Commission.

2.5 Evaluation of the dietary guideline on dietary patterns

The evaluation of effects and associations of more plant based dietary patterns with chronic disease risk are described in Chapter 3 of this background document.
The committee used the totality of findings described in this document, together with conclusions based environmental and chemical food safety aspects,[19,20] to evaluate the DDG2015 guideline on dietary patterns.

3 Description of the evidence

This chapter describes the scientific evidence on the associations or effects of more plant based dietary patterns with risks of chronic diseases or causal risk factors. The findings are described per report, and for the committee's literature search on the Planetary Health Diet of the Eat-Lancet Commission.

3.1 Advisory report *Dutch dietary guidelines 2015*

The literature search on dietary patterns for the DDG2015concerned (MAs of) prospective cohort studies and RCTs into the into the effects of various dietary patterns on the risk of chronic diseases and its causal risk factors. The evaluation focused on dietary patterns that are based on foods and beverages; dietary patterns based on specific nutrients were not considered. The DDG2015 committee only included cohort studies of dietary patterns defined using an a priori method; no dietary patterns defined using a posterior methods were considered. Literature on vegetarian and vegan diets was also searched. The dietary patterns evaluated included a Mediterranean dietary pattern, DASH diet, Scandinavian dietary pattern and a dietary pattern in accordance with the guidelines.[2,3]

The conclusions for effects and associations with a strong level of evidence drawn in the DDG2015 are listed below. Only conclusions with a strong level of evidence are listed, since only these are considered for deriving a guideline.[2,3]

- A high score compared to a low score on indices for a recommended dietary pattern that scores high on the consumption of vegetables, fruit, whole grain products, nuts, legumes, oils rich in cis-unsaturated fatty acids, semi-skimmed and skimmed dairy products, poultry, and fish; that is low in red and processed meat, full-fat dairy products, beverages (and other products) with added sugar, hard fats and table salt; and that is moderate in alcohol consumption is associated with:
- an approximately 20% lower risk of all-cause mortality
- an approximately 20% lower risk of CVD
- an approximately 20% lower risk of CHD
- an approximately 20% lower risk of stroke
- an approximately 15% lower risk of type 2 diabetes
- an approximately 15% lower risk of colorectal cancer
- A vegetarian diet is associated with an approximately 25% lower risk of CHD compared to a non-vegetarian diet.
- Following a recommended diet, such as a vegetarian diet, new Scandinavian diet, or DASH diet, lowers systolic blood pressure by approximately 5 mmHg and diastolic blood pressure by approximately 3 mmHg compared to a typical Western diet.

3.2 Advisory report *A healthy protein transition*

For the purpose of the Health Council's advisory report *A healthy protein transition* (2023),[21] an update of the literature review of the DDG2015 into health effects of plant-based dietary patterns was conducted. The search period covered July 2014 (search date DDG2015) to May 2022. Various types of plant-based diets were considered: adherence to the Plant-based Dietary Index (PDI), vegetarian, vegan, flexitarian, semi-vegetarian, lacto-vegetarian, lacto-ovo-vegetarian, and pesco-vegetarian diets. These are not entirely plant-based diets. The Protein transition committee did not consider the Mediterranean, Scandinavian, and other so-called healthy diets. Included evidence was restricted to dietary patterns that were defined a priori; dietary patterns that were defined a posteriori were not considered.[4]

The Protein transition committee did not draw formal conclusions according to a decision tree, but summarised the evidence (main findings) as follows:[4]

- Results from systematic reviews (SRs) and MAs of observational studies published since 2015 show:
  - inverse associations of plant-based and vegetarian diets with risks of incident and fatal CHD;
  - inverse associations of plant-based diets with risks of all-cause mortality, CVD and type 2 diabetes;
  - an inverse association between vegetarian diets and fatal CVD.
- Results from SRs and MAs of RCTs with causal risk factors show that, as compared to omnivorous diet:
  - vegetarian diets reduce systolic blood pressure (5 mmHg) and diastolic blood pressure (2 mmHg);
  - vegetarian diets reduce LDL cholesterol and body weight, but with heterogeneity in effect sizes;
  - vegan diets reduce LDL cholesterol and body weight, but not blood pressure.

3.3 Scientific reports of the Dietary Guidelines Advisory Committee

In 2020, the Dietary Guidelines Advisory Committee (DGAC) prepared scientific reports based on SRs evaluating the effects of foods and dietary patterns on (chronic) diseases and risk factors to inform the 2020-2025 Dietary Guidelines for Americans (DGA). The search period for the SRs covered 2014 to the end of 2019 or beginning of 2020. Evaluated health outcomes included: adiposity (e.g. body composition), obesity, blood lipids, blood pressure, CVD, type 2 diabetes, breast cancer, colorectal cancer, lung cancer, neurocognitive health, bone health, sarcopenia and all-cause mortality. In 2025, the DGAC published updated SRs, to inform the new (2025-2030) DGA. SRs were updated for the following health outcomes: adiposity, obesity, blood lipids, blood pressure, CVD, type 2 diabetes, breast cancer, colorectal cancer and cognitive decline (and not for all-cause mortality, bone health and lung cancer). De search dates for the

2025 SRs were between May 2023 and January 2024. The DGAC included studies that examined consumption of and/or adherence to a dietary pattern measured or derived using a variety of approaches, such as adherence to a priori patterns (indices/scores), data driven patterns (factor or cluster analysis), reduced rank regression, or other methods.[22]

Based on an extensive evaluation of the literature, the DGAC drew conclusion statements and graded the strength of the evidence for each dietary pattern-health outcome relationship.[7,8] This was done for children and adults separately. Subsequently, the DGAC considered the totality of the specific conclusions for each dietary pattern-health outcome relationship and identified a dietary pattern that was consistently related to beneficial health. So, it concluded that a healthy dietary pattern for individuals ages 2 years and older is characterised by:

- higher intakes of vegetables, fruits, legumes, nuts, whole grains, fish/seafood and vegetable oils higher in unsaturated fat, and;
- lower intakes of red and processed meats, sugar-sweetened foods and beverages, refined grains and saturated fat.

Some of these healthy dietary patterns also include consumption of low- or non-fat dairy and foods lower in sodium.
The health outcomes for which beneficial associations with the above described healthy dietary pattern were observed include:

- for children and adolescents: systolic and diastolic blood pressure (evidence grade: moderate), adiposity and obesity later in childhood and early adulthood (evidence grade: limited);
- for adults and older adults: CVD, blood lipids, blood pressure, type 2 diabetes (evidence grade: strong), adiposity (i.e. body fat, body weight, body mass index, waist circumference), obesity, postmenopausal breast cancer, colorectal cancer, age-related cognitive decline, mild cognitive impairment, dementia, Alzheimer's disease, hip fracture and all-cause mortality (evidence grade: moderate).

3.4 Advisory report *Nordic Nutrition Recommendations 2023*

For the Nordic Nutrition Recommendations 2023 (NNR2023), a scoping review was conducted on the health effects of health-oriented dietary patterns.[5,6] This review was solely based on existing systematic reviews from the 2020 DGAC; no literature update was performed. Because the NNR advisory report and background papers do not provide additional information on dietary patterns as compared to the DGAC reports, only the scientific reports of the DGAC are discussed (above, see section 3.3).

3.5 Planetary Health Diet

The Planetary Health Diet 1.0 was presented in 2019 by the EAT-Lancet Commission.[18] The Planetary Health Diet provides ranges of different food groups that

together constitute a dietary pattern that is supposed to be beneficial for human health and the environment.
Very recently, in October 2025, the 2.0 version of the Planetary Health Diet was introduced,[23] that builds forward on the 1.0 version. The ranges of different food groups that together constitute the Planetary Health Diet 2.0 are very similar to the 1.0 version. Therefore, the committee expects that the below described findings, that apply to the 1.0 version, would not be substantially different for the 2.0 version of the diet.

The committee's systematic literature search for MAs or SRs into effects or associations of the Planetary Health Diet with health outcomes yielded relevant MAs for the following health outcomes: all-cause mortality,[24,25] total CVD,[25,26] fatal CVD,[24,25] CHD,[25,26] stroke,[25,26] type 2 diabetes[25,27,28] and total cancer.[25] The committee noted that the MA by Liu et al.[25] (2024) was most complete (i.e. covered all studies that were also included in the other MAs) for all mentioned health outcomes. The committee therefore focused on the findings from this MA. The findings are briefly described below.

The MA by Liu et al.[25] (2024) includes studies published between January 2019 and October 2024. A total of 6 to 16 cohort studies per health outcome were included. Four different Planetary Health Diet scoring systems were used across the included studies: Colizzi, Hanley-Cook, Knuppel and Stubbendorff.[29-32] The main results of the MA are described in Table 1. In short, this MA shows that greater adherence to the Planetary Health Diet was associated with lower risks of all-cause mortality, total or fatal CVD, CHD, type 2 diabetes and total or fatal cancer. For stroke, no statistically significant association was observed, but the point estimate pointed in a protective direction. Substantial heterogeneity between studies was observed in the findings related to all-cause mortality, CHD, stroke, type 2 diabetes and cancer. Subgroup analyses for all-cause mortality, type 2 diabetes and cancer suggested that this was not explained by geographic location or follow-up duration (these subgroup analyses were not performed for CHD and stroke). Also, for all-cause mortality, CVD and cancer, sensitivity analyses indicated quite consistent results across various scoring systems. Only for type 2 diabetes, the observed associations appeared to differ by scoring system: no association was observed among the two studies that used the Stubbendorff score, whereas a significant beneficial association was observed among the 4 studies using the Knuppel score. This observation should be interpreted with caution, however, given the small number of studies per subgroup. Sensitivity analyses furthermore showed that omitting any one study from the analysis did not substantially change the pooled risk estimate, nor did excluding studies of low quality. According to Liu et al. and based on the Newcastle-Ottawa Scale, 26 out of the 28 studies were of high-quality. Based on visual inspection of Begg's funnel plots and Egger's linear regression tests, there was no indication of publication bias. The MA was supported by

the Innovation Fund for Outstanding PhD Candidates of Peking University Health Science Centre.

Table 1 Main characteristics and results on the associations of adherence to the Planetary Health Diet of the EAT-Lancet Commission with risks of all-cause mortality, incident or fatal CVD, CHD, stroke, type 2 diabetes and incident or fatal cancer from the meta-analysis by Liu et al. (2024).[25] The results represent the risk associated with greater adherence to the Planetary Health Diet.

Health outcome	n PCS; n cases	Strength of the association: HR (95%CI)	I^2	Study population (n)
All-cause mortality	6; 192,678	0.83 (0.78, 0.89)	86%	Europe (4), America (1), Asia (1)
Incident or fatal cardiovascular disease	12; 67,963	0.84 (0.81, 0.87)	35%	Europe (6), America (3), Asia (1)
Coronary heart disease[a]	10[b]; 20,109	0.73 (0.58, 0.91)	89%	Europe (9), Asia (1)
	3; 5,499	0.81 (0.74, 0.88)	NA	America (3)
Stroke	16[b]; 21,337	0.86 (0.73, 1.01)	90%	Europe (13), America (3)
Type 2 diabetes	6; 18,194	0.78 (0.65, 0.92)	94%	Europe (4), America (2)
Incident or fatal cancer[c]	9; 83,998	0.86 (0.80, 0.92)	69%	Europe (5), America (3), Asia (1)

Abbreviations: CI: confidence interval; CHD: coronary heart disease; CVD: cardiovascular disease; HR: hazard ratio; n: number; PCS: prospective cohort studies.

[a] The study by Sawicki et al. (2024) was included in the baseline table of the MA by Liu et al. but was for unknown reasons not included in the pooled analysis on CHD. The results from the study by Sawicki et al. were therefore presented separately in this table. Sawicki et al. performed a pooled analysis of 3 American cohorts.

[b] Including the pooled analysis of EPIC cohorts from 7 countries by Colizzi et al. (2024).[33]

[b] Including the pooled analysis of EPIC cohorts from 7 countries by Colizzi et al. (2024).[33]

[c] Combination of total cancer and subtypes of cancer (e.g. lung cancer, breast cancer, head and neck cancer).

3.6 Summary of findings in relation to the 2015 guideline on dietary patterns

Below, the findings from the aforementioned reports and literature search are summarised and linked to the current dietary guideline on dietary patterns.

- In the advisory report *A health protein transition* (2023) it was concluded that more plant-based dietary patterns are associated with a lower risk of morbidity or mortality due to CHD, CVD and type 2 diabetes, and that vegetarian diets may reduce LDL cholesterol and body weight.[4]
- In the 2020 and 2025 scientific reports of the DGAC it was concluded that there is strong evidence that dietary patterns characterised by higher intakes of vegetables, fruits, legumes, nuts and whole grains (and occasionally fish or vegetable oils high in unsaturated fat), and lower intakes of red meat, processed meat, refined grains, and sugary foods and beverages (and occasionally full-fat dairy) are associated with a lower risk of CVD and type 2 diabetes, and that there is moderate evidence for a favourable association of these dietary patterns with the risk of obesity, breast cancer, colorectal cancer and cognitive decline.[7,8]

- Based on its own systematic literature review, the committee found that eating more according to the Planetary Health Diet is favourably associated with a lower risk of diabetes, morbidity and mortality from CHD, cancer, and all-cause mortality.

The above findings, based on more recent literature, support the conclusions drawn in the DDG2015. They, moreover, provide additional evidence for the 2015 guideline to eat more plant-based, for example because a more plant based dietary pattern is now suggested to be also beneficial for reducing the risk of cognitive decline and a vegetarian dietary pattern may lower LDL cholesterol and body weight.

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Annex

A Literature search

Search criteria

The committee performed a literature search in PubMed, Scopus and Embase in April 2025 for recent meta-analyses (MAs), from 2019 onwards, into the effects or associations of the Planetary Health Diet of the EAT-Lancet Commission with health outcomes. To this end, the committee used the following search terms: EAT-Lancet, planetary health diet, planetary reference diet, healthy reference diet, planetary health diet index. The remaining search terms, aimed at selecting systematic reviews and meta-analyses or pooled analyses of randomised controlled trials or prospective cohort studies, were as follows: systematic review, literature review, quantitative review, umbrella review, quantitative overview, systematic overview, methodologic review, methodologic overview, meta-analysis, network meta-analysis, pooled analysis, individual participant data, individual patient data, IPD, individual-level data, multi-center study, multi-cohort study and Mendelian randomisation. Only studies performed in humans and published in English language were selected.

Selection of articles

First, from the articles retrieved via PubMed, Scopus and Embase, potentially relevant articles were selected based on titles and abstracts. Second, a further selection of eligible articles was made based on full-text screening.

For the Planetary Health Diet, a total of 188 articles were screened based on title and abstract (53 found in PubMed, 26 in Scopus and 80 in Embase). Of these, 17 were selected for assessment of eligibility based on full-text screening. In total, 6 articles were found eligible.

The 6 articles addressed different health outcomes, such as coronary heart disease (CHD) or type 2 diabetes or cancer. For each health outcome, the committee selected the most recent and comprehensive MAs from these 6 articles:

- For all-cause mortality and fatal cardiovascular (CVD), two MAs were identified: Bui et al. (2024)[24] and Liu et al. (2024).[25] Since all studies included in the MA by Bui et al. are also included in the MA by Liu et al., the committee only described the findings by Liu et al.
- For total CVD, CHD and stroke, two MAs were identified: Liu et al. (2024)[25] and Sawicki et al. (2024).[26] Since all studies included in the MA by Sawicki et al. are also included in the MA by Liu et al., the committee only described the findings by Liu et al.
- For type 2 diabetes, three MAs were identified: Lin et al. (2023),[27] Liu et al. (2024)[25] and Ojo et al. (2023).[28] Since all studies included in the MA by Lin et al. and Ojo et

al. are also included in the MA by Liu et al. (2024), the committee only described the findings by Liu et al.

- For cancer, only one MA was found: Liu et al. (2024).[25]

De Gezondheidsraad, ingesteld in 1902, is een adviesorgaan met als taak de regering en het parlement ‘voor te lichten over de stand der wetenschap ten aanzien van vraagstukken op het gebied van de volksgezondheid en het gezondheids(zorg)onderzoek’ (art. 22 Gezondheidswet). De Gezondheidsraad ontvangt de meeste adviesvragen van de bewindslieden van Volksgezondheid, Welzijn en Sport; Infrastructuur en Waterstaat; Sociale Zaken en Werkgelegenheid en Landbouw, Visserij, Voedselzekerheid en Natuur. De raad kan ook op eigen initiatief adviezen uitbrengen, en ontwikkelingen of trends signaleren die van belang zijn voor het overheidsbeleid. De adviezen van de Gezondheidsraad zijn openbaar en worden als regel opgesteld door multidisciplinaire commissies van – op persoonlijke titel benoemde – Nederlandse en soms buitenlandse deskundigen.

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