

WHO GUIDELINE: **FORTIFICATION OF MAIZE FLOUR AND CORN MEAL WITH VITAMINS AND MINERALS**



**World Health
Organization**

WHO GUIDELINE:
**FORTIFICATION OF
MAIZE FLOUR AND
CORN MEAL WITH
VITAMINS AND
MINERALS**



World Health
Organization

WHO guideline: fortification of maize flour and corn meal with vitamins and minerals.

ISBN 978-92-4-154993-6

© World Health Organization 2016

Some rights reserved. This work is available under the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 IGO licence (CC BY-NC-SA 3.0 IGO; <https://creativecommons.org/licenses/by-nc-sa/3.0/igo>).

Under the terms of this licence, you may copy, redistribute and adapt the work for non-commercial purposes, provided the work is appropriately cited, as indicated below. In any use of this work, there should be no suggestion that WHO endorses any specific organization, products or services. The use of the WHO logo is not permitted. If you adapt the work, then you must license your work under the same or equivalent Creative Commons licence. If you create a translation of this work, you should add the following disclaimer along with the suggested citation: "This translation was not created by the World Health Organization (WHO). WHO is not responsible for the content or accuracy of this translation. The original English edition shall be the binding and authentic edition".

Any mediation relating to disputes arising under the licence shall be conducted in accordance with the mediation rules of the World Intellectual Property Organization (<http://www.wipo.int/amc/en/mediation/rules>).

Cataloguing-in-Publication (CIP) data. CIP data are available at <http://apps.who.int/iris>.

Sales, rights and licensing. To purchase WHO publications, see <http://apps.who.int/bookorders>. To submit requests for commercial use and queries on rights and licensing, see <http://www.who.int/about/licensing>.

Third-party materials. If you wish to reuse material from this work that is attributed to a third party, such as tables, figures or images, it is your responsibility to determine whether permission is needed for that reuse and to obtain permission from the copyright holder. The risk of claims resulting from infringement of any third-party-owned component in the work rests solely with the user.

General disclaimers. The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of WHO concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

The mention of specific companies or of certain manufacturers' products does not imply that they are endorsed or recommended by WHO in preference to others of a similar nature that are not mentioned. Errors and omissions excepted, the names of proprietary products are distinguished by initial capital letters.

All reasonable precautions have been taken by WHO to verify the information contained in this publication. However, the published material is being distributed without warranty of any kind, either expressed or implied. The responsibility for the interpretation and use of the material lies with the reader. In no event shall WHO be liable for damages arising from its use.

Design and layout: Alberto March (Barcelona, Spain).

Photography by Leonel García (Barcelona, Spain).

SUGGESTED CITATION

WHO guideline: fortification of maize flour and corn meal with vitamins and minerals.
Geneva: World Health Organization; 2016. Licence: [CC BY-NC-SA 3.0 IGO](https://creativecommons.org/licenses/by-nc-sa/3.0/igo).

CONTENTS

Publication history	vii
Acknowledgements	vii
Financial support	viii
Executive summary	1
<i>Purpose of the guideline</i>	1
<i>Guideline development methodology</i>	2
<i>Available evidence</i>	2
<i>Recommendations</i>	3
<i>Remarks</i>	3
<i>Research gaps</i>	4
Scope and purpose	5
Background	5
Objectives	7
Summary of available evidence	7
<i>Fortification of maize flour and corn meal with vitamins and minerals</i>	8
Summary of direct evidence	14
Recommendations	14
Remarks	15
Research gaps	17
Dissemination, implementation and ethical considerations	17
<i>Dissemination</i>	17
<i>Equity, human rights and implementation considerations</i>	18
<i>Regulatory considerations</i>	20
<i>Ethical considerations</i>	21
Monitoring and evaluation of guideline implementation	23
Guideline development process	25
<i>Advisory groups</i>	25
<i>Scope of the guideline, evidence appraisal and decision-making</i>	25
<i>Management of competing interests</i>	27
Plans for updating the guideline	28
References	29

Annex 1.	GRADE “summary of findings” tables for meta-analysis of included studies with maize flour	34
A.	<i>Maize flour or maize-flour products fortified with iron plus other vitamins and minerals versus unfortified maize flour or maize-flour products (not containing iron or any other vitamins or minerals)</i>	34
B.	<i>Maize flour or maize flour products fortified with folic acid alone compared to no intervention for population health outcomes</i>	35
C.	<i>Maize flour or maize-flour products fortified with folic acid plus other vitamins and minerals versus unfortified maize flours or maize-flour products (not containing folic acid or any other vitamins or minerals)</i>	36
Annex 2.	Questions in population, intervention, control, outcomes (PICO) format	37
Annex 3.	Systematic reviews and author teams	40
	<i>Additional commissioned reviews on various aspects of maize flour fortification</i>	44
Annex 4.	Summary of the considerations of the members of the guideline development group – nutrition actions for determining the direction and the strength of the recommendations	45
Annex 5.	Logic model for fortification of maize flour and corn meal with vitamins and minerals in public health	47
Annex 6.	WHO steering committee for food fortification	48
Annex 7.	WHO guideline development groups	49
A.	<i>Guideline development group – micronutrients 2010–2011</i>	49
B.	<i>WHO guideline development group – nutrition actions 2013–2014</i>	50
Annex 8.	External resource experts	52
Annex 9.	Peer-reviewers	53
Annex 10.	WHO Secretariat	54

PUBLICATION HISTORY

This guideline, *Fortification of maize flour and corn meal with vitamins and minerals*, is a partial update of, and supersedes, the recommendations related to maize flour only in the 2009 WHO guideline, *Recommendations on wheat and maize flour fortification. Meeting report: interim consensus statement*, which was published during the interim period of the adoption of the evidence-informed guideline development process in WHO. The focus is on the use of this intervention as a public health strategy. Given the many types of maize flour and corn meal consumed in various countries in Africa and in the Americas as food vehicles for fortification, a separate guideline for this food vehicle was deemed necessary. In order to produce this guideline, the rigorous procedures described in the [WHO handbook for guideline development](#) were followed. This guideline complements the WHO/FAO (Food and Agriculture Organization of the United Nations) [Guidelines on food fortification with micronutrients](#) (2006) and the Pan American Health Organization (PAHO) publication, [Iron compounds for food fortification: guidelines for Latin America and the Caribbean](#) (2002). The overall direct evidence is limited but supports the use of maize flour and corn meal as a food vehicle for micronutrients where these foods are staples. This document expands the sections on dissemination and updates the summary of evidence used for the guideline, based on the most recent systematic reviews on the topic.

ACKNOWLEDGEMENTS

This guideline was coordinated by the World Health Organization (WHO) Evidence and Programme Guidance Unit, Department of Nutrition for Health and Development. Dr Maria Nieves Garcia-Casal, Dr Juan Pablo Peña-Rosas and Dr Lisa Rogers oversaw the preparation of this document. WHO acknowledges the technical contributions of the following individuals (in alphabetical order): Ms Hala Boukerdenna, Ms Evelyn Boy-Mena, Ms Zita Weise-Prinzo and Mr Gerardo Zamora.

We would like to express our gratitude to Dr Susan Norris from the WHO guidelines Review Committee Secretariat, and members of the Guidelines Review Committee, for their technical support throughout the process. Thanks are also due to Mr Issa T Matta and Ms Chantal Streijffert Garon from the WHO Office of the Legal Counsel and Ms Alma Alic, Department of Compliance and Risk Management and Ethics, for their support in the management of conflicts-of-interest procedures. Ms Jennifer Volonnino from the Evidence and Programme Guidance Unit, Department of Nutrition for Health and Development, provided logistic support.

Special thanks are extended to the authors of the systematic reviews used in this guideline, for their assistance and collaboration in preparing or updating them. We appreciate the feedback provided by a large number of international stakeholders during the guideline development process.

WHO gratefully acknowledges the technical input of the members of the WHO guideline development groups involved in this process, especially the chairs of the two meetings concerning this guideline, Dr Janet King (2010), and Ms Rusidah Selamat and Dr Rebecca Joyce Stoltzfus (2014). We thank the peer-reviewers for their thoughtful feedback of a preliminary version of this guideline. WHO is also grateful to the staff of the Cochrane Public Health Group for their support in developing and updating the systematic reviews used to inform this guideline.

FINANCIAL SUPPORT

WHO thanks the Bill & Melinda Gates Foundation for providing financial support for this work. We would also like to acknowledge the technical and financial support of the Centers for Disease Control and Prevention, especially the International Micronutrient Malnutrition Prevention and Control Programme (IMMPaCt) at the National Center for Chronic Disease Prevention and Health Promotion, and the National Center on Birth Defects and Developmental Disabilities, for supporting the retrieval, summary and assessment of the evidence informing this guideline.

We would like to thank Food Fortification Initiative and the Sackler Institute for Nutrition Research, New York Academy of Sciences, for their support in a non-normative consultation on technical considerations for maize-flour fortification as a public health strategy, held in New York, United States of America, 8–9 April 2013. The Global Alliance for Improved Nutrition and the Micronutrient Initiative also provided financial support for some of the systematic reviews in nutrition interventions commissioned to inform this guideline.

Donors do not fund specific guidelines and do not participate in any decision related to the guideline development process, including the composition of research questions, membership of the guideline groups, conduct and interpretation of systematic reviews, or formulation of the recommendations.

预览已结束，完整报告链接和二维码如下：

https://www.yunbaogao.cn/report/index/report?reportId=5_26697

