

# RELIABILITY OF MEASUREMENTS OF ANOGENITAL DISTANCE AND PENIS WIDTH IN BOYS AND ANOGENITAL DISTANCE IN GIRLS. MOTHER-CHILD COHORT IN CRETE (RHEA STUDY)

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**Background and aims:** In animal studies, different measurements of anogenital distance are indicators of *in-utero* exposure to androgens and chemicals with anti-androgen effect, though limited data exist for humans. There is little empirical evidence on the reliability of these measurements. We estimated the reliability of anogenital distance measurements in boys and girls.

**Methods:** The study included thirty 2-year-old children (13 boys and 17 girls) whose mothers participated in the Rhea study, Crete. Two experienced examiners performed 10 blind repeated measurements each (total 730 measurements for each examiner). Anogenital distance (AGD- from anus to upper penis), anoscrotal distance (ASD- from anus to scrotum) and penis width (PW) were measured in boys; anoclitoral (ACD-from anus to clitoris) and anofourchetal distance (AFD-from anus to fourchete) in girls. Ratios of anogenital distances divided by body weight were calculated. Mixed effect models were used to estimate the between-children, between- and within-examiner variance, as well as the reliability coefficient for each distance and ratio.

**Results:** In boys, mean ( $\pm$ SD) AGD, ASD and PW was 82( $\pm$ 6)mm, 44( $\pm$ 7)mm and 13( $\pm$ 1)mm, respectively. In girls mean ( $\pm$ SD) ACD and AFD was 49( $\pm$ 7)mm and 24( $\pm$ 4)mm, respectively. Mean differences between examiners varied from 0 to 4mm. Reliability coefficients for AGD, ASD, ACD and AFD ranged from 0.89 to 0.91 and were higher than for PW (0.75). Differences between children were the main source of variation for all anogenital distance measures. For AFD between examiner variation was also high (22%). Measurement variation for PW, within the same child and the same examiner was higher than for other measures (25%). Ratios by weight were stable and their main source of variation was the between-children variance.

**Conclusions:** Anogenital distance measurements and weight-ratios are highly reliable measures if conducted by experienced examiners and they are not affected by between- or within- examiner variation.