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Bone age advancement in prepubertal children with overweight and obesity

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INTRODUCTION

- Skeletal development is an indicator of physical maturation in both sexes during childhood and adolescence .
- It is well-known that advanced bone age (BA) can be observed in obese children and adolescents .
- The progression of skeletal maturation was found to be influenced by complex hormonal interactions involving estrogens, androgens, thyroid hormones, and the growth hormone.
- Insulin resistance and hyperinsulinemia were the possible causes of BA advancement because obese children often had elevated serum insulin levels.
- We therefore aimed to evaluate the relationship of insulin resistance or hyperinsulinemia with BA advancement in prepubertal obese children.

METHODS

- A total of 93 prepubertal obese children were included in this study.
- Obesity was defined as body mass index (BMI) values greater than the 95th percentile, after adjustment for age and gender.
- Subjects were divided into two groups based on ΔBA-CA.
- Advanced BA group was defined as ΔBA-CA more than 1 year, and normal BA group was defined as ΔBA-CA less than 1 year.
- Independent *t*-test was used compare between the advanced BA and normal BA groups

RESULTS

- Table 1 summarizes the clinical and demographic characteristics of the subjects. Of the 93 subjects (39 males and 54 females), 49 (52.6%) were categorized into the normal BA group and44 (47.4%) were categorized into the advanced BA group.
- The mean age was 7.42 ± 1.50 years (range, 4.6 to 10.8 years).
- Pearson's correlation test was performed among all of the subjects (n= 93). Fasting insulin and HOMA-IR were significantly and positively correlated with ΔBA-CA (r=0.255, and 0.230; *P*=0.014 and *P*=0.027, respectively; Fig.1).
- height SDS and QUICKI were significant predictors of ΔBA-CA (Table 2).

Table 1. Clinical and laboratory characteristics of the subjects (n=93)

	Total (n=93)	Normal Bone age (n=49)	Advanced Bone age* (n=44)	P-value
Sex(M/F)	39/54	25/24	14/30	
Age(year)	7.4 ± 1.5	7.2 ± 1.5	7.6 ± 1.4	0.149
Height SDS	1.12 ± 0.98	0.82 ± 0.97	1.46 ± 0.89	<0.001
Weight SDS	2.26 ± 0.63	2.19 ± 0.54	2.34 ± 0.73	0.293
BMI SDS	2.42 ± 0.46	2.38 ± 0.41	2.47 ± 0.50	0.398
Bone age(year)	8.54 ± 2.07	7.46 ± 1.61	9.74 ± 1.87	<0.001
IGF-1 SDS	188.3 ± 118.7	202.7 ± 128.2	165.5 ± 98.6	0.391
HbA1c (%)	5.6 ± 0.6	5.5 ± 0.8	5.7 ± 0.2	0.107
Fasting glucose (mmol/L)	5.16 ± 0.55	5.15 ± 0.55	5.16 ± 0.56	0.931
Insulin fasting (pmol/L)	19.9 ± 25.8	12.4 ± 12.0	28.2 ± 33.6	0.003
HOMA-IR	4.78 ± 6.77	2.97 ± 3.16	6.78 ± 8.89	0.006
QUICKI	0.33 ± 0.55	0.35 ± 0.32	0.31 ± 0.04	<0.001

*Advanced bone age group defined as the difference between bone age and chronological age above 1 year.

Table 2. Multivariate analysis of factors associated with peak growth hormone values (n=93, r^2=0.233, *P*<0.001)

Variables	Estimate	SE	P value
Height SDS	0.442	0.108	<0.001
QUICKI	-5.520	2.086	0.010

To determine significance of association with the difference between bone age and chronological age, linear regression was performed for multivariate analyses with stepwise variable selection, including height SDS, weight SDS, BMI SDS, fasting insulin, fasting glucose, and QUICKI.

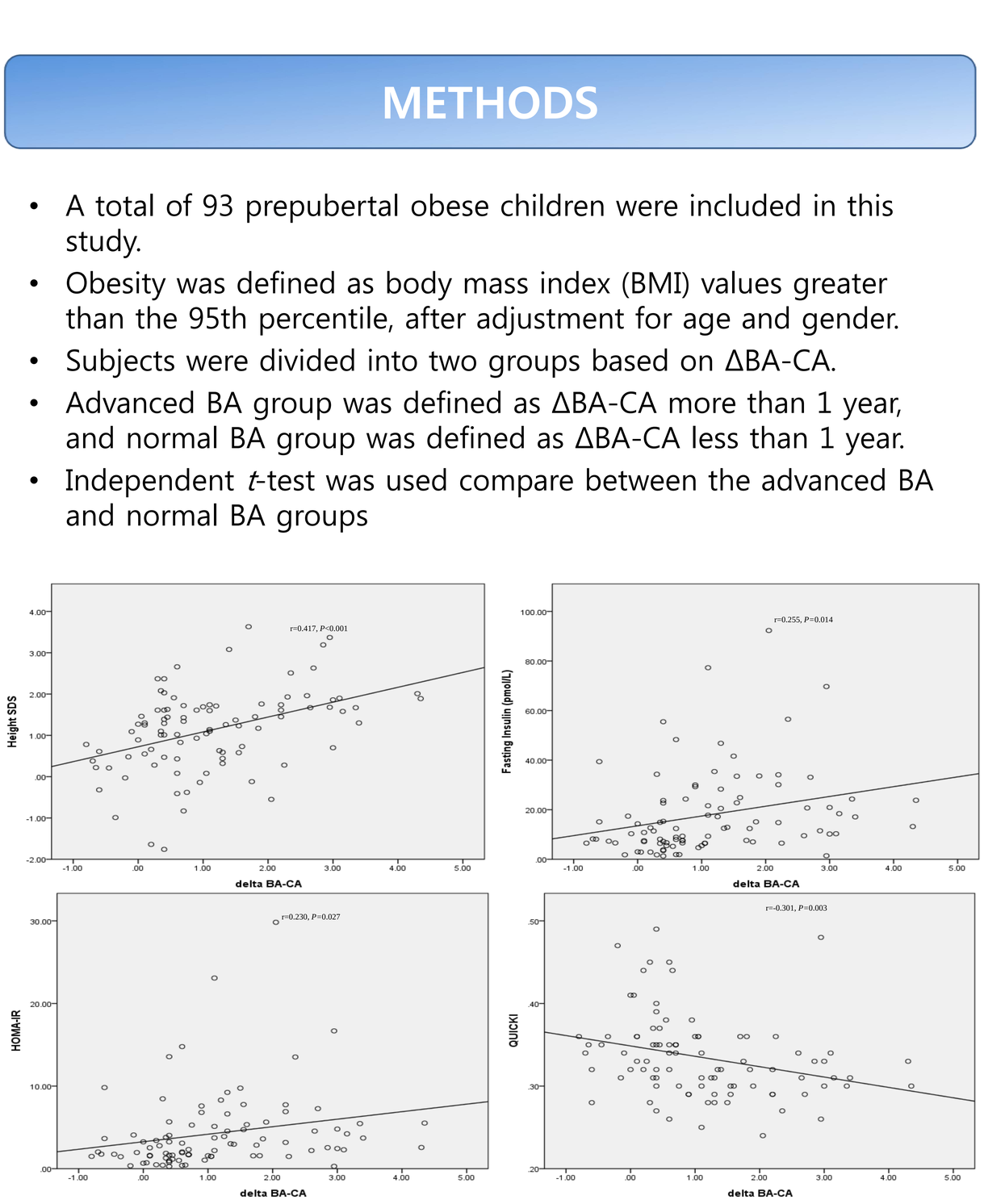

Fig. 1. Pearson correlation between height SDS, fasting insulin, HOMA-IR, QUICKI and delta BA-CA

CONCLUSION

The clinically significant finding of our study is that hyperinsulinemia and insulin resistance were associated with advanced BA. Therefore, insulin may affect skeletal maturation in obese children.

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