

Growth Maturity Gradients of Cephalo-Caudal and Cauchocephalic Sequences of Yadava and Vadabalija Girls of North-Coastal Andhra Pradesh

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ABSTRACT The present study, based on a cross-sectional sample of 632 Yadava and 608 Vadabalija girls in the age range of 1 to 20 years, confines to the evaluation of development-cum-maturational differences between Yadava and Vadabalija girls with the help of twenty-one anthropometric measurements. Analysis of the data reveal that all the measurements show maturational differences in some age group between Yadava *versus* Vadabalija girls. It can be inferred that the development-cum-maturation differences observed between these two groups may be due to genetic factor associated with socio-economic environment.

One way in which the organization of growth shows itself is through the presence of maturity gradients' (Tanner, 1964) which have been studied by others as well (Bayley, 1962; Sidhu, 1969; Nath, 1972; Krishna Rao, 1981; Jhingon and Nath 1985; Dharma Rao and Busi, 1991). The growth gradient of a measurement expresses the percentage of growth achieved at any age of its 'final' value as seen in a full grown adult. The present study deals with 21 anthropometric variables which studies to show development-cum-maturational direction of rural and agricultural, Yadava and fishing Vadabalija girls.

MATERIAL AND METHODS

The Yadava (Golla) of North Coastal Andhra region is traditionally a pastoral community occasionally engaged in farming. Vadabalija was one of the nine important fishing communities found in the North East Coastal tract of Andhra Pradesh. Data were collected, cross-sectionally on 632 Yadava girls and 608 Vadabalija girls aged 1 through 20 years, from 23 villages of Bheemunipatnam and Anandapuram mandals of Visakhapatnam district of Andhra Pradesh during January 1986 to June

1987. The age of each individual was calculated to three decimal places after Tanner et al. (1966). The 21 anthropometric measurements as recommended by IBP basic list were taken after Weiner and Lourie (1969).

RESULTS AND DISCUSSION

Percentage of growth gradients in nineteen age groups of Yadava and Vadabalija girls have been depicted in the tables 1 and 2. It can be concluded from the table that the percentage of growth gradients of these variables continuously and consistently increases throughout all age groups. All the twenty-one measurements investigated in the present study have been divided into six convenient groups viz; weight/height group, extremities and trunk group, chest-cum-extremities circumferential group, torso group, cephalo group and facial group in order to facilitate the comparison of ontogenic development of these variables. The exclusion of stature and body weight from such an analysis, since these measure the total human body and are not indicative of parts of the body. By combining cephalo and facial groups, it is observed that head breadth and bizygomatic diameter of cephalo group are first to mature

than head length of the facial group among Yadava girls, but in Vadabaliya girls only head breadth and bizygomatic diameter matured earlier than head length. This is suggestive of a caudo-cephalic gradient of growth among Yadava girls. This caudo-cephalic gradient becomes still clearer when the cephalo-facial measurements are compared with the torso measurements among these Yadava girls but in Vadabaliya girls cephalo-caudal direction of growth gradients is observed. In other words head length (99.78%), head breadth (99.92%) of Yadava girls have matured later torso measurements, biilio-cristal diameter (100.00%), biacromial diameter (99.97%), sitting height (99.99%) leads to caudo-cephalic gradients and facial measurements of Yadava girls *i.e.* morphological facial height, nasal height and nasal breadth (100.00%) except bizygomatic diameter (99.83%); bizygomatic have matured earlier than torso group (except biilio-cristal diameter) clearly suggestive of cephalo-caudal gradients among Yadava girls. In Vadabaliya girls head breadth (100.00%) and facial measurements bizygomatic diameter (100.00%), nasal height (100.00%), nasal breadth (100.00%) have matured earlier than torso measurements such as sitting height (99.97%), biilio-cristal diameter (99.96%) subscapular skinfold (80.00%) (except biacromial diameter) suggesting cephalo-caudal gradients of growth.

The caudo-cephalic gradient or reversal phenomenon is clearly visible when we observe the biilio-cristal diameter (100.00%) which matures earlier than biacromial diameter (99.97%) among Yadava girls quiet against in Vadabaliya girls. Further on comparing the sitting height (99.99%) with total arm length (100.00%) the height of anterior-iliac spine (99.94%) with total arm length (100.00%) in total, one gets a further indication of cephalo-caudal gradient of growth among Yadava girls. A similar trend is observed among Vadabaliya girls on comparing the sitting height (99.97%) with total arm length (99.98%) and caudo-

cephalic gradient is observed in the height of anterior-iliac spine (100.00%) with total arm length (99.98%) in total. In the present study as mentioned above the constituent segments of facial, trunk and extremities group clearly speak in favour of the 'reversal phenomenon'.

The circumferences reveal satisfactory view about the growth gradients which are caudo-cephalic. The caudo-cephalic gradient of growth can be clearly observed when we compare the upper arm circumference (99.77%) with calf circumference (100.00%) which is well advanced among Yadava and Vadabaliya girls upper arm circumference (99.96%), calf circumference (99.97%).

In the present study of the constituent measurements of the trunk, *i.e.* biilio-cristal diameter (99.96%) over biacromial diameter (100.00%) in Vadabaliya girls and biilio-cristal diameter (100.00%) over biacromial diameter (99.97%) in Yadava girls; the extremities, namely the height of anterior iliac spine (99.94%) (100.00%) over total arm length (100.00%) (99.98%) in both cases and cephalo-caudal direction in Yadava and caudo-cephalic direction in Vadabaliya girls and the triceps skinfold (96.08%) (91.70%) over subscapular (94.19%) (80.00%) skinfold in both the cases which mature earlier reveal of cephalo-caudal *i.e.* reversal of caudo-cephalic gradient of growth. Perhaps this is the reason why Tanner (1964) speaks of the smaller area gradients (as) being 'more complicated'. Tanner's expression, 'more complicated' is now to be viewed in the sense of caudo-cephalic gradients' instead of 'cephalo-caudal gradients'. This may, for the sake of brevity, be called reversal phenomenon. In the present study as mentioned above the constituent segments of trunk and extremities groups clearly speak in favour of the 'reversal phenomenon' *i.e.* (the caudo-cephalic gradient of growth). The present study is in agreement with the works of Sidhu (1969), Nath (1972), Krishna Rao (1981), Jhington and Nath (1985), Dharma Rao and Busi (1991) in terms of growth gradients.

Table 1 : Percentage of growth gradients in nineteen age groups (1 to 19 years) of Yadava girls obtained from adult value

Biological variables	Age groups (year) (mid-values)																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1. Stature	38.90	47.41	52.73	59.29	65.04	70.56	74.46	79.19	81.47	84.10	88.61	92.92	94.19	98.62	99.48	99.74	99.98	99.99	100.00
2. Sitting height	50.45	57.38	61.16	65.61	70.19	74.77	78.05	80.17	83.49	85.30	87.87	91.64	93.63	96.88	98.57	99.47	99.76	99.95	99.99
3. Height of anterior superior iliac spine	30.49	39.38	45.50	53.63	60.21	65.74	71.63	76.65	79.46	81.91	87.95	92.95	93.94	97.77	97.94	97.95	98.70	98.83	99.94
4. Total arm length	36.06	44.41	48.53	54.86	59.96	65.72	69.96	75.21	77.86	80.44	85.77	89.98	92.28	97.82	98.08	98.25	98.36	99.59	100.0
5. Biscroemial diameter	42.70	48.67	53.69	58.61	63.21	68.20	71.38	75.76	77.50	80.99	84.24	89.50	90.72	96.36	97.40	98.90	99.78	99.91	99.97
6. Transverse chest	53.76	60.68	63.84	64.96	66.18	69.20	71.32	73.76	77.03	78.46	80.36	85.99	88.62	92.21	95.02	96.37	97.71	98.79	100.00
7. Anterior posterior chest	49.28	56.06	58.77	63.46	65.85	69.52	70.52	72.13	74.25	75.42	77.08	82.03	84.76	89.71	92.94	95.61	98.11	99.22	100.00
8. Bilioeristal diameter	47.39	54.05	58.05	61.88	65.80	67.80	71.15	75.59	77.81	78.76	83.38	85.55	89.69	96.26	97.26	98.30	99.87	99.96	100.00
9. Nose height	52.75	59.17	67.20	71.79	76.15	80.04	82.11	87.38	88.30	89.45	90.82	94.95	96.33	97.71	98.62	99.31	99.77	100.00	100.00
10. Nose breadth	62.73	71.81	74.85	76.06	77.58	82.42	83.94	86.36	87.57	88.48	90.00	94.45	95.45	96.97	98.18	98.79	99.39	99.70	100.00
11. Morphological facial height	56.21	62.33	67.95	72.58	77.71	81.46	82.64	85.80	87.28	88.76	90.33	92.01	93.69	96.15	97.34	98.32	99.11	99.60	100.00
12. Wrist breadth	49.35	52.38	54.76	56.70	63.85	67.10	72.08	74.67	79.22	82.25	84.85	90.48	92.86	95.24	97.62	99.13	99.57	100.00	100.00
13. Head length	76.97	85.20	87.49	89.49	91.21	92.17	93.32	93.83	94.49	95.16	95.66	96.22	97.05	98.16	98.66	99.05	99.33	99.55	99.78
14. Head breadth	77.78	84.96	86.44	89.92	90.59	91.26	91.70	93.04	94.00	94.67	95.41	96.37	97.33	98.44	98.89	99.33	99.63	99.78	99.92
15. Biygomatic diameter	68.35	74.00	76.11	81.60	83.54	84.81	85.99	88.69	89.62	90.89	91.31	91.98	92.99	94.26	96.96	97.80	98.65	99.66	99.83
16. Bicondylar femur	47.04	52.81	58.30	63.06	65.22	66.67	70.27	73.74	76.91	78.64	81.53	87.16	89.32	92.50	94.66	96.82	98.41	99.42	100.00
17. Upper arm circumference	55.11	60.84	63.89	65.05	66.11	66.67	67.64	70.55	73.09	74.16	77.39	81.28	84.60	91.08	93.02	98.70	99.17	99.49	99.77
18. Calf circumference	49.91	55.77	60.04	63.87	67.28-69.91	72.29	75.13	77.05	80.35	83.84	86.75	89.41	94.03	95.81	99.29	99.71	99.96	100.00	
19. Triceps	84.20	91.75	97.18	91.25	81.39	72.63	65.89	68.01	72.74	72.94	73.44	74.24	77.36	90.44	83.30	93.36	102.71	103.02	96.08
20. Subscapular	60.12	61.42	59.61	60.12	59.61	57.01	53.71	56.51	58.81	59.51	60.12	64.13	69.34	74.45	80.26	89.98	100.10	118.44	94.19
21. Weight	11.37	18.40	22.95	26.98	31.97	37.15	40.41	46.18	50.50	54.92	60.31	69.20	73.49	84.76	89.33	97.18	97.85	98.45	98.81

Body weight in kg; Triceps, subscapular skinfolds in mm; All other biological variables in cm

Table 2 : Percentage of growth gradients in nineteen age groups (1 to 19 years) of Vadabatiya girls obtained from adult value

Biological variables	Age groups (year) (mid-values)																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1. Stature	38.40	46.45	51.91	56.03	62.26	67.93	70.50	74.21	78.61	81.60	83.94	86.76	90.81	93.72	96.60	98.69	99.26	99.83	99.99
2. Sitting height	50.01	57.35	61.22	64.23	68.53	73.91	75.87	77.80	81.15	83.81	85.11	87.33	91.54	94.40	97.14	98.95	99.58	99.84	99.97
3. Height of anterior superior iliac spine	30.79	39.21	45.63	51.17	58.22	64.47	66.51	72.00	77.35	81.41	83.73	87.34	91.21	93.76	96.19	98.09	99.90	99.99	100.00
4. Total arm length	36.85	44.52	49.28	53.09	59.46	64.66	67.41	71.88	77.09	80.50	82.60	86.33	89.78	94.40	97.63	99.88	99.93	99.96	99.98
5. Bicondylar diameter	41.58	49.42	53.64	57.45	62.24	67.73	69.57	74.73	78.15	81.30	83.81	85.12	90.21	94.70	97.88	99.76	99.88	99.94	100.00
6. Transverse chest	54.74	62.31	64.61	65.56	66.70	69.10	70.04	74.10	76.28	78.80	81.37	83.55	86.92	92.69	96.28	97.65	98.50	99.01	99.44
7. Anterior posterior chest	50.50	57.04	62.64	65.30	67.79	69.01	70.18	72.95	73.78	77.33	78.93	81.76	83.37	89.58	93.40	96.73	98.50	99.28	99.78
8. Bilioaristal diameter	49.49	55.13	58.64	61.95	65.38	69.15	71.65	73.77	77.84	81.31	83.05	84.91	88.98	95.08	97.88	99.11	99.49	99.79	99.96
9. Nose height	56.05	63.95	68.14	70.00	76.51	80.00	80.46	83.95	85.81	88.37	90.00	91.39	95.11	96.05	96.98	97.90	99.07	99.53	100.00
10. Nose breadth	61.90	68.15	70.83	72.61	75.59	79.76	81.25	83.92	85.71	87.20	88.39	90.18	91.67	94.34	96.13	97.61	98.51	99.10	100.00
11. Morphological facial height	56.50	63.49	67.77	71.07	77.48	80.10	80.97	84.47	85.34	87.28	88.25	89.03	91.46	92.62	94.76	96.79	97.86	98.83	99.51
12. Wrist breadth	47.38	51.31	53.71	56.55	62.00	66.37	69.43	73.58	79.26	82.31	84.71	89.30	92.14	93.89	97.16	98.25	99.13	100.00	100.00
13. Head length	76.95	85.51	87.92	89.24	90.28	91.88	92.31	92.91	93.69	94.18	94.67	95.33	96.10	97.69	98.24	99.23	99.72	99.89	99.94
14. Head breadth	77.42	84.60	88.30	89.11	90.15	91.56	91.86	92.45	93.11	95.11	95.93	96.89	97.78	98.81	99.26	99.40	99.85	100.00	100.00
15. Bizygomatic diameter	69.77	75.62	79.50	81.30	82.69	85.44	87.68	88.03	90.00	90.70	92.07	93.54	94.40	97.16	98.70	99.57	99.83	100.00	100.00
16. Bicondylar femur	47.36	54.49	60.77	63.48	66.61	68.47	70.47	74.75	79.17	81.45	83.45	87.59	91.58	93.00	95.58	98.00	99.57	100.00	100.00
17. Upper arm circumference	53.29	58.81	60.17	61.97	62.80	63.29	65.92	67.54	69.51	71.84	73.55	76.58	79.51	87.98	91.84	94.08	99.17	99.87	99.96
18. Calf circumference	49.17	55.27	58.66	62.01	64.69	67.64	68.86	71.77	75.19	76.92	78.79	82.14	85.36	90.99	94.34	97.11	99.86	99.93	99.97
19. Triceps	90.91	101.79	110.09	109.86	93.95	82.73	83.74	77.58	82.85	84.19	84.30	78.47	81.39	99.55	100.45	97.31	139.12	116.70	91.70
20. Subscapular	52.46	50.88	52.71	56.75	53.25	50.44	49.82	49.12	49.21	51.84	53.33	53.07	57.98	80.61	92.89	84.38	115.6	110.17	80.00
21. Weight	11.42	17.48	21.53	25.18	29.19	33.67	36.37	40.19	45.30	50.85	53.98	57.95	65.23	78.19	86.85	92.78	98.33	99.60	99.96

Body weight in kg. Triceps and subscapular skinfolds in mm. All other biological variables in cm.

The growth differences observed between the Yadava and Vadabaliya girls need to be explained at this juncture. The social status of both the caste groups in the prevailing Hindu caste system is low. The Vadabaliya community in particular is very poor, their occupation (fishing is not as dignified as that of the Yadavas (agriculturalist), they occupy a low position in the society, living mostly outside the villages, and are educationally backward. Both the groups are lower income groups. The factors associated with socio-economic environment may play a role in limiting growth potential throughout the growth period. The socio-economic status of Yadava community is considerably better than the Vadabaliya. However, owing to the occupation it is obvious that Vadabaliyas have easy access to and may consume fish and other sea foods abundantly as also shown by other studies (Busi et al., 1987). This high consumption of protein rich food of Vadabaliyas may have resulted in better growth.

Regarding the genetic differences, both Yadava and Vadabaliya are reproductively isolated from one another and also strictly endogamous. Raja Rajeswari (1988) in her study observed some difference between these two communities in their demographic, genetic and other characters. These inherent genetic factors affecting the velocity of growth which give the Vadabaliya girls a characteristic cross-sectional growth patterns in many variables which is quantitatively different from that observed in Yadava girls. This would be consistent with what is known of genetic factors affecting growth and development (Tanner, 1962) and comparative growth studies of different ethnic group (Eveleth and Tanner, 1976).

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