

Prenatal pesticide exposure and body composition at 10 to 15 years of age

Jeanette Tinggaard¹, Christine Wohlfahrt-Veje¹, Ida M Schmidt¹, Malene Boas¹, Steffen Husby², Katharina M Main¹, Niels E Skakkebæk¹, Tina K Jensen^{1,3}, Helle R Andersen³.

¹ Department of Growth and Reproduction, University Hospital of Copenhagen, Rigshospitalet

² Hans Christian Andersen Children's Hospital, University of Southern Denmark, Odense

³ Institute of Public Health, University of Southern Denmark, Odense

Disclosure statement: The authors have nothing to disclose



Background

Exposure to non-persistent pesticides may have an effect on prenatal growth and later risk of adiposity. Prenatal pesticide exposure has been found to be associated with lower birth weight and higher body fat percentage calculated from skinfolds at age 6-11 years⁽¹⁾. To our knowledge body composition measured by DXA in children prenatally exposed to pesticides has not previously been reported.

Objective

To study the effects of prenatal pesticide exposure on body composition measured by DXA in pubertal children.

Methods

A prospective study including 203 children born by female greenhouse workers and 44 aged matched controls was conducted. The children were examined at 3 months (N=203), 6-11 years (N=177) and 10-15 years of age (N=163). Assessment of exposure to pesticides was made during pregnancy before child birth. The following classification was used: unexposed, low exposure, medium or high exposure according to whether the pregnant women had handled pesticides or treated plants and with or without protective equipment.

Here we present results from the examination at age 10-15 years. This examination included measurement of height, weight, hip and waist circumference, skinfold measurements (biceps, triceps, subscapularis, suprailliac) (Figure 1) and assessment of pubertal stage according to Tanner. Furthermore, whole body DXA scan was performed (Lunar Prodigy, GE Healthcare, Madison, WI, USA) with determination of total and regional (android and gynoid) fat mass and fat percentage (Figure 2).

Results

Population, birth characteristics and clinical characteristics at 10-15 years of age are shown in table 1. The following parameters were significantly higher in exposed children compared to unexposed children: BMI SDS, waist circumference, skinfold measurements, total body fat percentage calculated from skinfolds (Slaughter equation)⁽²⁾ and measured by DXA along with total body fat SDS (Table 1, all P<0,05). When gender specific analyses were performed total body fat percentage and android and gynoid fat percentages (DXA) were no longer significantly higher in exposed boys compared to unexposed boys, but remained significant among girls (Table 1). Children prenatally exposed to pesticides had a +0.62 SD (0.29-0.95) (unadjusted) or +0.53 SD (0.18-0.88) (adjusted for maternal smoking during pregnancy, puberty and socioeconomic status) higher DXA total body fat SDS than unexposed children. The effect estimate was larger for higher exposed than medium exposed children: +0.57 SD (0.13-1.00) and +0.51 SD (0.11-0.91), respectively. Total body fat SDS calculated from skinfolds and DXA were strongly correlated (r=0.920 in boys and r=0.901 in girls) (Figure 3,A). Hip circumference correlated positively with absolute gynoid fat mass (r=0.771 in boys and r=0.894 in girls) and waist circumference correlated positively with absolute android fat mass (r= 0.717 in boys and r=0.861 in girls) (Figure 3,B and C).

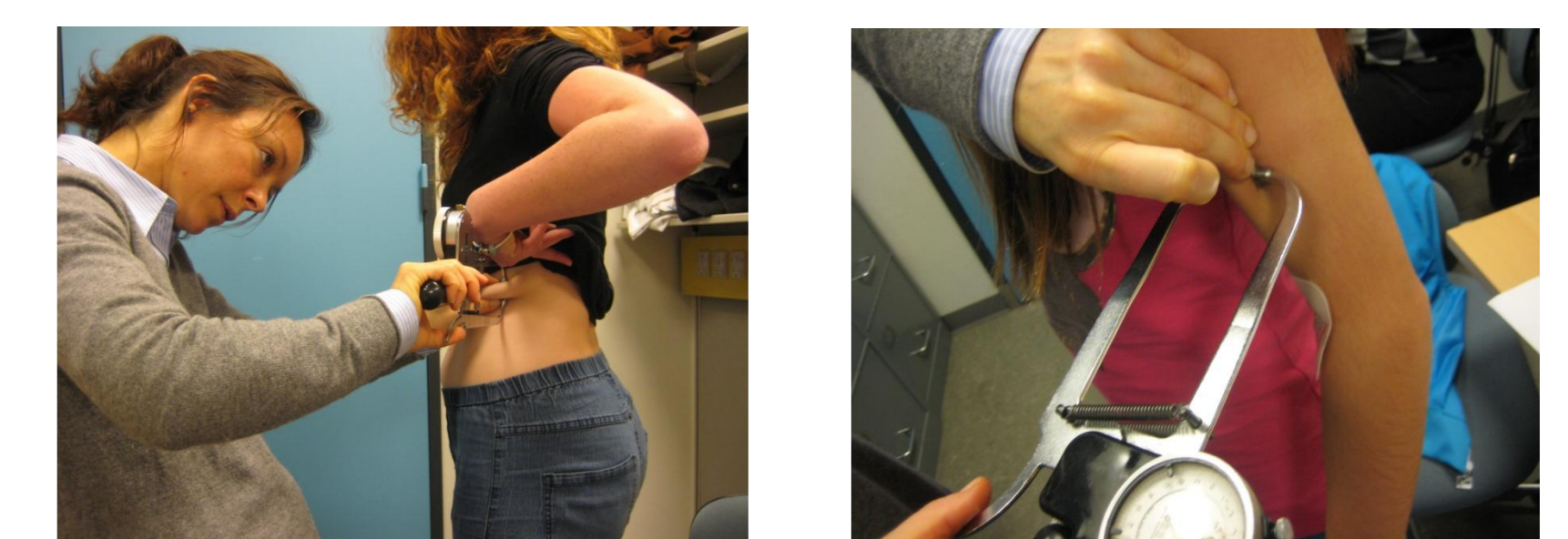


Figure 1 Measurement of skinfolds using a Harpenden Skinfold Calliper

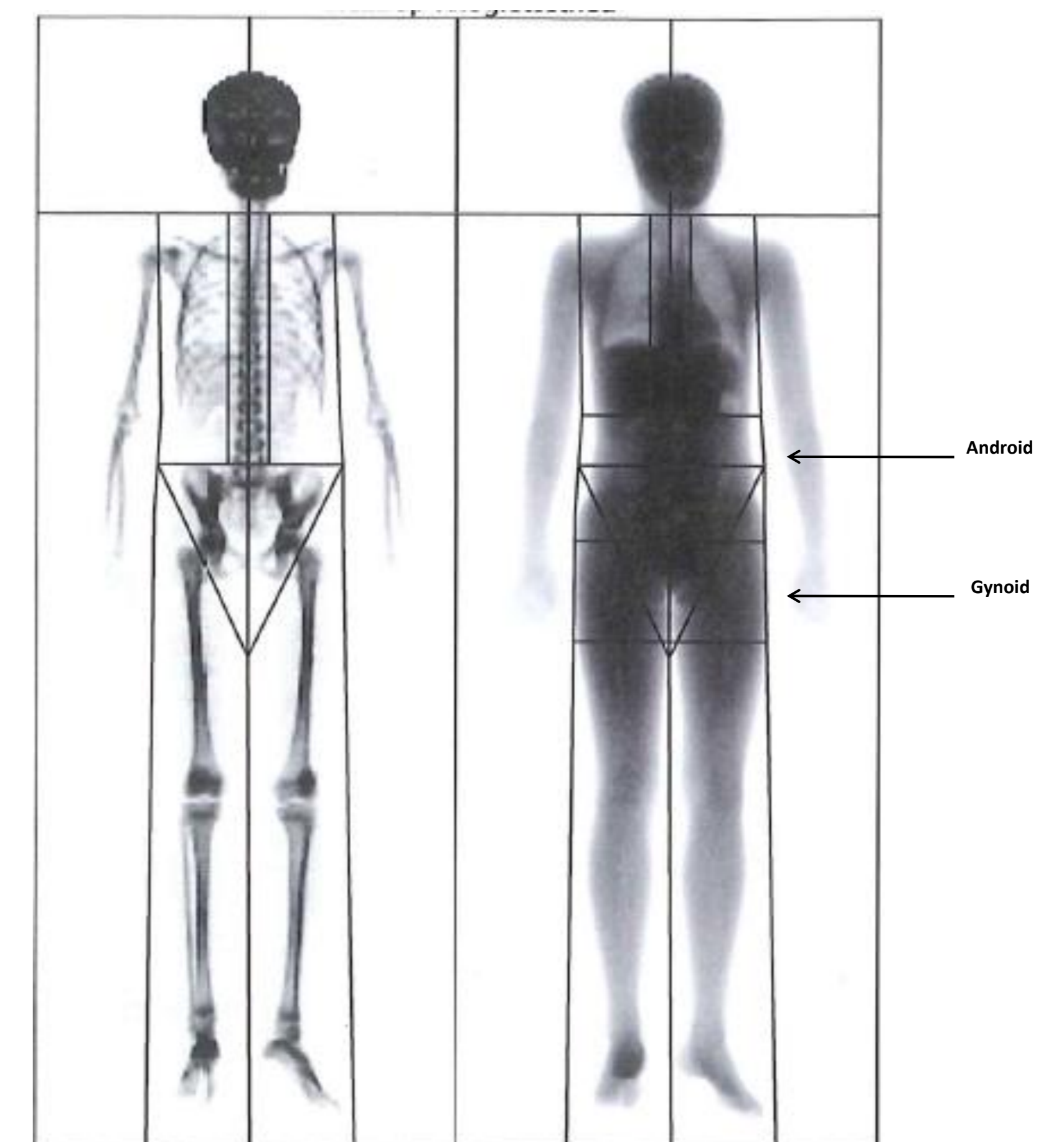


Figure 2 Example of whole body DXA scan with marking of the android and gynoid area for measurement of regional fat mass/percentage. The android area corresponds to the abdominal fat mass and the gynoid area corresponds to the fat mass around the hips.

	Girls		Boys	
	Unexposed (N=26)	Exposed (N=46)	Unexposed (N=36)	Exposed (N=55)
Age (yr)	11.8 (11.1-13.4)	12.9 (11.2-13.5)	12.5 (11.2-13.5)	12.2 (11.2-13.2)
Birth weight (g) #	3750 (3300-4000)	3500 (3140-3800)	3850 (3350-4125)	3600 (30410-4000)
Weight for gestational age (%) #	4.59 (-3.77-8.20)	-2.66 (-9.35-6.94)	1.26 (-6.57-12.08)	-3.64 (-9,74-8.42)
BMI SDS #	0.25 (-0.61-1.11)*	0.85 (-0.06-1.78)*	0.06 (-0.62-0.76)*	0.90 (0.08-1.86)*
Waist circumference #	62.6 (60.2-67,2) *	67.8 (62.8-75.2)	65.8 (60.2-71.7)	67.6 (64.2-73.9)
Total fat% (Slaughter) #	18.2 (16.7-21.7)*	22.4 (18.1-29.9)*	15.3 (12.5-20.5)*	18.7 (14.9-24.3)*
Total fat% (DXA) #	23.3 (20.0-28.4)*	28.2 (24.2-34.5)*	19.0 (10.7-28.3)	22.7 (16.2-31.1)
Android fat% (DXA) #	22.5 (18.7-32.6)*	31.6 (25.3-24.8)*	17.5 (9.8-32.5)	24.7 (16.2-36.1)
Gynoid fat% (DXA) #	36.0 (31.9-40.5)*	40.8 (36.1-44.8)*	30.1 (18.7-40.0)	35.2 /25.8-41.8)
Slaughter total fat mass SDS#	-0.08 (-0.44-0,76)*	0.50 (-0.07-1.68)*	-0.15 (-0.83-0.61)*	0.44 (-0.21-1.27)*
DXA total fat mass SDS#	0.15 (-0.32-0.80)*	0.79 (0,27-1.49)*	0.17 (-1.03-1.05)*	0.58 (-0.19-1.37)*
Puberty (yes)	24 (92.3)	42 (91.3)	22 (61.1)	39 (70.9)

Table 1 Birth characteristics and clinical characteristics. Values are presented as median (interquartile range), (continuous variables) or N (%) (categorical variables). Unexposed: unexposed+low exposure. Exposed: medium + high exposure. # P<0.05 between unexposed and exposed children. * P<0.05 between unexposed and exposed girls and boys, respectively (Mann-Whitney U-test for continuous variables and Fishers exact test for categorical variables).

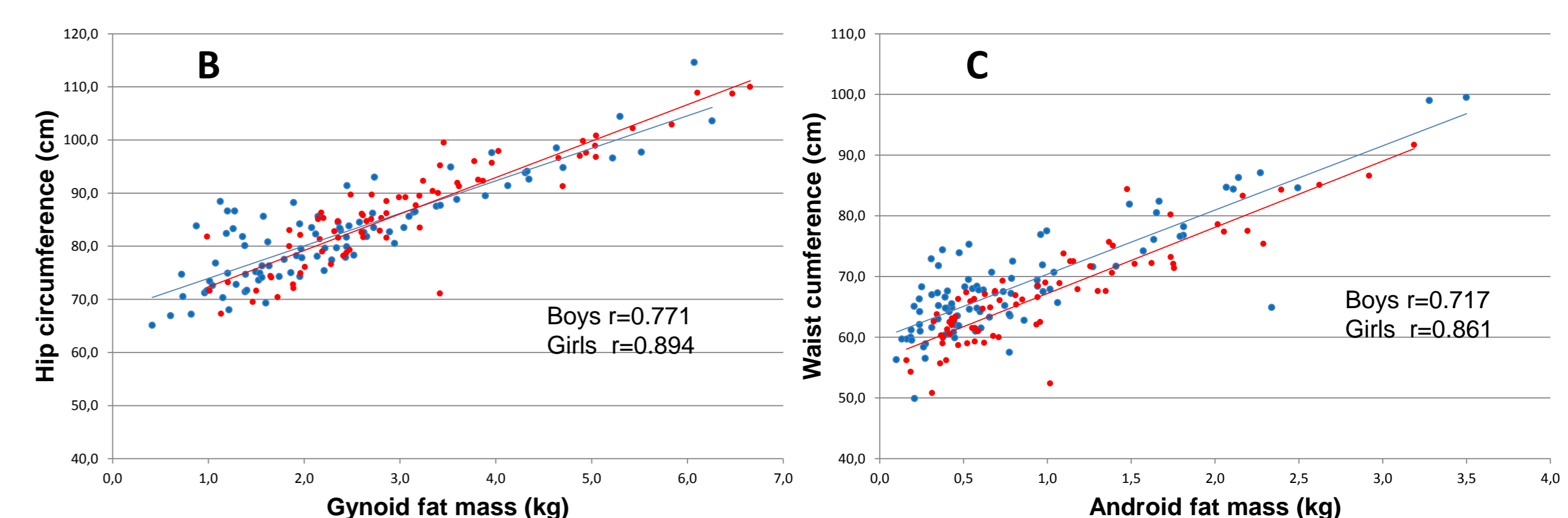
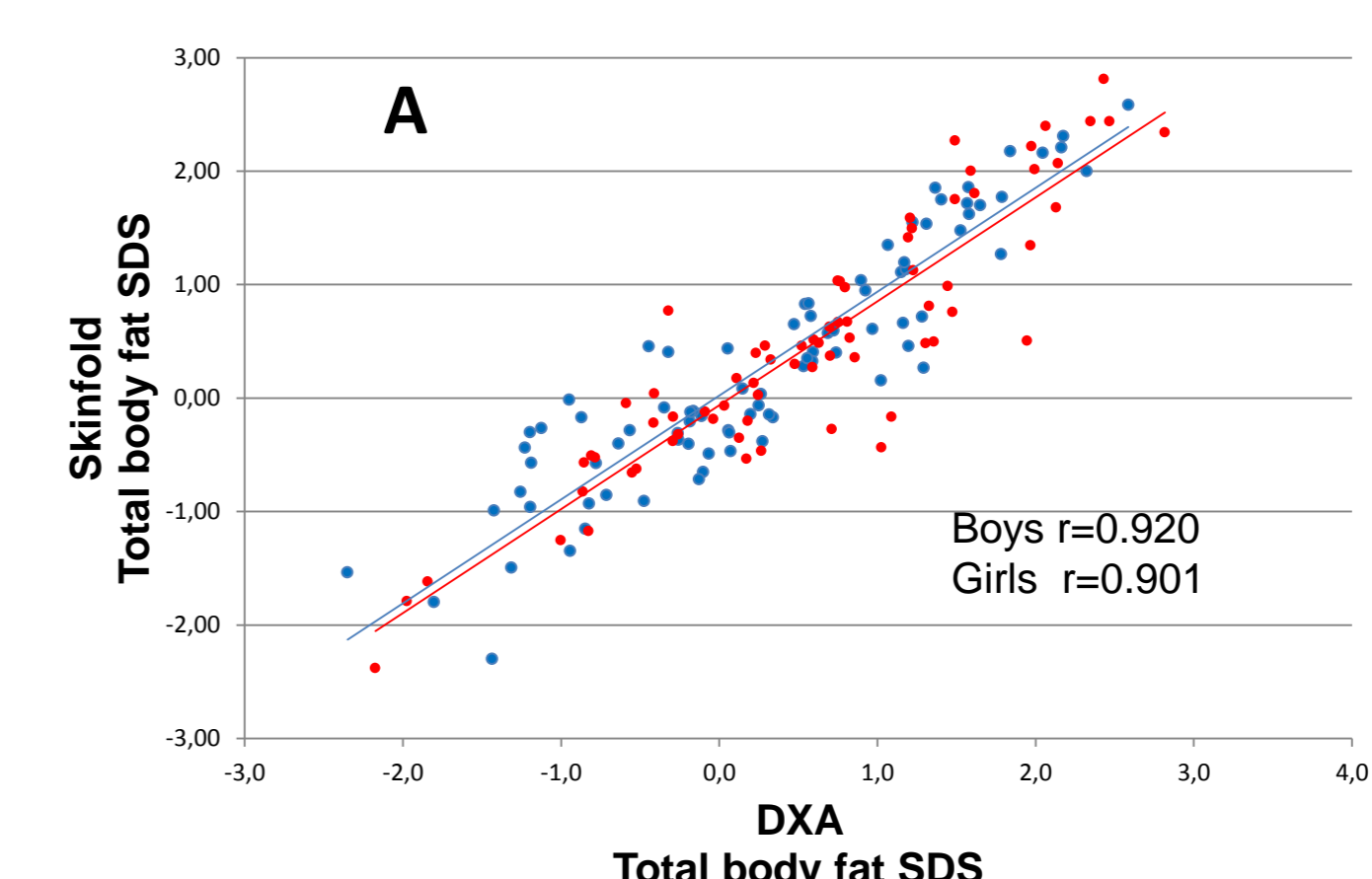


Figure 4 Correlation (Spearman) between A) Total body fat SDS measured from skinfolds versus DXA, B) Gynoid fat mass and hip circumference and C) Android fat mass and waist circumference. Red and blue dots and lines represent girls and boys, respectively.

Conclusions

- Skinfold measurement is a precise, quick and inexpensive way to calculate total body fat percentage in children.
- Hip and waist circumference may be used as a proxy for absolute gynoid and android fat mass in children aged 10-15 years
- Prenatal pesticide exposure is associated with childhood adiposity measured by skinfolds and DXA in both genders. The increment in adiposity included both android and gynoid regions, reflecting a possible increment in both visceral and subcutaneous fat.
- Exposure to non-persistent pesticides during fetal life is a risk factor for childhood adiposity.