Micronutrient Adequacy in Diets Consumed by School Children from Farming Communities of Tanzania

Victoria Gowele[1,2], Joyce Kinabo[1], Theresia Jumbe[1], Nyamizi Bundala[1], Laila Eleraky[2], Hadijah Mbwana[1], Constance Rybak[3], Stefan Sieber[3], Khamaldin Mutabazi[4], Hans Konrad Biesalski[2], Wolfgang Stuetz[2]

1. Introduction

Poor dietary intake is described as an important factor that may result in poor nutritional state and quality of life. Diets low in energy, vitamins, minerals, and other nutrients, may lead to retarded growth, poor cognitive development, anaemia and increased risk of infections during childhood.

2. Objective

This study aimed to assess the adequacy of zinc, iron and vitamin A intake in diets consumed by school children aged 5-10 years in Chamwino and Kilosa districts, Tanzania.

3. Materials and Methods

The Scale-N project aims to improve nutritional and micronutrient status (vitamin A, iron, zinc) in school-children (5-10 years) in 2 villages in Chamwino and 2 villages in Kilosa districts, Tanzania (scale-N.org). In a cross-sectional study, 666 households with school children were randomly recruited. Dietary assessment was conducted using a quantified 24 hours recall. Nutri-survey software was used for analysis of nutrient intake. Serum levels of zinc, iron and vitamin A (retinol binding protein) were determined using enzyme-linked immuno-sorbent assay and spectrophotometric methods. Data are presented as means (SD) and prevalence and compared using Kruskal-Wallis- (Mann-Whitney U-), and Chi-squared test.

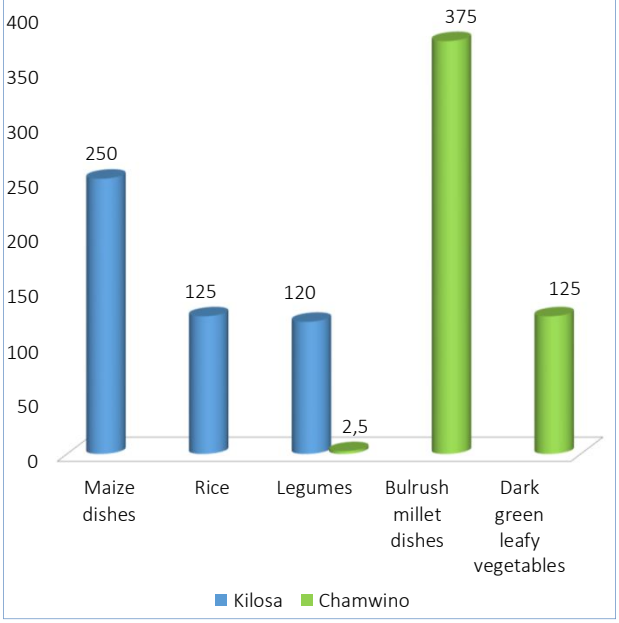

Figure 1. Median intakes of the main consumed foods (in gram) and thus relevant to energy, iron, vitamin A (RE) and zinc intake by districts.

4. Results

The prevalence of anaemia, iron, vitamin A deficiency and low serum zinc among children was high across all the four villages and differences were significant (Table 1). Recommended Daily Intake (RDI) for energy, vitamin A, iron and zinc was inadequate for 81, 62, 26 and 95 percent of the children in the study, respectively (Table 2). Maize, rice and legumes dishes in Kilosa while bulrush millet and dark green leafy vegetables in Chamwino district were the mainly consumed foods that predicted the intake of energy, zinc, iron and vitamin A in the study villages (Figure 1).

Table 1. Haemoglobin, vitamin A, iron status and serum zinc in school children (n=666) from villages in Chamwino and Kilosa districts, Tanzania

	Chamwino		Kilosa		
	Mzula	Chinoje	Tindiga	Mhenda-Kitunduweta	P-value
Children, N	**167**	**166**	**169**	**164**	
Hb <115g/L, n (%)	31 (**18.6**)	43 (**25.9**)	**100 (59.2)**	**112 (68.3)**	<0.001
Retinol <1.05 µmol/L, n (%)	104 (62.3)	128 (77.6)	100 (59.2)	103 (62.8)	0.002
Retinol <0.7 µmol/L, n (%)	13 (7.8)	31 (18.8)	17 (10.1)	13 (7.9)	0.004
SF <12 µg/L or sTfR >8.5 mg/L - Iron deficiency, **n (%)**	**32 (19.2)**	**25 (15.2)**	**62 (36.7)**	**65 (39.6)**	0.001
Zn <0.66 mg/L, n (%)	34 (20.4)	81 (49.1)	50 (29.6)	53 (32.3)	<0.001

Haemoglobin, Hb <115 g/L = Anemia, Retinol <1.05 µmol/L = Low Vitamin A status, Retinol <0.7 µmol/L = Vitamin A deficiency, SF <12 µg/L or sTfR >8.5 mg/L= Iron deficiency (SF = Serum Ferritin, sTfR = soluble transferrin receptor), Zn <0.66 mg/L= Low serum zinc

Table 2. Energy , vitamin A, iron & zinc intake of school children (n=666, 24 hr recall) from villages in Chamwino and Kilosa districts, Tanzania

		Chamwino		Kilosa		
	All	Mzula	Chinoje	Tindiga	Mhenda-Kitunduweta	RDI /d
Children, N	**666**	**167**	**166**	**169**	**164**	
Energy [Kcal] [1]	898 (579, 1296)	715 (469, 1003)[a]	550 (370, 759)[b]	1181 (865, 1505)[c]	1215 (979, 1559)[c]	1400
E <RDI, n (%) [2]	536 **(81)**	153 (92)[a]	159 (96)[a]	119 (70)[b]	105 (64)[b]	
Vitamin A [µg] [1]	320 (78, 711)	**478** (213, 807)[a]	**501** (307, 816)[a]	**164** (28, 730)[b]	**92** (30, 261)[c]	450 / 500
RE <RDI, n (%) [2]	411 **(62)**	83 (**50**)[a]	77 (**46**)[b]	114 (68)[c]	137 (84)[d]	
Iron [mg] [1]	11.5 (7.6, 18.6)	**15.9** (10.9, 22.7)[a]	**18.4** (13.1, 24.7)[a]	7.2 (5.3, 9.6)[b]	8.8 (6.2, 13)[c]	6 / 9
Iron <RDI, n (%) [2]	173 **(26)**	18 (11)[a]	7 (4.2)[b]	89 (53)[c]	59 (36)[d]	
Zinc [mg] [1]	4.9 (3.5, 6,5)	4.7 (3.3, 6.6)[a]	4.4 (3.3, 5.9)[a]	4.7 (3.5, 6.3)[a]	5.5 (4.2, 8.1)[b]	10.3/ 11.3
Zinc <RDI, n (%) [2]	635 **(95)**	159 (95)[a]	158 (95)[b]	166 **(98)**[c]	152 (93)[d]	

Figures are median (interquartile range - IQR) and range[1] and number (percentage)[2]. Kruskal-Wallis test for continuous variables and Chi-square test for prevalence; All P values are <0.001, except for Zinc <RDI, n (%) =0.122. villages not sharing a superscript letter are significant different (p< 0.05) to each other (Mann-Whitney U test). Recommended Daily Intake (RDI /d) in brackets for children (4-6 y)/children (7-9y) (FAO, 2001)[1]
For zinc the low bioavailability and for iron the 10% bioavailability was applied.

5. Conclusion and outlook

- Prevalence of anaemia and deficiencies of iron, zinc and vitamin A are of great concern in the study villages
- Micronutrient and energy content of the consumed diets were below the respective recommendation (RDI).
- Adequate consumption of locally available foods that are rich in vitamin A, iron, zinc and other micronutrients such as vegetables and fruits are highly recommended in order to improve children's micronutrient status in the study villages

Reference

[1] FAO (2001). FAO/WHO expert consultation on human vitamin and mineral requirements. http://www.fao.org/3/a-y2809e.pdf

Acknowledgement

The financial support of the Scale-N project by the German Federal Ministry of Food and Agriculture (BMEL) based on the decision of the Parliament of the Federal Republic of Germany through the Federal Office for Agriculture and Food (BLE) is highly acknowledged.

Contact: vgowele@sua.ac.tz
[1]Sokoine University of Agriculture, Food Technology, Nutrition and Consumer Sciences, Tanzania
[2]University of Hohenheim, Inst. of Biological Chemistry and Nutrition, Germany
[3]Leibniz Centre for Agricultural Landscape Research (ZALF), Inst. of Socio-Economics, Germany
[4]School of Agric. Economics & Business Studies, Sokoine University of Agriculture, Tanzania

Tropentag 17-19 September 2018,Gent-Belgium