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## Food Sourcing and the Relationship to Height of 6th to 7th Graders in Southern Ethiopia and Zambia

Flora Bescansa Luers

*University of Nebraska Lincoln*

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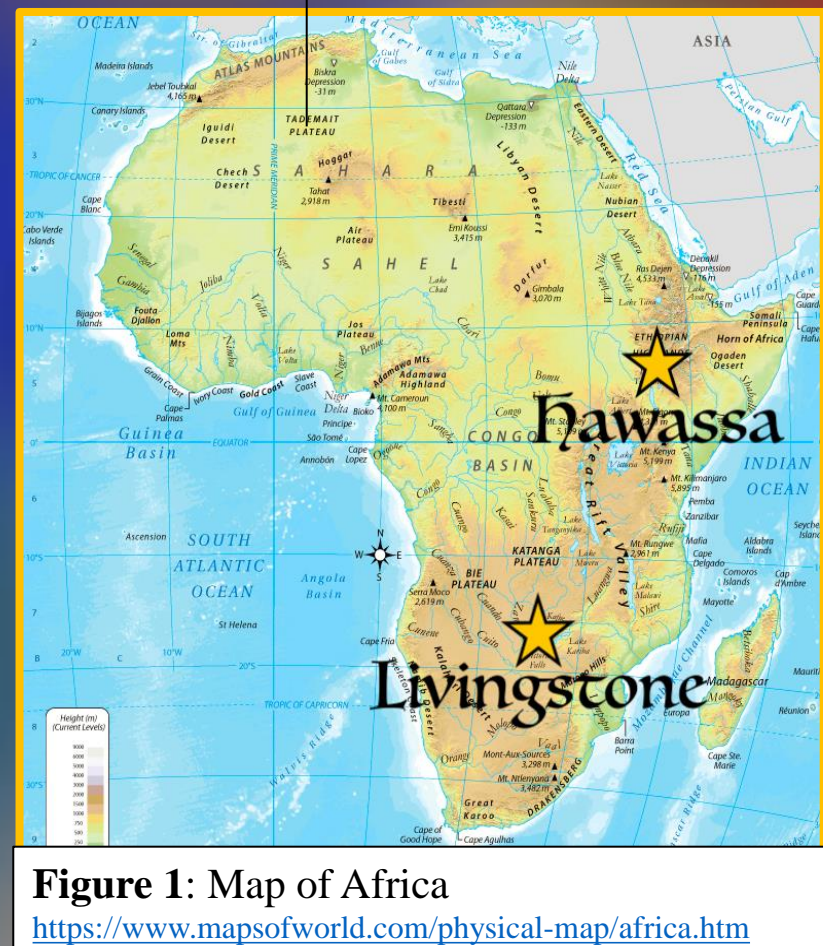
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**Figure 1:** Map of Africa <https://www.mapsofworld.com/physical-map/africa.htm>



**Figure 2:** Cooking *Nshima* in Zambia and Ethiopian Market

## Abstract

**Introduction:** Zambia and Ethiopia are Sub-Saharan African countries experiencing high rates of malnutrition and stunting. This study examines food sourcing and its relationship to stunting.

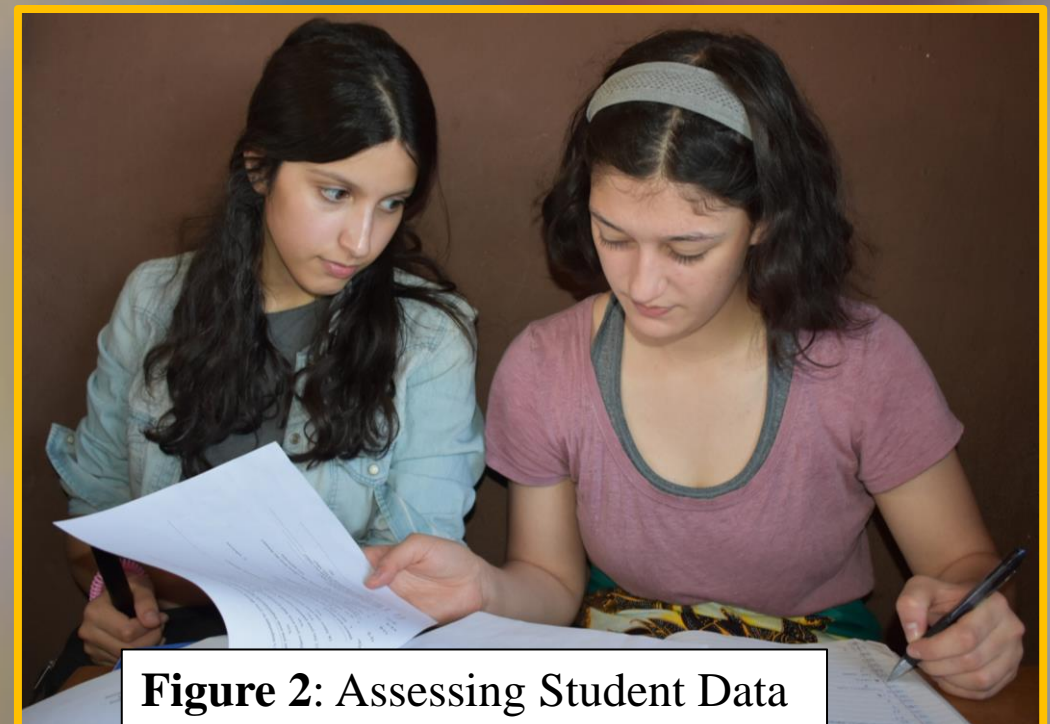
**Methods:** Anthropometric assessment and food frequency-sourcing interviews were taken for 488 6<sup>th</sup>-7<sup>th</sup> graders in Livingstone, Zambia and Hawassa, Ethiopia. Data were analyzed using ANOVA.

**Results:** Most students sourced food from local markets and home gardens; however, Zambian students used a greater variety of sources. Those sourcing from home gardens were significantly taller.

**Discussion:** Home gardening provides economic and health benefits, as well as food security. A focus on preservation and use of indigenous species is essential in increasing food and nutrition security and local biodiversity.

## Introduction

Zambia and Ethiopia are landlocked countries in Southern-Central Africa and the Eastern Horn region, respectively (**Figure 1**). As of 2020, 48% of Zambians were employed in agriculture, compared with 66% of Ethiopians' [12]. Zambia's per capita income was \$1,305.1 PPP, while Ethiopia's was \$855.8 PPP [13]. Both countries have high rates of malnutrition and growth stunting, reflecting that about 25% of the world's population suffering from hunger are from Sub-Saharan Africa [2]. About 40% of children under 5 in Zambia suffer from chronic malnutrition while approximately 15% of Ethiopia's under-fives face acute malnutrition and 38% from chronic malnutrition [14-15]. On average, a child in Ethiopia consumes 1.6 food groups, while only 5% consume daily consumption of four groups or more as recommended by WHO [8]. Both countries are experiencing a nutrition transition, but there is a marked difference between Zambia and Ethiopia [10-11]. Food and nutrition security cannot be attained with an understanding of food availability and accessibility. Consequently, this study focused on where families source their food and how often they do so.



**Figure 2:** Assessing Student Data



**Figure 3:** Interviewing in Zambia

## Methods

**Research Site:** Southern Zambia and Ethiopia, cities and surrounding areas within one hour of Livingstone and Hawassa, respectively (**Figure 1**).

**Research Period:** Late May and early June of 2019 in Zambia, and in June in Ethiopia. IRB # 20150515251EP with voluntary participation and no penalty for withdrawal at any point during the research period.

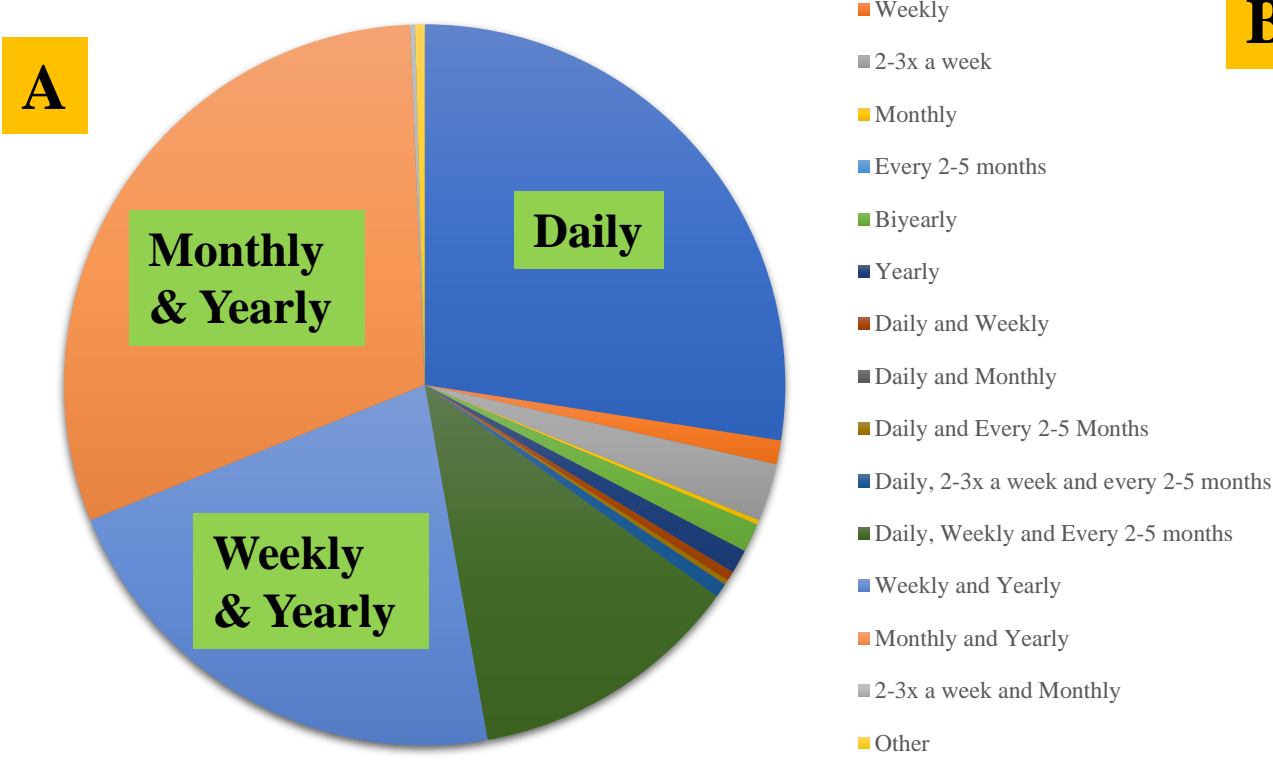
**Research Methods:** (1) anthropometric measures and (2) questionnaires on food dietary composition, and sources for and frequency of food sourcing and consumption as part of a larger study on food security, health and nutrition (**Figure 2, Figure 3**)

### Data Entry and Analysis:

- Data were entered into Microsoft Excel from field notebooks and Uploaded to R for descriptive and multivariate analyses
- For this project, demographic information, student height and sources for food acquisition were assessed and analyzed
- R was used to run ANOVA, using a data set that had been categorized through a hierarchical cluster analysis.
- Age and weight were controlled for in each analysis

## Results

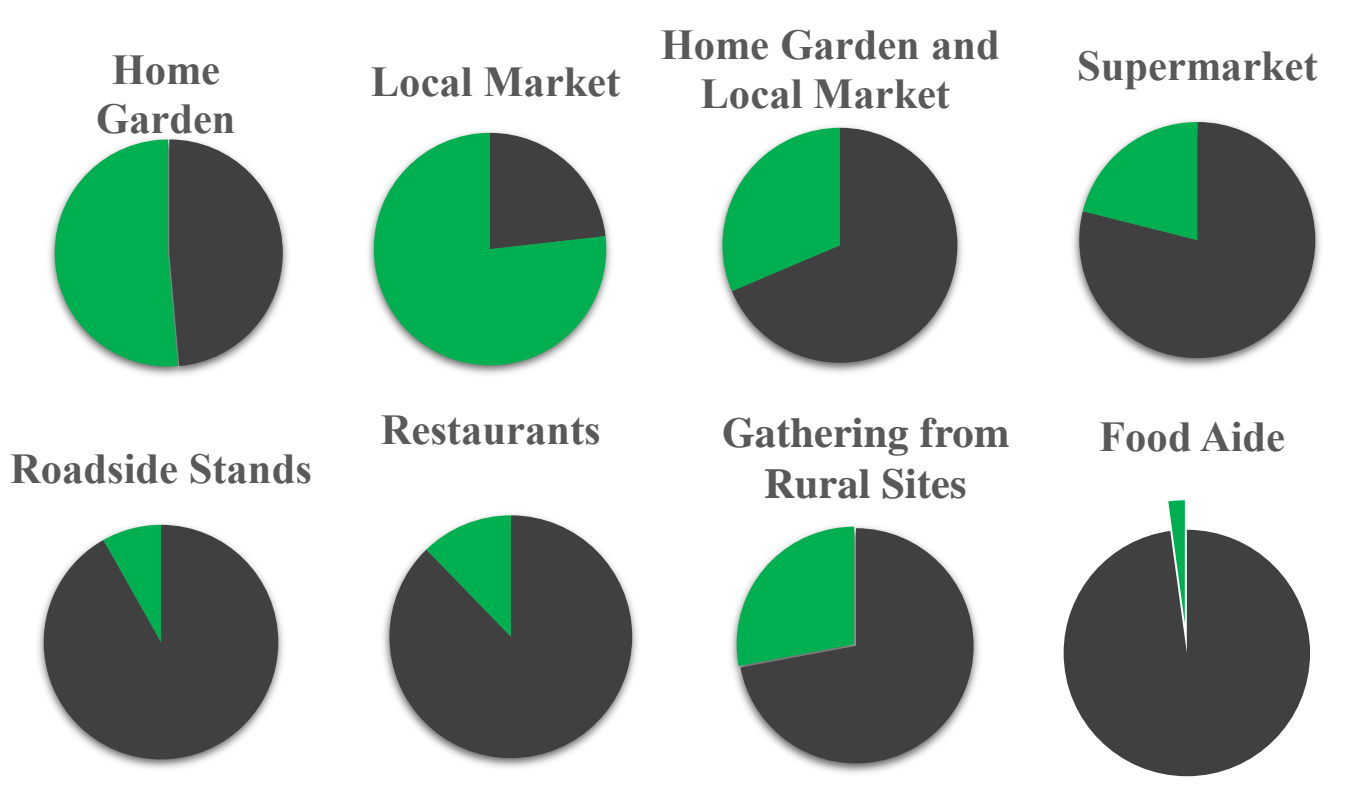
### Food Acquisition Frequency



**A:** The frequency of food acquisition reflects the total student sample. The most common responses for food acquisition frequency include “Monthly and Yearly” (30%), “Daily” (27%), and “Weekly and Yearly” (22%).

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### FOOD SOURCES



**B:** Students sourced food from the seven discrete categories, and combined categories “Home Garden” and “Local Market” The most popular food sources are “Home Garden(s)” (**Figure 4**) accounting for 51% and “Local Market” (**Figure 7**) accounting for 77%, with the overlap between these two sources accounting for 31% of students.

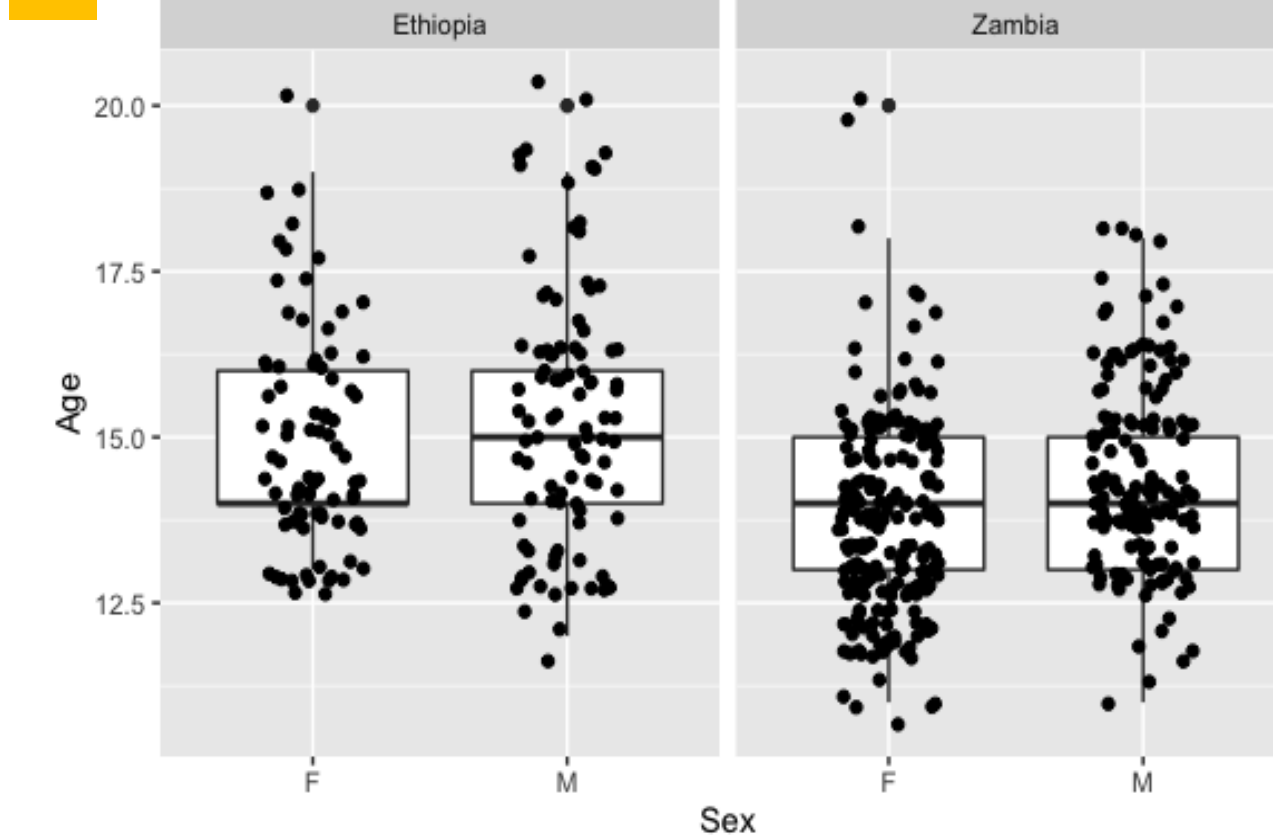


**Figure 4:** *Khat* at a home garden in Ethiopia



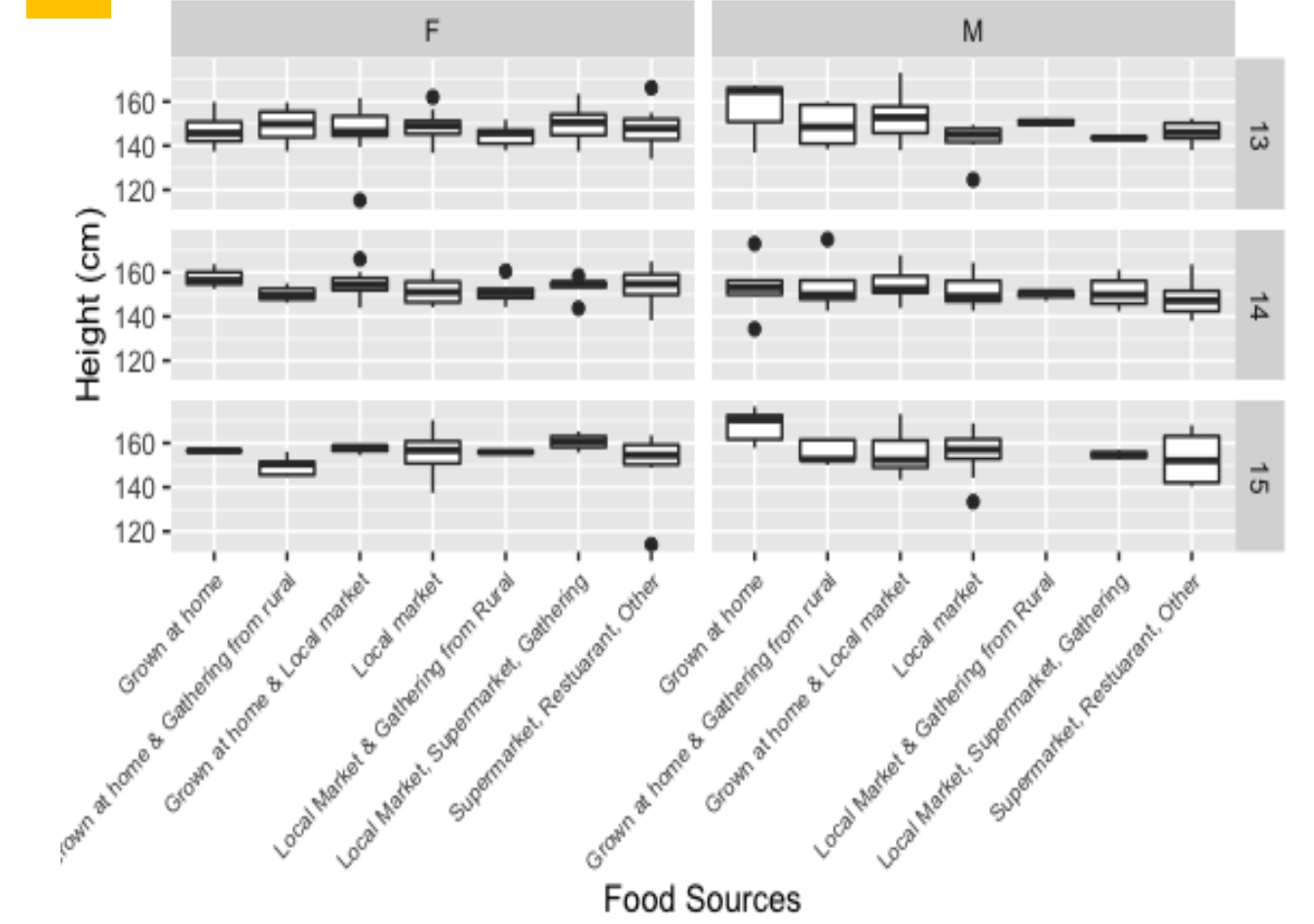
**Figure 5:** Research team from UNL-Hawassa

### C Age of 6th and 7th Graders in Southern Zambia and Ethiopia



**C:** The average age of students in Ethiopia was older than those in Zambia.

### D Height by Food Source Cluster (and Sex and Age)



**D:** The difference in height associated with the food source clusters was more evenly spread in the females than the males. There is a significant relationship between height and diets primarily sourced from a home garden (F=2.752, p=0.0129).



**Figure 6:** *nshima*, staple food of Zambia



**Figure 7:** Spices/Grains/Legumes in Ethiopian Open-air Market



**Figure 8:** *injera*, staple food of Ethiopia

## Discussion

- Ethiopia and Zambia are experiencing a nutrition transition, with approximately 40% of children undernourished. However, to address malnutrition and food security, data on food availability and accessibility is needed.
- Many students listed multiple intervals in which they acquire food. For example, some noted that their families visited the market daily, but harvested plants from home gardens once or twice a year. As a single category daily food acquisition was the most common response, supporting the idea that students are mostly consuming fresh food.
- The diets of 6-7<sup>th</sup> graders in Southern Zambia and Ethiopia are primarily sourced from home gardens and local markets. Home gardens ensure food security and consistent access to high nutrient foods. They can also be an important way to preserve indigenous food [1,3]. Consuming recently harvested produce may mean less nutrient loss compared to produce sold at the local markets and supermarkets [6][7].
- Students mainly sourcing their food from home gardens are more likely to be taller. This may suggest quicker and easier access to food. In addition to the physical benefits acquired from home gardens and local markets, these food sources also allow for economic mobility if families choose to sell surplus crops [7].
- Proximity to water or forests impacted use of locally foraged and fished foods; e.g., boys living near water fishing for their families and those in remote areas gathering indigenous fruits. Wild foods are an important resource for floral and faunal biodiversity, as well as providing a consistent source of food and income for vulnerable populations [4].
- Investing in home agriculture and diversifying diets in these populations may have a positive effect on the student's health. Moreover, incorporating indigenous and pre-colonial foods into diets provides both cultural and health benefits.

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