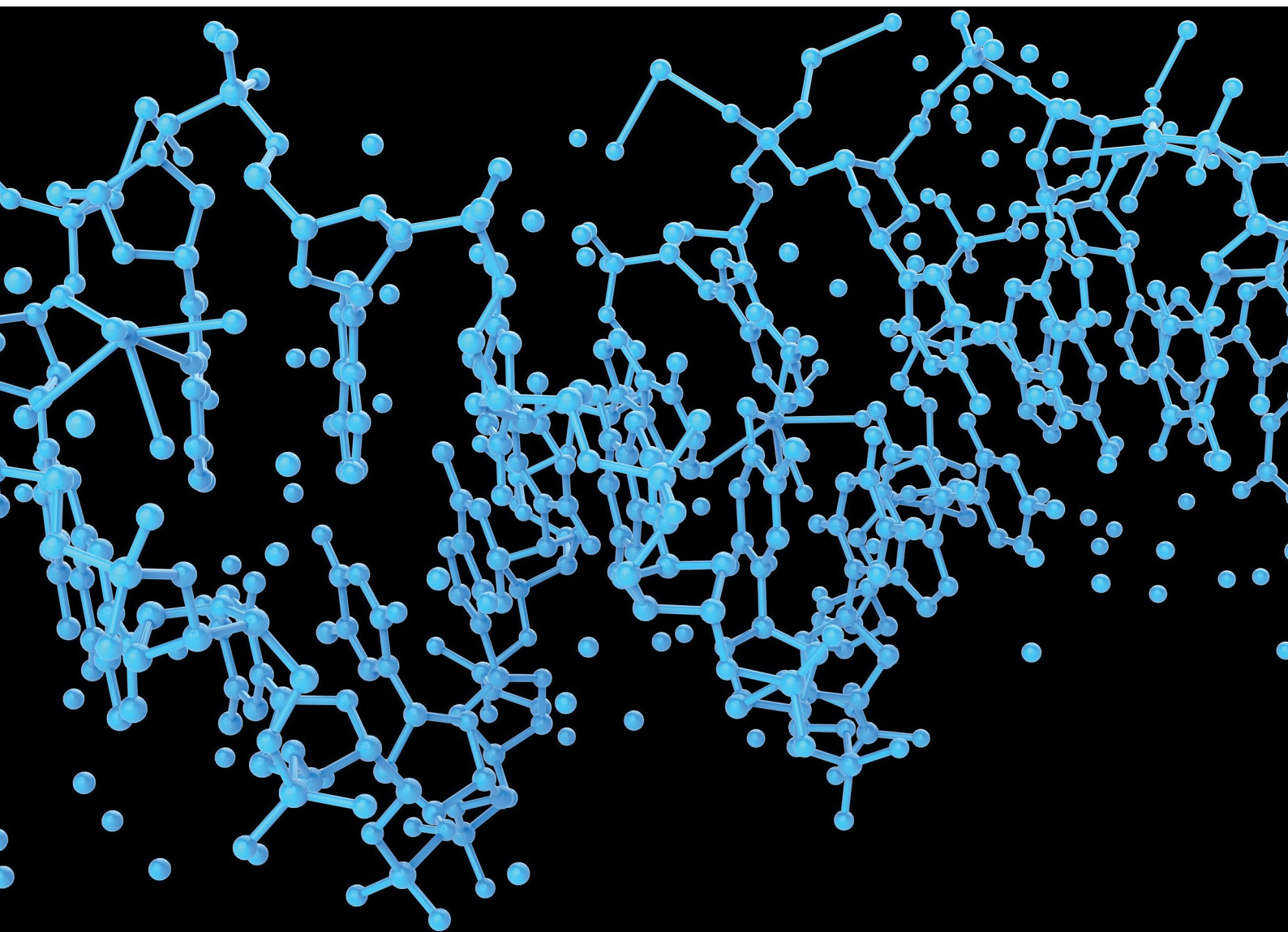


Nitrogen and protein content measurement and nitrogen to protein conversion factors for dairy and soy protein-based foods: a systematic review and modelling analysis



Food and Agriculture
Organization of the
United Nations



World Health
Organization



Food and Agriculture
Organization of the
United Nations



World Health
Organization

NITROGEN AND PROTEIN CONTENT MEASUREMENT AND NITROGEN TO PROTEIN CONVERSION FACTORS FOR DAIRY AND SOY PROTEIN-BASED FOODS: A SYSTEMATIC REVIEW AND MODELLING ANALYSIS

Prepared by:

Daniel Tomé¹

Christophe Cordella¹

Omar Dib¹

Christine Péron²

¹ UMR PNCA, AgroParisTech, INRA, Université Paris-Saclay, 75005 Paris, France

² Direction des Documentations, du Musée du Vivant et du CIRE (DDMC) (DG&S), AgroParisTech, Université Paris-Saclay, 75005 Paris, France

Nitrogen and protein content measurement and nitrogen to protein conversion factors for dairy and soy protein-based foods: a systematic review and modelling analysis

ISBN 978-92-5-132544-5 (FAO)

ISBN 978-92-4-151698-3 (WHO)

© World Health Organization and Food and Agriculture Organization of the United Nations, 2019

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 the World Health Organization (WHO) or the Food and Agriculture Organization of the United Nations (FAO) endorse any specific organization, products or services. The use of the WHO or FAO 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) or the Food and Agriculture Organization of the United Nations (FAO). WHO and FAO are 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>.

Suggested citation. Nitrogen and protein content measurement and nitrogen to protein conversion factors for dairy and soy protein-based foods: a systematic review and modelling analysis. Geneva: World Health Organization and Food and Agriculture Organization of the United Nations; 2019. Licence: CC BY-NC-SA 3.0 IGO.

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.

WHO Photographs. WHO photographs are copyrighted and are not to be reproduced in any medium without obtaining prior written permission. Requests for permission to reproduce WHO photographs should be addressed to: http://www.who.int/about/licensing/copyright_form/en/

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 or FAO concerning the legal or development status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted 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, whether or not these have been patented, does not imply that they are endorsed or recommended by WHO or FAO 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 and FAO 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 and FAO be liable for damages arising from its use.

The named authors alone are responsible for the views expressed in this publication.

Cover photo: © Zapp2Photo

CONTENTS

Acknowledgements	vii
Abbreviations	viii
1 Introduction	1
2 Background	2
2.1 Protein, protein nitrogen and non-protein nitrogen in foods	2
2.2 General principles of NPCFs	3
2.3 Approaches for calculation of NPCFs	4
2.3.1 Crude protein weight versus amino acid composition	4
2.3.2 Anhydrous weight of amino acids	5
2.3.3 Contribution of amide amino acids to protein nitrogen content	5
3 Methods	7
3.1 Systematic review of the literature	7
3.1.1 PICO questions	7
3.1.2 Literature review	8
3.1.3 Data analysis	8
3.2 Calculation of NPCFs	9
3.3 Modelling of non-protein nitrogen	10
3.4 Assessment of risk of bias and certainty of evidence	11
4 Results	12
4.1 Literature review	12
4.2 Analytical methods for nitrogen, amino acid and protein content in foods	14
4.2.1 Methods to determine total nitrogen content in foods	14
4.2.2 Methods for amino acid analysis	17
4.2.3 Other methods for protein analysis	23
4.3 NPCFs for milk-based and soy-based foods	26
4.3.1 Conversion factors for dairy-based foods	26
4.3.2 Conversion factors for soy-based foods	29
4.3.3 Pooled estimates for NPCFs	30
4.3.4 Certainty of the evidence	32
4.4 Modelling of non-protein nitrogen	32
5 Discussion	35
5.1 General considerations in calculating and NPCFs	35
5.1.1 Prosthetic groups	35
5.1.2 Non-protein nitrogen	36
5.1.3 Amide to acid ratio	37

5.2	Selecting NPCFs	37
5.3	Comparability with other reviews	38
5.4	Comparability with other conversion factors	38
6	Conclusion	39

Annexes **41**

Annex 1	Search strategy	43
Annex 2	Excluded studies	45
Annex 3	GRADE evidence profiles	47
	GRADE evidence profile 1 – Dairy-based ingredients	47
	GRADE evidence profile 2 – Soy-based ingredients	50
	GRADE evidence profile 3 – Dairy-based ingredients	53
	GRADE evidence profile 4 – Soy-based ingredients	55
Annex 4	Studies included in the GRADE assessment: dairy	57
Annex 5	Studies included in the GRADE assessment: soy	58
	Bibliography	59

Tables and figures

Table 1	The fractions of protein and nitrogen content in foods	4
Table 2	Values used to calculate NPCFs	6
Table 3	Total nitrogen and protein nitrogen content values for soy-based products and dairy-based products	11
Table 4	Methods for food protein analysis	14
Table 5	Kjeldahl methods and modifications for total protein measurement in food, by matrix	15
Table 6	Standards for total nitrogen and protein measurement in food and feed using the Dumas method	17
Table 7	Problematic amino acids during the protein hydrolysis procedure	19
Table 8	Main derivatization methods based on specific amine or amide reagents for amino acids analysis	20
Table 9	A selection of studies specifically related to amino acid analysis in milk and soybean products by gas chromatography and liquid chromatography	21
Table 10	Comparison of routine methods of food protein analysis	22
Table 11	Main interfering compounds for BCA protein assay	23
Table 12	Main compounds interfering with the Bradford reagent (Coomassie Brilliant Blue G250) or with proteins in samples, and incompatible sample preparation methods	24
Table 13	Linearity range and limit of detection of most used colorimetric assays for protein determination	24
Table 14	Protein concentrations determined by most used colorimetric assays for standard protein samples	25
Table 15	NPCFs reported for dairy-based foods and food ingredients	26

Table 16	NPCFs reported for soy-based foods and food ingredients	29
Table 17	Pooled estimates for NPCFs	32
Table 18	K_B values according to non-protein nitrogen content as a function of mean K_A valuesa	34
Table A.1	Keyword combinations used in the database searches of publications (1946–2019)	43
Table A.2	Requests from the corpus of the 3881 publications (1946–2019)	44
Table A.3	Additional requests from the corpus of the 3881 publications (1946–2019)	44
Fig. 1	Protein and nitrogen in foods	2
Fig. 2	PRISMA flow diagram of study selection for analytical methods and NPCFs	13
Fig. 3	Dispersion of calculated K_A values for dairy protein	28
Fig. 4	Dispersion of calculated K_A values for soy protein	31
Fig. 5	Relationship between K_A and K_B according to non-protein nitrogen level for milk-based (A) and soy-based (B) products	33
Fig. 6	All K_B values for both soy-based products and milk-based products as a function of non-protein nitrogen	34

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_24732

