

# Adiposity and pubertal status effects on thyroid function in obese children and adolescents

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## INTRODUCTION AND OBJECTIVES

In recent years, studies have consistently demonstrated higher TSH concentrations in obese children and adults compared with normal weight individuals, whereas the levels of thyroid hormones in peripheral blood remain within normal range. This euthyroid hyperthyrotropinemia on the background of a worldwide increase in childhood obesity raises the question of whether subjects with this elevated TSH should be treated. In this study, we compared a group of obese children and adolescents to a normal weight age-matched group in order to characterize the thyroid function in correlation with BMI and pubertal status in males and females.

## METHODS

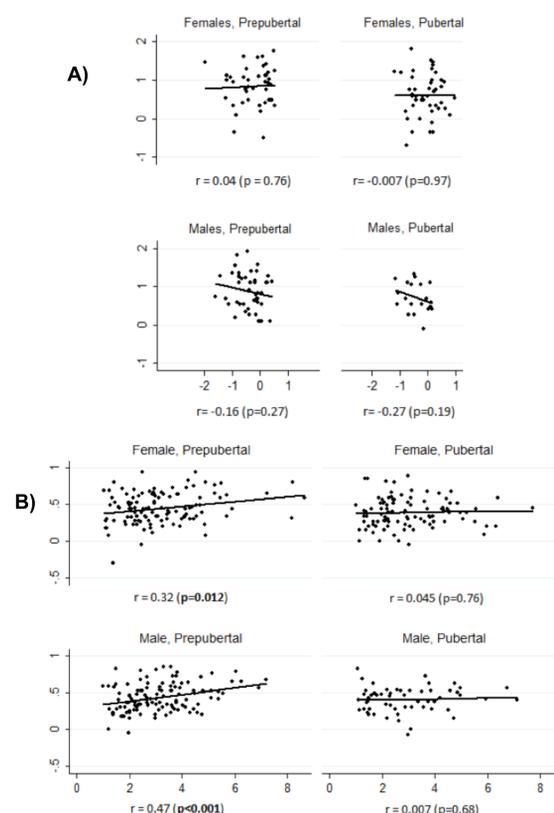
The study groups included 389 obese children (BMI z-score > 2) and 158 healthy normal-weight children, who served as controls. Mean BMI Z-score in pre-pubertal and pubertal subgroups of the obese children was not significantly different (BMI<sub>m</sub> = 3.16 vs 2.96). TSH, T<sub>4</sub> and T<sub>3</sub> were assessed. TSH values were log-transformed for the statistical analysis. T-test was used with statistical significance p<0.05.

## RESULTS

Normal weight group (n=158)				
		Log TSH	T <sub>4</sub>	T <sub>3</sub>
		Mean ± SD (95% CI)	Mean ± SD (95% CI)	Mean ± SD (95% CI)
Females (89)	Prepubertal (44)	0.85 ± 0.5 (0.7-1)	8.84 ± 1.23 (8.47-9.22)	189.5 ± 17.7 (184-194.8)
	Pubertal (45)	0.6 ± 0.55 (0.44-0.77)	8.01 ± 1.22 (7.65-8.38)	165.1 ± 31.5 (155.7-174.6)
P value		<b>P=0.0471</b>	<b>P=0.003</b>	<b>P&lt;0.001</b>
Males (69)	Prepubertal (47)	0.87 ± 0.47 (0.73-1)	8.51 ± 1.13 (8.18-8.85)	187.4 ± 26.5 (179.6-195.2)
	Pubertal (21)	0.69 ± 0.38 (0.7-0.93)	7.94 ± 1.15 (8.06-8.61)	162 ± 19.6 (153.2-171)
P value		P=0.228	P=0.08	P=0.1

Obese group (n=389)				
		Log TSH	T <sub>4</sub>	T <sub>3</sub>
		Mean ± SD (95% CI)	Mean ± SD (95% CI)	Mean ± SD (95% CI)
Females (220)	Prepubertal (116)	0.45 ± 0.2 (0.41-0.49)	9.34 ± 1.38 (9.1-9.59)	199.2 ± 32.7 (193.2-205.3)
	Pubertal (100)	0.39 ± 0.2 (0.35-0.43)	8.43 ± 1.41 (8.15-8.71)	186.3 ± 31.9 (179.9-192.6)
P value		<b>P=0.0384</b>	<b>P&lt;0.001</b>	<b>P&lt;0.001</b>
Males (169)	Prepubertal (114)	0.43 ± 0.19 (0.4-0.47)	8.92 ± 1.4 (8.66-9.19)	191.8 ± 31.9 (185.7-197.9)
	Pubertal (59)	0.4 ± 0.17 (0.36-0.45)	8.52 ± 1.26 (8.18-8.86)	188.5 ± 26.3 (181.3-195.6)
P value		P=0.51	P=0.1	P=0.75

Statistical analysis of TSH and T<sub>4</sub>, T<sub>3</sub> values in normal and obese groups stratified by gender and pubertal status



Correlation between TSH and BMI in A) normal weight and B) obese group

- 1) Mean serum TSH value of obese group was higher (2.95 mU/l ± 1.2) compared to that (2.42 mU/l ± 1.43) of normal weight group (P<0.0001)
- 2) Only in females of both obese and control groups, serum TSH, T<sub>4</sub> and T<sub>3</sub> concentrations were all lower during puberty compared to the pre-pubertal period
- 3) In obese pre-pubertal girls and boys, a statistically significant correlation between TSH and BMI was found (coefficients r=0.32, P=0.012 and r=0.47, P<0.001 respectively) that is **not** sustained after initiation of puberty

## CONCLUSIONS

Our results confirm the TSH elevation observed in obese children and furthermore, imply that puberty has an impact on thyroid axis function and may abrogate the positive correlation between TSH and BMI in obese children.

## References

1. Reinehr T. Thyroid function in the nutritionally obese child and adolescent. *Curr Opin Pediatr.* 2011.
2. Longhi S, Radetti G. Thyroid function and obesity. *Journal of clinical research in pediatric endocrinology.* 2013;5 Suppl 1:40-4.
3. Gertig AM, Niechcial E, Skowronska B. Thyroid axis alterations in childhood obesity. *Pediatric endocrinology, diabetes, and metabolism.* 2012;18(3):116-9.