## Results

The estimation results are summarized in Table 2. All level-1 fixed effects and level-2 random effects were found to be significant at the 0.01 level. To facilitate straightforward comparison of the causal effects, all variables were transformed/standardized to a mean of zero and standard deviation of one. Conclusions based on non-standardized values support identical inferences.

The results are consistent with the relationships postulated by the functional model of bone development. Modulators influence muscle strengthd, which in turn, along with modulators influences bone properties. Therefore, modulators that influence muscle strength have an indirect influence on bone properties. In terms of standard unit changes, the direct impact of muscle strength and physical maturation on bone properties was 0.29 and 0.18. Physical maturation also influenced bone properties through its impact on muscle strength. The unit impact of physical maturation on grip strength was 0.62. Therefore, the indirect impact of physical maturation on bone properties was 0.18 (0.29 0.62). The total impact of physical maturation on bone properties was 0.81 (0.62 0.29 $0.62).

Modulators influence muscle strength, which in turn, along with modulators influences bone properties. Specifically, muscle strength changes are explained by physical maturation and energy intake and bone proprety changes are explained by muscle strength, osteoclast activity, and physical maturity. The mediating effect of muscle strength

In SEM terminiology, muscle strength mediated the effect of physical maturation and energy intake on bone properties. Therefore, caloric intake indirectly influenced bone properties and physical maturation both directly and indirectly influenced bone properties.

In terms of standard unit changes, the direct impact of muscle strength and physical maturation on bone properties was {rg} and {rm}. However, physical maturation also influenced bone properties through its impact on muscle strength. The unit impact of physical maturation on grip strength was {gm}. Therefore. the indirect impact of physical maturation on bone properties was {irm}, resulting in a total impact of {trm}.

Osteoclast activity had a similar effect in boys and girls ({bn} and {gn}). The impact of physical maturation on muscle strength was {DMM} points greater for boys than girls, albeit the difference is not significant.

The estimation results are summarized in Table 2. All level-1 fixed effects and level-2 random effects were found to be significant at the 0.01 level. To facilitate straightforward comparison of the causal effects, all variables were transformed/standardized to a mean of zero and standard deviation of one. Conclusions based on non-standardized values support identical inferences.

txt /// The results are consistent with the relationships postulated by the functional model of bone development. Physical maturity and nutrition influence muscle strength, which in-turn, along osteoclast activity, and physical maturity influences bone properties. In SEM terminiology, muscle strength mediates the effect of physical maturation and energy intake on bone properties. Therefore, caloric intake indirectly influenced bone properties and physical maturation both directly and indirectly influenced bone properties.