Analysis of Daasanach growth in relation to ecology and subsistence strategy

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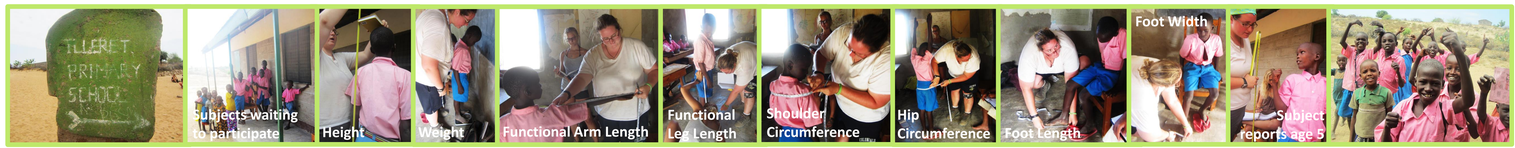
INTRODUCTION

Body size is highly variable across modern human populations. Adult body size is the product of the interactions between genetic information and extrinsic nutritional and environmental factors during subadult growth and development. Research on the effects of these extrinsic factors on growth, relative adult size, and life history strategies among some traditional societies has led to a theoretical basis to understand variation in body size among modern humans. Furthermore, studies spanning traditional populations have shown correlations between growth patterns and ecological factors (Walker et al. 2006). However, deviations from theoretical life history patterns raise interesting questions concerning adaptation to environmental conditions. In this study, a cross- sectional ontogenetic sample from the Daasanach tribe, a traditional African savanna/ desert pastoralist group from Ileret, Kenya on the northeast coast of Lake Turkana was measured to test the hypothesis that their growth follows the expected pattern from ecologically similar groups of a delayed and long adolescent growth spurt following a rapid childhood growth.

METHODS

- Data collected from Daasanach individuals from Ileret, Kenya (n=223; males: n=177, females: n=46).
  - Subadults (age <25) sampled from the Ileret Primary School where students are provided daily meals to control for unknown age and socio-economic factors that may affect nutrition and health (n= 213; males: n=171, females: n=42).
  - Adults (25<age<55) recruited from the Ileret Catholic Mission, age not always precisely known, no control for socio-economic status (n=10; males: n=6, females: n=4).
- Subjects measured once where recorded value agreed upon by two researchers.
  - Measurements: Stature, Weight, Functional Arm Length, Functional Leg Length, Shoulder Circumference, Hip Circumference, Foot Length, and Foot Width at Distal Metatarsal Heads.
- Ages reported by subject or school administrator.



- For the purposes of this study only height data were used from male subjects.
- Data were analyzed using LOESS Regression to obtain growth velocity curves, and t- tests to compare sample populations.

RESULTS

- Compared to other traditional populations, Daasanach males exhibit an early adolescent growth spurt at all critical points: take off velocity, peak velocity, and return to take off velocity (Figure 3).
- Daasanach males adhere to the trend of decreased adolescent growth spurt duration (ARTO-ATO) with increased adult stature (Figure 4).
- Daasanach males show a slower childhood (age 3-10) velocity than expected for their adult stature (Figure 5).

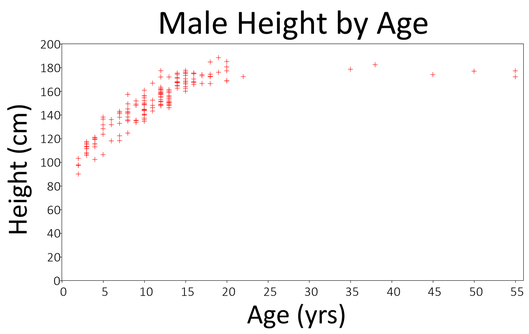


Figure 1. Heights (cm) of male Daasanach subjects by age.

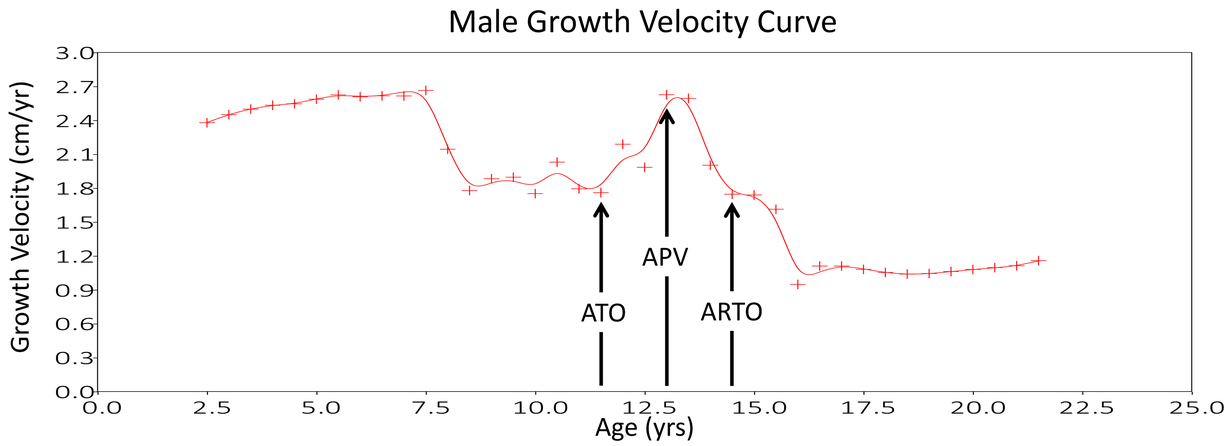


Figure 2. Subadult male Daasanach growth velocity (cm/yr) curve showing age at take off velocity (ATO), age at peak velocity (APV), and age at return to take off velocity (ARTO).

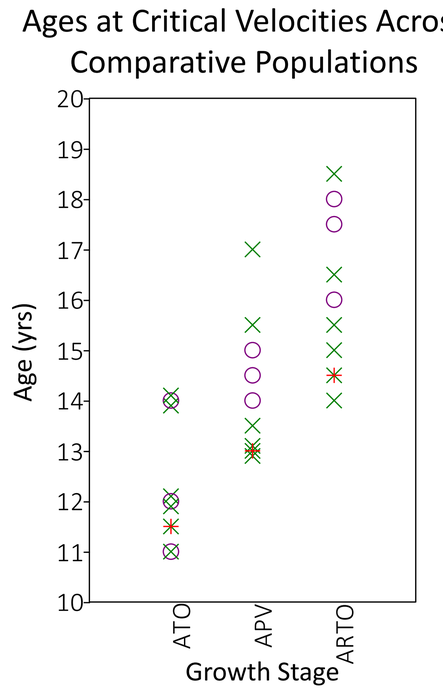


Figure 3. Age at Take Off Velocity (ATO), Age at Peak Velocity (APV), and Age at Return to Take Off Velocity (ARTO) for the Daasanach (red cross), six ecologically similar populations (green x), and three ecologically dissimilar populations (purple circle). Data for comparative populations obtained from Walker et al. 2006.

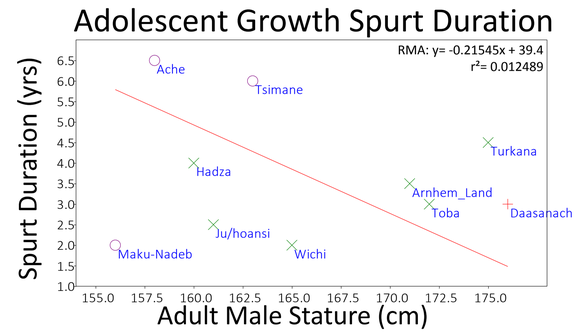


Figure 4. Adolescent growth spurt duration (ARTO - ATO) for each population by adult body size. Populations coded by ecological type as described in Figure 3. Data for comparative populations obtained from Walker et al. 2006.

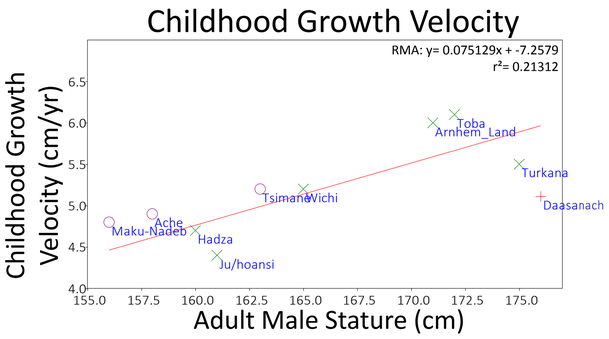


Figure 5. Childhood growth velocity (age 3-10) for each population by adult body size. Populations coded by ecological type as described in Figure 3. Data for comparative populations obtained from Walker et al. 2006.

DISCUSSION AND CONCLUSIONS

In testing the hypothesis that Daasanach growth patterns match that expected based on their ecological factors the results show that:

- From the comparative populations, ecological type distinctly groups populations in respect to adult height, however, growth trajectory does not group showing highly variable growth trajectories towards similar final heights.
  - Daasanach grow slowly during childhood for their adult height compared to other reported populations.
  - Daasanach reach critical velocities (take off, peak, and return to take off) that describe the adolescent growth spurt at early ages compared to the other populations.
  - The duration of the Daasanach growth spurt is relatively short for their adult height.
  - Though the critical velocities are unfortunately unavailable for the comparative populations, Daasanach may have a much higher absolute growth velocity during the adolescent growth spurt than expected.
  - A more intense growth spurt explains how the Daasanach can surpass most other populations in stature though they obtain less of their growth during childhood and experience short growth spurt duration.
- Further investigation into other external factors such as nutritional availability or mortality risk is needed to better understand variations in growth trajectories independent of a population's adult stature.

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