

Dimensional changes in structures of craniofacial and brain in precocious puberty: Developmental surrogate markers of the brain as a secondary sex characteristic in puberty

INTRODUCTION

At puberty, sex-specific changes are observed in the reproductive organs, as well as in the craniofacial structures and specific parts of the brain.

Changes are observed evident especially in nasal bone, jaw, teeth, orbital and maxillary bones and soft tissues such as lips.

It has been reported that puberty triggers sex-specific organizational and activational remodeling of the brain.

Investigation of these changes will reveal to which structures investment is allocated for reproductive-related behaviors.

AIM

The aim of the study is to investigate the changes in linear measurements in craniofacial and brain structures in girls diagnosed with precocious puberty (PP) as an early variant of puberty, and to investigate the relationship between these structures and pubertal markers.

METHOD

A total of 86 diagnosed with precocious puberty (PP) and 37 healthy girls aged 6.5 to 8.4 years were included in the study.

The following structures were measured in all participants using cranial magnetic resonance imaging:

clivus-anterior nasal spin gap, interzygomatic, interuncal and transverse nasal spaces, nasal length, pituitary height, mediolateral and craniocaudal dimensions of the right and left hippocampus, and biparietal and temporal diameters.

The dimensions of the structures measured in PP and healthy children were compared.

Correlations between pubertal findings and these measurements were evaluated.

RESULTS

• *Transverse nasal distance, nasal length, right hippocampus dimensions (craniocaudal and mediolateral) and biparietal diameters were found to be higher in girls with prepubertal precocious puberty ($p=0.001$, $p<0.001$, $p=0.029$ and $p<0.001$).*

• *A positive correlation was found between transverse nasal distance and pituitary height ($r=0.476$) and right hippocampus dimensions ($r_{\text{mediolateral}}=0.323$; $r_{\text{craniocaudal}}=0.512$) in healthy children, while it was not found in girls with PP.*

• *A positive correlation was found between uterine length and clivus-anterior nasal spin distance ($r=0.377$), transverse nasal distance ($r=0.433$) and interuncal lengths ($r=0.380$) in girls with PP.*

The linear measurements of craniofacial and brain regions in girls with precocious puberty and healthy

	Precocious puberty (n=86)	Healthy (n=37)	p
Yaş (year)	7.84±0.26	7.82±0.35	0.878
Boy (cm)	130.06±6.05	131.02±6.92	0.262
Kilo (kg)	30.30±5.82	30.95±6.21	0.533
BMI (kg/m ²)	17.77±2.39	17.80±2.55	0.958
Anterior nasal spine length	65.09±8.74	64.25±8.31	0.151
Interzygomatic distance	86.54±16.78	85.66±10.84	0.249
Interuncal distance	17.70±4.98	18.29±2.84	0.158
Transverse nasal distance	30.75±6.83	29.22±2.02	0.001
Nasal length	21.51±3.35	19.72±3.38	<0.001
Pituitary height	5.15±1.12	4.66±0.71	0.013
Right hippocampus			
mediolateral distance	18.82±2.85	18.16±1.19	0.029
craniocaudal distance	15.61±2.21	14.21±1.45	<0.001
Left hippocampus			
mediolateral distance	18.48±1.36	18.02±1.60	0.105
craniocaudal distance	15.56±1.89	14.16±1.36	<0.001
Biparietal diameter	132.52±24.34	129.83±27.36	0.007
Bitemporal diameter	121.18±24.20	120.64±28.34	0.588
Head circumference	498.66±14.40	499.37±17.22	0.812

Lateralization of between right and left hippocampus linear measurements in girls with precocious puberty and healthy

	Mediolateral hippocampus			Craniocaudal hippocampus		
	Right	Left	p	Right	Left	p
Healthy	18.06±1.95	18.02±2.58	0.673	18.04±2.58	14.16±1.86	<0.001
Precocious puberty	18.82±2.85	15.56±1.89	<0.001	15.61±2.21	15.56±1.89	0.831

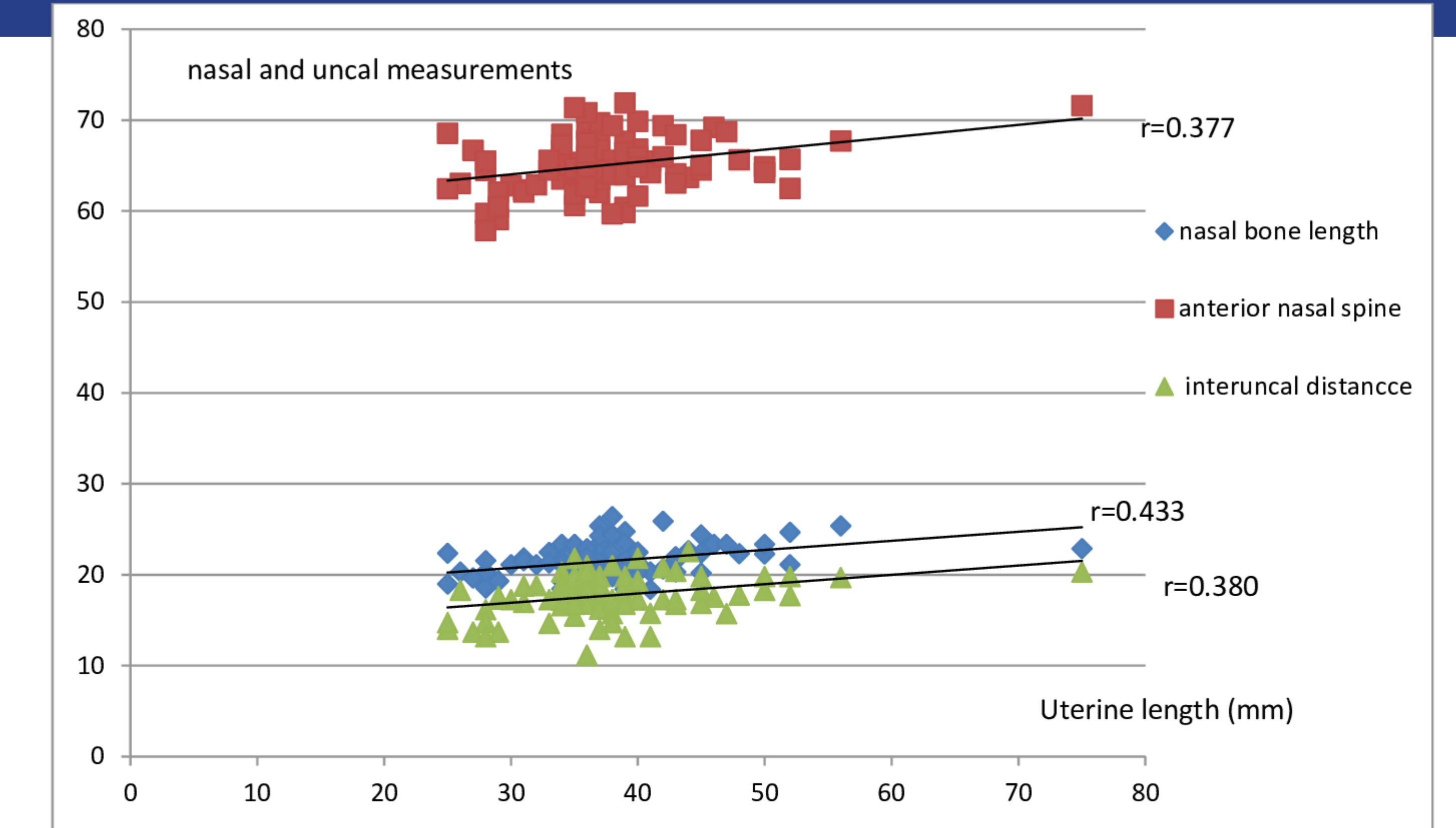


Figure : Correlation between uterine length and craniofacial linear measurements



Correlation between transverse nasal length and pituitary height in children with precocious puberty and healthy

CONCLUSIONS

This study showed that linear dimensions of nasal, pituitary and hippocampus were higher in girls with PP.

It also demonstrated that while there was a positive correlation between linear measurements of nose and uterus length in healthy children, the positive correlation between most cranial structures disappeared in girls with PP, which indicates a highly heterogeneous brain and craniofacial anthropometry that develops at puberty.

REFERENCES

Herting MM, Sowell ER. Puberty and structural brain development in humans. *Front Neuroendocrinol.* 2017 Jan;44:122-137. doi: 10.1016/j.yfrne.2016.12.003. Epub 2016 Dec 19. PMID: 28007528; PMCID: PMC5612369.

Koolschijn PC, Crone EA. Sex differences and structural brain maturation from childhood to early adulthood. *Dev Cogn Neurosci.* 2013 Jul;5:106-18. doi: 10.1016/j.dcn.2013.02.003. Epub 2013 Feb 24. PMID: 23500670; PMCID: PMC6987760.

Karaoglan M, Çolakoğlu Er H. The relationship between the olfactory bulb and precocious puberty: from the nose to the pituitary. *J Pediatr Endocrinol Metab.* 2019 Sep 25;32(9):1013-1021

ACKNOWLEDGEMENTS

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