5-2020

Protein Availability and Consumption, and Stunting Rates, for Primary School Children in the Southern Regions of Ethiopia and Zambia

Megan Wackel

Protein Availability and Consumption, and Stunting Rates, for Primary School Children in the Southern Regions of Ethiopia and Zambia

Megan Wackel

PROBLEM

- Stunting is common in Sub-Sahara Africa, with millions of children who are short in stature also experiencing poor overall health and development, as well as poor school performance (Semba 2016; Semba, et al., 2016).
- As many as 39% of children under 5 years of age in Ethiopia's Sidama Region (formerly SNNPR) can be classified as stunted (CSA & ICF 2016). By comparison, 29% of under 5's in Zambia's Southern Province have short height for age (CSA, MOH, & ICF 2018).
- Low protein and essential amino acid intake, among populations of 116 countries, has been suggested as the primary cause of stunting (Semba 2016; Semba, et al., 2016).
- Given that Ethiopia and Zambia have high rates of stunting, children are unlikely to be consuming protein on a regular basis. Because data on protein availability and dietary intake are limited, this study was designed to explore availability and consumption patterns of protein-rich foods among primary school children in the southern regions of each country.

PROJECT QUESTION

Primary school children in the southern regions of Ethiopia and Zambia with high stunting rates will also have limited protein intake (e.g., meat, dairy, eggs, pulses) and/or limited access to protein-rich foods.

METHODS

Environment: Research was conducted in Zambia's Southern Province within one-hour of the City of Livingstone, and in Ethiopia's Sidama Region, no more than one hour from Hawassa Town. Data were collected in 5 schools near Livingstone and 4 schools near Hawassa (Figure 1).

Experimental Setup: This project was conducted under IRB 20150515251 EP. Students could opt out of participation at any time without repercussions. Inventories were made of all available foods in markets for Hawassa, Ethiopia, and Livingstone, Zambia. Both markets are the main sources of food for school children who participated in surveys and anthropometric assessments. A food survey was administered to 6th and 7th grade children to understand consumption patterns (Figure 2). Anthropometric assessments were performed, including height, weight, and mid-upper arm circumference (MUAC) (Figure 3).

Statistical Analysis: Data were entered into Excel and analyzed using *Staistica*. Height-for-age Z-scores (HAZ) and MUAC measures were made and data were assessed using the WHO statistical software, *AnthroPlus*[5].

Figure 1: Map of Africa; Research Sites Marked by Red Stars [https://7continents.guide/wp-content/uploads/2018/09/map-of-africa.gif]

Figure 2: Survey Administration

Figure 3: Anthropometric Assessment

RESULTS

Table 1: Protein Foods in Zambian and Ethiopian Markets

FOOD	ZAMBIA		ETHIOPIA	
	NEVER	CONSUMES	NEVER	CONSUMES
Eggs	4.5	80.3	4.5	91.3
Beef	5.9	78.9	3.3	85.6
Lamb *	39.7	45.1	17.7	71.3
Goat *	28.2	56.6	12.7	76.2
Pork *	37.5	47.4	84.0	5.0
Chicken	2.0	82.8	3.3	85.6
Fish	4.5	80.3	4.4	84.5
Mice *	54.4	30.5	86.7	2.3
Caterpillar*	41.7	43.1	87.8	1.1
Peanuts	3.7	81.1	10.5	78.5
Beans	2.0	82.8	5.5	83.4
Milk	3.4	81.4	7.2	81.7
Cheese	20.0	64.8	32.6	56.3
Yogurt	8.4	76.3	14.4	74.6
Lentils*	74.9	9.9	2.8	86.2
Peas	18.3	66.5	9.9	79.0
Chickpeas*	52.1	32.6	3.9	85.0
Soybean*	11.6	73.3	50.3	38.7

Key: * = significantly different ($p < 0.05$); yellow box = most consumed

Figure 4: Pulses for Sale in Hawassa Market

Figure 5: Tilapia Catch at Lake Hawassa

- There were 18 different protein sources in Zambian-Ethiopian markets: 4 mammals, 3 dairy items, 6 pulses, 1 rodent, 1 insect, 1 bird, and eggs (Table 1; Figure 4-5).
- Children in each country had a unique pattern of consumption based on available proteins. In Zambia, pork, mice, caterpillar, and soybeans were more common protein sources. By contrast, Ethiopian children reported eating more lamb, goat, lentils, and chickpeas, but no rodents or insects (Table 1).
- Some protein foods were never eaten by a majority in one country of the other; 84-88% of Ethiopian children reported no consumption of mice, caterpillars and pork, while more than 86% of Zambian children never consume lentils (Table 1).
- The remaining categories yielded similar results for children in each country. For example, eggs, beef, chicken, fish, and dairy products were consumed in approximately equal amounts (Table 1).

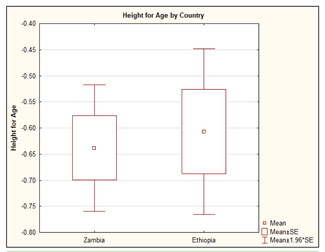

Figure 6: Height for Age by Country

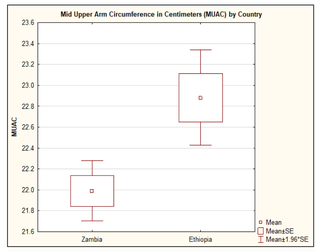

Figure 7: MUAC by Country

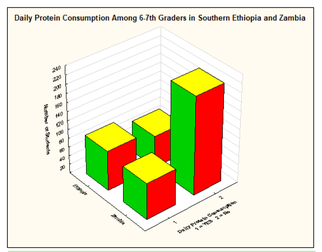

Figure 8: Protein Intake in 6th - 7th Graders

- Approximately equal numbers of children in both countries are shorter than expected for their age, with 72% of Ethiopian students and 71% of Zambian participants possessing negative height for age z-scores (Figure 6).
- Although 6th-7th graders in the Southern Province of Zambia are, on average, shorter for their age than are children in Ethiopia's Sidama Region, these differences between countries are not significant.
- Stunting rates were different between the cohorts; nearly 10% of Zambian versus 8% of Ethiopian 6th-7th grade children could be classified as stunted (HAZ < -2).
- Moreover, there are no significant differences between height for age (HAZ) and protein consumption among the participants.
- However, there are significant differences ($p < 0.03$) in MUAC values between the children of Ethiopia and Zambia's southern areas. Sixth and 7th graders in Livingstone have a smaller MUAC compared to children of comparable age who live near Hawassa (21.99 versus 22.88 respectively) (Figure 7).
- As is true for height, there are no significant differences between MUAC values and whether protein is regularly consumed.
- Daily protein consumption is significantly different between the children of Ethiopia and Zambia's southern regions; Ethiopian children report protein consumption daily as compared to Zambian children (Figure 8).
- Ethiopian children reported the most common daily food consumed as *shiro*, a dish make from chickpeas, other pulses, and spices. By contrast, Zambian children indicated that they eat *nshima* daily, a staple food made from corn and with limited protein.

DISCUSSION

- Stunting is present in both sample populations from the southern regions of Ethiopia and Zambia; however, differences between Ethiopian and Zambian 6th-7th graders are the reverse of under 5 stunting rates reported by the country-specific DHS reports. Specifically, higher percentages of under 5's are stunted in Ethiopia's Sidama Region, while 6th and 7th graders show higher percentages of stunting in Zambia's Southern Province.
- Market inventories yielded a variety of protein sources in both Ethiopia and Zambia; however, 6th-7th graders in Zambia's Southern Province were less likely to consume one or more protein-rich foods each day as compared to 6th-7th graders in Ethiopia's Sidama region.
- Although there is overlap in the proteins students reportedly consumed, there were also unique or more commonly eaten sources in each country.
- Perhaps because Zambia was colonized, many of the available protein choices are not indigenous to Africa, e.g., pork and soy. Daily protein consumption in Ethiopia of one or more pulses (dried seeds of legumes) may be due to Ethiopia's history of independence. Indigenous food patterns are still common and may be of higher nutritional quality.
- Daily protein consumption may account for better height-for-age values, less stunting, and larger MUAC scores among Ethiopian participants.
- The student participants in this study may not be representative of their respective peers. In Ethiopia, children needing 6th-7th grade education are part of the same class, regardless of age. Thus older students may alter the mean anthropometric scores obtained in Ethiopia.
- To understand the full effect of protein consumption on stunting rates, food diaries and health data would need to collected in a longitudinal study design.

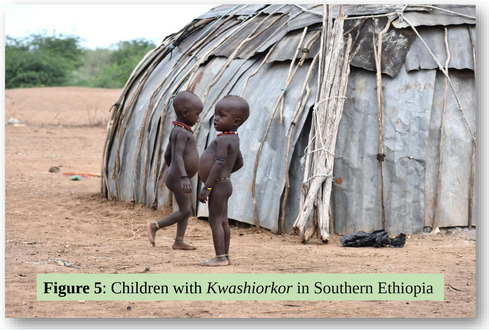

Figure 5: Children with *Kwashiorkor* in Southern Ethiopia

BIBLIOGRAPHY

Central Statistical Agency (CSA) [Ethiopia] & ICF. (2016). Ethiopia Demographic and Health Survey 2016. Addis Ababa, Ethiopia, and Rockville, Maryland, USA: CSA and ICF.
Seid, E., Derseh, L., Derso, T., Assefa, M., Gonete, K.A., & Tariku, A. (2018). Nutrient consumption and associated factors among school age children in Dewa Chefe District, northeast Ethiopia: a cross-sectional study. *BMC Research Notes*. 11:669.
Semba, R.D., Trehan, I., Gonzalez-Freire, M., Kraemer, K., Moaddel, R., Ordiz, M.I., Ferrucci, L., & Manary, M.J. (2016). Perspective: The potential role of essential amino acids and the mechanistic target of rapamycin complex 1 (mTORC1) pathway in the pathogenesis of child stunting. *American Society for Nutrition*. 7:853-65.
Semba, R.D. (2016). The rise and fall of protein malnutrition in global health. *Annals of Nutrition & Metabolism*. 69:79-88.
WHO AnthroPlus for personal computers Manual: Software for assessing growth of the world's children and adolescents. Geneva: WHO, 2009.
Zambia Statistics Agency, Ministry of Health (MOH) Zambia, & ICF. (2019). Zambia Demographic and Health Survey 2018. Lusaka, Zambia, and Rockville, Maryland, USA: Zambia Statistics Agency, Ministry of Health, and ICF.

ACKNOWLEDGEMENTS

This research was supported by the UNL 'Undergraduate Creative Activities and Research Experience' (UCARE), STEMGen Abroad Scholarship & Frank E. & Inez L. Mussehl Scholarship. I would like to thank Dr. Mary Willis for the feedback and support throughout the research process, Alazar Kirubel and graduate students of Hawassa University for their work on the project, and my research team through The University of Nebraska-Lincoln.