Launch of the public consultation on the WHO draft guideline on carbohydrate intake

7 October 2022
Opening remarks

Dr Francesco Branca
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Department of Nutrition and Food Safety
World Health Organization
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7 October 2022

Background

Dr Chizuru Nishida
Unit Head
Safe, Healthy and Sustainable Diet Unit
Department of Nutrition and Food Safety
World Health Organization
Summary history of WHO’s guidance development on CHO intake

Since the 1950s, FAO/WHO have regularly held joint expert meetings to:

- review the state of scientific knowledge on the role of various nutrients in the human diet
- provide guidance on their requirements and recommended intakes
Summary history of WHO’s guidance development on CHO intake


- 1st to focus on the topic of CHO
- Reviewed the role of CHO as determinants of human health and diseases:
  1. As sources of energy contributing to improve nutritional status
  2. As determinants of sensory qualities of foods (i.e. flavour, texture and acceptability of foods)
  3. Influence on physiology and pathology of large intestine (i.e. the role of dietary fibre)
  4. As potential determinants of dental caries, obesity, CVD and diabetes
  5. As they relate to the nutrition of infants and young children (i.e. the role of lactose and its inclusion in complementary foods)
- Inappropriate to focus on nutritional effects of a single dietary component due to wide range of CHO consumed in the diet – Integration of a wide range of interactive effects.
- Further studies needed to understand interactions between CHO and other components of the diet
Summary history of WHO’s guidance development on CHO intake


- Much progress in understanding the role of CHO in human nutrition/health, including:
  1. Role of dietary fibre (i.e. role in moderating the process of digestion in small intestine and potential as a major substrate for fermentation in the colon)
  2. Diverse physiological roles (i.e. dependent upon the site, rate and extent of digestion, fermentation in the gut)
  3. Potential in enhancing physical performance through glycogen loading
  4. Relationship between diet and NCDs (including obesity, type 2 diabetes, CHD, and some forms of cancer)

- Confirmed CHO are not only an energy source, but also have important impacts on the maintenance of health

- Recommendations were made:
  1. Terminology of dietary CHO should be based on molecular size (degree of polymerization or DP) with additional terms to define nutritional groupings based on physiological properties
  2. Total CHO in the diet should be measured as the sum of the individual CHO rather than “by difference”
  3. Analysis and labelling of dietary CHO should be based on chemical divisions
  4. At least 55% of total energy should be provided from a variety of CHO sources, regardless of the nature of the dietary pattern
  5. glycaemic index (GI) – measures the impact of foods on the integrated response of blood glucose – be used to compare foods of similar composition within food groups
Summary history of WHO’s guidance development on CHO intake

- Recommended 55 - 75% of total energy – based on protein and fat requirements
- Recommended to increase intake of minimally-processed CHO and decrease intake of free sugars (< 10% of energy intake).
- Indicated that regular consumption of whole-grain cereals, fruits and vegetables was likely to reduce risk of diet-related NCDs.
- Best definition of dietary fibre remains to be established, given the potential benefits of resistant starch

- Held as follow-up to 2001 Joint FAO/WHO/UNU Expert Consultation on Human Energy Requirements (FAO, 2004) to review issues of how best to match energy requirements with food intakes (as new energy requirement values were established based on energy expenditure)
- Addressed request by CCNFSDU for harmonizing energy conversion factors (to enable uniformity in labelling and information provided to consumers)
- Reviewed commonly used analytical methods for protein, fat and CHO, and made recommendations on preferred then the “state-of-the-art” methods and most appropriate technology and existing acceptable methods used in absence of preferred methods
Summary history of WHO’s guidance development on CHO intake


- FAO and WHO agreed to undertake a scientific "update" on key issues related to CHO in human nutrition.

- The key issues identified:
  - terminology and classification
  - measurement
  - physiology
  - carbohydrates and diseases (i.e. obesity, diabetes mellitus, cardiovascular diseases, and cancer)
  - glycemic index and glycemic load
Summary history of WHO’s guidance development on CHO intake

**WHO guideline on carbohydrate intake in adults and children (2022)**

- WHO Nutrition Guidance Expert Advisory Group (NUGAG) Subgroup on Diet and Health
  - Started to work in 2015 following the WHO guideline process

- **Systematic reviews:**
  - Dietary fibre intake in childhood or adolescence and subsequent health outcomes: A systematic review of prospective observational studies (Diabetes Obes Metab 2020) – Reynolds, A et al
WHO guideline development

Ms Rebekah Thomas
Technical Officer
WHO Guidelines Review Committee
World Health Organization

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Systematic reviews and concise summaries of findings are rarely used. Processes for developing recommendations typically rely heavily on experts in a particular content area and not on representatives of those who will have to live with the recommendations or on experts in particular methodological areas. Relatively little attention has also been given to roles and responsibilities related to effective dissemination and implementation strategies and their rigorous evaluation.
Continuous improvement...a living guideline development handbook!
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• Standard
• Compiled/consolidated
• Rapid advice guideline
• Emergency interim
Principles for trustworthy and credible guidelines

- **Evidence-based** - meet the highest quality standards for evidence-based guidelines
- **Diverse and inclusive**
- **Relevant and usable** Incorporate multiple processes to minimize bias and optimize usability
- **Explicit** in assessing the quality of the evidence and translating evidence to recommendations
- **Transparent** in all judgments and decision making processes
Guideline development process

1. **Scope the guideline**
2. **Consider logic models**
3. **Consider all relevant evidence for decision-making**
4. **Set up guideline panel and external review group**
5. **Formulate PICO/SPICE or other questions and select outcomes**
6. **Evidence retrieval, assessment, synthesis**
7. **Appraise certainty of the body of evidence**
8. **Formulate recommendations**
9. **Include explicit consideration of:**
   - Benefits and harms
   - Resource use/feasibility
   - Health equity/non-discrimination
   - Human rights/sociocultural
10. **Disseminate, implement**
11. **Evaluate impact**

- **Manage declarations of interest**
- **GRC approval - Proposal**
- **GRC approval - PICO, GDG, DOI**
- **GRC approval - Final guideline**

- **GRC Secretariat support**
WHO guideline development: a system of checks and balances

Guideline Development group (external experts)
- **Independent** experts, acting in an **individual** capacity
- Are **non-remunerated**
- Finalize scope, key questions, formulate recommendations

External Review group
- Review **scope** and/or **final** guideline for technical accuracy and to flag other implementation considerations.
- Do not change recommendations

WHO Steering group (internal)
- Supports the GDG procedurally and administratively
- Screens all contributors for conflicts of interest
- Commissions/perform systematic reviews
- Drafts guideline text under guidance of GDG

Technical resource persons
- Methodologist/Systematic reviewers
WHO guideline development: minimizing bias, maximising transparency and usability

**Methods**
- **Explicit** and **transparent**
- Use **GRADE or other tools** which provide an explicit approach to:
  - Assessing the **certainty** of the evidence across studies and outcomes
  - Converting evidence to recommendation in consideration of all relevant factors (feasibility, equity, acceptability etc)
- Reflect a well-described **scope, objectives** and **target audience**
- Include detailed **funding** sources
- Adhere to WHO reporting **standards**

**Recommendations**
- Based on **consensus**
- Informed by **best available**, and **up-to-date evidence**
- Accompanied by a **rationale**, an assessment of the **certainty of the evidence**, the **strength** of the recommendation, and any differences in opinion among the guideline development group.
- Are clearly articulated and precise
Evidence retrieval, assessment and synthesis and formulation of recommendations

To “reach agreement on a **common, sensible** approach to grading 1) quality of evidence and 2) strength of recommendations.”
A. Recommendations are based on a balanced judgement of benefits and harms, values and preferences, resource use and quality of evidence

1) Quality/certainty of evidence
   ✪✪✪✪ (High)/✪✪✪✪ (Moderate)/✪✪✪ (Low)/✪✪ (Very low)

2) Strength of recommendation: 2 grades :
   conditional (weak/context-specific)
   strong

(May be for or against an intervention).
Certainty of evidence

Certainty of evidence based on assessment of:

1. limitations in detailed design and execution (risk of bias criteria)
2. Inconsistency (or heterogeneity)
3. Indirectness (PICO and applicability)
4. Imprecision (number of events and confidence intervals)
5. Publication bias

3 factors can increase certainty

1. Large magnitude of effect
2. All plausible residual confounding may be working to reduce the demonstrated effect or increase the effect if no effect was observed
3. Dose-response gradient
Implications of a strong recommendation

Most people in the situation would want the recommended course of action and only a small proportion would not.
Implications of a conditional recommendation

The majority of people in your situation would want the recommended course of action, but many would not.

Requires shared decision-making and involvement of stakeholders.
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Uptake of recommendations

Adoption of recommendations across 44 guidelines in 20 countries

Strong: 82%
Conditional: 61%
## Evidence-to-decision making

<table>
<thead>
<tr>
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<tbody>
<tr>
<td><strong>Problem</strong></td>
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<td>Rehfuess &amp; Stratil</td>
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<tr>
<td>Benefits</td>
<td>Desirable effects</td>
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<tr>
<td>Harms</td>
<td>Undesirable effects</td>
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<tr>
<td>Certainty of evidence</td>
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<tr>
<td>Values and preferences</td>
<td>Values</td>
<td></td>
</tr>
<tr>
<td>Balance of effects</td>
<td>Balance of health benefits and harms</td>
<td></td>
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<tr>
<td>Resource considerations</td>
<td>Resources required</td>
<td>Financial and economic considerations</td>
</tr>
<tr>
<td>Cost effectiveness</td>
<td></td>
<td></td>
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<tr>
<td>Equity</td>
<td>Health equity, equality, non-discrimination</td>
<td></td>
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<tr>
<td>Acceptability</td>
<td>Human rights and socio-cultural acceptability</td>
<td></td>
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<tr>
<td>Feasibility</td>
<td>Feasibility and health system considerations</td>
<td></td>
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<tr>
<td>Societal impact</td>
<td></td>
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</tr>
</tbody>
</table>
Rules of Procedure: Group decision making

**WHO recommendations should be based on consensus**
- Defined as general agreement among the decision makers
- Minor disagreements can be addressed in the Remarks Section of the guideline
- Voting can be used as a tool to achieve consensus

**If consensus cannot be reached, voting can be used**
- 2/3 majority, anonymous or hand-raising, Chair’s discretion
Recommendation
“At primary health-care facilities, health workers should provide general nutrition counselling to caregivers of overweight children aged less than 5 years (strength of recommendation: conditional; very low quality evidence).”

Justification remarks
Implementation consideration
Research priority

Supported by:
GRADE/CerQual Evidence profile
Quality assessment of the body of evidence.

Evidence to decision framework
Strength assessment of the recommendation.
Living guidelines: trustworthy and up-to-date

Standard WHO guidelines are updated every 3-5 years

‘Living’ guidelines are updated every week / month / ? and/or triggered by rules or algorithms that determine when emerging evidence would change a recommendation

REMDESIVIR GUIDELINE

SOLIDARITY trial data 15 Oct 2020
SAM recommendations 20 Nov 2020

‘Living’ guidelines: trustworthy and up-to-date

Current Model:
Intermittently updated guidelines

- Define scope
- Develop SR
- Develop guideline
- Guideline approval
- Publication / Dissemination
- Implementation

Change in policy?
New product in market?

Living Evidence:
Continuously updated guidelines

- Define scope
- Update search strategy & run search
- Update systematic review
- Disseminate updated recommendations
- Revise scope based on feedback, policy & practice
- Update recommendations
- Guideline approval
- Publication / Dissemination
- Implementation

Change in policy?
New product in market?

Currency / reliability

404 days (11.8 mo)

Management of chronic pain in children
Creation: 12 NOV 18
Planning / background: 16 Jan 20
1st Submission of guidelines: 19 JUL 20
Guidance decision: 18 NOV 20
Date of publication: 25 DEC 2020
Base for computable ‘SMART’ guidelines

**EXISTING MODEL WITH ENHANCEMENTS**

- Living guidelines approach
- Digital curation of recommendations

**PREPARING TO GO DIGITAL**

- Human-readable operational components
- Structured workflows
- Decision-support documentation
- Data dictionaries
- Specificity of user(s), beneficiaries

**INTEROPERABLE DIGITAL COMPONENTS**

- Software specifications
- Standard terminologies, value sets, data formats, calculations for decision-support and indicator population and data exchange

**CUSTOMIZABLE SOFTWARE**

- Fully executable software tools
- Mechanism for real-time updates

**ADVANCED ANALYTICS FOR PRECISION HEALTH**

- Advanced analytics for greater local relevance and precision
- AI-based decision support
- Continuous improvement of software code

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**FIRST ANTENATAL VISIT**

- Confirm pregnancy
- Full medical history
- Physical examination
- Screenings
- Confirmed HIV status, existing ART Check:
  - Viral load
    - Yes
      - Continue current ART regimen
    - No
      - Repeat VL one month later

- Viral load suppressed?
  - Yes
  - No
    - Switch ART regimen
Systematic review results

Dr Andrew Reynolds
Senior Research Fellow
University of Otago
New Zealand
Systematic reviews

Fibre

Wholegrains

Vegetables

Fruit

Pulses
Reynolds AN, Diep Pham HT, Montez J, Mann J. Dietary fibre intakes in childhood or adolescence and subsequent health outcomes: systematic review of prospective observational studies. Diabetes, Obesity and Metabolism. 2020

Child intakes

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Results for dietary fibre

1. Observational studies of fibre intakes and hard outcomes
2. RCTs of changing fibre intakes on cardiometabolic risk factors

<table>
<thead>
<tr>
<th></th>
<th>Number of studies</th>
<th>Number of cases or number in intervention</th>
<th>Person-years or number of controls</th>
<th>Effect size (95% CI)</th>
<th>GRADE quality</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Observational studies</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All-cause mortality</td>
<td>10</td>
<td>80 139</td>
<td>12.3 million person-years</td>
<td>RR 0.85 (0.79–0.91)</td>
<td>Moderate</td>
</tr>
<tr>
<td>Coronary heart disease mortality</td>
<td>10</td>
<td>7243</td>
<td>6.9 million person-years</td>
<td>RR 0.69 (0.60–0.81)*</td>
<td>Moderate</td>
</tr>
<tr>
<td>Coronary heart disease incidence</td>
<td>9</td>
<td>7155</td>
<td>2.7 million person-years</td>
<td>RR 0.76 (0.69–0.83)</td>
<td>Moderate</td>
</tr>
<tr>
<td>Stroke mortality</td>
<td>2</td>
<td>1103</td>
<td>1.3 million person-years</td>
<td>RR 0.80 (0.56–1.14)</td>
<td>Very low</td>
</tr>
<tr>
<td>Stroke incidence</td>
<td>9</td>
<td>13 134</td>
<td>4.6 million person-years</td>
<td>RR 0.78 (0.69–0.88)†</td>
<td>Low</td>
</tr>
<tr>
<td>Type 2 diabetes incidence</td>
<td>17</td>
<td>48 468</td>
<td>6.9 million person-years</td>
<td>RR 0.84 (0.78–0.90)</td>
<td>Moderate</td>
</tr>
<tr>
<td>Colorectal cancer incidence</td>
<td>22</td>
<td>22 920</td>
<td>16.9 million person-years</td>
<td>RR 0.84 (0.78–0.89)</td>
<td>Moderate</td>
</tr>
<tr>
<td>Cancer mortality</td>
<td>5</td>
<td>29 593</td>
<td>11.2 million person-years</td>
<td>RR 0.87 (0.79–0.95)</td>
<td>Moderate</td>
</tr>
<tr>
<td><strong>Randomised trials</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change in bodyweight (kg)</td>
<td>27</td>
<td>12 94</td>
<td>1 201</td>
<td>MD −0.37 (−0.63 to −0.11)</td>
<td>High</td>
</tr>
<tr>
<td>Change in glycated haemoglobin A1c (%)</td>
<td>6</td>
<td>191</td>
<td>189</td>
<td>SMD −0.35 (−0.73 to 0.03)</td>
<td>Low</td>
</tr>
<tr>
<td>Change in total cholesterol (mmol/L)</td>
<td>36</td>
<td>1 832</td>
<td>1 671</td>
<td>MD −0.15† (−0.22 to −0.07)</td>
<td>Moderate</td>
</tr>
<tr>
<td>Change in systolic blood pressure (mm Hg)</td>
<td>15</td>
<td>1 064</td>
<td>988</td>
<td>MD −1.27† (−2.50 to −0.04)</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

RR=relative risk. MD=mean difference. SMD=standardised mean difference. *Egger’s test for bias (p=0.0040). Trim and fill analysis did not change the direction or significance of the pooled estimate. †The high heterogeneity of the pooled effect size (>50%) is unexplained by sensitivity analyses.

Table 1: Effects of higher compared with lower intakes of total dietary fibre on critical outcomes
## Results for whole grains

1. Observational studies of wholegrain intakes and hard outcomes
2. RCTs of changing wholegrain intakes on cardiometabolic risk factors

### Observational studies

<table>
<thead>
<tr>
<th>Condition</th>
<th>Number of studies</th>
<th>Number of cases or number in intervention</th>
<th>Person-years or number of controls</th>
<th>Effect size (95% CI)</th>
<th>GRADE quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>All-cause mortality</td>
<td>9</td>
<td>99,224</td>
<td>10.7 million person-years</td>
<td>RR 0.81 (0.72–0.90)*</td>
<td>Low</td>
</tr>
<tr>
<td>Coronary heart disease mortality</td>
<td>2</td>
<td>1,588</td>
<td>2.0 million person-years</td>
<td>RR 0.66 (0.56–0.77)</td>
<td>Low</td>
</tr>
<tr>
<td>Coronary heart disease incidence</td>
<td>6</td>
<td>7,697</td>
<td>2.8 million person-years</td>
<td>RR 0.80 (0.70–0.91)*</td>
<td>Low</td>
</tr>
<tr>
<td>Stroke mortality</td>
<td>2</td>
<td>694</td>
<td>2.0 million person-years</td>
<td>RR 0.74 (0.58–0.94)</td>
<td>Low</td>
</tr>
<tr>
<td>Stroke incidence</td>
<td>3</td>
<td>1,247</td>
<td>1.1 million person-years</td>
<td>RR 0.86 (0.61–1.21)</td>
<td>Very low</td>
</tr>
<tr>
<td>Type 2 diabetes incidence</td>
<td>8</td>
<td>14,686</td>
<td>3.9 million person-years</td>
<td>RR 0.67 (0.58–0.78)*</td>
<td>Low</td>
</tr>
<tr>
<td>Colorectal cancer incidence</td>
<td>7</td>
<td>8,803</td>
<td>6.8 million person-years</td>
<td>RR 0.87 (0.79–0.96)</td>
<td>Moderate</td>
</tr>
<tr>
<td>Cancer mortality</td>
<td>5</td>
<td>32,727</td>
<td>10.1 million person-years</td>
<td>RR 0.84 (0.76–0.92)*</td>
<td>Low</td>
</tr>
</tbody>
</table>

### Randomised trials

<table>
<thead>
<tr>
<th>Condition</th>
<th>Number of studies</th>
<th>Number of cases or number in intervention</th>
<th>Person-years or number of controls</th>
<th>Effect size (95% CI)</th>
<th>GRADE quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in bodyweight (kg)</td>
<td>11</td>
<td>498</td>
<td>421</td>
<td>MD −0.62 (−1.19 to −0.05)</td>
<td>Moderate</td>
</tr>
<tr>
<td>Change in glycated haemoglobin A1c (%)</td>
<td>3</td>
<td>141</td>
<td>141</td>
<td>SMD 0.54 (−1.28 to 0.20)</td>
<td>Low</td>
</tr>
<tr>
<td>Change in total cholesterol (mmol/L)</td>
<td>17</td>
<td>772</td>
<td>701</td>
<td>MD −0.09 (−0.23 to 0.04)</td>
<td>Moderate</td>
</tr>
<tr>
<td>Change in systolic blood pressure (mm Hg)</td>
<td>8</td>
<td>493</td>
<td>432</td>
<td>MD −1.01 (−2.46 to 0.44)</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

*Detailed justification for the GRADE quality of evidence is given in the appendix pp 35–50 for observational studies and appendix pp 105–136 for trials. RR=relative risk. MD=mean difference. SMD=standardised mean difference. *The high heterogeneity of the pooled effect size (>50%) is unexplained by sensitivity analyses.*

*Table 2: Effects of higher compared with lower intakes of whole grains on critical outcomes*
## Results for vegetables and fruits

### 1. Observational studies of vegetable and fruit intakes and hard outcomes

#### Summary of results from meta-analyses of higher compared with lower intake of vegetables and fruit

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Pooled estimate (95%CI)</th>
<th>No. studies</th>
<th>No. participants</th>
<th>Certainty</th>
</tr>
</thead>
<tbody>
<tr>
<td>All-cause mortality*</td>
<td>RR 0.82 (0.79 to 0.86)</td>
<td>22</td>
<td>1 035 556</td>
<td>Low</td>
</tr>
<tr>
<td>CVD*</td>
<td>RR 0.84 (0.79 to 0.90)</td>
<td>16</td>
<td>963 240</td>
<td>Low</td>
</tr>
<tr>
<td>CHD*</td>
<td>RR 0.87 (0.83 to 0.91)</td>
<td>16</td>
<td>792 197</td>
<td>Moderate</td>
</tr>
<tr>
<td>Stroke*</td>
<td>RR 0.79 (0.71 to 0.88)</td>
<td>8</td>
<td>226 910</td>
<td>Moderate</td>
</tr>
<tr>
<td>Total cancer*</td>
<td>RR 0.93 (0.87 to 0.98)</td>
<td>13</td>
<td>904 300</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

RR: relative risk, CI: confidence intervals
Results for pulses

1. Observational studies of pulses intake and hard outcomes

Summary of results from meta-analyses for higher compared to lower intakes of pulses

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Pooled estimate (95%CI)</th>
<th>No. studies</th>
<th>No. participants</th>
<th>Certainty</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVD</td>
<td>RR 0.90 (0.84 to 0.97)</td>
<td>5</td>
<td>129 692</td>
<td>Low</td>
</tr>
<tr>
<td>CHD*</td>
<td>RR 0.90 (0.84 to 0.97)</td>
<td>10</td>
<td>313 414</td>
<td>Moderate</td>
</tr>
<tr>
<td>Stroke</td>
<td>RR 1.01 (0.89 to 1.14)</td>
<td>6</td>
<td>266 241</td>
<td>Low</td>
</tr>
<tr>
<td>Type 2 diabetes</td>
<td>RR 0.79 (0.71 to 0.87)</td>
<td>2</td>
<td>100 179</td>
<td>Very low</td>
</tr>
</tbody>
</table>

RR: relative risk, CI: confidence intervals
Childhood intakes of fibre, whole grains, refined grains, vegetables and fruit

1. Observational studies of childhood intakes and diverse outcomes

**Forty-five publications reporting on 44,676 participants from 31 cohorts.**

**Twenty-six studies reported on body weight, nine on blood pressure, eight on blood lipids, seven on glycaemic control, three on bone health, three on metabolic syndrome, three on cognition and development, one of growth, and one on bowel habits.**

**Summary**

- The findings from studies on dietary fibre indicated potential benefits for total cholesterol (including non HDL cholesterol), and bowel habits.
- The findings from studies on vegetables indicated potential benefits for total cholesterol and decreased risk of metabolic syndrome later on in life.
- The findings from studies on fruit indicated a potential decreased risk of metabolic syndrome later on in life and improved outcomes in school.
- The findings on whole grains indicated a potential inverse association on weight gain.
- The findings on refined grains indicated a potential positive association on weight gain.

What was clear for all dietary exposures was that the current literature identified no adverse effects from higher intakes of dietary fibre, vegetables, fruit, and whole grains.
Draft recommendations and supporting information

Professor Shiriki Kumanyika
Chair, WHO NUGAG Subgroup on Diet and Health
Emeritus Professor
Perelman School of Medicine
University of Pennsylvania
United States of America
Recommendations on carbohydrate intake

Recommendations based on

• Review of the scientific evidence
• Review of evidence on potentially mitigating factors
Evidence to recommendations

<table>
<thead>
<tr>
<th>Potential mitigating factor</th>
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<tbody>
<tr>
<td>Magnitude of the desirable effects</td>
</tr>
<tr>
<td>Magnitude of the undesirable effects</td>
</tr>
<tr>
<td>Overall certainty of the evidence</td>
</tr>
<tr>
<td>Balance of desirable and undesirable effects</td>
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<tr>
<td>Values and preferences</td>
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<tr>
<td>Resource implications</td>
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<td>Cost-effectiveness</td>
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<tr>
<td>Acceptability to key stakeholders</td>
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<tr>
<td>Feasibility of implementing</td>
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<tr>
<td>Impact on health equity</td>
</tr>
</tbody>
</table>
Evidence to recommendation

Comprehensive reviews of the relevant literature were conducted for each of the potentially mitigating factors.

Results were reviewed and discussed by NUGAG in order to make judgements.
Evidence to recommendations

<table>
<thead>
<tr>
<th>Potential mitigating factor</th>
<th>Judgement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Food sources of carbs</td>
</tr>
<tr>
<td>Magnitude of the desirable effects</td>
<td>Moderate to large</td>
</tr>
<tr>
<td>Magnitude of the undesirable effects</td>
<td>Small (whole grains)*</td>
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<tr>
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<td>Moderate</td>
</tr>
<tr>
<td>Balance of desirable and undesirable effects</td>
<td></td>
</tr>
<tr>
<td>Values and preferences</td>
<td>Probably no important uncertainty or variability</td>
</tr>
<tr>
<td>Resource implications</td>
<td>Varies</td>
</tr>
<tr>
<td>Cost-effectiveness</td>
<td>Varies</td>
</tr>
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<td>Acceptability to key stakeholders</td>
<td>Probably yes</td>
</tr>
<tr>
<td>Feasibility of implementing</td>
<td>Probably yes</td>
</tr>
<tr>
<td>Impact on health equity</td>
<td>Probably increases health equity but may vary</td>
</tr>
</tbody>
</table>

* Unexplained increased risk of prostate cancer with whole grains, and endometrial cancer with fibre
Recommendations on carbohydrate intake

1. WHO recommends that carbohydrate intake should come primarily from whole grains, vegetables, fruits and pulses *(strong recommendation)*
Recommendations on carbohydrate intake

2. In adults, WHO recommends an intake of at least 400 grams of vegetables and fruits per day (*strong* recommendation)

3. In children and adolescents, WHO suggests the following intakes of vegetables and fruits: (*conditional recommendation*)
   - 2-5 years old, at least 250 grams per day
   - 6-9 years old, at least 340 grams per day
   - 10 years or older, at least 400 grams per day
Recommendations on carbohydrate intake

4. In adults, WHO recommends an intake of at least 25 grams per day of naturally-occurring dietary fibre as consumed in foods (strong recommendation).

5. In children and adolescents, WHO suggests the following intakes of naturally-occurring dietary fibre as consumed in foods: (conditional recommendation)
   - 2-5 years old, at least 15 grams per day
   - 6-9 years old, at least 21 grams per day
   - 10 years or older, at least 25 grams per day
Rationale for the recommendations

• Robust evidence from observational studies
• Recommended levels of intake in adults based on dose-response relationships
• Data for children were relatively limited but consistent with adult data
  • Because recommended intake values for children (vegetables, fruits and dietary fibre) were extrapolated from adults values, their strength was considered conditional
Key remarks
Addressing carbohydrate quality

One of the original aims of updating the guidance on carbohydrate intake was to provide guidance on carbohydrate quality. Having considered the available evidence relating to food sources of carbohydrate, dietary fibre, starch digestibility and glycaemic response as measured by glycaemic index and glycaemic load, the NUGAG Subgroup on Diet and Health concluded that providing guidance on dietary fibre and food sources of carbohydrate with proven benefit in terms of important health outcomes were the most effective means of addressing carbohydrate quality.
Amount of carbohydrate intake not in scope

The scope of this guideline did not include an update to the previous WHO guidance on amount of total carbohydrate intake (which was not determined directly but by calories remaining after defining amounts of dietary fat and protein) and therefore does not contain recommendations on amount. Results from a 2018 meta-analysis suggest that a range of total carbohydrate intake appears to be compatible with a healthy diet, with intakes of approximately 40–70% of total energy intake associated with reduced risk of mortality. This is largely consistent with the range of carbohydrate intake resulting from current WHO guidance on protein intake and recently updated guidance on total fat intake.
Types of food covered

All types of whole grains
Vegetables, fruits and pulses

Related caveats and considerations
Whole grains

Whole grains contain the naturally-occurring components of the kernel (i.e. bran, germ, and endosperm). Some processed foods are labelled whole grain as long as these three components of the grain are included, regardless of the extent to which the grains have been processed, and highly processed products labelled as whole grain are becoming increasingly available (e.g. products containing flour from milled whole grains with added fat, sugar or salt). Because there is evidence to suggest that the naturally occurring structure of intact whole grains contributes to its observed health effects, minimally processed whole grains are preferred.
Vegetables and fruits

While fresh vegetables and fruits are a good choice when and where available, in some settings fresh vegetables and fruits present a significant risk for foodborne illness. In areas where risk of foodborne illness is known to be high, selecting vegetables and fruits with hard skins or peels that can be removed, thoroughly washing with potable water, or consuming cooked or canned varieties can lessen risk of illness.
Vegetables and fruits

The recommendations are not limited to fresh vegetables and fruits; cooked, frozen or canned may also be acceptable. However, there is some evidence that tinned fruits (possibly because of free sugars in the syrups) may be associated with poor health outcomes. Specific evidence for dried fruits and fruit juices is very limited and results inconsistent, however both are concentrated sources of sugars, as are fruit concentrates and should therefore be consumed sparingly and in accordance with WHO recommendations on free sugars intake. Similarly, though there wasn’t any specific evidence identified for canned vegetables, some canned vegetables contain added sodium and should therefore be consumed in accordance with WHO recommendations on sodium intake.
Preparation and level of processing

The method of preparation and level of processing should be considered when consuming whole grains, vegetables, fruits and pulses, and should be compatible with other WHO macronutrient recommendations as indicated in the following bullet. For example, frying and addition of sauces or condiments significantly increases the amount of fat, sugars or salt. Therefore, fresh foods or those otherwise minimally processed or modified without added fat, sugars or salt are preferred.
Additional dietary considerations

Plant-based foods contain a variety of compounds, some of which have been shown to inhibit absorption of certain nutrients (many of these compounds have also been shown to have health benefit unrelated to their impact on nutrient absorption). The extent to which nutrient absorption might occur varies from person to person and is generally only observed at very high intakes and in those with existing nutritional deficiencies. In addition, methods of preparation including soaking, heating, germination and fermentation appear to reduce inhibitory potential. Therefore, while those with nutritional deficiencies may need to adopt behaviours that minimise the ability of these compounds to inhibit absorption of other nutrients, those with adequate, diverse diets can generally consume whole grains, vegetables, fruits and pulses with little to no risk.
Naturally occurring dietary fiber

The source of dietary fibre in the evidence for disease and mortality outcomes is fibre naturally occurring in foods and not extracted or synthetic fibre. Although there was limited evidence for a small reduction in total cholesterol with use of extracted or synthetic fibre, further research on disease outcomes associated with these types of fibre is needed before conclusions on potential health benefits can be drawn. Therefore, the recommendations specifically cover dietary fibre naturally-occurring in foods.
Children under age 2 not covered

These recommendations do not cover children under two years of age, however whole grains, vegetables, fruits and pulses can be healthy sources of carbohydrates in complementary foods consumed by children from six months to two years of age and are strongly preferred to foods containing free sugars.
Public consultation process

Dr Jason Montez
Scientist
Standards and Scientific Advice Food & Nutrition
Department of Nutrition and Food Safety
World Health Organization
Public consultation

Open from: 7 October (14h CEST) – 6 November 2022 (23:59 CET)

The public consultation is open to all, However, a completed and signed Declaration of Interest (DOI) form must accompany any comments.

Comments on:

- overall clarity
- considerations and implications for adaptation and implementation of the guideline
- context and setting-specific issues that have not yet been captured, and
- any errors of fact or missing data.
Closing remarks

Dr Francesco Branca
Director
Department of Nutrition and Food Safety
World Health Organization