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Does Passive Smoking affect the Reproductive Period of a Marginalised Population Living in Hilly Terrain? A Study among the Hrusso Females of Arunachal Pradesh

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ABSTRACT

Objective: This study aims to determine the reproductive span among the females. Furthermore, it also assesses the association of passive smoking with age at menarche.

Material and methods: A total of 484 adult Hrusso females were assessed in the study. Retrospective method was used to collect the reproductive data. Data on passive smoking was taken using specific questionnaire with questions regarding number of smokers in the family and number of times getting the exposure in a day.

Results: The mean age at menarche among the Hrusso girls is found to be 11.2 years. The variance among the four age cohorts across all the age at menarche categories is found to be statistically significant. The waist height ratio has shown that 45.55% females were at risk of cardio-metabolic syndrome which is not significant among the age cohorts. BMI and WHtR are found to be significant predictors of variability in age at menarche among the Russo girls.

Conclusion: This study has shown that those with normal weight and no exposure to smoking are having a significantly late onset of menarche. It can also be said that passive smoking and high BMI also directly or indirectly are helping in having a longer reproductive period among the Hrussos.

Key words: Hrusso, Females, Reproductive span, Menarche, Smoking

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INTRODUCTION

Menses onset is under the control of the hypothalamic-pituitary-gonadal system, so exposures that affect the endocrine or central nervous system or its development might lead to alterations. A secular declining trend in the age of menarche has been reported in most of the developed and developing countries since the beginning of 20th century across the globe [1,2]. Studies also documented the trend towards earlier menarche in England, Israel, China India, Korea, Ghana, Mexico, Thailand and the USA [3-12].

Early menarche in girls was a risk factor for the occurrence of morbid obesity, hypertension as well as breast and endometrial cancer [13,14]. Factors affecting early puberty can be categorized in two distinct ways: genetically determinant and non-genetically determinant [15-18]. In early adolescence, obesity has an important impact on health leading to earlier pubertal onset, manifested by earlier thelarche and menarche [19,20].

There are many theories that explain why the trend towards earlier puberty has occurred, ranging from environmental toxins to changes in socioeconomic status, but it is clear that nutritional status plays an essential role in the timing and progression of puberty. However, it is yet to be elucidated whether weight gain precedes early puberty, early puberty predisposes to abnormal weight gain or both. Several epidemiological reports in the past 30 years indicated a relationship between earlier menarche in girls and increased body mass index (BMI) [21]. Increased body fat at birth or in early childhood and a rapid increase in BMI during infancy predict earlier onset of puberty [22–24].

Smoking, in some populations, has been a widely spread non-genetic exposure, both during pregnancy and childhood. And cigarette smoking exposure included

three forms: prenatal tobacco smoke (PTS), childhood environment tobacco smoke (ETS), and both PTS and ETS. Worldwide, almost half of children were exposed to ETS [25]. Results on associations between three forms of smoking exposure and puberty timing from the past decade and more years were inconsistent. The study by Fukuda 2013 [26] reported earlier menarche in relatively young daughters with PTS exposure. However, finding by Zhang 2014 [27] showed that PTS had no effect on age of menarche of daughters. Kolasa, et al. [28] reported an earlier age at menarche related to ETS exposure, while Shrestha, et al. [29] found no association between age at menarche and ETS.

Present study was conducted among the Hrusso females of Arunachal Pradesh. Hrusso is a marginalised population, also known as Aka, residing in the hilly terrains of South-eastern part of West Kameng district of Arunachal Pradesh. According to Census of India (2011), the total population of Aka tribe is only 8167. This study aims to determine the reproductive span among the females. Furthermore, it also assesses the association of passive smoking with age at menarche.

MATERIALS AND METHODS

This study was conducted among the Hrusso tribe of Arunachal Pradesh. The data was collected in the month of February, 2018. A total of 292 girls ranging from 17-24 years were taken as representative sample for the age at menarche and 192 females, 45+ were taken as the sample for age at menopause. The sample size was estimated using OpenEpi software. The sample size falls in 99% confidence level of the total population. Purposive sampling was used for data collection.

The sample was assessed for three anthropometric characteristics; height, weight and waist circumference. All the measurements were taken in standard protocols described by Weiner and [30].

The data on reproductive period was collected using retrospective method. Subjects of the adolescent sample could easily recall the age at menarche, as it was a recent event. However, for the adult sample, most of them could remember a relative age at menopause not an absolute one. A prior written consent was taken from the village authority explaining the aims of the study. Furthermore, each subject was provided with ample liberty to before participation in the study, in addition to taking verbal consent from each one of them. The data on age on menarche was collected just to enumerate a reproductive life span of the population.

Data on passive smoking was taken using specific questionnaire with questions regarding number of smokers in the family and number of times getting the exposure in a day. This was open to those who were not contemporarily exposed to passive smoking at home but have had from early to at least late childhood. A person who had never smoked was defined as one who had smoked fewer than 100 cigarettes in his or her lifetime [31]. Childhood passive smoking exposure was defined as living with one or more smokers and being exposed to the smoker's tobacco smoke for at least 15 minutes daily on more than one day every week in the same household [32] during childhood. Two self-reported measurements were used. The first on density was defined by the presence of zero, one, or two or more smokers living in the same household when the participant was a child. The other on frequency was defined as no exposure, < 5 days/week, or ≥5 days/week of exposure (one day was defined as exposure >15 min). Related questions were asked as follows: (1) Were there any smokers who lived with you in the same household during your childhood? 1. No, there were not; 2. Yes, there were; (2) If yes, how many smokers lived with you during childhood? 1. None; 2. One; 3. Two or more; (3) Did the smoker ever smoke in front you for more than 15 min in one day? 1. Yes; 2. No; and (4) What was the frequency of smokers smoking in front of you? 1. Never; 2. <5 days/week; 3. ≥5 days/week (one day was defined as an exposure >15 min). We used questions (1) and (3) to define passive smoking status in childhood; question (2) was used to define the density of passive smoking; and question (4) for frequency of passive smoking during childhood.

Waist-Height ratio was used for assessing cardio-metabolic risk factors. WHO suggests that, waist circumference and central adiposity indices are much more convincing and stronger in getting a clear picture of risk factor of cardiovascular diseases (CVD) and mortality caused by obesity, than BMI, as these avoid the need for age, sex and ethnic differences [33]. The universally accepted critical value which signifies increased risk is 0.5 [34].

40 > 0.5 critical value

40 – 50 between 0.5 and 0.6

50 < 0.6 onwards

All the statistical analysis was done using IBM SPSS 26.0 and Microsoft Excel version 2021. The data was introduced using descriptive statistics. Chi square test was used to test the goodness of fit of the model as well as to assess variance among the age groups depending on their age at menarche, risk of cardio-metabolic diseases, number of smokers in the family, and frequency of exposure to passive smoking. Furthermore, Pearson's correlation coefficient and adjusted linear regression was used to assess association between the variables and their predictability of variance.

RESULTS

Table 1 shows that for all the anthropometric variables the variance among the four age cohort is statistically significant. For height and weight, a linear growth can be seen from the 17-18 age cohort till 23-24. The mean age at menarche among the Hrusso girls is found to be 11.2 years. the variance among the four age cohorts across all the age at menarche categories is found to be statistically significant. The waist height ratio has

shown that 45.55% females were at risk of cardio-metabolic syndrome which is not significant among the age cohorts. Maximum number of girls have had more than 1 smokers in the family. Similarly, the number of females being exposed to passive smoking more than 5 days a week is also highest among them. the median age at menopause is found to be 49 years among the Hrusso females, and the mean reproductive life span among them is 37.8 years.

Pearson's correlation coefficient has shown that age at menarche negatively and significantly associated with BMI, number of smokers in the family, frequency of exposure to passive smoking and waist-height ratio status. The strongest association is found with BMI, implying that the lower age at menarche is associated with high BMI. Similarly, higher number of smokers in the family is significantly associated with low age at menarche. Waist-height has also shown similar trend among the Russo girls (Table 2).

The adjusted linear regression analysis shows that BMI, number of smokers in the family, frequency of exposure to passive smoking and waist-height ratio together explains 21.5% of the variance in the age at menarche. BMI and WHtR are found to be significant predictors of variability in age at menarche among the Russo girls (Table 3).

Table 1: Descriptive statistics for anthropometric, reproductive and behavioural data.

	17-18	19-20	21-22	23-24	P value
Height	151.47 ± 5.39	152.19 ± 4.64	153.06 ± 4.49	153.13 ± 4.48	0
Weight	47 ± 4.56	47 ± 4.72	48 ± 4.40	48.46 ± 3.69	0
Waist circumference	76.97 ± 2.26	76.05 ± 2.22	78.22 ± 4.40	77.28 ± 3.69	0
BMI	20.42 ± 5.70	20.59 ± 5.61	20.59 ± 5.24	20.73 ± 4.90	0
Age at Menarche					
Mean age at menarche (mean ± sd) 11.2 ± 0.06					
Age groups				Total	
10	3 (1.03%)	0	6 (2.05%)	4 (1.37%)	13 (4.45%)	0
11	19 (6.51%)	32 10.96%)	19 (6.51%)	11 (3.77%)	81 (27.74%)	
12	17 (5.82%)	16 (5.48%)	10 (3.42%)	9 (3.08%)	52 (17.81%)	
13	36 (12.33%)	5 (1.71%)	11 (3.77%)	1 (0.34%)	53 (18.15%)	
14	13 (4.45%)	15 (5.14%)	3 (1.03%)	9 (3.08%)	40 (13.70%)	
15	13 (4.45%)	15 (5.14%)	8 (2.74%)	1 (0.34%)	37 (12.67%)	
16	3 (1.03%)	6 (2.05%)	4 (1.37%)	3 (1.03%)	16 (5.48%)	
WHtR status					
Normal	56 (19.18%)	53 (18.15%)	27 (9.25%)	23 (7.88%)	159 (54.45%)	0.254
At risk	48 (16.44%	36 (12.33%)	34 (11.64%)	15 (5.14%)	133 (45.55%)	
No. of smokers in the family					
None	33 (11.30%)	34 (11.64%)	20 (6.85%)	11 (3.77%)	98 (33.56%)	0.473
At least 1	28 (9.59%)	29 (9.93%)	23 (7.88%)	11 (3.77%)	91 (31.16%)	
More than 1	43 (14.73%)	26 (8.90%)	18 (6.16%)	16 (5.48%)	103 (35.27%)	
Frequency of exposure to passive smoking in a week					
Less than 3 days	33 (11.30%)	34 (11.64%)	20 (6.85%)	11 (3.77%)	98 (33.56%)	0.404
3 to 5 days	34 (11.64%)	28 (9.59%)	15 (5.14%)	8 (2.74%)	85 (29.11%)	
More than 5 days	37 (12.67%)	27 (9.25%)	26 (8.90%)	19 (6.51%)	109 (37.33%)	
Aged sample collected (45+)			N 192	Median age at menopause		49 years
Mean reproductive life span			37.8 years			

Table 2: Pearson's correlation coefficient between different variables.

	AAM	BMI	NSF	FEPS	WHtR
AAM	1	-0.422**	-0.204**	-0.166**	-0.265**
BMI		1	0.089	0.042	0.262**
NFS			1	0.847**	0.142*
FEPS				1	0.117*
WHtR					1

Note: Here, AAM=Age at Menarche BMI=Body Mass Index, NSF=No of Smokers in the Family, FEPS=Frequency of Exposure to Passive Smoking, WHtR=Waist-Height Ratio status

Table 3: Adjusted linear regression between age at menarche and other variables.

Variables	Standardized coefficients	Sig.	R2
BMI	-0.371	0	0.215
NSF	-0.131	0.184	
FEPS	-0.022	0.82	
WHtR	-0.146	0.007	

Note: Here, BMI=Body Mass Index, NSF=No of Smokers in the Family, FEPS=Frequency Exposed to Passive Smoking, WHtR=Waist-Height Ratio status

DISCUSSION

It has been found that the mean age at menarche among the Hrusso girls is 11.2 (± 0.06) years. Balaji Ramraj et al. in their study pointed out that the mean age at menarche among the adolescent girls was found to be 12.5 (± 1.42) years [35]. Another study conducted among the school girls of Northern Karnataka, the mean at menarche was found to be 13.6 (± 1.2) [36]. Among the tea tribe girls of Assam, the mean age at menarche was found to be 12.88 (± 0.07) [37]. The national mean age at menarche was 13.76 years in 2005 according to published works [7]. Studies have definitively proven a secular trend in the mean age at menarche. At least a month has been declining in the mean age at menarche among Indian Women in every decade. Studies have also shown that this is true for the developed and other developing countries as well. Studies later to 2005 conducted nation-wide have also recorded much lower age at menarche than the national average [38-42].

One of the most important factors that have been associated with early age at menarche is obesity [43-45]. Obesity and overweight have been seen as one of the risk factors that expedites the onset of the menarche. In the present study population as well, a significant association can be seen between age at menarche and BMI. Those who are attaining menarche at lower age are also having higher BMIs. Similarly, the waist-height ratio has also shown that those attaining menarche at higher age are also at less risk of cardio-metabolic syndrome. However, Ley et al. have found in their study that a shorter reproductive life is associated with higher risk of incident CVD [46]. Extremely early age at menarche is also associated with higher risk of CVD. This implies that those who attain menarche at a higher age and menopause early are significantly more at risk of cardiovascular diseases. At the same time those attaining menarche extremely early are also considered to be having higher risk. Another published work has established that, early menarche (<12 years) had found to be having higher risk of hypertension, incident cardiovascular disease, incident coronary heart disease, all-cause mortality, cardiovascular disease mortality and cancer mortality. It also showed that this association is not completely mediated by increased adiposity [47]. In the present study also, it was found that those having early age at menarche are also more at risk of cardio-metabolic syndrome. However, among those attaining menarche at a higher age are found to be normal. This shows that may be among the Hrusso women shorter reproductive period does not translate into higher CVD risk. The median age at menopause among the adult Hrusso females in 49 years, which gives us a reproductive life span of 37.8 years among them. This is higher than the standard reproductive life span of 34 years (15-49 years). This means that the mean age at menarche of the Hrusso women is comparatively at an early age and at the same time this has shown a higher risk of cardio-metabolic syndrome determined by central obesity.

Geographical differences have played dividend in the age at menarche among women specially in India. It has been found that the compared to the women of northern, central and western part, in the north-eastern, eastern and southern part of the country, women attain menarche at a lower age group. Assam, Arunachal Pradesh, Sikkim, Karnataka and Andhra Pradesh have the lowest mean age at menarche compared to the rest of the country. It can be said that the poor nutrition and health care system prevailing in most of the areas of northern, central and western part of the nation could be attributed to the higher age at menarche [7]. The present study showing a much lower age at menarche can be taken as an indicator that geographical differences do play a role in the age at menarche. Moreover, the since the Hrusso is a hilly tribe living in a very remote ecological setup and at an elevation, the environment, food intake and the early involvement in household chores of the females may be reckoned as important factors of the considerably low age at menarche. It has been seen in general that the nutritional status of the children and adolescent in North-East India are at much more favourable condition than the rest of the country. Many studies have already supported this on various platforms [48,49]. Even though the present population is a rural and remote one, the better nutritional status could be another reason of them attaining early menarche.

Next to BMI, the number of smokers present in a family has a significant impact on the age at menarche of the Hrusso girls. It was found that the higher the number of smokers in the family the lower the age at menarche among them. As the frequency of exposure to the passive smoking reduces the attainment of the age at menarche increases among the Hrusso girls. It can be seen among them that those who are overweight and are exposed to frequent passive smoking in the family has attained their menarche at a significantly early age. This association has already been established by some studies. It has been found that girls with high exposure to parental and environmental tobacco smoke had a mean age at menarche 4 months earlier than the unexposed girls did [50]. Similar studies have also administered that girls tend to have a high risk of early menarche of mothers who smoke [28,51]. Ferris et al. found that those girls who were exposed to parental smoking and environmental smoking had a later age at menarche than those with no exposure [52].

CONCLUSION

The present study can be concluded by saying that overweight, being at risk of CVD and frequent exposure to passive smoking are some of the major factors associated with early age at menarche. Those with normal weight and no exposure to smoking are having a significantly late onset of menarche. It can also be said that passive smoking and high BMI also directly or indirectly are helping in having a longer reproductive period among the Hrussos.

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