



Anthropometric measures of Hadza forager children and juveniles: Implications for Anthropology and Human Biology

Elle Ford & Alyssa N. Crittenden

McNair Scholars Institute, University of Nevada, Las Vegas



RONALD E. MCNAIR
POST-BACCALAUREATE
ACHIEVEMENT PROGRAM

Introduction

Understanding growth trajectories during child development is important for the fields of human biology, public health, medicine, and evolutionary medicine. To date, the majority of current references for childhood development and health are primarily derived from the World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC). To ensure a child is developing properly, is equipped with proper nutrition, and will sustain a healthy life through adolescence and adulthood, these measurements and standards are necessary. The current study aims to test whether or not these standards are applicable in non-industrial small-scale societies where differences from western populations include diet composition, environmental pressures, climate, economic activity, mortality rates, and childhood physical activity levels.

The Hadza

Currently residing in northern Tanzania, they are settled around the alkaline Lake Eyasi – the population is comprised of about 1000 people, of which only about 150-200 continue to forage. Data from mitochondrial DNA (mtDNA) suggests that the Hadza have some of the oldest known mtDNA tested from any population – dating to approximately 50,000 years ago (Tishkoff et al. 2007). The Hadza diet consists of both plant foods (berries, wild roots, legumes, and baobab fruit) and animal foods (game meat, birds, and honeycomb). The Hadza also offer a unique perspective on childhood – both cross culturally and in an evolutionary perspective. Hadza children are incredibly productive economically (Bleek 1931; Blurton Jones et al. 1989; Crittenden et al. 2013).



Lake Eyasi, Tanzania



Methods

Anthropometric data were collected in five camps over three field seasons during 2004 and 2005 by Alyssa Crittenden and colleagues. The current project reports child and adolescent height, weight, and body mass index (BMI [weight (kg)/height²(m²)]), and percent body fat (BF%) for a group of Hadza foragers living in the bush. In order to determine age and sex specific patterns, we analyzed trends in age vs. weight, age vs. height, age vs. BMI, and age vs. BF%, coded for sex. Two-tailed t-tests were then used to examine effects of sex and age on growth trajectories.

Results

Males are both significantly taller ($p=.009$) and heavier ($p=.002$) than their female counterparts. While females have a significantly higher body fat percentage (BF%) than their male counterparts ($p=.029$), males have a significantly higher BMI ($p=.0197$) – despite similar ranges in BMI values (males = 13.4-21.7 kg/m²; females = 13.1-22.4 kg/m²). When comparing our data to WHO growth reference studies, we found that the Hadza fall into the “stunted” category for height and “wasted” category for weight – yet in the healthy range for BMI. This suggests that Hadza children are healthy, yet small in stature. More data is needed with a larger sample size in order to determine what this means for health patterns in the future as the diet continues to change.

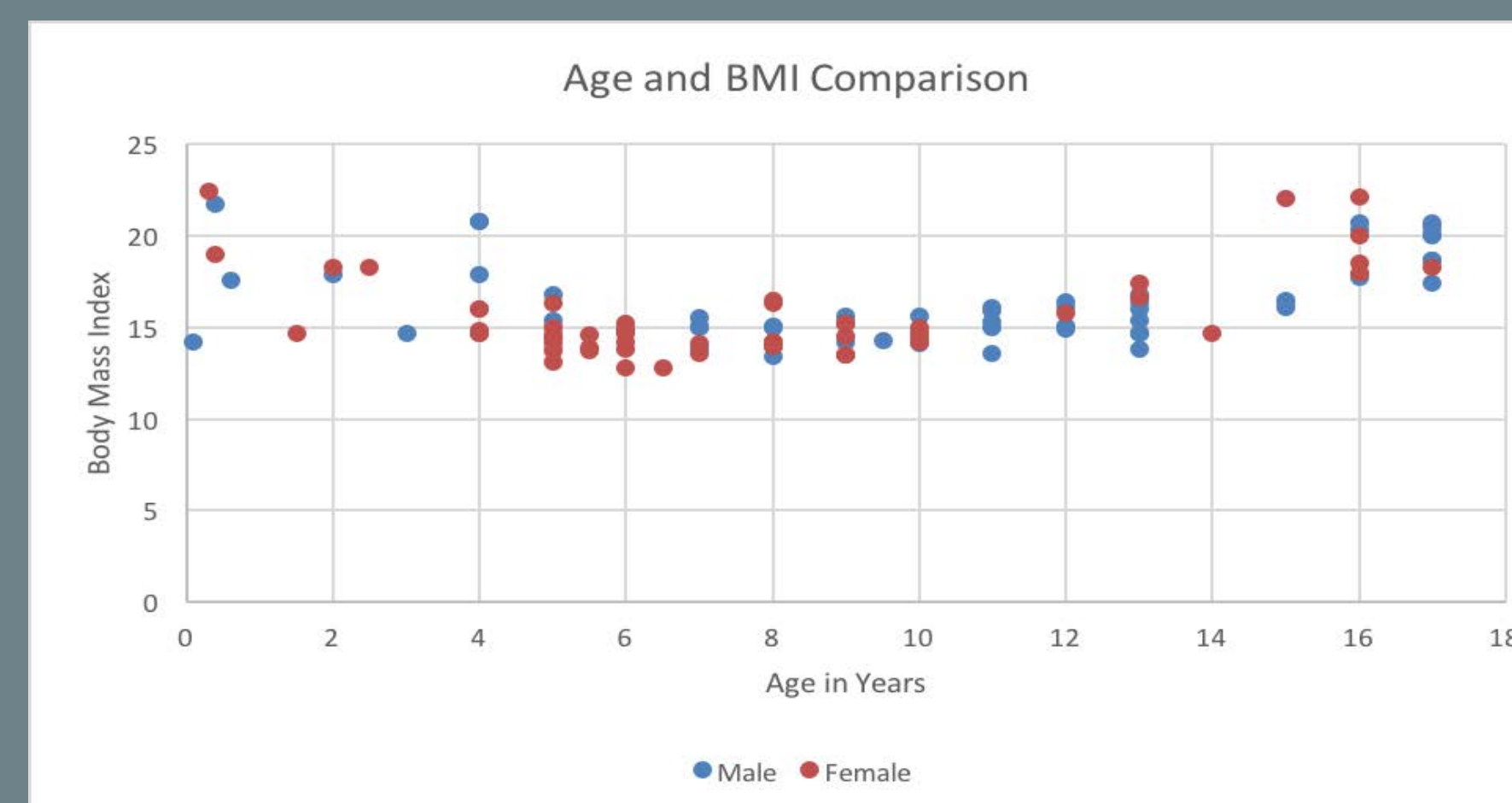


TABLE 1. Descriptive summary of anthropometric data

	Males (n=54)			Females (n=60)		
	Mean	SD	Range	Mean	SD	Range
Age (years)	10.4	0.4	0.1-17	7.7	3.9	0.3-17
Height (cm)	124.9	27.8	42-152	112.5	21.6	50.0-150.9
Weight (kg)	27.1	12.3	2.5-47.8	20.6	9.9	5.6-41.3
BMI (kg/m ²)	16.5	2.2	14.2-20.7	15.5	2.2	22.4-18.3
BF%	11.1	4.6	2-21.5	13.5	7.0	6.5-20

SD, standard deviation; BMI body mass index; BF%, percent body fat

Conclusion

What we can say about forager children, in general, based on a comparison of other small-scale non-industrial populations is that while some growth metrics fall within the range that WHO considers healthy, the majority do not. Future work will need to tease apart population specific growth tertiles for the Hadza and calculate weight-for-height, height-for-age and weight-for-age using the Z-score classification system. The information from this study is critical for many reasons. First, the data highlight how important it is to obtain values from many different populations (outside of the post-industrialized west) in order to better understand basic variation in human patterns of growth. Second, these data facilitate a greater comprehension of cross-cultural variation among small-scale non-industrial populations, particularly foragers. Lastly, the current project may aid in the assessment of the nutrition status of Hadza adolescents as they continue to transition away from a wild diet to one that is dominated by domesticated cultigens.

Works Cited

Marlowe, Frank. *The Hadza: hunter-gatherers of Tanzania*. Vol. 3. Univ of California Press, 2010.

Tishkoff, Sarah A., Mary Katherine Gonder, Brenna M. Henn, Holly Mortensen, Alec Knight, Christopher Gignoux, Neil Fernandopulle et al. "History of click-speaking populations of Africa inferred from mtDNA and Y chromosome genetic variation." *Molecular biology and evolution* 24, no. 10 (2007): 2180-2195.

Bleek, Dorothea F. "The Hadzapi or Watindega I of Tanganyika Territory." *Africa* 4, no. 3 (1931): 273-286.

Jones, N.G.B., Hawkes, K. and O'Connell, J.F. (1989). Modeling and measuring costs of children in two foraging societies. In V. Standen and R.A. Foley (Eds.), *Comparative Socioecology* (pp. 367-390). Oxford: Blackwell Scientific.

Crittenden, A. N., Nancy L. Conklin-Brittain, David A. Zes, Margaret J. Schoeninger, and Frank W. Marlowe. "Juvenile foraging among the Hadza: implications for human life history." *Evolution and Human Behavior* 34, no. 4 (2013): 299-304.

Acknowledgments

This material is based upon work supported by the National Science Foundation under grant numbers 0242455 and 1548143, UNLV OUR, and UNLV McNair. We would also like to extend thanks to the Hadza for their participation in this research.