Novel pubertal references for girls using ultrasound to stage breast development. The Bergen Growth Study 2.

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INTRODUCTION

Discriminating adipose tissue from glandular tissue is challenging when assessing breast development clinically. Breast ultrasound allows for a direct examination of the mammary gland and facilitates staging of breast maturation on a scale from 0 to 5, in which stage 2 (US B2) marks the onset of breast development. To date, no normative data have been reported for ultrasound breast staging (US B), and has not been systematically compared to Tanner B staging in a large sample.

OBJECTIVES

To present novel pubertal references for US B, and the first references for Tanner breast (B) and pubic hair (PH) stages, and menarche for girls living in Norway, and to compare two methods to assess pubertal breast development (US B and Tanner B). Further we compare age at menarche in the current study with the first Bergen Growth Study (BGS1 in 2003-06).

METHODS

A cross-sectional sample of 703 girls (6.1- 16.2 years) living in Bergen, Norway, were included into the Bergen Growth study 2 in 2016 and 2017. The girls were examined with ultrasound to determine US B (n = 696). Tanner B (n=700) and PH (n=372) stages were assessed clinically and menarcheal status was recorded (n=643). Ages at entering US B1-5, Tanner B and PH pubertal stages 2-5, and menarche were estimated using generalized linear (probit) and generalized additive models (GAM). Agreement in pubertal breast staging done by US B and Tanner B was examined using kappa statistics with linear weights. Logistic regression with age as covariate was used to compare if age at menarche had advanced since BGS1. The Nordic girls only were selected for this analyses.

CONCLUSION

The comparison of US B and Tanner B indicated good overall agreement in determining glandular maturation throughout puberty, although ultrasound enables detection of changes in breast tissue ahead of clinically identifiable visual or palpable changes. The estimated ages at onset of breast development, PH and menarche in our study are in accordance with recent European studies. A decrease of 2.8 months in age at menarche was observed between BGS1 and BGS2 and warrants further surveillance of pubertal development in Norway.

REFERENCE

Bruserud, I. S., Roelants, M., Oehme, N. H. B., Eide, G. E., Bjerknes, R., Rosendahl, K., & Juliusson, P. B. (2018). Ultrasound assessment of pubertal breast development in girls: intra- and interobserver agreement. *Pediatr Radiol*.

RESULTS

Table 1 Distribution of ultrasound based breast stages (US B) and Tanner breast (B) stages. The agreement between the two methods was very good (kappa coefficient 0.87; 95% CI: 0.85, 0.88). Numbers in bold indicate assessed corresponding stages by both methods

		Breast Ultrasound (US B) assessment						
		US B0	**US B1**	**US B2**	**US B3**	**US B4**	**US B5**	**Total**
Tanner B assessment	**B1**	**166**	**128**	16	0	0	0	310
	B2	1	3	**65**	12	2	0	83
	B3	0	0	13	**43**	25	2	83
	B4	0	0	0	15	**77**	16	108
	B5	0	0	0	5	33	**73**	111
Total		167	131	94	75	137	91	695

Figure 1 Reference curves for breast development: Solid lines represent reference curves for Ultrasound based stages for breast development (US B) (n = 696) and broken/dashed lines represent reference curves for Tanner breast (B) (n = 700) stages.

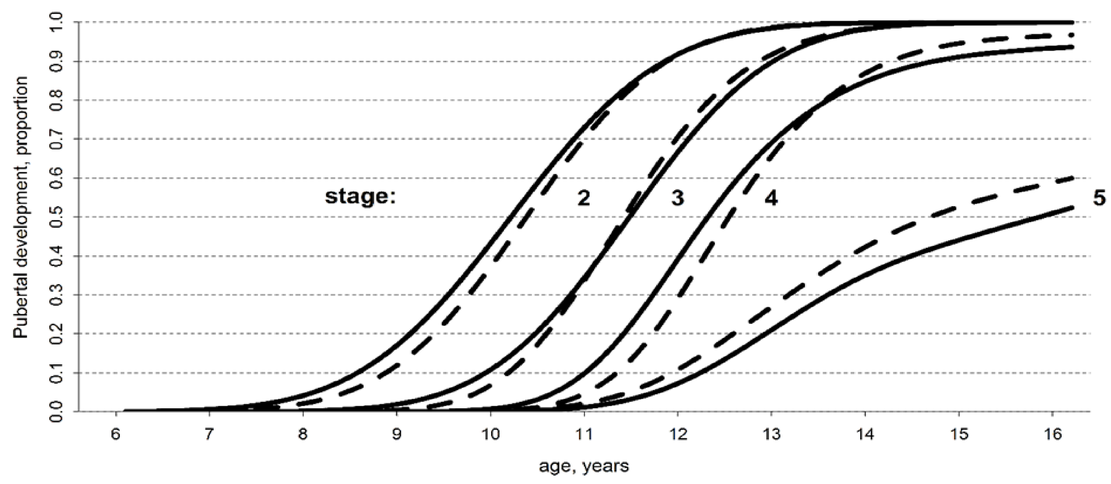

Table 2 Age references for onset of breast development according to US B and Tanner B, pubic hair (PH2) and menarche. median ages with associated 3rd and 97th percentiles, and mean (SD) ages are presented for each pubertal marker. There was a significant (p=0.028) difference in age at menarche between BGS1 and BGS2.

	P3	P50	P97	Mean (SD)
US B2	7.8	10.2	12.6	10.2 (1.3)
Tanner B2	8.2	10.4	12.6	10.4 (1.2)
Tanner PH2	8.6	10.9	13.2	10.9 (1.2)
Menarche	11.0	12.7	15.9	12.9 (1.2)

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