

A study on comparison of anthropometrical measurements in oraon and non-oraon boys

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Abstract

A few studies based on published data have indicated patterns of anthropometric variation along ethnic, geographic, latitude, longitude and altitude, nutrition and several confounding variables. Many growth studies have been published for the tribal populations of Chhattisgarh. However, no study, especially with regard to the growth status of the Oraons of Chhattisgarh has been undertaken. Cases taken in this study were registered cases in government schools of Jashpur district. 200 boys (100 Oraon and 100 Non Oraon) were included in the study according to inclusion and exclusion criteria. Age range was 5-18 yrs. At most of the ages BMI was less for OT boys than NO boys, except at the age periods of 17+ and 18+ where the BMI of OT boys was more than NO boys. In the age period of 15+ the BMI of OT and NO boys was found to be same. The difference was statistically significant at age periods of 7+, 8+ and 10+ and highly significant in age period of 17+.

Keywords: Anthropometrical measurements, Oraon Boys, BMI, OT(Oraon tribe), NO (Non Oraon)

Introduction

Anthropometry is the longest-used measure of human variation, one which has undergone considerable change in understanding and interpretation since the nineteenth century^[1].

With changing meaning has come change in usage: from racial classification to international public health and, most recently, anthropometric history. Thus, anthropometry has been used in the creation and validation of racial typologies, in the determination of healthy or strong physique, as a measure of physiological and developmental plasticity in relation to environmental quality and in the investigation of human welfare in relation to both health and economics^[2, 3].

The history of anthropometry includes use as an early tool of physical anthropology, use for identification, use for the purposes of understanding human physical variation, in paleoanthropology and in various attempts to correlate physical with racial and psychological traits^[4].

The population of Chhattisgarh is notable for the high proportion of Scheduled Tribes. Of the total population, tribals constitute at least 32.5 percent, which is a significantly high percentage. In Jashpur the tribals are 65.37% of the total population. Oraon is one of the major populations amongst all the tribals found in Jashpur. Total population of Jashpur district according to 2011 census is 851,669. Total population of Oraon tribe in Chhattisgarh is 756,000^[5].

A few studies based on published data have indicated patterns of anthropometric variation along ethnic, geographic, latitude, longitude and altitude, nutrition and several confounding variables^[5, 6].

Many growth studies have been published for the tribal populations of Chhattisgarh. However, no study, especially with regard to the growth status of the Oraons of Chhattisgarh has been undertaken. So, more growth and nutritional studies are needed to carry out in Oraon population of Chhattisgarh with a view to understanding the nutritional status of children. This work is an attempt to study the growth status of Oraon tribe boys of Pathalgaon block, Jashpur district, Chhattisgarh state and compare them with Non-Oraon population of the same region.

Methodology

Study design: This is an Observational cross-sectional study. (Comparative study).

Study area: This study was conducted in Pathalgaon block of Jashpur district, Chhattisgarh.

Sample size: 200 (100 Oraon and 100 Non-Oraon) boys according to sample size calculation using 95% confidence interval anticipated and absolute precision of 0.05.

Sampling method: Cases taken in this study were registered cases in government schools of Jashpur district. 200 boys (100 Oraon and 100 Non Oraon) were included in the study according to inclusion and exclusion criteria. Age range was 5-18 yrs.

Study technique: Interview technique and clinical examination.

Ethical consideration: Written informed consent was obtained from the parents or guardian of all subjects in their own language.

Statistical analysis: The analysis, comparison and interpretation of the data with statistical methods was done.

Inclusion criteria

- Children of schools of Pathalgaon block, Jashpur district, Chhattisgarh.
- Age group 5 to 18 yrs. Male and apparently healthy.

Exclusion criteria

- Children other than schools of Pathalgaon block, Jashpur district, Chhattisgarh.
- Females.
- Age less than 05 yrs & more than 18 yrs.
- Apparently ill child.

Variables: Name, father's name, age, residential address, weight, stature, sitting height, and various other anthropometric parameters mentioned in the study.

Materials

- Sliding Calliper
- Spreading Calliper

- Portable electronic weighing machine
- Measuring tape.
- Anthropometer.

Results

Table 1: BMI comparison

BMI (Kg/m ²)									
Age	Non Oraon(NO)				Oraon Tribe(OT)				P value
	No.	Mean	S.D.	S.E	No.	Mean	S.D.	S.E	
5+	6.00	13.10	0.72	0.29	6.00	13.56	1.64	0.67	0.55
6+	5.00	14.11	1.43	0.64	7.00	13.58	0.74	0.28	0.41
7+	7.00	16.45	2.58	0.98	7.00	12.95	1.06	0.40	0.01
8+	9.00	15.98	1.98	0.66	5.00	13.59	1.25	0.56	0.03
9+	10.00	15.96	2.04	0.65	6.00	14.77	1.69	0.69	0.25
10+	5.00	17.33	1.91	0.85	8.00	14.47	1.84	0.65	0.02
11+	10.00	15.21	1.05	0.33	6.00	14.30	0.93	0.38	0.10
12+	8.00	16.35	1.75	0.62	10.00	15.68	1.29	0.41	0.36
13+	6.00	19.32	6.09	2.49	5.00	16.57	2.58	1.15	0.38
14+	6.00	18.67	3.63	1.48	9.00	16.59	1.60	0.53	0.15
15+	7.00	17.96	0.87	0.33	7.00	17.96	1.27	0.48	0.99
16+	7.00	17.20	1.35	0.51	10.00	16.72	1.21	0.38	0.45
17+	8.00	17.48	1.06	0.38	7.00	19.41	0.98	0.37	0.00
18+	6.00	18.98	1.70	0.70	7.00	19.43	1.25	0.47	0.60
Total	100.00	16.65	2.69	0.27	100.00	15.79	2.43	0.24	0.02

Table 2: BMI categories in study subjects

Characteristics		Tribe		Total
		Non-Oraon	Oraon	
BMI Category	Normal	86	90	176
	Overweight	7	1	8
	Obese	5	0	5
	Underweight	2	9	11
Total		100	100	200

The mean value for body mass index changes markedly within the entire period of growth in both groups.

The index varies between 12.95 to 19.43 in OT and NO together. The highest value for this index is observed at 18+ years in OT, while the lowest value is observed at 7+ in OT.

Most of the OT boys (90%) were normal and 1% was overweight, whereas 9% were underweight. No OT boys were found to be obese.

Most of the NO boys (86%) were normal and 7% were overweight, whereas 2% were underweight. 5% NO boys were found to be obese.

At most of the ages BMI was less for OT boys than NO boys, except at the age periods of 17+ and 18+ where the BMI of OT boys was more than NO boys. In the age period of 15+ the BMI of OT and NO boys was found to be same. The difference was statistically significant at age periods of 7+, 8+ and 10+ and highly significant in age period of 17+.

When Oraon tribe (OT) and Non-Oraon (NO) boys were compared, it was seen that the distance curve for OT boys ran below the distance curve for NO boys except in the age period of 7+, 8+, 9+, 10+ and 12+, where the distance curve for OT boys ran above the distance curve for NO boys. Difference is significant at the age periods of 10+ and 17+ (p value <

0.05) and highly significant at the age period of 16+ (p value <0.01).

The S.D. varied from a minimum of 1.23 and 1.54 at 13+ and 10+ to a maximum of 6.08 and 6.28 at 5+ and 18+, indicating the extent of variation in the total sample of Oraon tribe boys and Non-Oraon boys respectively.

Table 3: Total Arm Length (cm)

Age	Non Oraon(NO)				Oraon Tribe(OT)				P value
	No.	Mean	S.D.	S.E	No.	Mean	S.D.	S.E	
5+	6.00	47.28	1.51	0.62	6.00	47.08	1.36	0.55	0.81
6+	5.00	48.16	1.63	0.73	7.00	48.64	2.01	0.76	0.67
7+	7.00	52.84	2.32	0.88	7.00	52.57	2.41	0.91	0.83
8+	9.00	54.27	2.04	0.68	5.00	55.36	1.39	0.62	0.31
9+	10.00	58.93	4.91	1.55	6.00	55.87	3.57	1.46	0.21
10+	5.00	63.08	2.45	1.10	8.00	62.58	1.82	0.64	0.68
11+	10.00	66.59	2.37	0.75	6.00	64.33	1.63	0.67	0.06
12+	8.00	70.14	2.25	0.79	10.00	69.06	1.04	0.33	0.20
13+	6.00	70.90	6.35	2.59	5.00	69.60	2.75	1.23	0.68
14+	6.00	73.45	3.21	1.31	9.00	75.43	2.52	0.84	0.20
15+	7.00	73.56	2.91	1.10	7.00	72.83	2.17	0.82	0.60
16+	7.00	75.57	1.35	0.51	10.00	74.72	1.14	0.36	0.18
17+	8.00	75.78	1.77	0.63	7.00	75.84	1.15	0.44	0.93
18+	6.00	74.05	3.16	1.29	7.00	75.46	2.52	0.95	0.39
Total	100.00	64.75	10.12	1.01	100.00	65.23	10.28	1.03	0.74

When Oraon tribe (OT) and Non-Oraon (NO) boys were compared, it was seen that the distance curve for OT boys ran below the distance curve for NO boys except in the age period of 6+, 8+, 14+ and 17+, where the distance curve for OT boys ran above the distance curve for NO boys.

The S.D. varied from a minimum of 1.04 and 1.35 at 12+ and 16+ to a maximum of 3.57 and 6.35 at 9+ and 13+, indicating the extent of variation in the total sample of Oraon tribe boys and Non-Oraon boys respectively.

Table 4: Biacromial Diameter (cm)

Age	Non Oraon(NO)				Oraon Tribe(OT)				P value
	No.	Mean	S.D.	S.E	No.	Mean	S.D.	S.E	
5+	6.00	26.12	1.12	0.46	6.00	25.57	1.28	0.52	0.45
6+	5.00	26.82	1.56	0.70	7.00	27.01	1.00	0.38	0.80
7+	7.00	27.94	1.37	0.52	7.00	28.16	1.64	0.62	0.80
8+	9.00	27.07	0.94	0.31	5.00	27.08	2.60	1.16	0.99
9+	10.00	30.90	1.77	0.56	6.00	32.00	0.82	0.34	0.18
10+	5.00	31.32	2.36	1.06	8.00	31.49	1.78	0.63	0.89
11+	10.00	32.05	0.90	0.28	6.00	32.55	0.95	0.39	0.31
12+	8.00	32.63	1.11	0.39	10.00	33.40	1.57	0.50	0.26
13+	6.00	34.62	2.55	1.04	5.00	34.98	2.14	0.96	0.81
14+	6.00	39.98	0.37	0.15	9.00	38.78	0.98	0.33	0.01
15+	7.00	38.10	1.58	0.60	7.00	37.53	1.37	0.52	0.48
16+	7.00	39.17	0.97	0.37	10.00	38.01	0.87	0.28	0.02
17+	8.00	39.70	0.88	0.31	7.00	39.39	0.98	0.37	0.52
18+	6.00	39.85	1.26	0.51	7.00	39.46	0.84	0.32	0.52
Total	100.00	33.22	5.12	0.51	100.00	33.67	4.88	0.49	0.53

When Oraon tribe (OT) and Non-Oraon (NO) boys were compared, it was seen that the distance curve for OT boys ran above the distance curve for NO boys except in the age period

of 5+, 14+, 15+, 16+, 17+ and 18+, where the distance curve for OT boys ran below the distance curve for NO boys. Difference is significant at the age periods of 14+ and 16+ (p value < 0.05).

The S.D. varied from a minimum of 0.82 and 0.37 at 9+ and 14+ to a maximum of 2.60 and 2.55 at 8+ and 13+, indicating the extent of variation in the total sample of Oraon tribe boys and Non-Oraon boys respectively.

Table 5: Biiliac Breadth (cm)

Age	Non Oraon(NO)				Oraon Tribe(OT)				P value
	No.	Mean	S.D.	S.E	No.	Mean	S.D.	S.E	
5+	6.00	17.88	0.53	0.22	6.00	17.52	0.61	0.25	0.29
6+	5.00	18.02	0.36	0.16	7.00	17.61	0.66	0.25	0.24
7+	7.00	18.94	1.11	0.42	7.00	18.33	0.96	0.36	0.29
8+	9.00	19.16	0.93	0.31	5.00	18.10	0.51	0.23	0.04
9+	10.00	20.91	1.47	0.46	6.00	20.42	1.57	0.64	0.54
10+	5.00	22.58	0.42	0.19	8.00	20.43	1.32	0.47	0.01
11+	10.00	21.05	1.09	0.34	6.00	19.73	0.53	0.22	0.02
12+	8.00	23.94	0.91	0.32	10.00	22.62	1.48	0.47	0.04
13+	6.00	26.23	4.67	1.91	5.00	24.60	0.53	0.24	0.46
14+	6.00	26.18	1.83	0.75	9.00	25.11	0.71	0.24	0.13
15+	7.00	24.36	0.40	0.15	7.00	24.20	0.48	0.18	0.51
16+	7.00	24.81	0.68	0.26	10.00	24.48	0.44	0.14	0.24
17+	8.00	26.03	0.80	0.28	7.00	26.01	0.53	0.20	0.98
18+	6.00	24.85	1.93	0.79	7.00	26.36	1.17	0.44	0.11
Total	100.00	22.42	3.25	0.32	100.00	22.08	3.23	0.32	0.45

When Oraon tribe (OT) and Non-Oraon (NO) boys were compared, it was seen that the distance curve for OT boys ran below the distance curve for NO boys except in the age period of 18+, where the distance curve for OT boys ran above the distance curve for NO boys. Difference is significant at the age periods of 8+, 10+, 11+ and 12+ (p value < 0.05).

The S.D. varied from a minimum of 0.44 and 0.36 at 16+ and 6+ to a maximum of 1.57 and 4.67 at 9+ and 13+, indicating the extent of variation in the total sample of Oraon tribe boys and Non-Oraon boys respectively.

Table 6: Upper Arm Circumference (cm)

Age	Non Oraon(NO)				Oraon Tribe(OT)				P value
	No.	Mean	S.D.	S.E	No.	Mean	S.D.	S.E	
5+	6.00	15.40	0.61	0.25	6.00	15.18	0.59	0.24	0.55
6+	5.00	16.56	0.95	0.43	7.00	15.87	0.45	0.17	0.12
7+	7.00	16.49	1.24	0.47	7.00	15.56	1.14	0.43	0.17
8+	9.00	16.86	1.63	0.54	5.00	16.28	0.31	0.14	0.46
9+	10.00	17.16	0.83	0.26	6.00	17.75	1.75	0.71	0.37
10+	5.00	18.70	2.03	0.91	8.00	16.64	1.19	0.42	0.04
11+	10.00	19.84	1.27	0.40	6.00	17.72	0.68	0.28	0.00
12+	8.00	21.08	1.81	0.64	10.00	19.87	0.99	0.31	0.09
13+	6.00	23.60	5.16	2.11	5.00	21.28	2.74	1.23	0.39
14+	6.00	23.28	1.90	0.78	9.00	21.81	1.33	0.44	0.10
15+	7.00	22.47	0.91	0.34	7.00	22.57	1.15	0.44	0.86
16+	7.00	22.57	1.10	0.41	10.00	22.15	0.99	0.31	0.42
17+	8.00	23.71	1.26	0.45	7.00	23.13	1.11	0.42	0.36
18+	6.00	24.25	1.37	0.56	7.00	24.20	0.27	0.10	0.93
Total	100.00	20.06	3.47	0.35	100.00	19.51	3.23	0.32	0.24

When Oraon tribe (OT) and Non-Oraon (NO) boys were compared, it was seen that the distance curve for OT boys ran below the distance curve for NO boys except in the age period of 9+ and 15+, where the distance curve for OT boys ran above the distance curve for NO boys. Difference is significant at the age period of 10+ (p value < 0.05) and highly significant at the age period of 11+ (p value < 0.01).

The S.D. varied from a minimum of 0.27 and 0.61 at 18+ and 5+ to a maximum of 2.74 and 5.16 at 13+ and 13+, indicating the extent of variation in the total sample of Oraon tribe boys and Non-Oraon boys respectively.

Table 7: Max Calf Circumference(cm)

Age	Non Oraon(NO)				Oraon Tribe(OT)				P value
	No.	Mean	S.D.	S.E	No.	Mean	S.D.	S.E	
5+	6.00	21.13	0.94	0.38	6.00	20.58	1.04	0.43	0.36
6+	5.00	20.86	0.86	0.38	7.00	20.33	1.09	0.41	0.39
7+	7.00	21.86	1.57	0.59	7.00	20.81	1.57	0.59	0.24
8+	9.00	23.39	1.39	0.46	5.00	22.22	0.76	0.34	0.11
9+	10.00	24.20	0.79	0.25	6.00	24.63	0.99	0.40	0.35
10+	5.00	25.86	2.64	1.18	8.00	24.16	0.89	0.31	0.12
11+	10.00	24.55	0.92	0.29	6.00	24.55	0.82	0.34	1.00
12+	8.00	26.40	1.56	0.55	10.00	25.88	1.92	0.61	0.55
13+	6.00	29.58	5.96	2.43	5.00	26.78	3.52	1.57	0.38
14+	6.00	29.80	3.59	1.46	9.00	28.47	2.79	0.93	0.43
15+	7.00	30.29	0.56	0.21	7.00	29.59	0.69	0.26	0.06
16+	7.00	30.20	0.56	0.21	10.00	29.80	0.83	0.26	0.29
17+	8.00	32.09	0.75	0.26	7.00	31.87	0.94	0.36	0.63
18+	6.00	31.33	1.18	0.48	7.00	31.37	0.68	0.26	0.94
Total	100.00	26.47	4.17	0.42	100.00	26.08	4.09	0.41	0.50

When Oraon tribe (OT) and Non-Oraon (NO) boys were compared, it was seen that the distance curve for OT boys ran below the distance curve for NO boys except in the age period of 9+ and 18+, where the distance curve for OT boys ran above the distance curve for NO boys. The distance curve for OT boys and NO boys coincided at age period of 11+.

The S.D. varied from a minimum of 0.68 and 0.56 at 18+ and 15+ , 16+ to a maximum of 3.52 and 5.96 at 13+ and 13+, indicating the extent of variation in the total sample of Oraon tribe boys and Non-Oraon boys respectively.

Table 8: Chest Breadth (cm)

Age	Non Oraon(NO)				Oraon Tribe(OT)				P value
	No.	Mean	S.D.	S.E	No.	Mean	S.D.	S.E	
5+	6.00	17.33	0.42	0.17	6.00	17.17	0.55	0.22	0.57
6+	5.00	18.00	1.00	0.45	7.00	17.99	0.89	0.34	0.98
7+	7.00	19.76	1.33	0.50	7.00	19.69	2.13	0.81	0.94
8+	9.00	20.14	1.35	0.45	5.00	19.26	1.24	0.55	0.25
9+	10.00	20.65	1.30	0.41	6.00	20.63	1.16	0.47	0.98
10+	5.00	21.32	0.90	0.40	8.00	21.24	1.14	0.40	0.89
11+	10.00	22.42	1.67	0.53	6.00	20.75	1.10	0.45	0.05
12+	8.00	23.88	1.31	0.46	10.00	22.33	1.66	0.53	0.05
13+	6.00	25.62	3.71	1.52	5.00	23.88	1.21	0.54	0.35
14+	6.00	26.23	0.92	0.37	9.00	25.58	0.86	0.29	0.18
15+	7.00	25.97	1.35	0.51	7.00	25.31	0.68	0.26	0.27
16+	7.00	25.27	0.78	0.30	10.00	25.19	0.60	0.19	0.81

17+	8.00	26.58	0.89	0.32	7.00	26.29	0.80	0.30	0.52
18+	6.00	26.10	1.17	0.48	7.00	26.43	1.17	0.44	0.62
Total	100.00	22.81	3.31	0.33	100.00	22.52	3.21	0.32	0.53

Discussion

This study was conducted on 100 Oraon tribe (OT) and 100 Non-Oraon (NO) boys studying in government schools of Pathalgaon block, Dist. Jashpur, Chhattisgarh. This area was chosen as it showed average density of Oraon tribe and Non-Oraon population as per data from block office, Pathalgaon.

Majority of the selected subject's parents belonged to moderate economic status & were mainly in small scale business (42%).

The present study examined the anthropometric parameters of growth of children from 5-18 years.

At all ages, OT boys weighed less than NO boys except in the age period of 17+ and 18+, where the OT boys weighed more than NO boys. At 17 years this difference was statistically highly significant.

Stature of most of the boys was normal. The height of OT and NO boys ran close throughout all the age groups. The stature of OT boys was significantly more than NO boys at 10 years.

Body Mass Index was used to assess the nutritional status.

Body Mass Index is used as an indicator of chronic energy deficiency (CED). According to JAMES et al (1988)^[7] the grades of CED are classified as follows for adults-BMI <16.0 as grade III undernutrition, 16.0-16.9 as grade II undernutrition, 17.0-18.4 as grade I undernutrition and >18.5 as normal. According to Centre for Disease Control (CDC), USA (2000)^[8], children were categorized into 4 groups: Obese (>95th percentile), overweight ($\geq 85^{\text{th}}$ percentile), normal (<85th percentile and $>5^{\text{th}}$ percentile) and underweight ($\leq 5^{\text{th}}$ percentile) using age and sex specific percentiles of BMI.

At most of the ages BMI was less for OT than NO boys and the difference was statistically significant at 7, 8 and 10 years. BMI of OT coincided with NO boys at 15 years, while crossed NO boys at 17 and 18 years. The difference was highly significant at 17yrs. This may be because of spurt in weight of OT boys at 17 and 18 yrs, while the height lagged behind.

In both, OT and NO, BMI progressively increased with age. According to Indian standards, BMI more than 15 is considered as normal. As a group, this was achieved at the age of 16 to 18 years.

In spite of undernutrition as assessed by BMI, stature did not seem to be affected. Mitra et al.,^[9] pointed out lower weight and stature for Kamar children of Raipur District, Chhattisgarh compared with the data for other tribes and for all India and attributed this to undernutrition.

Shukla et al.^[10] have observed a mean height of 170 and 173 cms. at the age of 18 years in rural and urban school boys respectively.

Gupta^[6] has reported a mean height of 162 cm. with a range of 142 to 177 cm. for Gond adult males from Kanker district.

When BMI is observed to be low in studied population, it is generally presumed to be the effect of undernutrition. But, undernutrition should also have adverse effect on stature. Heird (2003)^[41], Martins (2011)^[42].

Because of this disparity in observed stature and BMI, it is logical to think of other causes of low BMI. According to Mitra et al. growth represents a complex interaction of nutritional intake, absorption and requirements, all of which vary within and among populations. Nutritional requirements alone are complex function of body size, age, health and activity levels. (Pike & Brown, 1975)^[43]. Even the best estimates of nutritional intakes are not an ideal indicator of a population's nutritional status because intake accounts for only one of the relevant variables. (Dwyer, 1991, Floud, 1991)^[44, 45].

It was observed that among both the groups sitting height and total lower limb length

increased with age. The growth occurred throughout from 5 to 15 years. Afterwards, it became stable.

The Sitting Height (SH) of NO boys was more as compared to OT boys in younger age groups (5-8 years). Thereafter the SH of OT boys was more in all age groups except in 12 years. The difference was statistically significant between the two groups from 13 to 18 years. The total lower extremity length (TLL) was more in OT boys in the younger age groups (7-10 years) while TLL was more in NO boys in older age groups (13-18 years). This may be due to sudden growth spurt in NO boys at around 13 years.

To study association between body proportions for both SH and LL further study and calculation of correlation is needed. Fredriks et al. (2004)^[46], studying on Dutch children, observed the association between body proportions and height. As expected, for both SH and LL a strong positive association with height SDS was found in all age groups. The correlations between SH/H (or SH/LL) SDS and height were all negative and statistically significant.

Total arm length, Biacromial diameter and Biiliac breadth showed age related increase.

Upper arm circumference exhibited gradual and smooth increment throughout the age groups. NO boys seemed to be on higher side in all the age groups, with the difference being statistically significant in 10 and 11 years.

All other anthropometric measurements such as biacromial diameter, biiliac breadth, maximum calf circumference, chest breadth (transverse chest diameter) chest depth (antero posterior diameter), Chest circumference, show increasing trend with age in both groups, but it is not uniform in all the ages. However, comparison revealed that, the OT boy's show lower values for almost all the anthropometric measurements in most of the ages.

Similar result were found by Shukla et al. on their study on KV & JNV boys.

Conclusion

At all ages, OT boys weighed less than NO boys, except for 17 and 18 years, where the OT boys weighed more than NO boys. At 17 years this difference was statistically highly significant.

When BMI was compared, At most of the ages BMI was less for OT than NO boys and the difference was statistically significant at 7, 8 and 10 years. BMI of OT coincided with NO boys at 15 years, while crossed NO boys at 17 and 18 years. The difference was highly significant at 17 yrs. This may be because of spurt in weight of OT boys at 17 and 18 yrs, while the height lagged behind.

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