PHYSICAL CONDITIONING AND POSTURAL CONTROL IN ADULTS WITH ACHONDROPLASIA

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1 INTRODUCTION

Achondroplasia is a rare skeletal condition characterized by disproportionate short stature. Adults with achondroplasia face unique mobility challenges due to their skeletal proportions. They tend to exhibit poor physical activity compared with the general population [1-3]. Previous studies have established relationships between physical activity, handgrip strength (HGS), and postural control through centre of pressure (CoP) metrics [4,5]. Individuals with achondroplasia exhibit lower levels of physical activity due to biomechanical limitations [2], which are associated with decreased muscle strength and impaired postural control [1,2]. However, these associations remain unexplored in adults with achondroplasia. This study explores these relationships in adults with achondroplasia, hypothesizing that physical conditioning may influence postural stability.

2 METHODS

Sixteen adults with achondroplasia participated in the study (10 women, 6 men), mean age 37.2±13.6 years. Postural control was assessed using a Bertec® force plate during bilateral and unilateral standing tasks, performed each for 30 seconds: bipedal eyes opened (OE) and closed (CE), and unipedal open eyes with right foot (RF) and left foot (LF). Centre of pressure (CoP) linear measures Ellipse area (Area), amplitude (Amp) and nonlinear measures such as Sample Entropy (SaEn) and Correlation Dimension (CoDim), in both anteroposterior (AP) and mediolateral (ML) directions. Physical conditioning variables included handgrip strength (HGS); 6-minute walk test (6MWT), and self-reported physical activity level assessed by the International Physical Activity Questionnaire (IPAQ). Daily physical activity score (PAS) measured in metabolic equivalents (METs) was calculated. Data were analysed using Spearman correlation and linear regression models. Significance level was set at $p<0.05$.

3 RESULTS

Participants exhibited lower values compared with reference population, on a. physical activity scores (825±819 METs), with 56.25% classified as inactive (257±127METs), 43.75% as moderately active (1554±1485METs) and 0% as highly active, b. the 6MWT distance with a mean value of 396±85.1 m and c. a mean HGS of 11.3±5.43 kg [6-8]. Significant correlations were found between the 6MWT with Area_OE (rho=0.661, $p<0.001$) but not with Area_CE nor unilateral tasks. 6MWT also correlated with Codim_ML (-0.579), yet in a negative trend.

PAS correlated with unilateral Area_RF (0.514). The HGS showed multiple correlations with postural control measures either in both bilateral and unilateral tasks with note to Amp_AP_L (0.697, $p<0.01$), and in a negative trend with all analysed nonlinear measures. The most significant relationships were observed between HGS with CoDim_ML unilateral tasks ($R^2=0.625$, $p<0.001$).

4 DISCUSSION

The findings of this exploratory study align with previous studies showing lower physical activity levels in this population [1-3]. The observed lower physical conditioning suggest that reduced physical activity may play a role in balance and stability in adults with achondroplasia. The relationship between 6MWT and Area_OE, absent in other conditions, may reflect compensatory mechanisms in individuals with achondroplasia and altered postural control strategies. Adults with better aerobic capacity (6MWT) might rely more on dynamic adjustments during quiet standing, leading to larger ellipse area, especially when visual input is available to assist in balance control. The negative correlations between HGS and CoDim_ML underscores the role of muscle capacity in postural regulation [4,5] and suggests that individuals with greater handgrip strength tend to exhibit less complex postural control strategies. This may reflect a compensatory mechanism where stronger individuals rely on simpler, less adaptive postural control strategies to counteract these challenges.

5 CONCLUSIONS

This study sheds light into association between physical conditioning and postural control in adults with achondroplasia. Targeted strength training and physical activity programs may play a role to enhance balance and postural control, potentially improving overall functionality and quality of life in this population. Further research should investigate exercise program efficacy tailored to adults with achondroplasia.

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