

INERTIAL AND GEOMETRICAL SEGMENT PARAMETERS FOR FEMALE ELITE GYMNASTS

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OBJECTIVE

➤ To develop a geometrical and inertial model for female elite gymnasts including segment lengths, segment masses and centre of mass locations.

INTRODUCTION

- Body segment parameters (BSP) are essential to the kinetic analysis of human movement.
- Numerous models allowing for the computation of BSPs exist^{1,2}. These models do not necessarily apply to all populations.
- Female gymnasts are young and show a particular body type. They consequently require a model of their own.

RESULTS

- Mean and 95% CI for segments' masses, lengths and CoM locations are presented in Figure 2.
- Regression equations are available in the abstract^a.

METHODS

- 30 female elite gymnasts, performing at least at the national level, were measured during their training season (Table 1).

Table 1 – Subjects' demographics

Variable (n=30)		Mean	SD	Max	Min
Age	(Years)	14.4	3.4	25.0	11.0
Standing height	(m)	1.55	0.09	1.69	1.36
Weight	(kg)	48.29	11.38	73.00	29.90
BMI ⁴	(kg/m ²)	19.95	2.88	25.56	16.13

- Jensen's³ photogrammetric method was applied (Fig.1):
 - Front and side photographs of every subjects were digitized using a semi-automated software designed at the University of Valenciennes (Fig.2).
 - Uniform segment densities were derived from Dempster's⁴ (head, neck and trunk) and Drillis and Contini's⁵ (limbs).
- Hand and forearm volumetry, for volume verification, and tape and caliper anthropometry were performed.
- Mean and 95% Confidence Interval (CI) for segments masses, lengths and centre of mass (CoM) locations were computed. Linear regression equation coefficients for segment masses and lengths were also computed^a.
- Statistical analyses were performed using SPSS® 12.0.

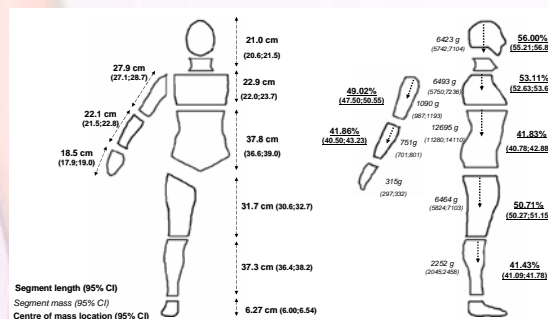


Figure 2 - Mean segment length, mass, and centre of mass location (95% CI)

CONCLUSIONS

- An individualized anthropometry method was applied to a female elite gymnast population.
- Measurement from this sample allowed for the creation of a new anthropometrical model dedicated to this specific population.
- Most of the data investigated showed either $r^2 > 0.6$ (7/10 for segment masses' equations) or 95% CI \leq mean \pm 4,3% (all segment lengths and 7/10 CoM locations).
- This simple method could be used in order to build models for new specific populations (other sports, pathologies, ethnic origins, etc.), or even performed in order to obtain individualized data for a given subject.

LIMITATIONS

- Uniform densities were applied to body segments.
- A limited number of subjects was tested.
- Most distal segments presented obviously biased data.
- Method should be compared to gold standard methods in individualized anthropometry like MRI or DXA methods.

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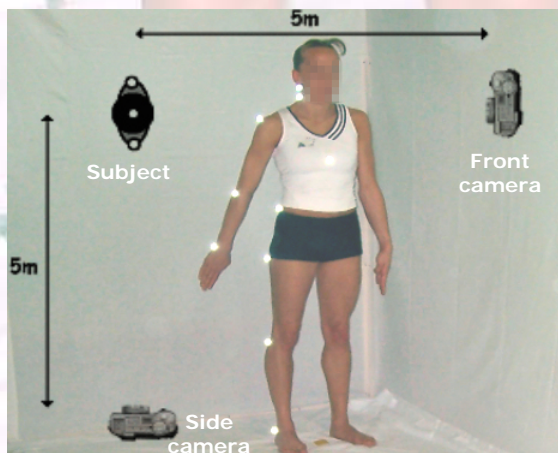


Figure 1 – Jensen's method set up