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INTER GENERATIONAL CHANGES IN SOMATOMETRIC MEASUREMENTS OF DESIA KANDHA OF SOUTHERN ODISHA

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ABSTRACT

The present study is an intergenerational study. Six somatometric measurements are taken on parent generation and filial generation of both sexes i.e. father-son and mother-daughter pairs of Desia Kandha of Ganjam district of Southern Odisha. The measurements are stature, sitting height, bi-acromial diameter, bi-iliocristal breadth, height radiale and height tibiale. 100 'Father –Son' pairs and 102 'Mother–Daughter' pairs of the Desia Kandha were measured. The result shows that lower mean value in stature, bi-iliocristal diameter, height radiale and height tibiale are found in case of Desia Kandha son and daughter in comparison with their father and mother. The filial generation of the Desia Kandha shows a negative secular trend of growth.

Keywords: Intergenerational, Desia Kandha, Somatometric measurements

INTRODUCTION

Height in man is polygenic in nature and the character of tallness is recessive to shortness. Greater incidence of short stature in the inbred samples indicates a greater frequency of genes for relatively short stature in a population. The size and shape of an adult is the result of a continuous interaction between genetic and environmental influences during growth (Eveleth and Tanner, 1990). The human being is the product of both heredity and environment. The environment of human includes his or her own society, the culture, civilization and climatic or ecological condition. The offspring inherit the physical and mental traits from either of the parents or both the parents.

The secular growth is a long term time frame growth which is associated with generational change. The word secular is derived from the Latin word "Saeculum" which means generation or age. Hence with the generation or age the growth

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phenomenon which affect increase growth velocity, earlier maturation and greater adult stature, are manifested with secular growth change. Secular trend of growth may take place in positive or negative direction depending on environmental changes, inbreeding, intermixture etc.

The most important biological phenomenon in human being is changes in body size that has taken place generation after generation. A continuous operation of heredity and variation is going on in nature. No two persons are exactly alike, not even the identical twins. The variation may be due to natural selection, mutation, hybridization (race crossing in case of human being) and environmental conditions. All these factors will result a small body size. When the environmental conditions are not congenial for a population, the body dimensions of that population will be decreased. This phenomenon is studied by Tobias (1972) who studied 90 sub-Saharan African populations measured over the past ninety years are reviewed. Decreased height or body size is found among the black Africans of Southern Africa. This negative trend is due to nutritional deterioration.

PRESENT STUDY AND THE DESIA KANDHA

Secular growth of a population depends on the mating patterns, mutation and environmental conditions of that population. The study on secular growth trend in India is a complex phenomenon. Indian Society is the combination of different endogamous groups like different religious groups, castes and tribes. Exogamy is very rare in traditional Indian society. So any change in body dimension in traditional society is due to improved environmental condition, instead of hetrosis. There are some societies which prefer cross cousin marriages, when such rules are followed by the members of a society, the genetic makeup of a population to be affected to a great extent. For example, the study conducted by Mukherjee & Lakshmanudu (1977) among 112 male and 24 female offspring of consanguineous marriages and 183 male and 84 female offspring of non - consanguineous marriage of an endogamous group of *Gampasati Kamma* caste and 179 inbred and 216 non-inbred males belonging to *Telaga* caste from Andhra Pradesh. Increase of stature was found among the offsprings of non-consanguineous marriages in comparison to the inbreeding depression noticed among the offsprings of consanguineous marriages. The Desia Kandha of Odisha are tribals, poor, landless with low level of literacy. The degree of inbreeding in the Kandha society is high due to consanguineous marriage particularly cross-cousin marriage. So this type of society was selected for the study of secular growth.

The Kandha population of Odisha is spread throughout the state in all the thirty districts, their main concentration being in covering districts of Rayagada, Kondhamal, Phulbani, Kalahandi, Koraput, Bolangir, Puri and Ganjam. They follow both their traditional religion and Hinduism. They are also settled in Andhra Pradesh and Madhya Pradesh to a large extent; and in Maharastra, Bihar and West Bengal in small number (Mandal *et al* 2002). The Kandhas are indigenous tribal group of India, believed to be of Proto-Australoid racial stock. The word "Kandh"

derived from the word Kandha (Shoulder). Different anthropologists like Thruston, Naik and Patnaik divided Kandha tribe into number of sub – group such groups as Dongria, Kutia, Penga, Jhuria, and Desia. The Desia Kandhas are living in Phulabani, Gajapati and Ganjam district. Desia Kandha of Ganjam distict is one of the endogamous group. Mainly they concentrated in the Eastern Ghats region of Kukudakhandi Block. Desia Kandhas are settled at foothills and depend mostly on cultivation. The fertile plains of this region lie between the high mountain ranges of Kerandimala hills and Ghadaghada River. Desia Kandha is not included in Primitive Tribal Group list.

Rice is the staple food for them and mainly they take food three times in a day. The Desia Kandhas are very fond of non-vegetarian food and they would like to have chicken, fish, pork, and other meat available from forest birds and animals. Now a days they don't take beef. They have their own concept of health as a part of their culture. But they have very little knowledge about modern concepts of health, hygiene and balanced diet. They depend on stream water for drinking purpose and this is the main cause they are frequently affected with diarrhoea, stomach disorder etc. Malaria and tuberculosis are very common among them. Due to pollution and dust they suffer from tuberculosis. They are living in hilly area and many crusher factories for stone cutting and making chips established nearby Kandha villages. This might be the main cause of tuberculosis found among them. After 60 years of independence; most of the people from this group are illiterate. They do not know the importance of education. The literacy level is low among them. In a few areas Aanganwadi Centres and schools are available. Kandhas are mainly dependent on cultivation and most of them work as daily wage labourers. They practice shifting cultivation (*Bagadachasa* in local language). Mostly the Kandhas are staying on foot hills.

MATERIAL AND METHOD

The present study aims to examine the secular change in somatometric measurements through generational analysis. Data on the Desia Kandhas are collected from both Ganjam and Gajapati district. Samples are collected from villages under Kukudakhandi, Digapahandi Block of Ganjam district and villages under Mohona Block of Gajapati district of Southern Odisha. A set of six somatometric measurements on body was selected to study the secular change of growth among the Desia Kandha. The parameters were stature, sitting height, bi-acromial diameter, bi-iliocristal breadth, height radiale and height tibiale. The study is conducted on both sexes i.e. father-son and mother-daughter pairs. It is an intergenerational study.

Data collection was carried out only on those individuals who organized life and were physically active. No illnesses were reported during the data collection and the individuals selected for study were not on any regular medication. Families where both the pairs have been available were included in the sample, although such ideal conditions were not easy to found as most boys went out as migrant labourers and girls leave their parental residence by getting married around 18 years age.

Certain criteria were taken in consideration while selecting the cohorts. They were as follows: Male parents who were above 55 years and female parents who were above 50 were not included in the sample as there is natural decrease of longitudinal somatometric measurements due to shrinkage of inter- vertebral discs and postural alterations with the aged. The minimum age for son and daughter selected for the sample was restricted to 22 years and 18 years respectively as they had attained maturity and maximum growth or height by that age. Pregnant mothers and adopted sons or daughters were also excluded from the study. Because the breadth measurement will vary in case of pregnant mother. As adopted children are not genetically related to their parents, they were excluded from the study. Families based on inter caste marriage were excluded. Because individual from inter caste marriage will differ in height from their relatives due to exogamy.

The measurements were taken as per the methods described in "Anthropometry" by I. Singh and Bhasin (1968). All the measurements were taken between 6 A.M and 10 A.M and between 5 P.M and 8 P.M. All the subjects were asked to stand on plain surface and measurements taken carefully by the author herself with the same set of Anthropometer.

The Sample Size

Group	*No. of Father - Son pairs*	*No. of Mother – Daughter pairs*	*Total*
DesiaKandha	100 (Hundred)	102 (Hundred two)	202 Pairs **(404 individuals)**

In statistical analysis calculations were done by using computerized statistical software, viz. SPSS 11.5 version and MS Excel. Statistical methods were used for the calculation of Mean, Standard Deviation, Standard Error of Mean, Standard Error of standard deviation, Range of each of the studied measurement.

RESULTS

In case of the Desia Kandha group, the sons show lower mean value for stature than their fathers that is -1.27 cms. (Table 1). But it is not statistically significant. In case of the Desia Kandha daughters they show lower mean stature than their mothers that is – 0.02 cms and it is not statistically significant (Table 2). The mean sitting height is higher in case of Desia Kandha daughters and sons but it is not statistically significant in both the sexes of filial generation. Bi-acromial diameter increases among the offspring generation of both the sexes. It is significantly higher for Desia Kandha daughters. The sons show higher mean value for bi-acromial diameter but the value is not statistically significant. The mean of bi-iliocristal breadth is decreased in filial generation. In case of Desia kandha sons and daughters have narrower hip than their fathers and mothers but the mean decrease is not at all significant. The Desia Kandha sons and daughters show decrease in height radiale in comparison to both the parents and this is also not statistically significant. The Desia Kandha sons and daughters show the

lower height tibiale than their parents but this decrease is not statistically significant.

In case of the Desia Kandha lower mean value in stature, bi-iliocristal breadth, height radiale and height tibiale are found among filial generation. So this shows negative secular trend of growth among the Desia Kandha. The Kandha shows negative secular growth like other tribes of Odisha.

DISCUSSION

Desia Kandhas are poor, uneducated and isolated from the main stream. They follow endogamy but cross cousin marriages are preferential marriages for them. Considering all these above factors the group is selected for the study of secular change of growth. In case of the Desia Kandha lower mean value in stature, bi-iliocristal breadth, height radiale and height tibiale are found in case of filial generation. So this shows negative secular trend of growth among the Desia Kandha of Southern Odisha. Stature is an important variable character which deserves careful consideration because it is stated that environment has an obvious effect on stature. In the same place two people may live side by side with variable stature because of heredity and environmental effect on human physical growth.

A cross-sectional sample of 400 Fathers, 400 Mothers, 292 Sons and 170 Daughters were examined and measured by Sudipta Ghosh and S.L. Malik in 2007. Positive secular trend is marked among the Santhalis; data were collected from number of villages of Ranibandh block of Bankura district of West Bengal (Ghosh and Malik, 2007).

In 2008 another study on secular growth of the Oraon has been conducted by Nanda. The study was based on five somatometric measurement like height vertex, height radiale etc. on 50 pairs of father-son and 90 pairs of mother-daughter of Oraon community of Western Odisha. It was observed that Oraon males demonstrated a positive secular trend in all measurements but the changes are not significant in any of the measurements. The Oraon female showed a positive secular trend in stature and breadth measurements. But changes were not statistically significant. Negative secular trend are found in some of the measurements, which might be due to their social and economic condition as stated by the author (Nanda, 2008).

Similar study on secular growth of Desia Kandha of Phulabani district was conducted by Mohanty in 1989. The result shows height, sitting height, the mean value of filial generation is high but as shown from the t- value, it is not significant one. These variations occurred due to suffering from long term diseases, bad natural condition, and lack of good nutrition or due to any other causes which is not known. (Mohanty, 1989)

In the present study the Desia Kandha sons show lower mean value for stature that is -1.27 cms, which is almost same with Koya sons as studied by Mohanta in 1978 (Table 3). All Other tribes studied by different authors show positive secular

change in stature. In the present study the Kandha daughters show negative secular trend for stature like the middle income group of Andhra Pradesh studied by Arya and Rao in 1988.

The parents and offspring of Desia Kandha are classified as very short, short, lower medium, medium, upper medium, tall and very tall according to Martin.

In case of Desia Kandha males out of 100 sample size 44 number of fathers come under short range (150.0 to 159.9 cms). The mean value of short fathers is 156.3 cms where as their sons show higher mean value that is 157.8 cms. 2 fathers come under tall range (170 to 179.9 cms). The mean value of tall fathers is 173.3 cms where as their sons show lower mean value 160.1 cms.

In case of Desia Kandha females out of 102 sample size 48 number of mothers come under short range (140.0 to 148.9 cms). The mean value of short mothers is 145.0 cms where as their daughters show higher mean value that is 146.7cms. 2 mothers come under tall range (159.0 to167.9 cms). The mean value of tall mothers is 159.4 cms where as their daughters show lower mean value of 151.7 cms.

All these results coincide with Sir Francis Galton's 'Regression towards Mediocrity in Hereditary stature' that is the average height of sons of a group of tall fathers is less than that of the fathers and average height of the sons of a group of short fathers is more than that of the fathers. The results have shown in Table no 4 & 5.

LINEAR REGRESSION ANALYSIS OF THE PRESENT STUDY

Regression lines have drawn to see father-son, mother-daughter correlation for six measurements of Desia Kandha. The measurements are stature, sitting height, bi-acromial diameter, bi-iliocristal breadth, height radiale and height tibiale. The purpose of this study is to access the variation of body measurements of a & b, the two constant for all the six measurements are presented in table no.6. In case of father- son correlation the fathers have been treated as X and the measurement of son taken as Y. Similarly in case of mother daughter, mother's measurement was taken as X and daughter's measurement taken on Y. The regression line for six measurements for father-son and mother-daughter are presented in Figure 1 to 12.

The range of coefficient of determination of Kandha fathers and sons is 0.24 to 0.007 for all the measurements. Among the Kandha mother and daughter the range of coefficient of determination is from 0.25 to 0.01 for all the measurements. All these show positive relationship. The low positive determination indicates more influence of environment.

Regression Analysis Interpretation of Desia Kandhas (Father - Son)

It was found from the data analysis of Desia Kandhas that the mean height of son is 158.54 cm corresponding to the mean height of 159.8 cm for father. It is revealed that the mean height of son is less than that of the father in the subsequent generation. From regression analysis, the slope coefficient is found to be 0.34. That

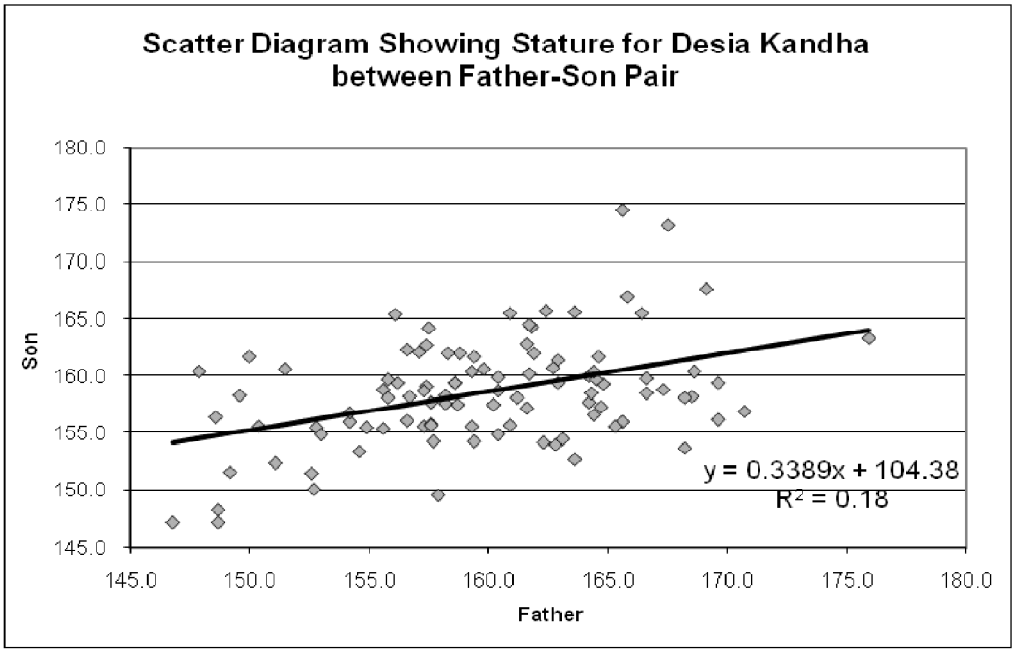

Figure 1: Graphical Presentation of Regression Trend Line Showing Stature among Desia Kandha Father- Son Pair

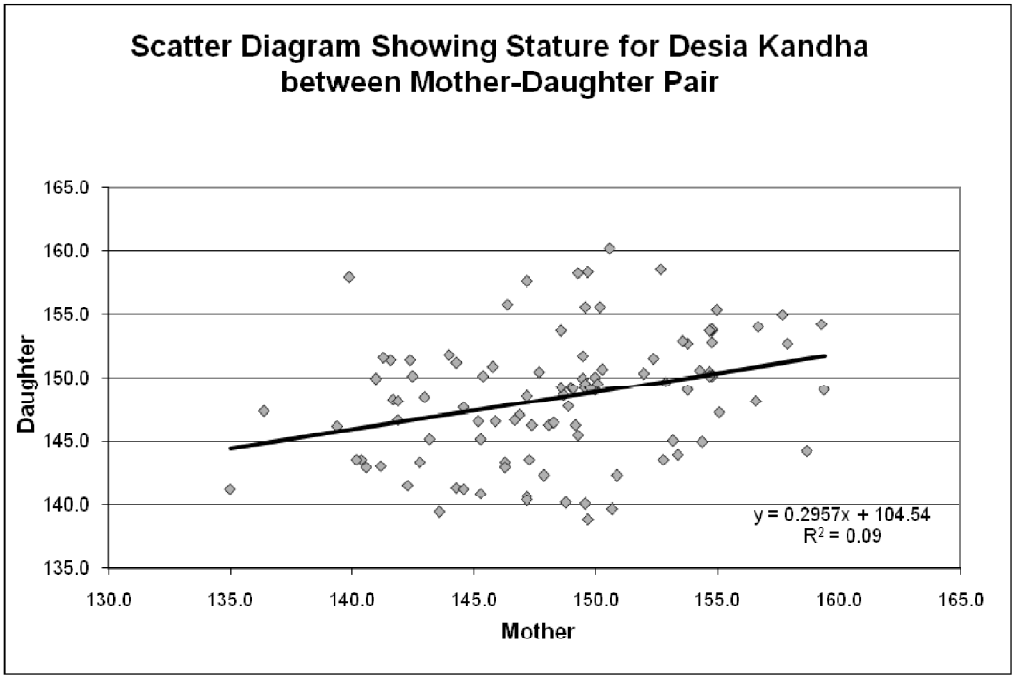

Figure 2: Graphical Presentation of Regression Trend Line Showing Stature among Desia Kandha Mother – Daughter Pair

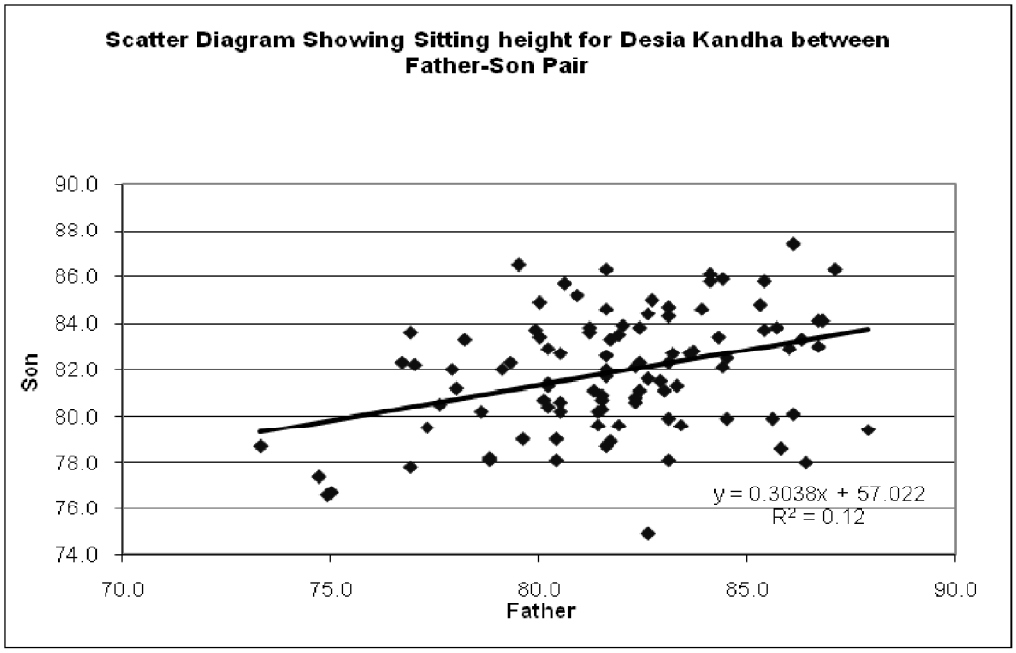

Figure 3: Graphical Presentation of Regression Trend Line Showing Sitting Height among Desia Kandha Father- Son Pair

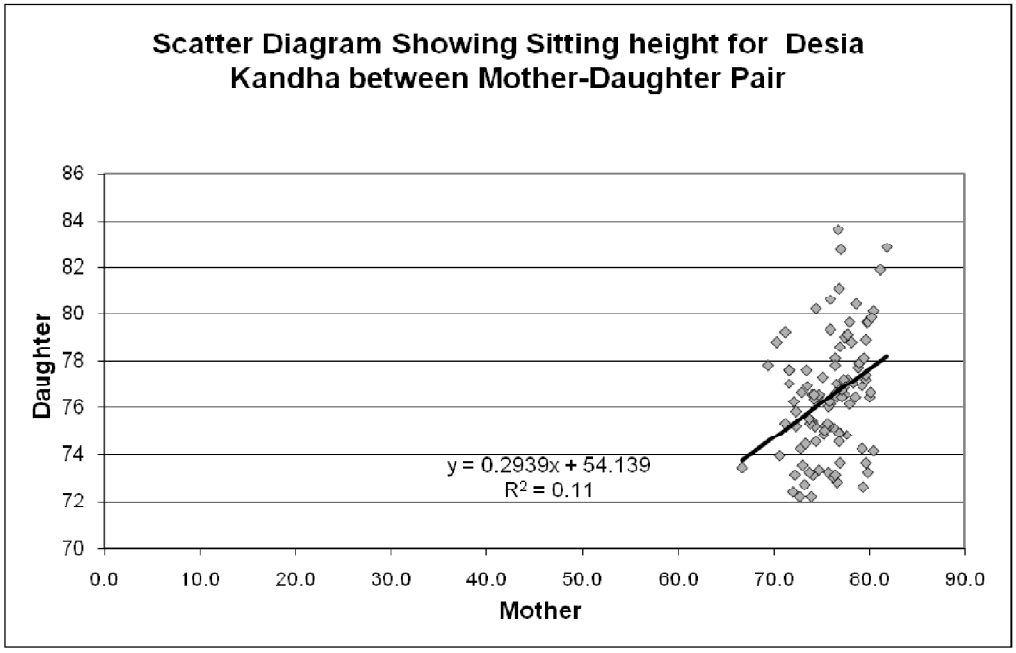

Figure 4: Graphical Presentation of Regression Trend Line Showing Sitting Height among Desia Kandha Mother- Daughter Pair

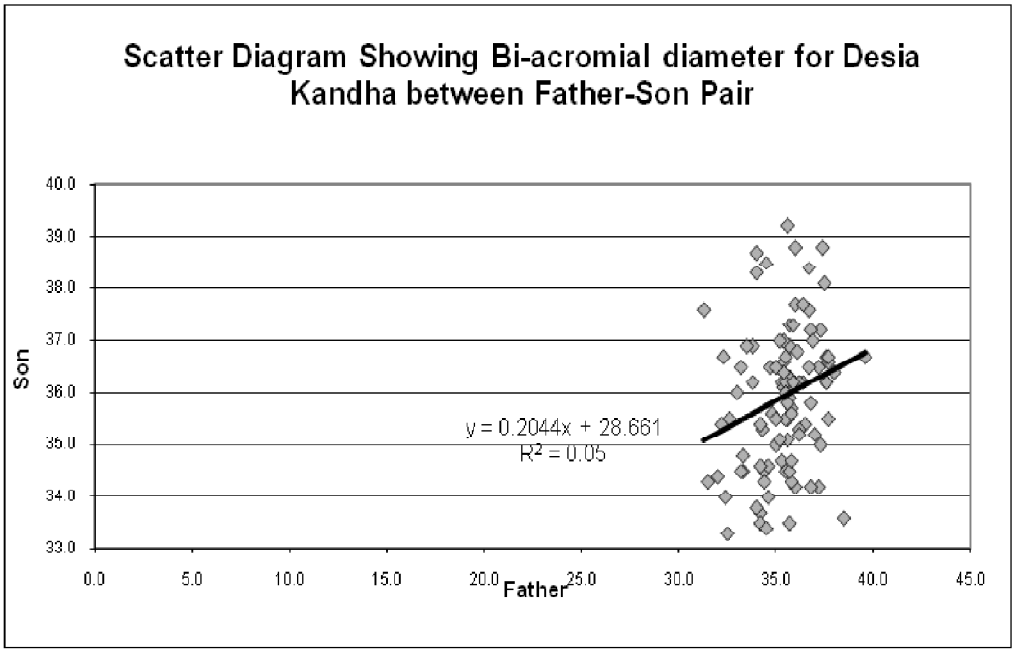

Figure 5: Graphical Presentation of Regression Trend Line Showing Bi-Acromial Diameter among Desia Kandha Father – Son Pair

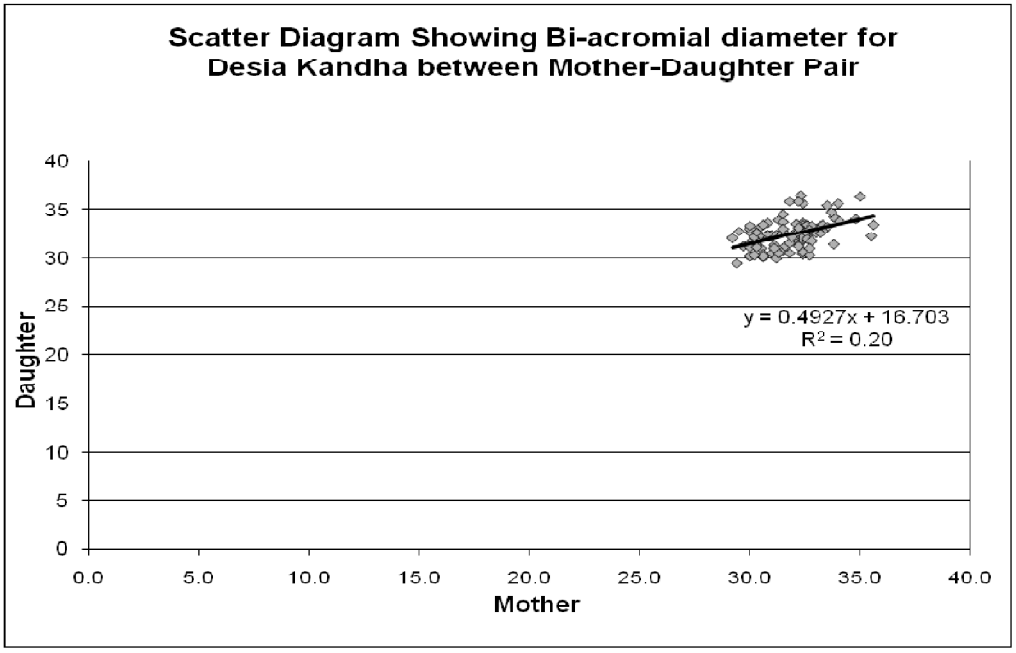

Figure 6: Graphical Presentation of Regression Trend Line Showing Bi-Acromial Diameter among Desia Kandha Mother-Daughter pair

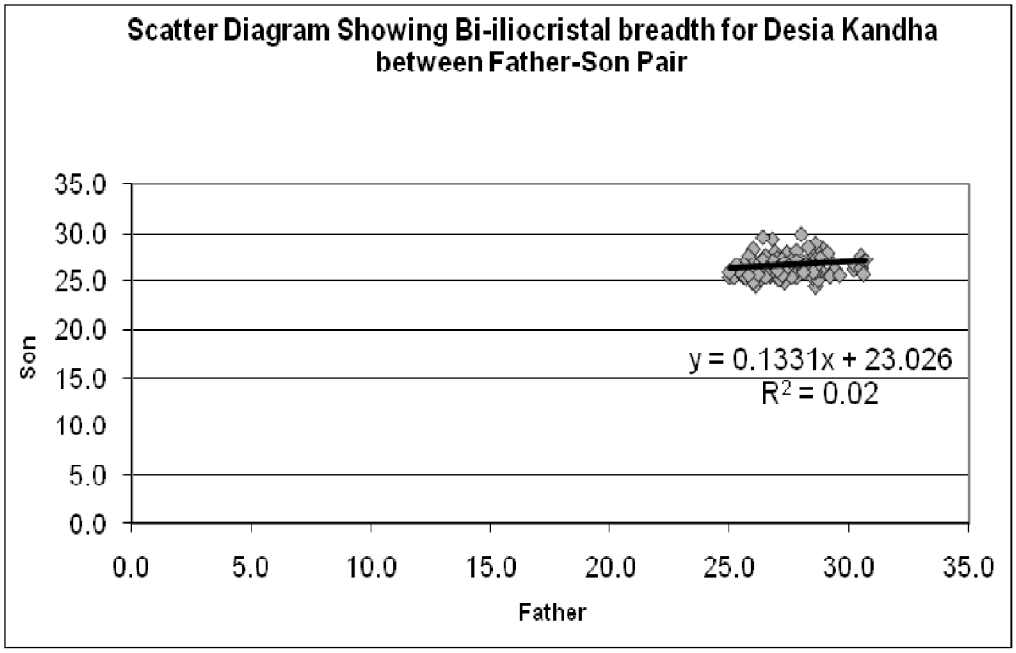

Figure 7: Graphical Presentation of Regression Trend Line Showing Bi-Iliocristal Breadth among Desia Kandha Father – Son Pair

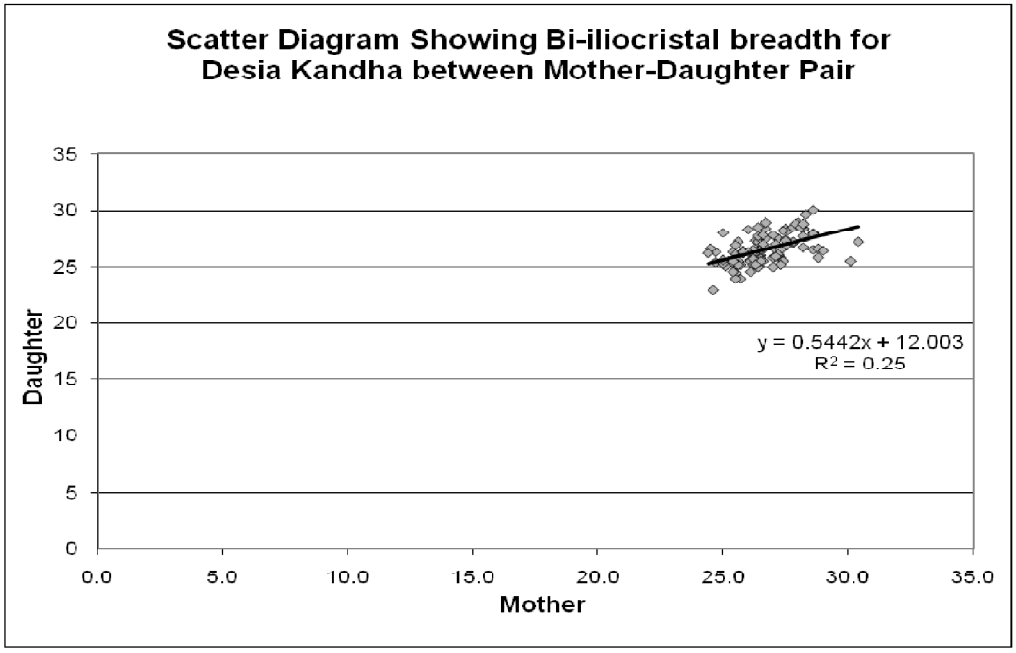

Figure 8: Graphical Presentation of Regression Trend Line Showing Bi-Iliocristal Breadth among Desia Kandha Mother – Daughter Pair

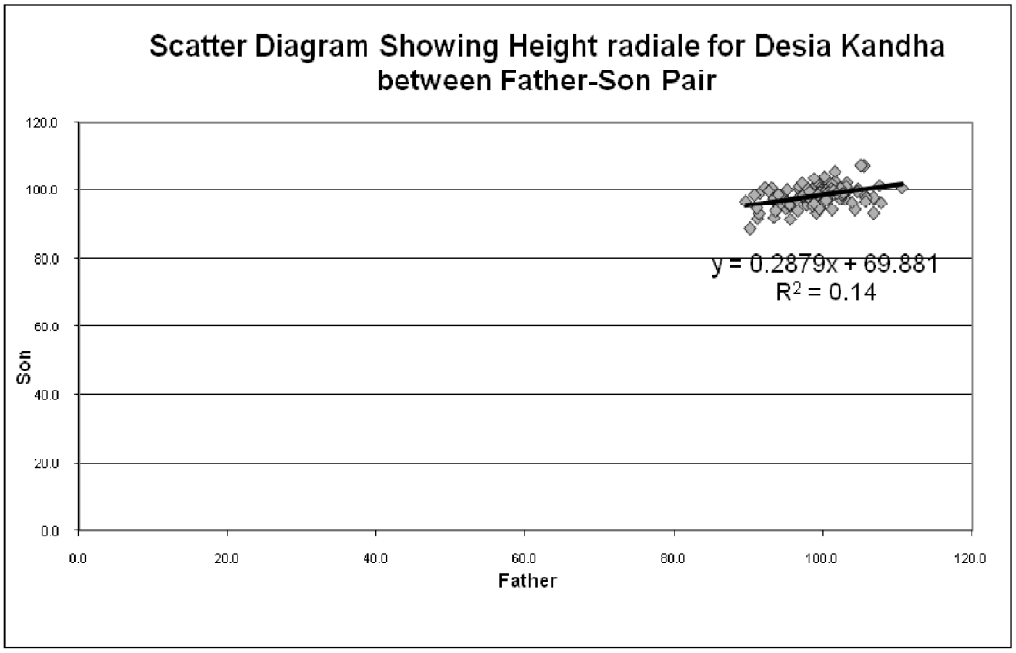

Figure 9: Graphical Presentation of Regression Trend Line Showing Height Radiale among Desia Kandha Father- Son Pair

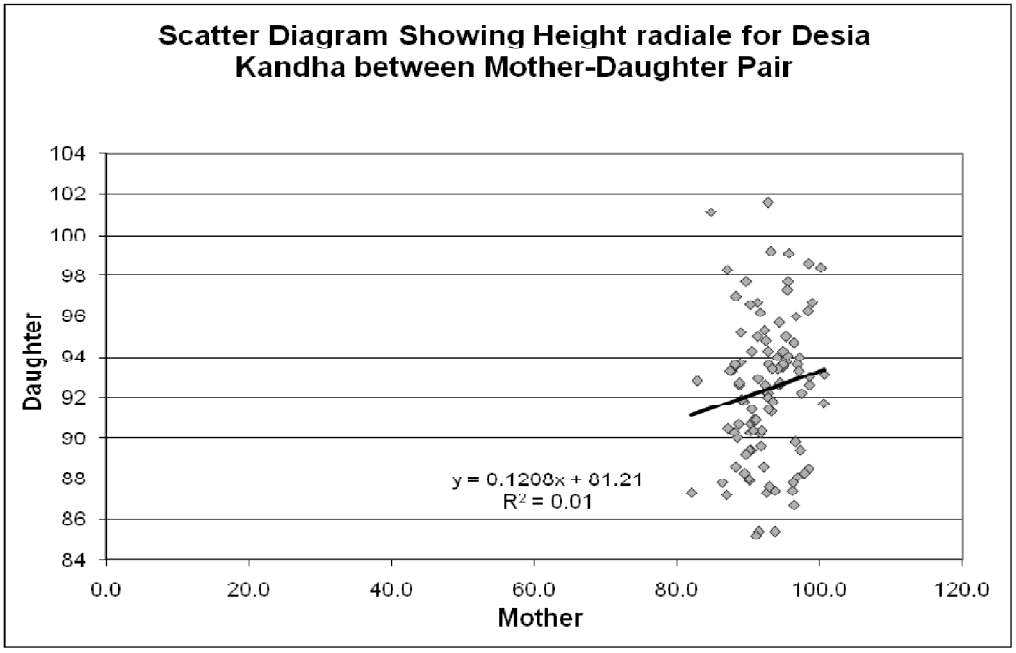

Figure 10: Graphical Presentation of Regression Trend Line Showing Height Radiale among Desia Kandha Mother –Daughter Pair

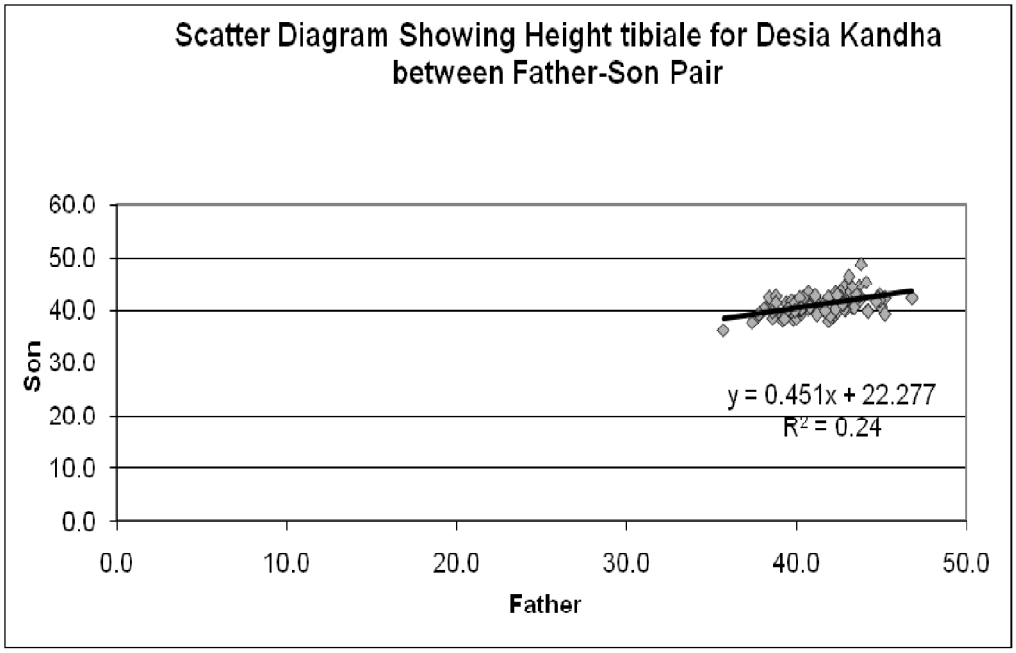

Figure 11: Graphical Presentation of Regression Trend Line Showing Height Tibiale among Desia Kandha Father – Son Pair

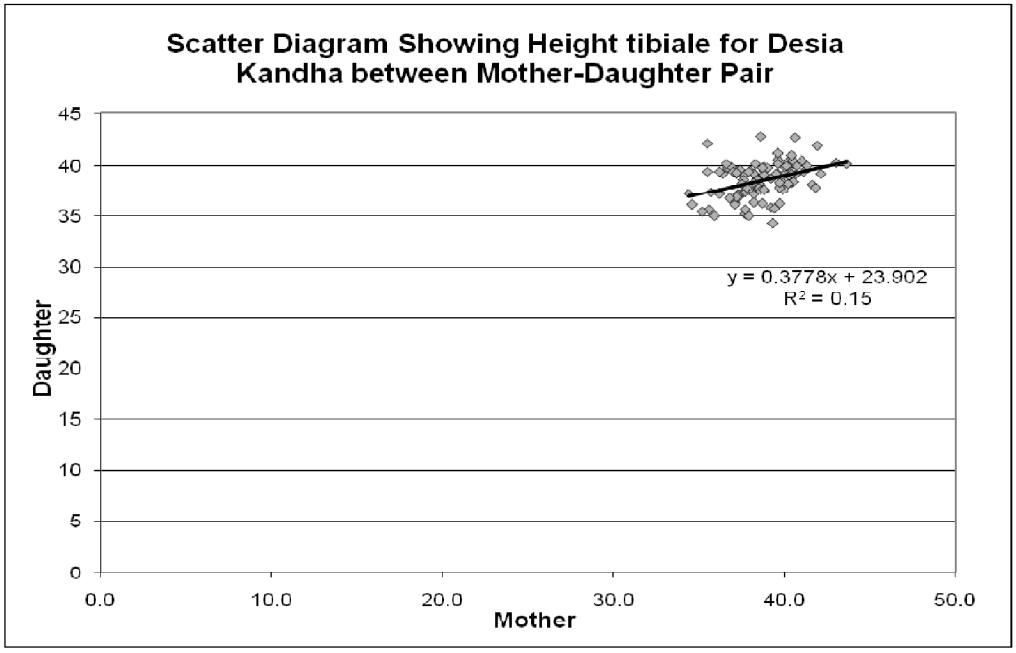

Figure 12: Graphical Presentation of Regression Trend Line Showing Height Tibiale among Desia Kandha Mother –Daughter Pair

is the increment in the value of dependent variable 'Y' (height of son) for a unit change in the value of the independent variable 'X' (height of fathers). This shows a significant positive relationship between the height of son and the father. The coefficient of determination explains 18 percent of the son's stature corresponding to their father's stature as hereditary stature.

The mean sitting height of Kandha son is 81.86 cm and the mean sitting height of father is 81.79 cm. It shows that the mean sitting height of son is more than that of the father in the subsequent generation. The slope coefficient is found to be 0.30. This shows a less significant positive relationship between the sitting height of son and the father. The coefficient of determination explains 12 percent of sitting height of son corresponding to their father's sitting height as heritable sitting height.

The mean bi-acromial diameter of Kandha son is 35.89 cm corresponding to the mean bi-acromial diameter of 35.39 cm for father. It is revealed that the mean bi-acromial diameter of son is more than that of the father in the subsequent generation. The slope coefficient is found to be 0.20. This shows a less significant positive relationship between the bi-acromial diameter of son and the father. The coefficient of determination explains 5 percent of inheritance of the son's bi-acromial diameter corresponding to their father's bi-acromial diameter.

The mean bi-iliocristal breadth of Kandha son is 26.69 cm and the mean bi-iliocristal breadth is 27.54 cm for father. The result shows that the mean bi-iliocrstal breadth of son is less than that of the father in the subsequent generation. From regression analysis, the slope coefficient is found to be 0.13. This shows a significant positive relationship between the bi-iliocristal breadth of son and the father. The coefficient of determination explains 2 percent of the son's bi-iliocristal breadth corresponding to their father's bi-iliocrstal breadth.

The mean height radiale of Kandha son is 98.44 cm corresponding to the mean height radiale of 99.47 cm for father. The result shows that the mean height radiale of son is less than that of the father in the subsequent generation. From regression analysis, the slope coefficient is found to be 0.29. This shows a significant positive relationship between the height radiale of son and the father. The coefficient of determination explains 14 percent of the son's height radiale corresponding to their father's height radiale as hereditary influence.

The mean height tibiale of Kandha son is 40.98 cm corresponding to the mean height tibiale of 41.47 cm for father. It is revealed that the mean height tibiale of son is less than that of the father in the subsequent generation. From regression analysis, the slope coefficient is found to be 0.45. This shows a significant positive relationship between the height tibiale of son and the father. The coefficient of determination explains 24 percent of the son's height tibiale corresponding to their father's height tibiale as hereditary influence.

Regression Analysis Interpretation of Desia Kandhas (Mother-Daughter)

It was observed from the data analysis that the mean height of Desia Kandha daughter is 148.44 cm corresponding to the mean height of 148.46 cm for mother. It

is revealed that the mean height of daughter is less than that of the mother in the subsequent generation. From regression analysis, the slope coefficient is found to be 0.29. That is the increment in the value of dependent variable 'Y' (height of daughter) for a unit change in the value of the independent variable 'X' (height of mother). This shows a significant positive relationship between the height of daughter and the mother. The coefficient of determination explains 9 percent of the daughter's stature corresponding to their mother's stature as hereditary stature.

The mean sitting height of Desia Kandha daughter is 76.45 cm and whereas the mean sitting height of mother is 76.92 cm. It shows that the mean sitting height of daughter is more than that of the mother. The slope coefficient is found to be 0.29. This shows a significant positive relationship between the sitting height of daughter and the mother. The coefficient of determination explains 11 percent of sitting height of daughter corresponding to their mother's sitting height as heritable sitting height.

The mean bi-acromial diameter of Kandha daughter is 32.38 cm corresponding to the mean bi-acromial diameter of 31.82 cm for mother. The mean value of both the generation shows that the mean bi-acromial diameter of daughter is more than that of the mother. The slope coefficient is found to be 0.49. This shows a significant positive relationship between the bi-acromial diameter of daughter and the mother. The coefficient of determination explains 20 percent of inheritance of the daughter's bi-acromial diameter corresponding to their mother's bi-acromial diameter.

The mean bi-iliocristal breadth of Kandha daughter is 26.53 cm and the mean bi-iliocristal breadth of mother is 26.70 cm. The values show that the mean bi-iliocristal breadth of daughter is less than that of the mother in the subsequent generation. The slope coefficient is found to be 0.54. This shows a significant positive relationship between the bi-iliocristal breadth of daughter and the mother. The coefficient of determination explains 25 percent of the daughter's bi-iliocristal breadth corresponding to their mother's bi-iliocristal breadth as hereditary influence.

The mean height radiale of Kandha daughter is 92.38 cm corresponding to the mean height radiale of 92.50 cm of mother. It is revealed that the mean height radiale of daughter is less than that of the mother in the subsequent generation. From regression analysis, the slope coefficient is found to be 0.12. This shows a significant positive relationship between the height radiale of daughter and the mother. The coefficient of determination explains 1 percent of the daughter's height radiale corresponding to their mother's height radiale as hereditary influence.

The mean height tibiale of Kandha daughter is 38.50 cm corresponding to the mean height tibiale of 38.66 cm of mother. The result shows that the mean height tibiale of daughter is less than that of the mother in the subsequent generation. From regression analysis, the slope coefficient is found to be 0.38. This shows a significant positive relationship between the height tibiale of daughter and the mother. The coefficient of determination explains 15 percent of inheritance of the daughter's height tibiale corresponding to their mother's height tibiale.

CONCLUSION

The Desia Kandha sons and daughters show statistically insignificant lower mean value for stature, bi-iliocristal breadth, height radiale and height tibiale. That is negative secular trend is found. But in sitting height, bi-acromial diameter. Desia Kandha sons and daughters show higher mean value in comparison to their parental generation but these higher values are not statistically significant. The Kandha sons show lower body weight in comparison to their fathers, while daughters show higher body weight in comparison to their mothers. But in both the cases values are not statistically significant.

The Kandha are also shifting cultivators. The Kandha welcome more children in a family. This is because; the offspring will help the parents in their agricultural work and earn as daily labourer. They prefer cross cousin marriage and sororate type of marriage to avoid bride price. There is no need of money for medical expenses and education of family members. They use their traditional herbal medicine and all most all are illiterate. So large family norm is preferred. The distribution of food is divided mostly among the eight to nine members of a family. The joint family system is not found in the Kandha society.

So far as secular growth in concerned the Kandha are showing negative trend in stature, bi-iliocristal breadth, height radiale and height tibiale.

The Kandha of present study are demonstrating same type of change observed among the Koya of Odisha, the Oraon of Westren Odisha and the Desia Kandha of Phulbani are illiterate and land less with poor economic condition. They are living in very unhygienic and unhealthy condition. Rice is their staple food. The Desia Kandha children are not getting proper diet during growing period. The growing infants after one year are deprived of mother's milk, as the mother cannot give proper attention to the child due to birth of a second child. No other milk is given to the children because the Kandha cannot purchase milk from outside. Milk is important for the growth of the bones, the consumption of milk by infant, children and juveniles are directly related to greater average height of a population as pointed out by Takahashi (1984).

It is observed that almost 80 to 85% marriages are consanguineous marriages or cross cousin marriages. This indicates it is an inbred group due to the assertive mating the genes responsible for short stature remain inside the group. The equilibrium in gene frequencies in an inbred population is not disturbed and no outside genes for tallness are entering inside the population. Recently it has already been proved that the offspring of consanguineous marriages are shorter than the offspring of non-consanguineous marriages.

So these factors might be the causes of negative secular change among the Desia Kandha. To study this negative secular growth trend of the Desia Kandha of Ganjam district, further investigations on their economic condition, social changes and nutritional status are necessary.

Table 1: Statistical Constants of Different Somatometric Measurements among the Desia Kandha Male

		Father			*Son*							
Sl. No	*Measurements*	*Range in Cms*	*Mean ± SE in cms*	*S.D. ± SE in cm*	*Range in Cms*	*Mean ± SE in cms*	*S.D. ± SE in cm*	*Difference for Mean (Son - Father)*	*t- test Father/ Son*	*Son > Father %*	*Son = Father %*	*Son < Father %*
1	Stature	146.8 to 175.9	159.81 ± 0.58	5.84 ± 0.41	147.2 to 174.5	158.54 ± 0.46	4.66 ± 0.33	-1.27	1.70	45	0	55
2	Sitting height	73.3 to 87.9	81.79 ± 0.29	2.98 ± 0.21	74.9 to 87.4	81.86 ± 0.25	2.54 ± 0.18	0.07	0.19	50	0	50
3	Bi-acromial diameter	31.3 to 39.6	35.39 ± 0.15	1.59 ± 0.11	33.3 to 39.2	35.89 ± 0.13	1.35 ± 0.09	0.50	2.41	57	04	39
4	Bi-iliocristal breadth	25.0 to 30.7	27.54 ± 0.13	1.32 ± 0.09	24.6 to 30.0	26.69 ± 0.11	1.10 ± 0.07	-0.85	4.94*	26	01	73
5	Height radiale	89.6 to 110.6	99.47 ± 0.53	5.31 ± 0.37	88.8 to 107.6	98.44 ± 0.32	3.28 ± 0.23	-1.03	1.64	45	02	53
6	Height tibiale	35.7 to 46.8	41.47 ± 0.20	2.03 ± 0.14	36.2 to 48.7	40.98 ± 0.18	1.85 ± 0.13	-0.49	1.80	58	04	38

* Significant at 0.01 level

Table 2: Statistical Constants of Different Somatometric Measurements among the Desia Kandha Female

		Mother			Daughter							
Sl. No	*Measurements*	*Range in Cms*	*Mean ± SE in cms*	*S.D. ± SE in cm*	*Range in Cms*	*Mean ± SE in cms*	*S.D. ± SE in cm*	*Difference for Mean (Daughter - Mother)*	*t- test Mother/ Daughter*	*Daughter >Mother %*	*Daughter Mother %*	*Daughter <Mother %*
1	Stature	135.0 to 159.4	148.46 ± 0.51	5.21 ± 0.36	138.9 to 160.2	148.44 ± 0.48	4.91 ± 0.34	-0.02	0.02	45.1	2.94	51.96
2	Sitting height	66.7 to 81.8	76.15 ± 0.37	3.76 ± 0.26	72.0 to 83.6	76.45 ± 0.24	2.50 ± 0.17	0.30	0.68	50.98	0	49.02
3	Bi- acromial diameter	29.2 to 35.6	31.82 ± 0.13	1.32 ± 0.09	29.5 to 36.4	32.38 ± 0.14	1.45 ± 0.10	0.56	2.87*	63.73	0	36.27
4	Bi- iliocristal breadth	24.4 to 30.4	26.70 ± 0.11	1.20 ± 0.08	23.0 to 30.0	26.53 ± 0.13	1.31 ± 0.09	-0.17	0.94	45.10	3.92	50.98
5	Height radiale	82.0 to 100.6	92.50 ± 0.37	3.82 ± 0.26	85.2 to 101.6	92.38 ± 0.34	3.53 ± 0.24	-0.12	0.22	45.10	1.96	52.94
6	Height tibiale	34.4 to 43.6	38.66 ± 0.18	1.81 ± 0.12	34.3 to 42.8	38.50 ± 0.17	1.73 ± 0.12	-0.16	0.64	39.22	3.92	56.86

* Significant at 0.01 level

Table 3: Secular Changes in Height (cms) Through Generational Studies

Sl. No	*Group*	*Son*	*Father*	*Increase*	*Daughter*	*Mother*	*Increase*	*Investigators*
1.	Low Income Group (A.P)	161.6	159.5	+2.1	149.0	148.0	+0.6	Saroj& Rao, 1988
2.	Middle Income Group (A.P)	163.4	161.3	+2.1	150.0	150.8	-0.8	-do-
3.	Upper Income Group (A.P)	162.7	161.9	+0.8	150.0	149.3	+0.7	-do-
4.	Kandha of Odisha	159.7	159.3	+0.4	-	-	-	Mohanty, 1989
5.	Koya of Odisha	159.8	161.0	-1.2	-	-	-	Mohanta, 1978
6.	Oraon of Western Odisha	161.2	159.6	+1.6	150.2	149.7	+0.5	Nanda, 2008
7.	Santhal of West Bengal	162.8	159.8	3.0	150.7	148.9	1.7	Ghosh & Malik, 2007
8.	Kandha of Southern Odisha	158.54	159.81	-1.27	148.44	148.46	-0.02	Sahu (Present Study)

Table 4: Martin's Classification of Stature and the Desia Kandha Male

Classification	*Stature Range Variation According to Martin Male (cm)*	*Frequency of Kandha Fathers*	*Father (Mean value in cm)*	*Frequency of Kandha Daughters*	*Son (Mean value in cm)*
Very Short	130.0 – 149.9	07	148.5	04	152.8
Short	150.0 – 159.9	44	156.3	63	157.8
Lower Medium	160.0 – 163.9	22	161.9	21	159.5
Medium	164.0 – 166.9	16	165.1	09	160.5
Upper Medium	167.0 – 169.9	09	168.5	01	160.6
Tall	170.0 – 179.9	02	173.3	02	160.1
Very Tall	180.0 – 199.9	0	Nil	0	Nil

(Ghoshmaulik and Rath, 2000)

Range / Mean of the Desia Kandha Males

Range in cm Father	*(Mean value in cm) Father*	*Range in cm Son*	*(Mean value in cm) Son*
146.8 to 175.9	159.81	147.2 to 174.5	158.54

Table 5: Martin's Classification of Stature and the Desia Kandha Female

Classification	*Stature Range Variation According to Martin female (cm)*	*Frequency of Kandha Mothers*	*Mother (Mean value in cm)*	*Frequency of Kandha Daughters*	*Daughter (Mean value in cm)*
Very Short	121.0 – 139.9	04	137.7	03	148.2
Short	140.0 – 148.9	48	145.0	47	146.7
Lower Medium	149.0 – 152.9	27	150.3	35	149.7
Medium	153.0 – 155.9	16	154.4	11	150.4
Upper Medium	156.0 – 158.9	05	157.5	05	150.8
Tall	159.0 – 167.9	02	159.4	01	151.7
Very Tall	168.0 – 186.9	0	Nil	0	Nil

(Ghoshmaulik and Rath, 2000**)**

Range / Mean of the DesiaKandha Females

Range in cmMother	*(Mean value in cm) Mother*	*Range in cm Daughter*	*(Mean value in cm) Daughter*
135.0 to 159.4	148.46	138.9 to 160.2	148.44

Table 6: Showing a.b. and R^2 value of Father-Son, Mother-Daughter the Desia Kandha for different measurements

The Desia Kandha

		Father - Son			*Mother - Daughter*		
Sl. No	*Measurements*	*a.*	*b.*	R^2	*a.*	*b.*	R^2
1.	Stature	104.38	0.34	0.18	104.54	0.29	0.09
2.	Sitting height	57.02	0.30	0.12	54.14	0.29	0.11
3.	Bi-acromial diameter	28.66	0.20	0.05	16.70	0.49	0.20
4.	Bi-iliocristal breadth	23.03	0.13	0.02	12.00	0.54	0.25
5.	Height radiale	69.88	0.29	0.14	81.21	0.12	0.01
6.	Height tibiale	22.28	0.45	0.24	23.90	0.38	0.15

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