Validation of a food group based nutrition software to assess nutrient intake in Tanzania

Christine Lambert[1], Laila Eleraky[1], Hadijah Mbwana[2], Joyce Kinabo[2], Hans Konrad Biesalski[1], Simon Riedel[1], Christian Widmer[3], Ute Gola[3] and Wolfgang Stuetz[1]

[1] Institute of Biological Chemistry und Nutrition, University of Hohenheim, Germany
[2] Department of Food Technology, Nutrition and Consumer Sciences, SOKOINE University of Agriculture, Morogoro, Tanzania
[3] day-med-concept GmbH, Berlin, Germany

Background: Analysis of food intake by 24 h recalls or food frequency questionnaires are the common methods to quantify nutrient intake in larger surveys. After data acquisition, data analysis is time consuming and individual results can not be provided to the participants directly after the interview. These limitations can be overcome by the nutrition software CIMI (Calculator of inadequate micronutrient intake), which calculates nutrient intake using food groups automatically and directly after data input. Feedback to the respondent enhances willingness to participate in such surveys and provision of reliable answers. In addition, face-to-face feedback can help to improve nutritional quality directly.
The present study verifies the accuracy of the CIMI program by comparing the results with the established nutrition software NUTRISURVEY.

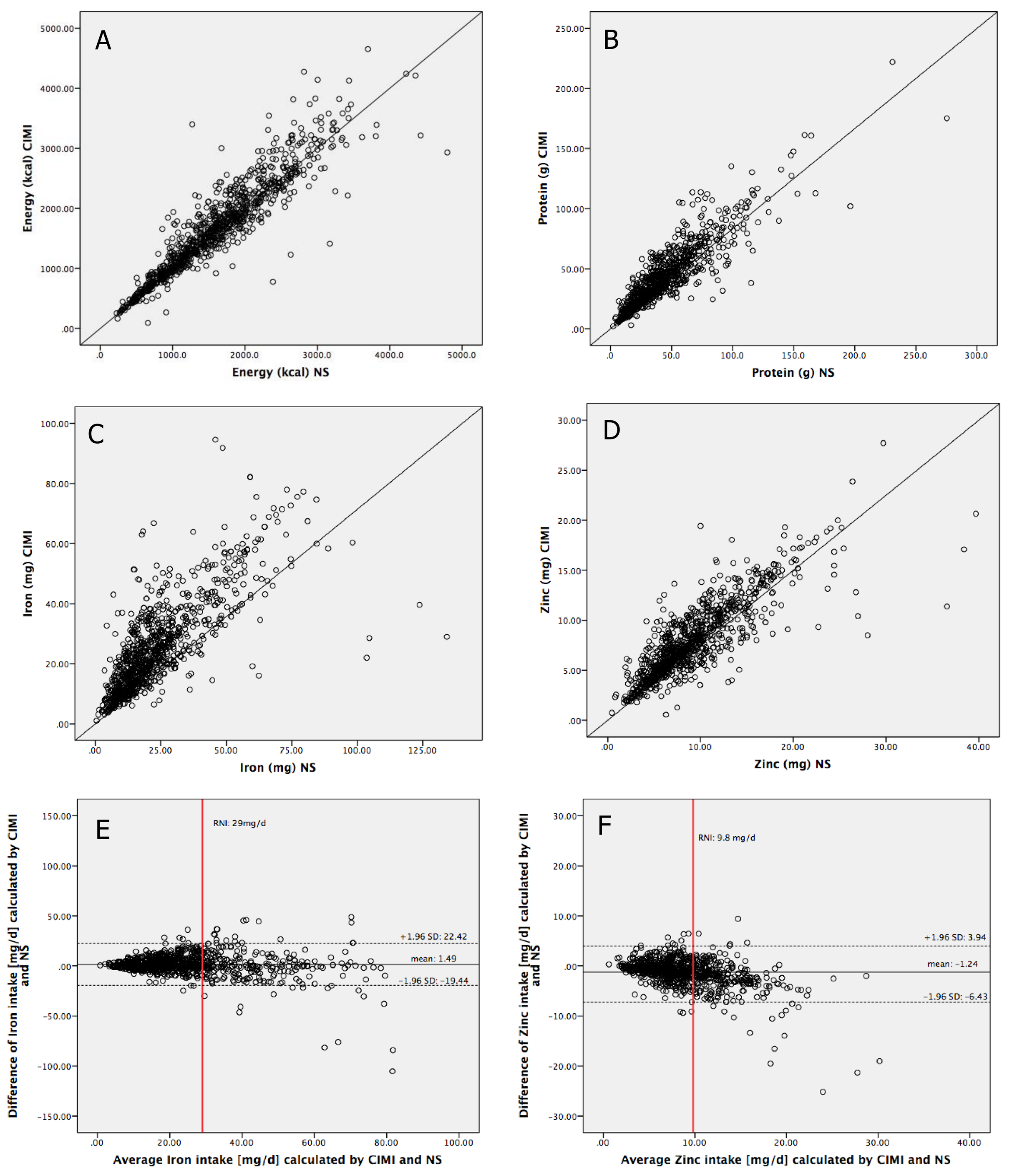
Methods: 24 h dietary recalls of 1013 Tanzanian women from Kilosa and Chamwino districts collected in the Trans-SEC project (347 women, January to May 2015) and the Scale-N study (666 women, July to August 2016) were analyzed by two different methods: (1) Nutrient calculation with the nutrition software NUTRISURVEY (NS), based on single food items and (2) the program CIMI, which analyses nutrient intake by 24 different food/beverages groups. These groups reflect an average nutrient composition of foods that are typical for the Tanzanian eating pattern. Macro- and micronutrient intake calculation of NS and CIMI were compared using SPSS 24.

Results: Differences in nutrient intake between CIMI and NS were marginal: out of the 14 analyzed macro- and micronutrients, mean difference +/- standard deviation were for energy +65kcal +/- 283, protein -1.4g +/-15.5, retinol equivalents -170µg, vitamin B1 +0.15mg +/- 0.33, iron +1.5mg +/-10.7, and zinc -1.2mg +/-2.6. Nutrients with a very high accuracy (difference expressed as % of NS result: +/-0<5%) were energy, protein, carbohydrates, vitamin B2 and B6. Those with a good accuracy (+/-5-15%) were vitamin B1 and C, iron and zinc. Moderate accuracy (+/-15-30%) showed retinol equivalents, vitamin B12, folic acid and calcium. Fat was the only nutrient which was not calculated adequately by CIMI.

Table 1:
Results of mean nutrient intake calculation +/- SD by Nutrisurvey and CIMI. Low mean differences between both methods and high Pearson's correlation coefficients represent high conformity of CIMI with the reference method.

	CIMI		Nutrisurvey		Δ CIMI - Nutrisurvey		Pearson R
	Mean	SD	Mean	SD	Mean	SD	
Energy [kcal]	1632	779	1567	737	65	283	0.936
Protein [g]	40.1	25.8	41.5	28.5	-1.4	12.5	0.890
Fat [g]	44.4	37.5	30.3	23.9	14.1	24.1	0.792
Carbohydrates [g]	258	131	261	142	-3.6	52.6	0.935
Retinol equivalents [µg]	516	556	687	821	-171	715	0.541
Vitamin B1 [mg]	1.23	0.52	1.07	0.60	0.16	0.33	0.844
Vitamin B2 [mg]	1.07	0.57	1.12	0.73	-0.05	0.47	0.794
Vitamin B6 [mg]	1.54	0.73	1.52	0.87	0.01	0.51	0.831
Folic acid [µg]	289	156	374	248	-86	162	0.794
Vitamin B12 [µg]	0.71	1.78	0.98	2.36	-0.27	1.65	0.607
Vitamin C [mg]	45.6	41.0	39.9	56.4	5.7	49.1	0.534
Calcium [mg]	436	287	572	570	-136	481	0.548
Iron [mg]	25.3	15.1	23.8	16.7	1.5	10.7	0.789
Zinc [mg]	7.8	3.6	9.1	4.8	-1.2	2.6	0.851

Figure 1:
Correlation of energy (A) and protein (B), iron (C) and zinc (D) intake between Nutrisurvey (NS) and CIMI in women. Bland-Altman plots of iron (E) and zinc intake (F) display high agreement between the two methods, especially for intake amounts below recommended nutrient intake (RNI). RNI is represented by a red line.



Discussion: The food group based approach of CIMI is suitable to identify persons with low energy, protein or micronutrient intake. Time for data input is less compared to 24h recall methods analyzing single food items. Although calculation of fat intake by CIMI was lower compared to Nutrisurvey, computation of energy intake which is more relevant in nutrition analysis, showed high conformity. Vitamin C calculation was prone to a lower accuracy, due to high variability of vitamin C content of foods within the food groups regarding fruits and vegetables. But critical discrepancies have only been observed in a some cases in ranges above the recommended nutrient intake. The objective of CIMI to identify persons with low nutrient intake is not affected by this limitation.

Conclusion: CIMI is a valid and timesaving instrument to measure nutrient intake in Tanzania. A soon available CIMI-app will also consider mineral bioavailability, fulfillment of recommendations and adjustment of food groups by the respondent. This will lead to an improved, user-friendly handling with even more accurate results.

References: Jati IR, Widmer C, Purwestri RC, Wirawan NN, Gola U, Lambert C and Biesalski HK, Design and validation of a program to identify inadequate intake of iron, zinc, and vitamin A Nutrition 2014, 30 (11–12):1310–1317.

Tropentag 2018
17-19 September 2018
Ghent, Belgium

With financial support from
Federal Ministry of Education and Research
Bundesanstalt für Landwirtschaft und Ernährung
Federal Ministry for Economic Cooperation and Development