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Quantitative Sonometeric Bone Age (SBA) as a Function of Height and BMI

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Background:

- It is commonly believed that short stature is associated with delayed BA and that obesity is associated with advanced BA.
- For ethical reasons, this assumption was never tested in healthy children.
- We have previously shown that BA assessed by sonographic BAUS™, is reproducible and comparable to both GP and TW3 X-ray assessment of BA.
- This provides a safe, simple and irradiation-free method for the assessment of BA in healthy children.

Aim of the study:

To understand the dependency of SBA on a child's height and BMI in healthy children with normal stature and BMI.

Hypotheses:

Shorter and thinner pre-pubertal and pubertal children boys and girls will have delayed BA as compared to taller and heavier children.

Study design:

This was a cross sectional study of healthy children with normal stature and BMI in an outpatient pediatric clinic.

A total of 650 healthy children (333 boys and 317 girls)

Age: 4–17 years

Height range 5-95%.

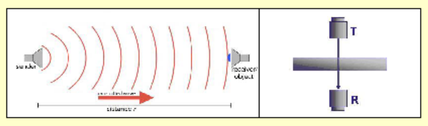
BMI < 90%

Exclusion criteria were: bone and joint diseases, systemic diseases known to impair growth, hand and wrist deformities, recent fractures, and soft tissue swelling.

SBA was assessed using SonicBone BAUS™.

The SonicBone (SB) device

The SonicBone device (Rishon Lezion, Israel) is a small (50cm X 25cm X 25cm), portable, bone sonometer. A transmitter probe and a receiver probe are located at the edges of the measured bone area.



Two parameters were measured:

a) Speed of propagation through bone (speed-of-sound, SOS, m/sec) of inaudible high frequency waves of a short ultrasound pulse;

b) attenuation (ATN; the decay rate) of the sound wave by the bone as a function of the distance (mm) it travels between a transmitter and a receiver.

The Method:

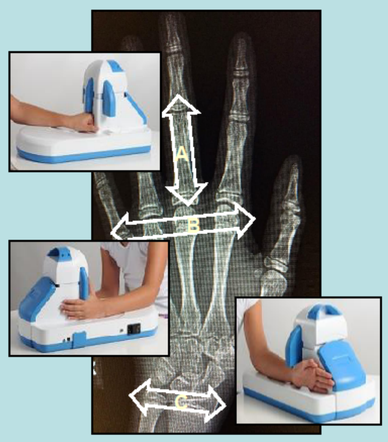
Three sites of assessment:

A) A phalange (P), measuring SOS and ATN along the bent proximal third phalanx shaft, growth plate and epiphysis;

B) metacarpals (MC), measuring SOS and ATN for the distal metacarpal epiphyses;

C) wrist (W), measuring SOS and ATN at the distal radius' and ulna's secondary ossification centers.

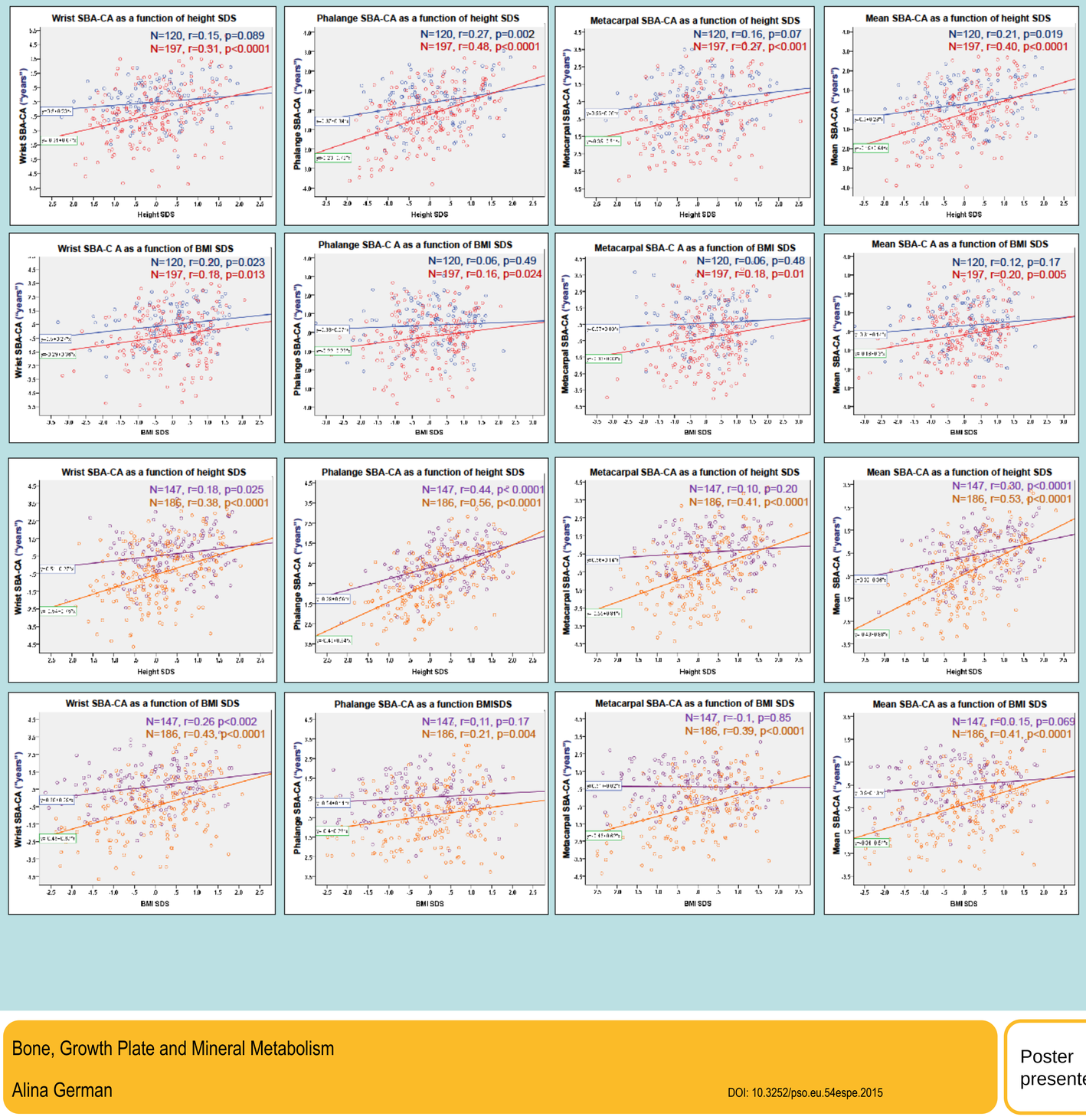
The average of those three sites was defined as the child's BA by SBA.



Results:

	Prepubertal boys	Pubertal boys	Prepubertal girls	Pubertal girls
N	147	186	120	197
Height SDS	0.40±0.83	0.07± 0.84	0.06± 0.90	-0.005 ±0.88
BMI SDS	0.24±1.10	-0.04±1.0	0.06±1.01	-0.06±0.91
W SBA [–] CA ("years")	0.61±1.22	-0.48 ±1.64	0.51±1.30	-0.31±1.88
P SBA [–] CA ("years")	0.51±1.04	-0.40±1.42	0.39±1.11	-0.24±1.32
M SBA [–] CA ("years")	0.61±1.10	-0.48±1.67	0.58±1.40	-0.35±1.65
Mean SBA [–] CA ("years")	0.46±0.98	-0.36±1.40	0.32±1.16	-0.19±1.38

Girls
Prepubertal
Pubertal



Boys
Prepubertal
Pubertal

Conclusions

1.Shorter and thinner pubertal but not pre-pubertal children have delayed SBA as compared to taller and heavier children.

2. The full-length phalanx maturation is affected by height more than the wrist and metacarpals' epiphyses.

3. The radius-ulna epiphyses are affected by BMI more than the metacarpals and phalanx.

4. These influences have to be accounted for in the assessment of a BA.

* SL is an employee of SonicBone and ZH is an independent consultant to the company.

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