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## Running From Malnutrition: Zambian Children and Growth in the Eastern and Southern Provinces

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# Running From Malnutrition: Zambian Children and Growth in the Eastern and Southern Provinces

Cole Murphy

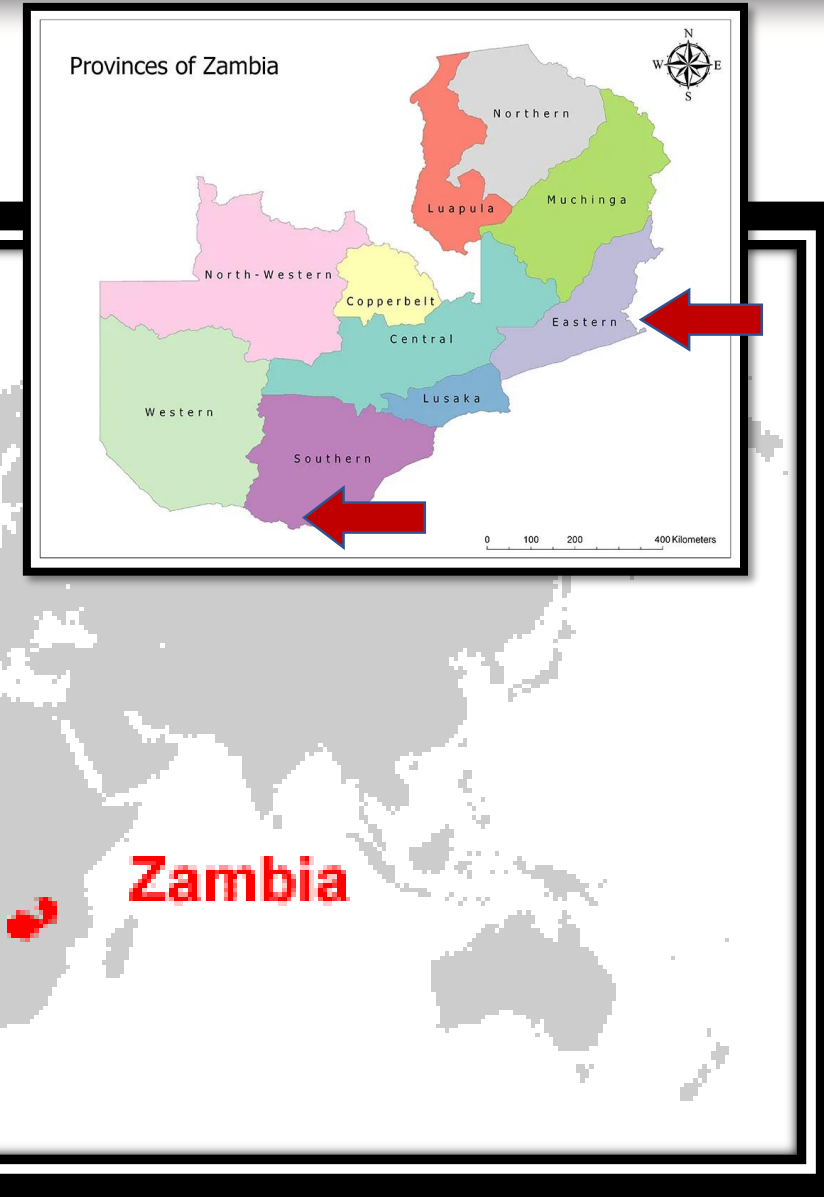


Figure 1: Map of Africa with Zambia in Red; Insert of Zambia's provinces  
Source: <https://geology.com/world/zambia-satellite-image.shtml>; <https://www.mappr.co/counties/zambia/>

## INTRODUCTION

Historically, stunting has been a major public health issue in much of sub-Saharan Africa and continues to yield severe consequences for physical and mental development throughout the lifespan (Iversen et al., 2022).

Both household food insecurity and dietary diversity are significantly associated with stunting in Sub-Saharan Africa (Gassara et al., 2021).

- According to the Zambia Demographic and Health survey, 45% of children under 5 years old are stunted (Yamauchi et al., 2022).
- In Zambia, children's nutritional intake is minimal, and the dietary intake is monotonous, with about 76% of calories coming from carbohydrates (Yamauchi et al., 2022).
- Low consumption of fat, protein, and micronutrients leads to numerous nutrition deficiencies and health problems.
- Calcium intake and physical activity, especially during the late childhood, which is a critical period for bone accretion, is the grade A recommendation to promote maximal bone health (Zemel et al., 2016)
- Adjusting for body mass, total energy expenditure peaks during the first 10 years of life (Gibbons 2022), consequently, optimizing nutritional intake is important.
- Energy expenditure among Zambians is high due to such factors as lack of transportation, large-sized towns, and the need to walk to market to acquire food for each meal.
- Malnutrition must be a critical research focus in Africa; however, examining the impact that energy expenditure plays is often overlooked in the research

## Problem

Although malnutrition rates remain high in Zambia, there are limited data for primary school children on factors that contribute to poor growth. This study was designed to examine one factor rarely considered in research about stunting, i.e., energy expenditure among primary school children and its contribution to short stature.



Figure 2: UNL Crew



Figure 3: Household Visit in Chipata

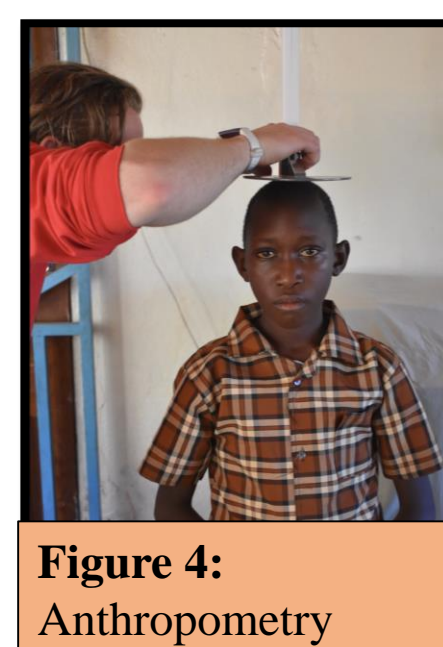


Figure 4: Anthropometry



Figure 5: Local Market Food



Figure 6: Hanging Out with Students

## METHODS

**Subjects:**  
6-7<sup>th</sup> grade students aged 8-18

**Environment:**  
Eastern Province: 1 hour radius of Chipata → 2 primary schools (Fig 1)  
Southern Province: 1 hour radius of Livingstone → 2 primary schools, 2 primary/secondary schools (Fig 1)

**Experimental Design:**  
Research conducted under IRB #20150515251EP with voluntary participation  
Data collected in May-June 2022 as part of a larger Food Security, Health & Nutrition project  
Anthropometric data collected (Fig 4, Fig 7)  
Interviews with 767 Zambian students (Fig 15)  
Observations in hospitals  
Interviews with hospital dietitians

**Statistical Analysis:**  
Data hand-written in composition notebooks  
Entered in an Excel and uploaded to Statistica  
Descriptive and correlational analyses conducted

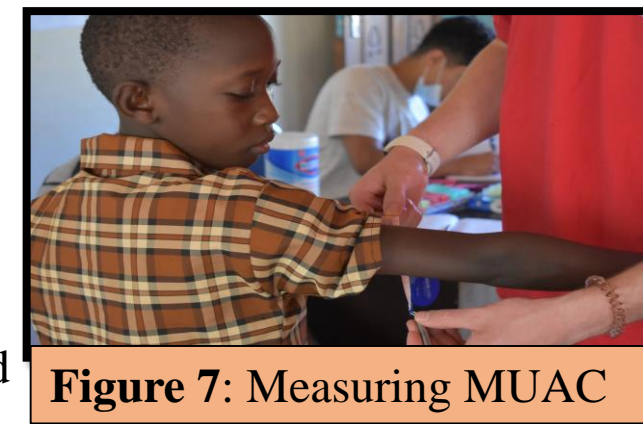


Figure 7: Measuring MUAC

## RESULTS

Among the 767 students interviewed, 97% walk to school (Fig 8). The amount of time students spend walking ranges from 1 minute to 180 minutes. The majority (45%) of students walk 1-19 minutes, followed by students who walk 20-39 minutes (29%) (Fig 8). Approximately 23% of students walk 40-100+ minutes (Fig 8).

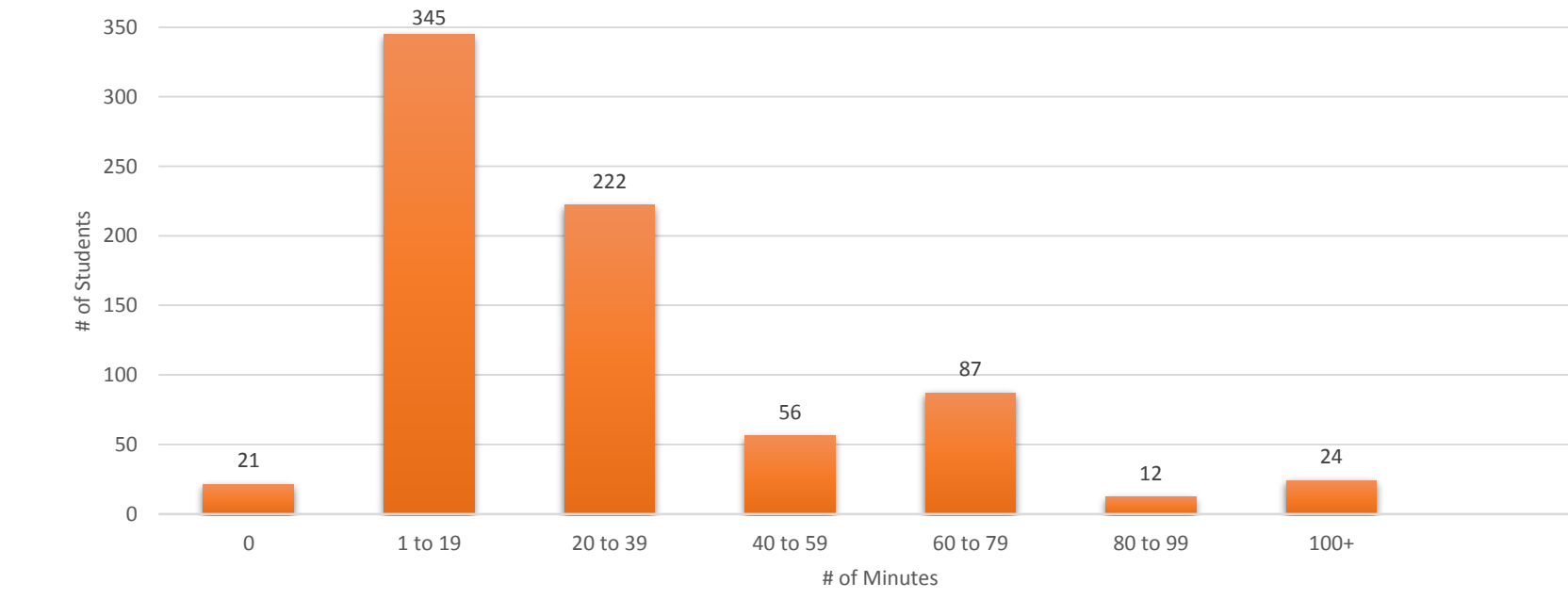


Figure 8: Amount of Time Spent Walking To and From School

Students reported running on a weekly basis from 0-720+ minutes (Fig 9). Most children (37%) run between 1-199 minutes each week (Fig 9). The second most common (33%) number of minutes spent running varied from 120-239 (Fig 9). Finally, 20% of students ran from 240-720+ minutes on average each week (Fig 9).

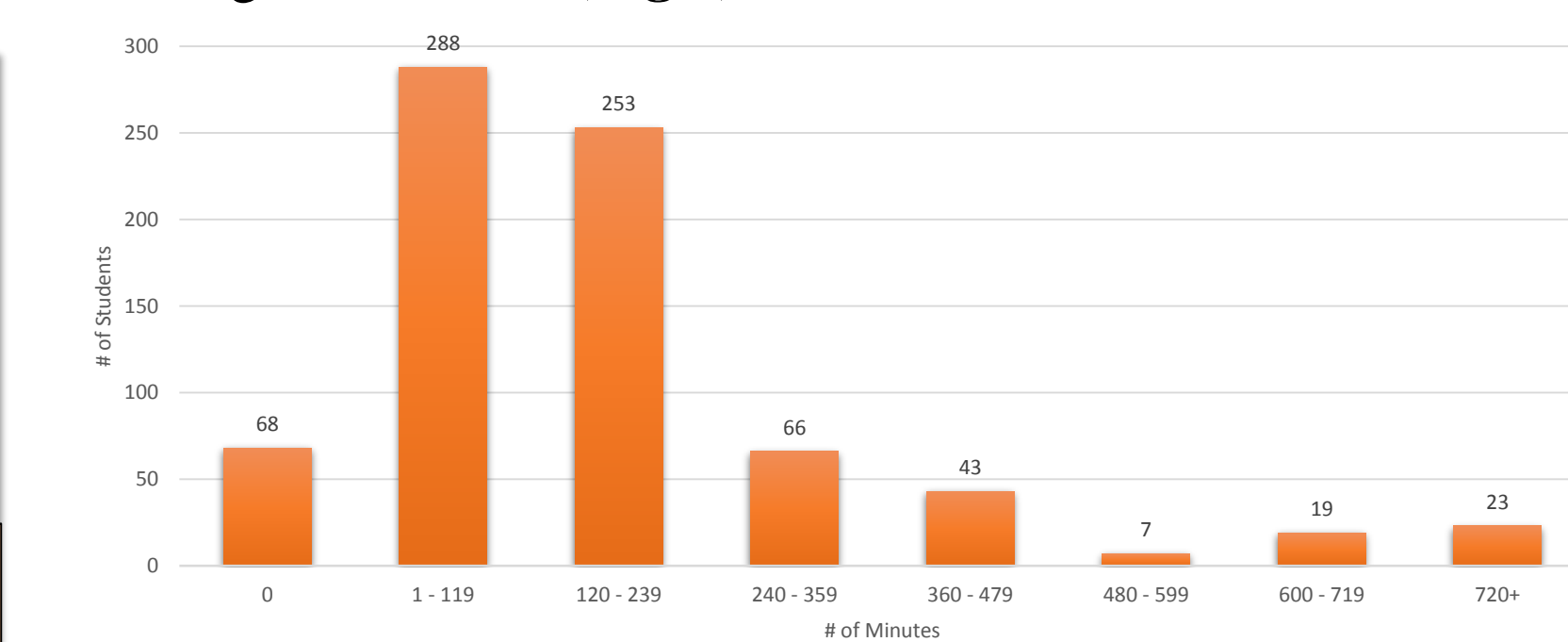


Figure 9: Minutes of running each week

Of the Zambian children interviewed, 31% do not eat before coming to school (Fig 10). While at school, 98% of students eat lunch (Fig 11).

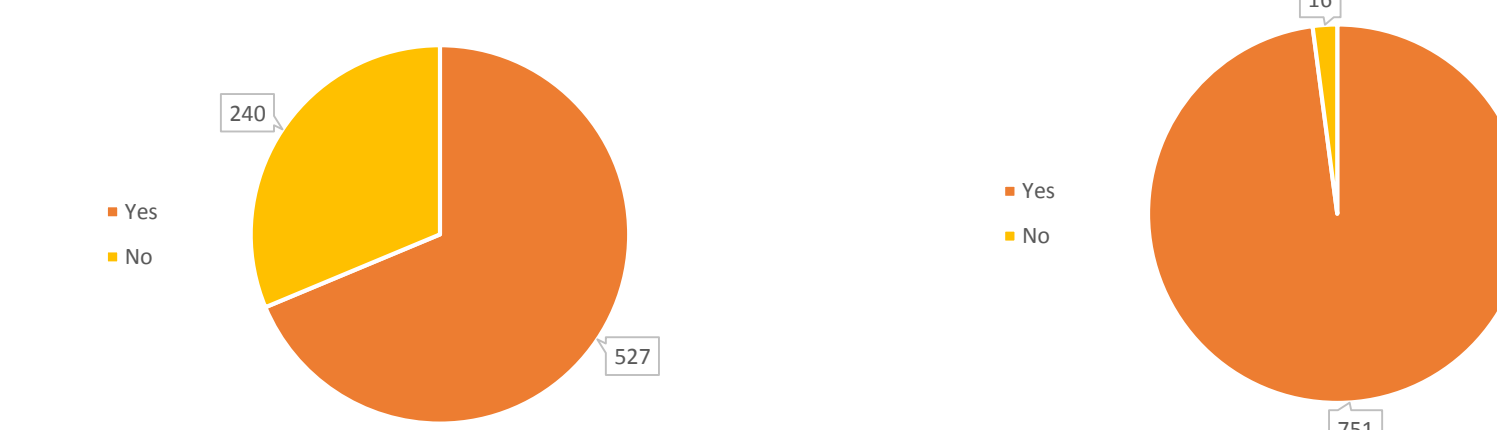


Figure 10: Do You Eat Breakfast?

Figure 11: Do You Eat Lunch?

Of the 767 students that were a part of the study, 40% are stunted with a Z score of -2+ (Fig 12). The average Height-For-Age Z-Score (HAZ) was -.72 (Fig 12). The largest outlier was 9.01 standard deviations below the average (Fig 12).

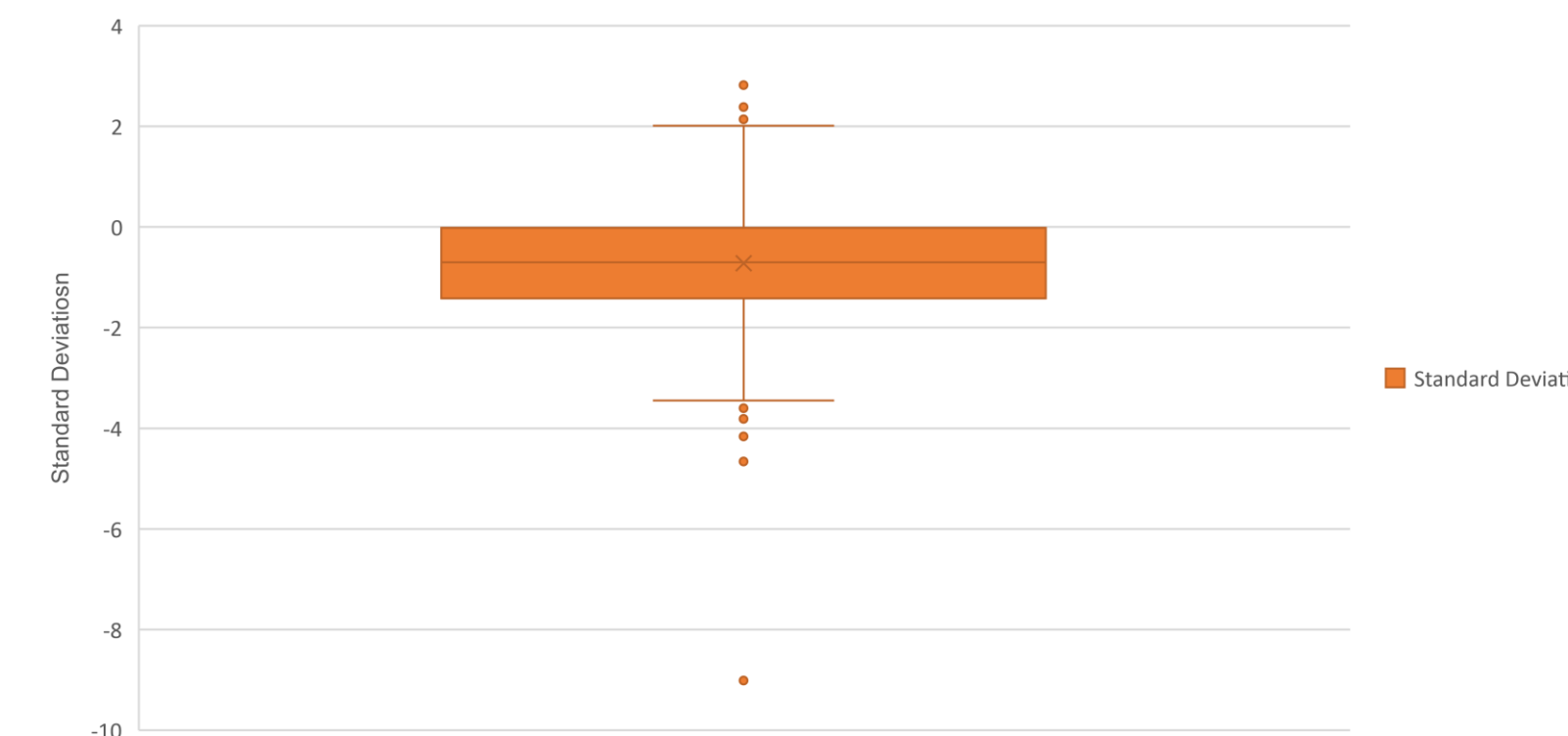


Figure 12: Box & Whisker plot showing HAZ scores

## DISCUSSION

Stunting remains a major factor in the health and wellbeing of Sub-Saharan African populations. Although some factors clearly contribute to poor growth, few studies have been conducted on primary school children, and rarely is energy expenditure considered.

- Nearly all children interviewed have no transportation available (97%), so they must walk to school. A student walks, on average, just under 30 minutes to get to and from school. One 7th grade student stated that he walks a total of 180 minutes every day. There was no statistical relationship between HAZ and minutes walked to school each day.
- In addition to getting to school on foot, 75% of participants run on their own time. The average student runs just over 2.5 hours each week. This is important when thinking about the contributors to a net negative intake of calories. Again, there was no statistically relationship between HAZ and minutes a child reportedly ran each week.
- There are some students (31%) that do not eat breakfast and a small amount (2%) that do not eat lunch. That so many students, n=240, do not eat breakfast is alarming, especially when considering that they walk to school and that food options for lunch are limited.
- Of the 767 students interviewed, 307 were stunted based on WHO height for age standards.
- It is important to acknowledge the lack of clean water and diversity of meals, as well as the temperature outside. This increases the sweat rate, speeding up dehydration. About 25% of the students interviewed did not have access to a clean water source at home.
- If children could expend less energy walking to school, they might be able to decrease stunting, increase MUAC, and improve HAZ values.
- Students in this sample ranged in age from 8-18 years old. However, only 8% were 16 and older.
- Although all students knew some English, and translators were present to interpret as needed, it is possible that some responses were inaccurate based on language issues.

Our sample is not a random one; not all schools gave permission for data collection, some children were absent during assessments, and the study was restricted to May – June 2022 and not longitudinal. In addition, energy expenditure was not measured, rather it was self-reported.  
Despite these limitations, many of the children in this sample are not consuming enough nutrition to account for energy expenditure and this is undoubtedly a factor contributing to stunted growth.

To fully understand the effect energy expenditure has on malnutrition, health data, exercise logs, and food intake would need to be monitored in a longitudinal study. Because so much energy is required in the first decade of life (Gibbons, 2022), programs should be redesigned to provide food at the most critical times for growth for children in Sub-Saharan Africa.



Figure 13: Playing & Teaching Soccer



Figure 14: Preparing a Meal

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Figure 15: Interviewing Students



Figure 16: Livingstone Household Visit