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Nutritional Status, Dietary Intake And Onset of Menarche Among Socio-economically Backward Adolescent Scheduled Tribe Female Subjects of Birbhum District Of West Bengal

Krishna Roy
Professor of Physiology and Principal, Sister Nibedita Government General Degree College For Girls, Alipore, Kolkata 700027. e- mail: krishna.roy@rediffmail.com

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ABSTRACT

The present study was undertaken among adolescent female subjects belonging to low socio- economic status in the Birbhum district of West Bengal. The aim of this study is to determine the age of onset of menarche (first appearance of menstrual cycle) and the role of nutritional status if any. A cross-sectional study was conducted in four blocks of the district. Data was collected from July 2012 to April 2014, using a pre-tested structured questionnaire interview schedule; and nutritional status was measured by weight, height, Body Mass Index (BMI), Mid Upper arm Circumference (MUAC) and also through daily dietary intake . Data were obtained from 436 no of adolescent Scheduled tribe and Scheduled caste girls aged 10-17 years. An attempt has been made to find correlation if any between the nutritional status and menarcheal age of two different types of S.T. (Santal and Kora) populations .Dietary intake of all these subjects was also evaluated by door to door survey.

The result had revealed that these tribal adolescent girls exhibited diminished skeletal maturity and low Body Mass Index. Negative correlation was found for age at menarche and BMI. The mean Menarcheal age for these two types of tribal community in the district seemed to be significantly lower from the result obtained by other workers studied in this aspect.

1.0 Introduction

Adolescents represent around 16% of the global world's population and more than half of them globally are found in Asia (UNICEF Data). Of all the developmental milestones associated with adolescent years, menarche among girls is the most noteworthy and among many other factors, nutrition has an important bearing to it. (Cameron and Nadgdee 1996, Roy 2008, Pramanik 2015). Menarche or the first menstrual blood flow is an important milestone of female reproductive system and marks the beginning of a multitude of physical, physiological and psychological changes in the lives of the adolescent girls. (Karapanaou and Papadimitrou 2010) It constitutes an important aspect of population dynamics as average age at menarche is an excellent overall comparative indicator of population health, timing of maturation and it is widely used as demographic indicator of population fecundity. (Komura et al 1992). Age at menarche occurs earlier than it once did in many parts of the world and this decline in age is seen in some developing countries due to improvement in nutritional status, specially in early childhood, irrespective of heredity. (Leenstra et al 2005, Sachan et al 2012, Goyal et al 2017, Onyiriuka and Egbagbe 2013, Cameron and Nadgdee 1996, Hochberg and Belski 2013). Information in this regard in the context of India has been studied by various workers (Chatterjee et al 2005, Acharaya et al 2006, Roy and Biswas 2008, Dahia and Rahi 2010) and also among rural adolescent girls living in abject poverty (Scheduled Caste and Scheduled Tribe) (Bandyopadhyay 2004, Chatterjee et al 2005, and Roy and Biswas 2008). In West Bengal available data seem fragmentary and demands further investigations. (Roy and Biswas 2008, Pramanik 2015, De 2016) considering role Menarche or the first menstrual blood flow is an important milestone of female reproductive system. It also marks the beginning of a multitude of physical, physiological and psychological changes in the lives of the adolescent girls. Onset of menarcheal age varies from population to population and depends on variety of biosocial factors. Such as Education, Socio-economic condition etc., Family size, Psycho social stress) (Khatoon et al 2011, Henneberg and Louw 1995), and also on genetic factors (Dvorynk and Haq 2012, ahanfar et al 2013,), Geographical factors, climate, environment (Valsik et al 1963, ahanfar et al 2013, Sohn 2016) General Health, Physical exercise (Afshariani et al 2016) and status of Nutrition (Beatrice et al 2014, Dahia and Rahi 2010) and specially with Body Mass Index (BMI) (Freedman et al 2002, Gavela et al 2015). Although studies have been carried out by several workers on the menarcheal age and nutritional status in different states of India, meaningful studies on the Santals or other tribes in West Bengal are still very few. (Bandyopadhyay 2004, Roy and biswas 2008).

2.0 Objective of the study

Onset of reproductive age of of girls depends much on nutrition and numerous studies have been carried out among this aspect throughout the world. But reports are very few in the Indian context, specially on the socio economically poor rural community of West Bengal. Considering this, a cross sectional study was aimed in one of the backward districts of West Bengal, the Birbhum district, hitherto untouched by the researchers. The objective of the present study was to study nutritional status of the tribal girls from poor socio economic background, in terms of anthropometry and daily food intake pattern. Besides this, it was also aimed to

investigate whether nutritional status in terms of BMI is related to the onset of mean age at menarche of the adolescent girls of the studied population..

3.0 Materials and Methods

A) Study design, Subjects and Study area:

i) The study was conducted in the rural areas of Birbhum. The district is the habitat for a variety of Scheduled Tribe (S.T.) populations. Within nineteen blocks of the district, four blocks were randomly selected and using simple random sampling procedure, subjects were chosen from 8 of the villages, taking 2 villages from each of the blocks for the purpose of detailed study.

ii) All those villages represent more than 40% and above of S.T. populations and are located within 05 km radius from the district headquarter. These villages therefore were selected for the study, keeping in view of the operational/survey feasibility.

iii) A total of 436 adolescent girls (SANTAL, and KOWRA tribes) were selected for the study. All adolescent girls aged 10-17 yr, who were apparently healthy, were included in the study. Subjects with physical deformities or history of chronic illness were excluded. The adolescent girls attending the schools were interviewed and studied. But subjects who were not attending schools were covered by domiciliary visits.

iv) Control subjects of 55 number were chosen at random from all these villages. They belonged to non S. T. community and came from well to do families.

B) Study period: Data was collected through July 2012 to April 2013. And July 2013 to April 2014

C) Study Methods Adopted

i)Nutritional status was measured by

a) Nutritional Anthropometry: Mainly Height for age, and Body Mass Index (BMI) for age and MUAC were estimated. Degree of under-nutrition can easily be measured by MUAC (Dasgupta et al 2010). BMI values were compared with age specific reference BMI value (WHO reference 2007)

Portable weighing machine, anthropometer, and steel tape were used for various standard anthropometric measurements. Height was measured by anthropometric rod to the nearest 0.1 cm; Weight was recorded by weighing machine to the nearest 0.5 kg. Each subject was weighed with minimum clothing and no footwear. Structured questionnaires were followed to know details of socioeconomic status of studied adolescents such as age of subjects, menarcheal age, socio-economic status. Prevalence of stunting was measured by Height for Age (< 3rd centile NCHS/WHO) (WHO reference data) and more precisely nutritional status was estimated using WHO recommended age specific cut off points of BMI based on NHANES percentile values (<5th percentile NHNEAS)

MUAC was measured on bare skin nearest to 0.1 cm using an inextensible measuring tape after marking the midpoint of the upper arm between Olecranon and Acromial Process. The measurement was taken in a relaxed position of the arm (Dasgupta et al 2010).

b) Dietary intake of all these subjects was also evaluated by twenty four hour recall method.

c)Menarcheal Age of each subject was obtained by "status-quo" method. (Hennebergand and Louw1995). With this method it was possible to collect menarche data for large representative samples of girls within a comparatively short period. Only the age of the girls and information whether menstruation has already occurred was collected. Those who answered affirmatively were then asked to recall the year and month of occurrence. Menarcheal age was then converted into the original age with addition of the nearest fraction in decimal value.

d) Statistical Analysis : Determined Correlation between Nutritional status and Menarcheal age. An attempt has been made to find correlation if any between the nutritional status in terms of BMI and menarcheal age of and S.T. (Santal and Kora) populations.

4.0 Result

A total number of 436 adolescent girls were studied. Of them 241 girls came from ST Santal community and the rest 195 girls came from S.T Kowra community. And the study was conducted in two different time periods (Stage I and Stage II). In stage I, 138 number of subjects were available for the Santal community, and 98 number from the Kowra community. In Stage II, the number for Santals were 103 and those from the Kowra community were 97only.. Table 1 had shown menarcheal age of different tribal communities of Birbhum district of West Bengal in two stages of study periods.. It appeared that compared to the control group, the mean menarcheal age is much delayed in tribal Santal and Kowra community (>14 yrs) in the first stage, but in the Stage II, to some extent a better profile for the Kowra community was noticed. (12.98 ±1.34).

Nutritional status of different communities in terms of Stunting and Thinness is depicted in Table 2A, 2B and 3A, 3B. respectively. Table 2A had shown prevalence of stunting in the tribal community in the Stage I study period.. Alarming incidence of stunting was noted in Stage I in the age group 14-15 years for Santals (almost 56%-61%) and in the age group of 14 years for the Kowra tribes (56%). In stage II, Stunting was also found to be alarming in the age group of 14 years for the Santal community (57%). compared to the Kowra community as only 25%. (Table 2B)

Regarding thinness status of these Tribal girls, majority of the Santals showed it at the 14 and 15 year age groups (57.8% and 43.75% respectively) in the Stage- I. The Kowra girls were also found to be very thin in the14 and 15 year age groups (48% and 47. 05% respectively). (Table 3A) In stage II, major thinness could be seen around 14 years (57.14%) for the Santals in 14 years, though the representative number was rather few. Kowra girls on the otherhand, were found to be thin around 12 year age group (35%). If we consider the average value, altogether 38.14% of Santal girls and 29.1% of Kowra girls had shown thinness. (Table 3B). Stunting and thinness on an average for the Control adolescent girls were reported to be only 12.7% and 10.9% respectively. (Table 3C). Apart from stunting and thinness, Mid-upper-arm circumference (MUAC) was also evaluated in the subjects to measure content of the arm muscle and fat area around mid upper arm through measurement of MUAC. (Table 4A and 4B). It can not be denied that assessment of nutritional status by middle upper arm circumference (MUAC) is much easier, more convenient and requires less expertise

than assessment with body mass index (BMI). It has been found from this study (Table 4A and 4B) that the proportion of under nourishment was significant according to MUAC as it was compared with reference value with those for Santals and Kowra girls for all age groups studied in the stage I and somewhat better nutritional status for the Kowra girls in the second study period, Stage II (Table 4A and 4B). Dietary intake of 10 representative subjects from all the study groups in two stages and control subjects was studied (Table 5A, 5B, 5C, 5D) Daily average intake of calorie, Protein and Fat was estimated in adolescents of all age groups (Table 5A and 5B). Next, dietary intake status with respect to Indian reference value was also evaluate in all age groups (Table 5C and 5D). So far as under-nutrition is concerned, compared to the girls of control group,. girls of the two tribal communities had shown consistent reports of the prevalent degree of under-nutrition specially in the 13 to 15 years age groups.

Finally, statistical analysis of main marker of nutritional status (BMI value determined and age specific status monitored) and menarcheal age of Scheduled Tribe adolescent girls in terms of Pearson's Product moment correlation coefficient was done (Table 6) and the result had shown significantly negative correlation,. i.e. menarcheal age was found to be greater for girls wth low BMI correlated at 0.001 level.

5.0 Discussions

Throughout the world, specially in the developed countries, there is a downward inclination of mean menarcheal age (Komura et al 1992, Hochberg and Belski 2013, Pinola et al 2012, Gavela et al 2015). Recenly, in the Indian context, menarcheal age in Bengali girsl has been found around 12.2years (Pramanik et al 2015) In this cross sectional study conducted in the Birbhum District of West Bengal, nutritional status and menarcheal age of the adolescent Tribal girls (Santals and Kowra) were evaluated. Throughout the world, the researchers working in this area, have shown among all determinants of the menarcheal age, nutritional status is the most important determinant. (Jee et al 2009, Daniel et al 2010, Pathak et al 2014, Dahiya and Rahi 2010, Freedman et al 2002, Hesketh and Ding 2002). While Kazem et 2013, have put more stress on the contribution of BMI for the onset of Menarche, Hesketh and Ding have claimed that in China, apart from BMI some other unmeasured environmental variable may have role for the onset of Menarche in rural and urban populations. Along with other determinants of nutritional status, importance of MUAC is no less that of BMI (Jeyakumar et al 2013). In the Indian context, specially studies on the onset of menarcheal age and nutritional status have been undertaken in South Delhi (Acharya et al 2006.), Punjab (Goyal et al 2017), Lucknow (Khatoon et al 2011), West Bengal (Pramanik et al 2015, De 2017), but usually not in the tribal. community of Birbhum in particular. Earlier, Roy 2006, had indicated poor nutritional status in the rural Santals of Birbhum district of West Bengal. In the present study, the tribal subjects were found to suffer from profound malnutrition as can be seen in the estimate of BMI (Table 3A and 3B) and MUAC (Table 4A and 4B). Along with poor nutritional status, the menarcheal age of the Santals and Kowra seemed to be much delayed compared to the control group. (Table 3C). Skeletal maturity of these subjects in terms of age specific reference value (WHO multicentre Growth reference Study group 2006) were found to be much less specially at 13-15- years age group. (Table 2A and 2B) Compared to the control group, degree of thinness is

remarkable (Table 3A and 3B) Recent studies by Gavela et al 2015 in Spain and Geum et al 2010, in Korean girls have clearly shown that improved BMI is related with early menarche. Many years ago, Frish and Revelle in 1970, declared that a critical body weight is required to attain menarcheal age. In West Bengal, earlier studies by Bandypadhyay 2004, Roy and Biswas2008, had pointed out delayed menarcheal age in the Santal populations compared to the other local communities because of their poor nutritional health status. But there was no such studies in the Kowra community of west Bengal. In the present study, compared to the standard Indian reference values, the tribal subjects were found to take much lesser amount of Calorie, Proteins and fats in their daily diet. In the two stages of study period. Menarcheal age of the Santals are found to be specially delayed in this district in both the study periods and the Kowra tribes are also not in a safer position.. sampling may affect some lower values in Stage II studies and larger population based studies may throw more light in this area. On top of these, statistically significant negative correlation between BMI status and onset of menarcheal age, demands that improvement of their nutritional status is a basic necessity for them.

6.0 Ethical Considerations

Ethical issues (Including Informed Consent from the subjects were collected before the study period) were given due considerations for this study.

7.0 Conclusion

Nutritional status as estimated in rural adolescents in terms of age specific stunting, thinness (BMI), muscle mass (MUAC) and dietary intake, revealed a gloomy picture among all the communities, compared with the control, matching, well to do rural populations studied. A slight hopeful facts and figures could be obtained from S.C. Ruidas community. The present study had revealed that the menarcheal age of the adolescent girls of poor socio economic background was significantly higher than the control well to do group, irrespective of ethnicity and this may be largely because of dietary deficiencies. The Santals and the Kowra tribes, having alarmingly poor dietary intake, showed much delayed menarcheal age.

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9.0 LIST of TABLES

Table 1.Menarcheal Age Of Socio-economically Poor Adolescent Tribal Girls. (Total No: 436)

Menarcheal age in years	Frequency of subjects attaining Menarche				
	STAGE I		STAGE II		
Fractions of age considered in decimal scale	Santal N=138	Kowra N=98	Kowra N=103	Santal N=97	Control N= 55
10+	0	0	01	01	03
11+	02	0	02	04	18
12+	16	12	40	27	21
13+	37	34	46	51	09
14+	64	25	12	07	04
15+	16	17	02	06	0
16+	02	08	0	01	0
17+	01	02	0	0	0
Mean ± S.D.	**14.22±3.98**	**14.34 ±2.76**	**12.98 ±1.34**	**13.33 ± 1.83**	**11.54 ± 2.84**

Table 2A: Prevalence of Stunting Among Adolescent Scheduled Tribe girls (Total No: 236) in Stage I study period.

Age (yrs)	N	Height (cm)	<3rd percentile	N	Height (cm)	<3rd percentile
		Mean ± SD	WHO*		Mean ± SD	WHO *
		Santals			Kowra	
10+	0	0		0	----------	-----
11+	2	137± 0.22	0 (0%)	0	----------	------
12+	16	138.76± 4.38	05 (31.25%)	12	137.65± 3.45	04 (33%)
13+	37	141.25± 5.74	12 (32.43%)	34	140.9.± 5.22	15 (44.11 %)
14+	64	144.62± 6.22	39 (60.93%)	25	145.84.± 4.37	14 (56%)
15	16	146.31 ±8.35	09 (56.25%)	17	146.34.± 1.36.	06 (35%)
16	2	148.5± 0.45	02 (100%)	08	147.72. ±1.87.	03 (37.5%)
17	1	149.47	01 (100%)	02	159.4± 0.25	02 (100%)
Total	**138**		68 (49.27%)	**98**		44 (44.89%)

Table 2B: Prevalence of Stunting Among Adolescent Scheduled -Tribe Girls. (Total No: 200) in stage II study period.

		KOWRA		SANTAL		
Age (yrs)	N	Height (cm) Mean ± S.D	<3rd Percentile WHO*	N	Height (cm) Mean ± S.D	<3rd Percentile WHO*
10+	01		0 (0%)	01	132.4	0 (0%)
11+	02	137± 0.22	0 (0%)	04	136.8±2.42	1 (25%)
12+	40	138.76± 4.38	11 (27.5%)	27	139.55± 5.85	10 (37.03%)
13+	46	141.25± 5.74	08 (17.39%)	51	141.74± 3.87	19 (37.25%)
14+	12	144.62± 6.22	03 (25%)	07	146.28..± 7.41	04 (57.14%)
15+	02	146.31 ±8.35	01 (50%)	06	146.34.±3.63.	02 (33.3%)
16+	0	148.5± 0.45	-------	01	149.4	01 (100%)
17+	0	149.47	--------	0	---------	--------
Total	103		**23 (22.3%)**	97		**37 (38.14%)**

Table 3A. Prevalence of Thinness Among Adolescent Scheduled Tribe Girls (Total No: 236) in Stage I study period.

	SANTALS			KOWRA		
Age (yrs)	N	BMI Mean ± S.D	<5th Percentile NHANES*	N	BMI Mean ± S.D	<5th Percentile NHANES*
10+	0		----	0	-------	-------
11+	02	14.88± 0.87	0 (0%)	01	14.6**	--------
12+	16	15,28.± 0.83	04 (25%)	12	15.67.± 0.76	03 (25%)

13+	37	16.16.± 1.35	14 (37.93%)	34	16.34. ± 1.84	13 (38.23%)
14+	64	16.42.± 2.49	37 (57.8%)	25	16.79± 1.87	12 (48%)
15+	16	17.08 ±1.95	7 (43.75%)	17	16.96.±2.14.	08 (47.05%)
16+	02	17.59.± 0.28	01 (50%)	08	17.15±.0.74	04 (50%)
17+	01	17.86	01 (100%)	02	17.35± 0.28	02 (100%)
Total	138		**64 (46.37%)**	98	** No Menarche	**42 (42.85%)**

Table 3B:Prevalece Of Thinness Among adolescent Scdule Tribe Girls. (Total No=200) in stage II Study period.

		KOWRA			SANTAL	
Age	**N**	**BMI**	**< 5th Percentile**	**N**	**BMI**	**< 5th Percentile**
yrs		**Mean SD**	**NHNEAS*%**		**Mean SD**	**NHNEAS*%**
10+	1	14.9	0 (0%)	1	14.63	0 (0%)
11+	2	14.9 ±0.46	0 (0%)	4	14.76 ±0.62	01 (25%)
12+	40	15.85± 1.86	14 (355)	27	15.39 ±1.61	10 (37.03%)
13+	46	16.75± 2.79	13 (28.2%)	51	16.34 ±2.29	18 (31.7%)
14+	12	17.54 ±1.74	02 (16.6%)	7	16.88± 1.91	04 (57.14%)
15+	2	17.87± 1.09	01 (50%)	6	17.55± 0.62	03 (50%)
16+	0			1	16.65	01 (100%)
17+	0			0		
Total	**103**		**30 (29.1%)**	**97**		**37 (38.14%)**

Table 3C: **Prevalence of Stunting and Thinness Among Control**
Adolescent Girls (Total: 55)

Age (yrs)	**N**	**Height (cm)**	**<3rd percentile**	**BMI**	**<5th Percentile**
		Mean SD	WHO*	Mean SD	NHNEAS* (%)
10+	3	133.5 ± 0.41	0 (0%)	15.7± 0.12	0 (0%)
11+	18	140.7± 0.93	0 (0%)	15.9± 0.41	03 (16%)
12+	21	143.6± 0.86	02 (9.5%)	16.8± 0.61	01 (4.76%)
13+	9	148.5± 1.95	03 (33%)	17.4± 2.29	02 (22.2%)
14+	4	151.8 ±1.44	01 (25%)	17.9± 0.91	0
15	2	152.6 ± 1,09	01 (50%)	18.4± 0.11	0
16	0	---------		----------	----------
17	0	----------		----------	----------
Total	55		07 (12.7%)		06 (10.9%)

Table 4A: MUAC (Mean ± SE) Study of Scheduled Tribe Girls According to Age . in Stage I study period.

Age (yrs)	Observed MUAC (cm) Mean ± SE				Difference of Mean MUAC		
	Santal (N=135)	Kowra (N=88)	Control (N=55)	Reference value*	Santal	Kowra	Control
11	18.4±0.21 (n=02)	----------	21.1±0.68 (n=18)	25.3 ±0.41	7.9	-	4.2
12	19.2±0.73 (n=16)	19.3±0.47 (n=12)	21.9±0.86 (n=21)	25.5 ±0.44	6.3	6.2	3.6
13	19.8 ±1.64 (n=37)	20.1±0.98. (n=34)	22.2±0.32 (n=09)	26.9 ±0.32	7.1	6.8	4.7
14	20.7±0.82 (n=64)	20.5±.0.86 (n=25)	22.5±0.28 (n=04)	27.0 ±0.52	6.3	6.5	4.5
15	21.1±0.77 (n=16)	20.9 ±0.87 (n=17)	23.3±0.16 (n=02)	27.7 ±0.27	6.6	6.8	3.4
*NHS Report 2008							

Table 4B: MUAC (Mean ± SE) Study of Scheduled Tribe Girls According to Age in stage II study period period.

Age (yrs)	Observed MUAC (cm) Mean ± SE			Difference of Mean MUAC	
	KOWRA=102)	SANTAL (N=95)	Reference value*	KOWRA	SANTAL
11	19.7 ±0.22 (n==02	19.2 ±0.45 (n=04)	25.3 ±0.41	5.6	6.1
12	20.2 ±1.32 (n=40)	19.6 ±2.57 (n=27)	25.5 ±0.44	5.3	5.9
13	21.3 ±2.71 (n=46)	20.2 ±1.67 (n=51)	26.9 ±0.32	5.6	6.7
14	21.8 ±0.63 (n=12)	20.7 ±.0.37 (n=07)	27.0 ±0.52	5.2	6.3
15	22.6 ±0.28 (n=02)	21.4 ±0.63 (n=06)	27.7 ±0.27	5.1	6.3
*NHS Report 2008					

Table 5A : Daily Average Energy And Nutrient Intake of rural Tribal Adolescents (10-12 years) in Stage I and Stage II study periods.

Energy/ Nutrient	Average Intake /day (Mean+_ S.D.)					RDA*
	STAGE I		STAGE II			
	Santal (n=10)	Kowra (n=10)	Kowra (n=10)	Santal (n=10)	Control (n=10)	
Calorie (Kcal)	1560.4+ 107.8	1605.7+99.4	1772.62+ 86.9	1753.59+ 112.95_	1904.78+ 83.68	2008
Protein (g)	30.2+ 8.36	29.5+ 15.96	35.1.+ 9.86	32.8+ 5.77	41.72+ 2.98	40.4
Fat (g)	18.64+ 6.54	21.94+ 5.88	30.88._+ 3.82	31.63+ 7.22	42.72+5.74	35
• NFI Bulletin 2010						

Table 5B: Daily Average Energy And Nutrient Intake of rural Adolescent Tribal girls (13-15 years)) in Stage I and Stage II study periods.

Energy/ Nutrient	**Average Intake /day (Mean+_ S.D.)**					**RDA***
	STAGE I		**STAGE II**			
	Santal (n=10)	Kowra (n=10)	Kowra (n=10)	Santal (n=10)	Control (n=10)	
Calorie (Kcal)	1889.43+98 .59	1904.78+89 .2	2135.67+ 118.4	2015.6+ 123.07	2387.82+ 69.98	2328
Protein (g)	37.8+ 8.24	35 .2+ 9,43	43.6.+ 8.66	40.86+ 6.91	55.4+ 8.04	51.9
Fat (g)	29.6+ 6.34	28.3+ 8.42	34.94._+ 6,61	33.55+ 7.8	63.74+ 9.97	40
• NFI Bulletin 2010						

Table 5.C.Dietary Intake Status of Rural Adolescent Tribal Girls (10-12yrs) With Respect to reference value * in two stages			
Category	Calorie	Protein	Fat
Santal	<23.3%	<25.2%	<46.8%
Kowra	<21,1%	<26.9%	<37.4%
Kowra	<12.8%	<18.8%	<9.7%
Santal	<18.6	<13.1%	<12.0%
Control	>6.0	>1.02%	>17.0%
• NFI Bulletin 2010			

Table 5D. Dietary Intake Status of rural adolescent Girls (13-15 years) With respect to Reference value* in two stages.

Subject Category	Calorie	Protein	Fat
Santal	<18.8%	<27.1%	<26.0%
Kowra	<19.3%	<32.1%	<29.25%
Kowra	<08.2%	<15.9%	<12.7%
Santal	<13.6	<21.3%	<16.2%
Control	>2.56	>6.7%	>39.2%

- NFI Bulletin 2010

Table 6. Comparison of Pearson's Correlation coefficient (r) for Nutritional status with Menarcheal age among rural Adolescent Tribal Girls

Type of variable	Menarcheal age of Tribal girls		Menarcheal age of Control women
	SANTALS	KOWRA	
(Pooled Mean Value)	N=235	N=201	N=55
BMI	-0.39	-0.47	-0.38
Correlation coefficient significant at 0.001 level.			

10.0 Acknowledgements

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