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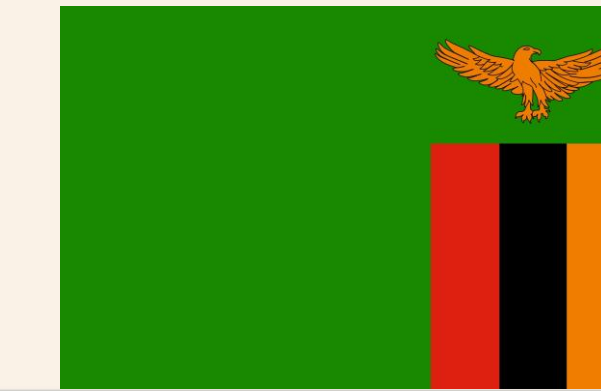
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# Grains, Grasses, and Tubers: Staple Carbohydrates in the Diets of Middle School Children of Southern Zambia and Ethiopia

Brianna Juma



## ABSTRACT

**Purpose:** Survey staple carbohydrate availability in local markets, complete anthropometric assessment, and interview primary school children about carbohydrate consumption in Southern Zambia and Ethiopia

**Methods:** Market inventories, anthropometric assessments, and interviews of 6th and 7th grade students

**Results:** Ethiopians have a greater diversity of available carbohydrates, have better overall anthropometric values compared to Zambian children, and consume more nutritious and varied carbohydrate types.

**Conclusions:** Diversity in carbohydrate availability and consumption, as well as more nutritious options, are associated with healthier growth rates among primary school children in Southern regions of Zambia and Ethiopia.



Figure 1: Map of Africa with Research Locations Marked with Red Stars

## INTRODUCTION

- Dietary diversity is critical to overall health and wellness.<sup>1</sup>
- Diets high in carbohydrate staples often lead to nutrient deficiencies and are correlated with stunting and poor development.<sup>3</sup>
- In both Zambia and Ethiopia < 5-stunting rates remain at approximately 35%.<sup>2</sup>
- Cereal grains and tubers are central to the diets of populations in Southern Zambia and Ethiopia, due to affordability and high availability.<sup>4,5</sup>

## PURPOSE

- The purpose of this research is to survey staple carbohydrate availability in local markets, complete anthropometric assessments, and interview primary school children about consumption in Southern Zambia and Ethiopia, regions where little is known about the dietary intake of primary school children.



Figure 2: Potatoes and Fermented Enset for Sale in Zambian and Ethiopian Markets

## METHODS

- Participants:**
- 6<sup>th</sup>-7<sup>th</sup> grade students: 369 from Zambia, 183 from Ethiopia
- Site:**
- May-June 2019
  - Site 1: Southern Province, Livingstone, Zambia (Figure 1)
  - Site 2: Sidama region (Formerly SNNPR), Hawassa, Ethiopia (Figure 1)
- Research Design:**
- Data collected: (1) Market Inventories (Figure 3A); (2) Anthropometric Assessment: Height, weight, Mid-Upper Arm Circumference (MUAC) (Figure 3B & 3C) and (3) Interview/Questionnaire (Demography, Foods Consumed) (Figure 3D)
- IRB # 20150515251EP with voluntary participation
- Data analysis:**
- Data were entered, analyzed with *Excel*, *Statistica*, and WHO AnthroPlus<sup>6</sup>



Figure 3: A) Market inventory B) Height measurement C) MUAC D) Interview

## RESULTS

### MARKET

- Rice, corn, oat, wheat, millet, cassava, and Irish potato varieties were available at both central markets.
- Ethiopia's Hawassa market had 6 unique staple carbohydrates (Figure 4): barley, rye, sorghum (*Sorghum bicolor*), *teff* (*Eragrostis tef*), *enset* (*Ensete ventricosum*), and African sweet potatoes, while yams were the only unique carbohydrate in Zambia's Livingstone market.
- Ethiopia's market had 4 processed staple food products including biscuits, bread, pastry, and pasta. These products accounted for 18.2% of all staple products found.
- Zambia's market had twice as many processed staple food products compared to Ethiopia's market. These processed products, which include potato chips, fried corn snacks, lemon cremes, cookies, and donuts, accounted for 39.1% of all carbohydrate products found in the market.



Figure 4: Grains, Grasses, Pulses: Hawassa Market, Ethiopia



Figure 5: White Corn: Livingstone Market, Zambia

### INTERVIEW

- Similar percentages of students in Zambia and Ethiopia reported consuming corn, wheat, and pasta (Table 1).
- More children reported eating rice and cassava in Zambia, while in Ethiopia more children reported *teff*, *enset*, and Irish potato consumption (Table 1).
- In Zambia, 25.8% of students reported eating only a staple carbohydrate each day, typically in the form of *nshima* (the Zambian staple of corn (Figure 7)).
- For Ethiopian students, 19.7% reported the sole consumption of staple carbohydrates each day, however, a wider variety, e.g., *injera* from *teff*, *kocho* from *enset*, Irish potatoes, and *keta* flatbread of corn or wheat, was consumed.

### ANTHROPOMETRICS

- Primary school children in both Zambia and Ethiopia were below the expected BMI for their age; however the Zambian students had a significantly lower BMI ( $p < .03$ ) (Box and Whisker A; Table 2).
- Zambian students had significantly smaller MUAC values compared to Ethiopian students ( $p < .001$ ) (Box and Whisker B; Table 2).
- There were no significant differences in height for age; however 10% of children in Zambia are stunted versus 8% of children in Ethiopia ( $z$ -score =  $< -2.0$ ) (Box and Whisker C; Table 2).

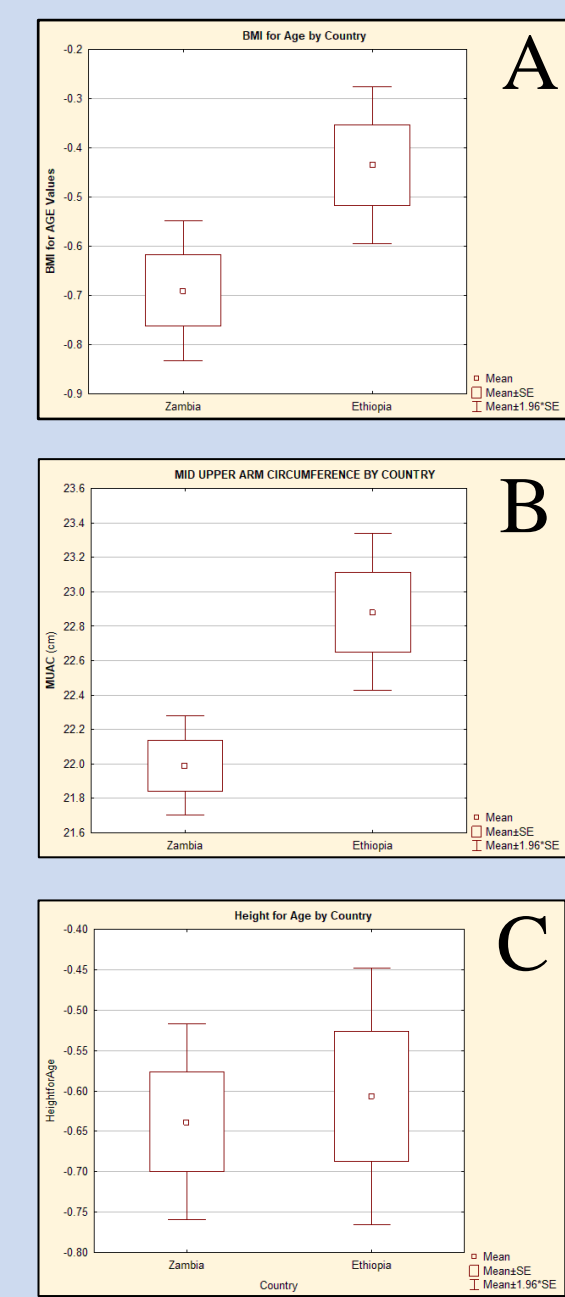


Table 1: Staple Carbohydrates Consumed by Primary School Children

Carbohydrate	Reported consumption (%):		Carbohydrate	Reported consumption (%):	
	Zambia	Ethiopia		Zambia	Ethiopia
Corn	84.2	87.9	Rice	81.4	77.9
Wheat	84.2	87.9	Barley	0.3	70.7
Cassava	76.9	46.4	Teff	0	87.8
Yams	15.5	42.0	Sorghum	0	48.1
Potatoes	67.9	87.8	Enset	0	85.1
African Sweet Potatoes	71.0	77.9	Amaranth	0	6.1
Pasta/Macaroni	73.2	86.7	Missing Responses	15.2	11.02

Table 2: Descriptive Statistics for Anthropometric Measurements

Measurement	Country	Mean	S.D.	p value
BMI (A)	Zambia	-0.69	1.34	0.031
	Ethiopia	-0.44	1.09	
MUAC (B)	Zambia	21.99	2.77	0.001
	Ethiopia	22.88	3.13	
Height for Age (C)	Zambia	-0.64	1.16	0.763
	Ethiopia	-0.61	1.08	

## DISCUSSION

- There is greater variety in the carbohydrates available to and consumed by children living near Hawassa, Ethiopia compared with those living near Livingstone, Zambia. Diets that include a greater variety of nutritious carbohydrates are more likely to provide optimal nutrition.<sup>1</sup>
- Zambia's primary staple, corn, was introduced through colonization and is not as nutritious as the indigenous staples eaten in Ethiopia.<sup>7</sup> For example, Ethiopia's indigenous grass *teff* has more iron, protein, and essential fatty acids, as well as a better balance of essential amino acids than does corn. All of these macro and micronutrients are vital for proper growth and development.<sup>8</sup>
- Though stunting was present in both countries, MUAC and BMI values among primary school children in Ethiopia were significantly higher than those for children of the same age in Zambia. Though no causation can be assumed, this might support the idea that a diet with more nutritious, diversified carbohydrates can benefit growth and development.
- Limitations to this research include (1) that interviews and self-report, rather than food diaries, were used to assess intake; (2) the sample of 6<sup>th</sup> and 7<sup>th</sup> graders from each country was not randomly selected, (3) the entire province or region was not sampled and (4) market inventories were completed for a single season, and may look different throughout the year.
- Nevertheless, our data reflects the literature on nutrition and health for populations in Southern Zambia and Ethiopia. Stunting remains problematic in both regions, and when children are eating a more diverse diet, including indigenous grains, they are relatively healthier. Therefore, when diets rely heavily on carbohydrates, varied and nutritious options can make a difference.



Figure 6: Injera-making in Ethiopia



Figure 7: Nshima-making in Zambia

## REFERENCES

- Hirvonen, K., & Hoddinott, J. (2016). Agricultural production and children's diets: evidence from rural Ethiopia. *Agricultural Economics*, 48(4), 469-480. doi: 10.1111/agec.12348
- UNICEF, WHO, & World Bank. (2018). Prevalence of stunting, height for age (% of children under 5). Retrieved from <https://data.worldbank.org/indicator/SH.STA.STNT.ZS>
- Meerman, J., & Aphane, J. (n.d.). Impact Of High Food Prices On Nutrition. FAO Nutrition Division (ESN). Retrieved from [http://www.fao.org/fileadmin/user\\_upload/agn/pdf/Meerman\\_Aphane\\_ICN2\\_FINAL.pdf](http://www.fao.org/fileadmin/user_upload/agn/pdf/Meerman_Aphane_ICN2_FINAL.pdf)
- Chapoto, A., Govereh, J., Haggblade, S., & Jane, T. (2014). Staple food prices in Zambia. COMESA. Retrieved from [https://www.researchgate.net/profile/Antony\\_Chapoto/publication/46471049\\_Staple\\_food\\_prices\\_in\\_Zambia/link/s/09e4150632d3650164000000/Staple-food-prices-in-Zambia.pdf](https://www.researchgate.net/profile/Antony_Chapoto/publication/46471049_Staple_food_prices_in_Zambia/link/s/09e4150632d3650164000000/Staple-food-prices-in-Zambia.pdf)
- FAO. (2010). Nutrition Country Profiles: Federal Democratic Republic of Ethiopia. Retrieved from [http://www.fao.org/ag/agn/nutrition/eth\\_en.stm](http://www.fao.org/ag/agn/nutrition/eth_en.stm)
- WHO AnthroPlus for personal computers Manual: Software for assessing growth of the world's children and adolescents. Geneva: WHO, 2009 (<http://www.who.int/growthref/tools/en/>).
- Mecann, J. (2014). Maize and Grace: History, Corn, and Africa's New Landscapes, 1500-1999. *Food History: Critical and Primary Sources*. doi: 10.5040/9781474220132-ch-001
- Baye, K. (n.d.). Tef: Nutrient Composition and Health Benefits. International Food Policy Research Institute.

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