

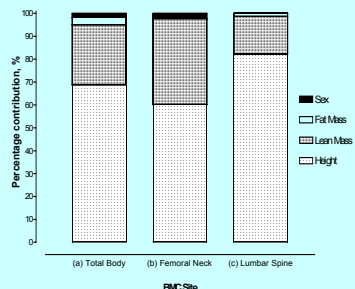


# The Effects of Physical Activity on Bone Mass Development: A 15-Year Prospective Study During Adolescents And Young Adulthood

A.D.G. Baxter-Jones, R.L., Mirwald, K.C.  
Kowalski, D.A. Bailey

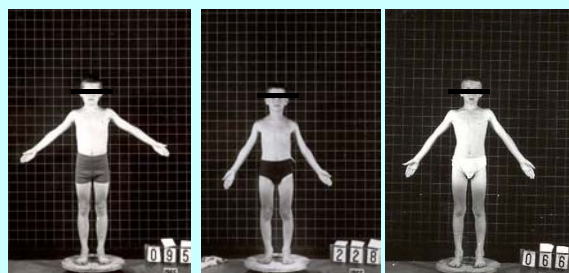


**Site-specific percentage contributions of each fixed effect in a hierarchial models on the predication of bone mineral content (BMC) at peak height velocity (PHV).**



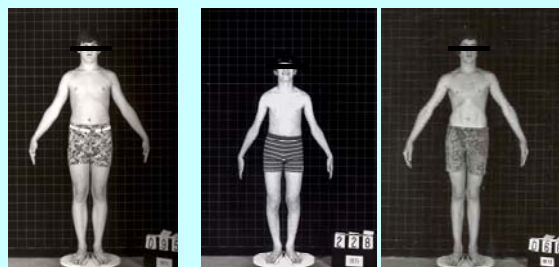
A. D. G. Baxter-Jones, R. L. Mirwald, H. A. McKay, and D. A. Bailey. A longitudinal analysis of sex differences in bone mineral accrual in healthy 8 to 19 year old boys and girls. *Ann Hum Biol* 30 (2):160-175, 2003.

## Three Boys Age 7



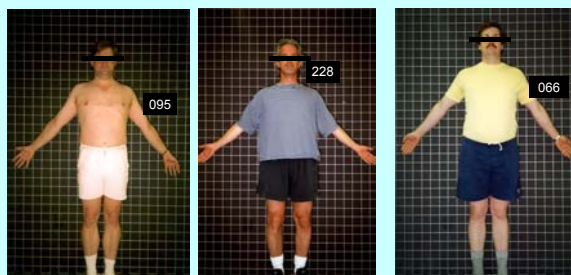
Age 7.3 Ht 128 Wt 25.5      Age 6.7 Ht 120 Wt 21.6      Age 7.1 Ht 130 Wt 25.9

## Three Boys Age 14



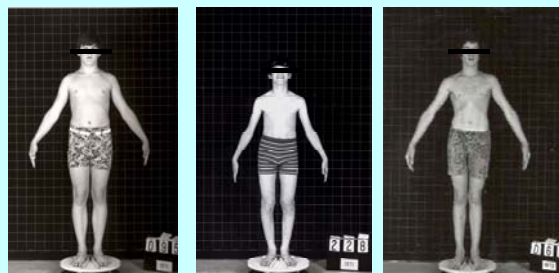
Age 14.3 Ht 173 Wt 67.9      Age 13.6 Ht 156.5 Wt 41.5      Age 14.1 Ht 173.6 Wt 55.4

## Three Men Age 40



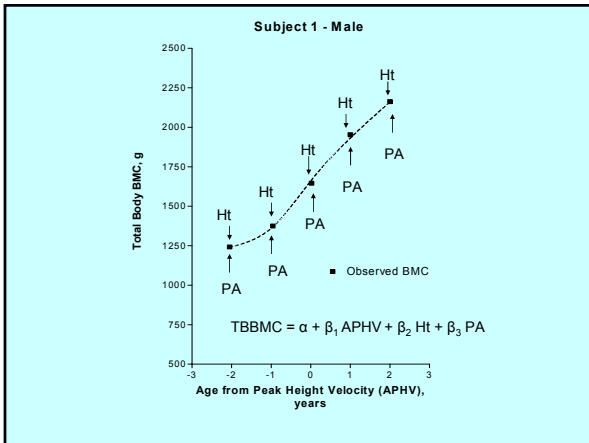
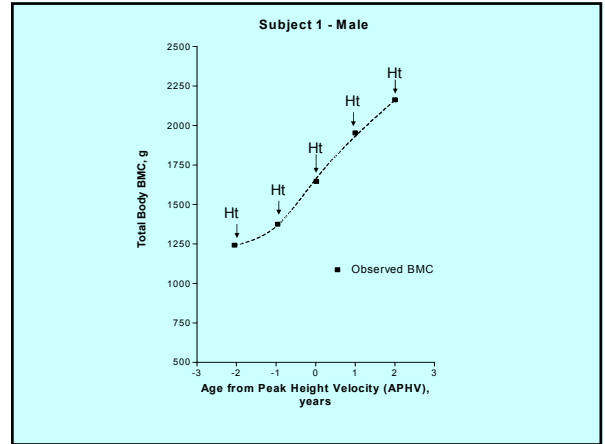
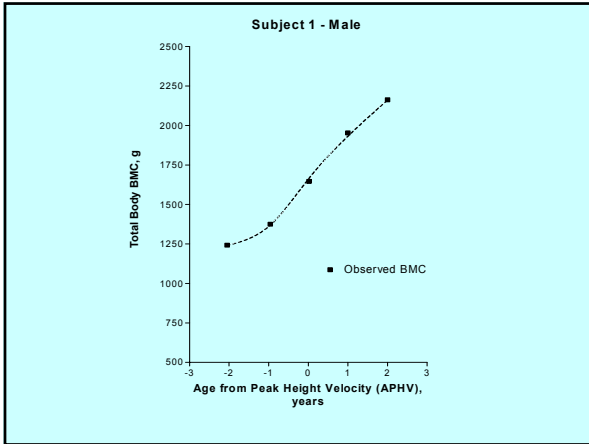
Age 40.4 Ht 179.3 Wt 97      Age 39.7 Ht 180 Wt 83      Age 39.8 Ht 195 Wt 118

## Three Boys Age 14



Age 14.3 Ht 173 Wt 67.9 Remaining growth = 6.3 cm  
Age 13.6 Ht 156.5 Wt 41.5 Remaining growth = 23.6 cm  
Age 14.1 Ht 173.6 Wt 55.4 Remaining growth = 21.5 cm





### Analysis

(EQ 1)  $y_i = \alpha + \beta x_i + \varepsilon$   $i = n$  measurements  
(1-7)

Fixed Effects      Random Effects

(EQ 2)  $y_{ij} = \alpha_j + \beta x_{ij} + \varepsilon_{ij}$   $j = n$  subjects  
(1-251)

2 levels of variance within individuals and between individuals

(EQ 3)  $y_{ij} = \alpha_j + \beta_j x_{ij} + \varepsilon_{ij}$

### Analysis

(EQ 4)  $y_{ij} = \alpha_j + \beta_j x_{ij} + \beta_j x_{2ij} + \dots + \varepsilon_{ij}$

$TBBMC_{ij} = \alpha_j + \beta_{1j} APHV_{ij} + \dots + \beta_{Htj} Ht_{ij} + \beta_{PAj} PA_{ij} + \varepsilon_{ij}$

$TBBMC = -715.3 + (69.1 * APHV) + (9.08 * APHV^2) - (1.48 * APHV^3) + (6.45 * Ht) + (0.03 * Lm) + (0.01 * Fm) + (11.2 * PA)$

TBBMC = total body bone mineral content (g)  
 APHV = biological age  
 Ht = height (cm)  
 Lm = lean mass (g)  
 Fm = fat mass (g)  
 PA = physical activity (score 1 to 5).

### Independent Effect of Physical Activity

$PA * 11.2 \pm 5.2 \text{ g}, p > 0.05$

So, what does this all mean?

If you had 2 boys of the same biological age, stature, lean and fat mass, but different PA level then ...

Most Active PA = 5 ; this would add 56 g BMC to TBBMC

Least Active PA = 1 ; this would add 11.2 g BMC to TBBMC

## Summary

- For a child of the same sex, age and size
- We predict the most active will have 44.8g more Total Body BMC than the least active

## Conclusion

Physical activity has a significant independent effect on TBBMC accrual during childhood and adolescence

## ACKNOWLEDGEMENTS

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BMAS Group members include D.A. Bailey, A.D.G. Baxter-Jones, P.E. Crocker, K.S. Davison, D.T. Drinkwater, E. Dudzic, R.A. Faulkner, K. Kowalski, H.A. McKay, R.L. Mirwald, W.M. Wallace, S.J. Whiting