TBW Assessment by Deuterium Dilution in Spanish Adolescents

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Introduction

Total body water (TBW) assessment is a cornerstone in order to validate equations to estimate body composition components as fat mass and fat free mass. Deuterium dilution technique (D2DT) is considered the gold standard method to assess TBW, however in Spain there are not any reference data using D2DT. The knowledge of specific references for Spanish population must be a goal for the biological studies of Spanish people.

Objective

It was our aim to assess TBW using the D2DT in a sample of Spanish adolescents.

Material and Methods

- 224 specimens of urine from 150 adolescents (113 girls and 111 boys) were taken to analyze. A dose of 0.1 grams of 2D2O per kg of body weight was administrated; afterwards it was followed by 4-hours stabilization period.
- The isotope (deuterium oxide (D2O)) dilution method was used to measure TBW with an isotope-ratio mass-spectrometer.
- Averages by sex and Tanner stages were calculated for %TBW and TBW. General lineal model were used to analyze differences and interactions between groups.

Results

%TBW was significantly different between boys and girls for total sample (59.0±5.6% vs. 55.5±4.3%, *P<0.001; table 1*); nevertheless, this result was not observed in 13 years old group (58.3±4.1% vs. 59.5±7.9%, *P>0.05, figure 2)*. Significant differences were found for absolute TBW (Kg) among 12 years and other groups of age for boys (15, 16 and +17; *P<0.05,* figure 1) and girls (+17; *P<0.05,* figure 1) but not for maturation groups (*P*>0.05).

Table 1. Sample characteristics. Differences between boys and girls.

Variables		Girls (n=113)				Boys (n=111)					Total (n=224)			
		Mean	SD	Min.	Max.	Mean	SD	Min.	Max.		Mean	SD	Min.	Max.
Age	*(years)*	15.1	± 1.7	12.0	19.0	15.1	± 1.7	12	18		15.08	± 1.720	12.0	19.0
Weight	*(kg)*	54.8	± 9.21	34.7	83.1	66.5	± 16.6	36	132.7	***	60.6	± 14.6	34.7	132.7
Height	*(cm)*	159.8	± 6.92	135.5	181.5	169.9	± 8.1	146.5	185.5	***	164.8	± 9.1	135.5	185.5
BMI	*(kg/m2)*	21.4	± 3.05	15.4	31.3	22.9	± 4.7	14.9	40.2	***	22.1	± 4.0	14.9	40.2
TBW	*(Kg)*	30.2	± 4.80	19.6	45.5	38.7	± 7.9	22.7	64.9	***	34.5	± 7.8	19.6	64.9
%TBW	*(%)*	55.5	± 4.28	41.9	66.8	59.0	± 5.6	42.3	69.7	***	57.2	± 5.26	41.9	69.7

***, *P<0.001 for independent sample T-test*

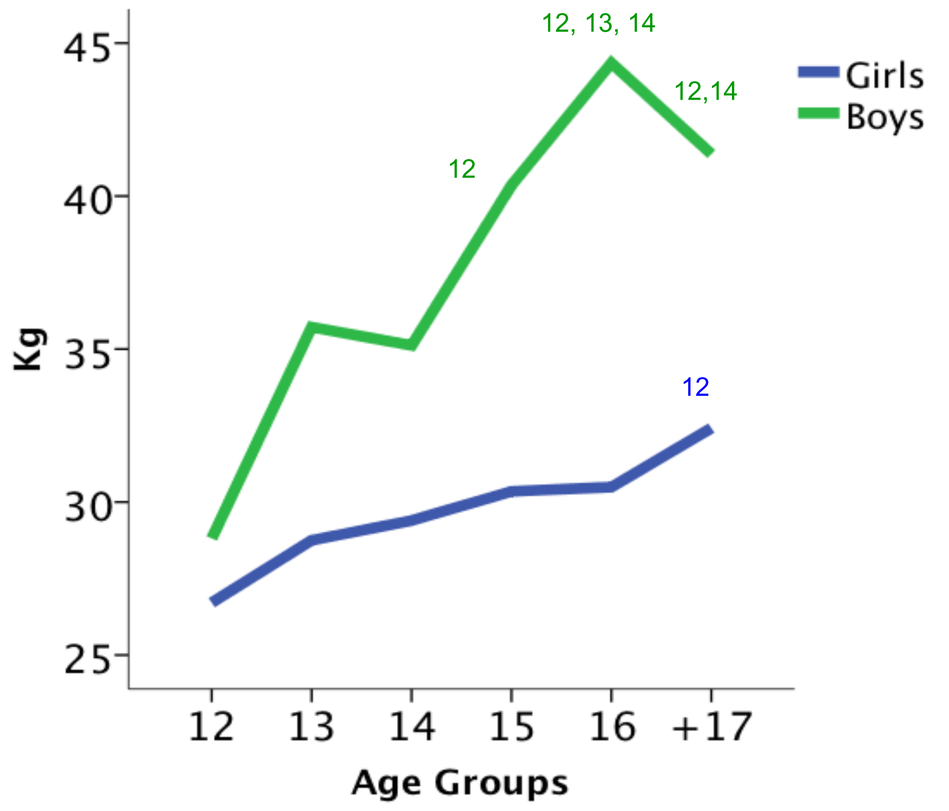

Figure 1. Differences of Total Body Water.
Numbers over the lines indicates significant differences (P<0.05) both categories (number and that where number is over).

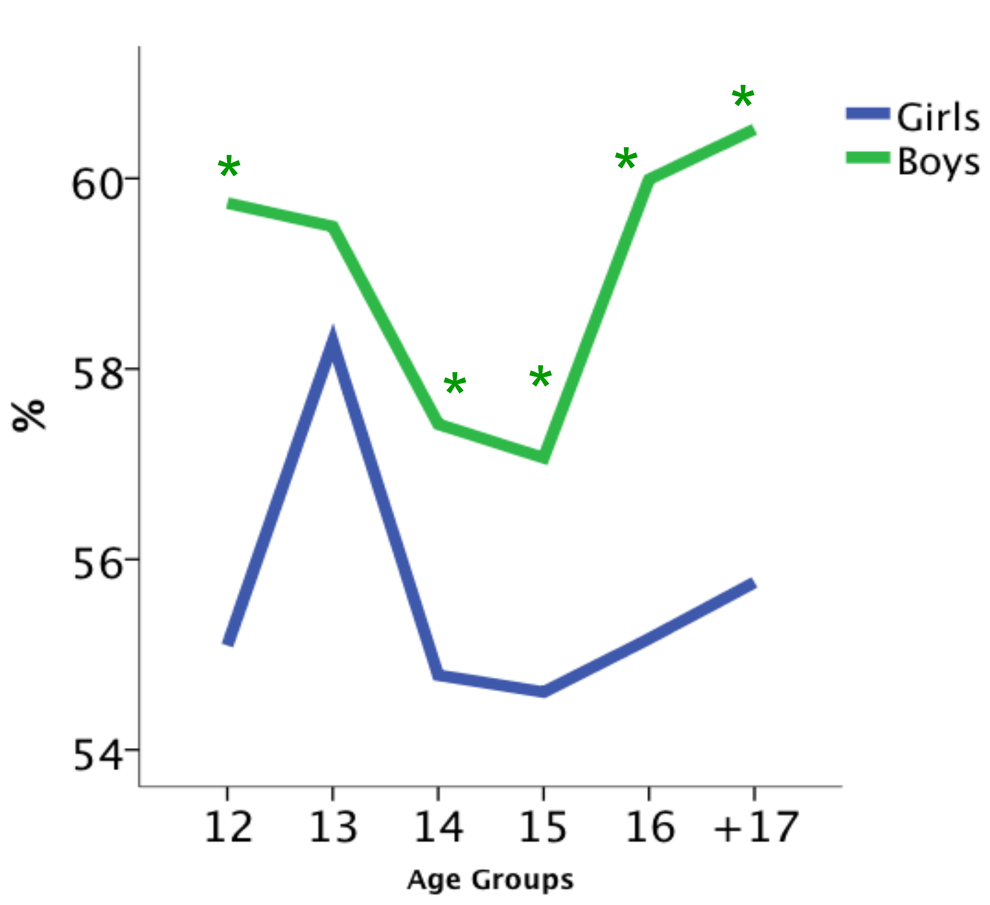

Figure 2. Differences of percent of Total Body Water among age groups and sex.
Asteriscs indicates significant differences between sex (P<0.05)

Discussion

- This study has been the first in Spain, which have measured TBW ***in vivo*** using D2DT. As expected TBW increased significantly along the adolescence. However, girls' TBW appeared to be statistically different only between 12 and 18 groups. In boys the steep gain of TBW after the age of 14 could be a consequence of hormonal changes that occurs during puberty, however this could not be confirmed by maturation assessment with Tanner's photographic models.
- Our D_2O results are partially in accordance with the classical studies (Fomon et col. 1982; Lohman et col., 1986), whom measured TBW in children and adolescents, and showed significant differences each two years.
- These data can be useful to validate new methods and equations from bioimpedance analysis (Quiterio et col. 2010)

References

• **Fomon** SJ, Haschke F, Ziegler EE, Nelson SE. Body composition of reference children from birth to age 10 years. *Am J Clin Nutr.* 1982;35:1169–75.
• **Lohman** TG. Applicability of body composition techniques and constants of children and youths. *Exer Sports Sci Rev*. 1986;14:325–57.
•Quiterio, A.L., *et al.* Total body water measurements in adolescent athletes: a comparison of six field methods with deuterium dilution. *J Strength Cond Res* **23**, 1225-1237 (2009).