

Mode of Feeding in Infancy and its Related Parameters

Rafia Bano*

Department of Clinical Nutrition, College of Applied Medical Sciences, University of Hail, KSA

Abstract: The study aims to assess the relation between breastfeeding duration and age at menarche. Analysis was based on a cross sectional study on adolescent girls in the age group 10 – 15 years. The main outcome was self-reported age at menarche. Pearson's correlation was used to investigate the relation between duration of exclusive and any breastfeeding with age at menarche with adjustment sequentially for specific sets of known socioeconomic, maternal, and genetic, confounders [1].

Menarche is a critical biomarker in the reproductive life of females [2]. It serves as an intermediate health outcome that affects women's wellbeing at later stages of life [3]. There appears to be trend for decreasing age at menarche worldwide. There are contradictory reports of lowering age at menarche due to increasing BMI in the population [4]. The tempo, level of growth and maturation during adolescence may have important implication to future adult health. The purpose of the study was to examine mode of feeding in infancy and its effect on BMI and age at menarche [5].

700 girls, 10-15 years were selected by multistage random sampling procedure. Age of the girls, Socioeconomic Status, BMI, menstrual status and mode of feeding in infancy were identified by questionnaire. Quetelet Index (wt/h^2) was used to identify the BMI. B. G. Prasad method of social classification was used to grade the Socio economic Status [6].

Mean age at menarche was found to be 12.36 ± 1.15 years. It was observed that mode of feeding infancy was significantly correlated ($P < 0.01$) with the age at menarche, Socioeconomic Status and educational qualification of mothers. However, the study suggested that girls who were formula fed deposit more body fat and were overweight.

Keywords: Mode of feeding, Body Mass Index, Menarche, Infancy.

INTRODUCTION

Menarche is however only a single event in the combination of physical changes which constitute puberty. There appears to be a trend of decreasing age at menarche worldwide [7]. Other factors aside, it is often assumed that this trend is due to increase in body fat mass secondary to excessive calorie consumption. There has been an increased incidence of obesity in the Indian subcontinent [8] and the question whether an earlier menarche is attributed to weight gain, is therefore an important one. Also the girls who were formula fed deposit more body fat than girls who were breast fed resulting in early attainment of menarche [7].

Early menarche is among the few established risk factors for breast cancer [9-11]. It has also been associated with metabolic syndrome [12], teenage depression [13], and overweight [14, 15].

Only recently have studies begun to investigate the effect of early life events on the timing of puberty, with the majority of studies focusing on birth weight, birth length, gestational age, and ponderal index [1, 3, 16]. Although nutrition in early development and childhood has a significant effect on the timing of menarche [17], it is surprising that little attention has been given to the

potential role of breastfeeding. Breastfeeding has been shown to be inversely associated with weight gain during childhood [18-20], which in itself is a risk factor for early age at menarche [3, 21].

Nutrition as an important regulator of the tempo of growth and obesity is usually associated with tall, childhood stature and earlier pubertal development [22]. According to Dunger *et al.*, 2006 [22] mode of feeding in infancy is positively correlated to BMI with bottle fed girls having higher BMIs. Several longitudinal studies have documented that timing of puberty is most closely linked to infant weight gain suggesting an early window for interventions of growth and adolescent development.

According to Ong KK (2009) [19], formula feeding results in faster early infancy weight gain and was associated with increased body fat mass at 10 years and also with earlier age at menarche. Schneider A P (1987) [23] showed in their study that improved nutrition during early childhood results in earlier attainment of fertility milestones.

According to Ginna Wall MN (2007) [24] breast feeding lowers the risk of obesity and decreases the ovulatory age.

METHODOLOGY

The present cross section study was under taken in adolescent school girls aged 10-15 years from four

*Address correspondence to this author at the Department of Clinical Nutrition, College of Applied Medical Sciences, University of Hail, KSA; Tel: 00966536662964; E-mail: rafiazafar78@gmail.com

different regions of Aligarh city. A 2.7% sample from among the total adolescent school going girls during the academic session 2005-2006 was selected for the study.

The study was carried out using a pretested and modified questionnaire. Identification data and age of the girls were ascertained from school records. The girls were told to ask the questions regarding their mode of feeding in infancy, duration of breastfeeding and whether it was partial or exclusive from their mothers and was noted in the questionnaire in the follow up visits. Standing height was measured using stadiometre and weight was measured using standard weighing machine. These values were used to calculate BMI using quetelet index (wt/h^2).

Age at Menarche

The analysis sample for the present study includes all girls who participated in the survey and had complete data on breastfeeding. The main outcome of the study was age at menarche, self reported in the surveys as the year of the occurrence of the first menstrual cycle. For the purpose of this study, age at menarche was used as a continuous and as a categorical variable. The categorical variable was grouped into early (<11.5 years), average (11.5–13.5 years), and late (>13.5 years) menarche. The age limit for early and late menarche was determined as 1 standard deviation away from the estimated mean age at menarche [3, 4]. Premenarcheal girls who were 14 years of age or older at the time of the interview were classified in the late menarche group [3, 6, 21].

Breastfeeding

The durations of exclusive breastfeeding and any breastfeeding were the main independent variables in the study.

Exclusive breastfeeding was defined as the intake of breast milk alone without any other type of milk, liquid, or food. Its duration was calculated as the infant's age when exclusive breastfeeding was terminated. Based on the recall of feeding patterns, this information was reported by the mother. Any breastfeeding, on the other hand, was defined as the intake of breast milk regardless of other type of food or drink intake. The duration of any breastfeeding, reported bimonthly by the mother for the first 24 months of life, was defined as the infant's age in days when any breastfeeding had been permanently stopped [28]. The present study has taken into account only the exclusively breast fed girls for statistical analysis.

ICMR classification was used to grade BMI [24]. B. G. Prasad method of social classification [6] modified as per the price index of 2002 was adopted for Socioeconomic Status. The selected sample was then categorized as High Income Group (HIG), Middle Income Group (MIG) and Low Income Group (LIG). Chi square and pearson's correlation was used to determine the association between age at menarche and other variables through SPSS-17.0 software.

RESULTS

Results of the study concluded that among 700 girls studied 400 were found to be post menarcheal. The mean age at menarche in the present study was found to be 12.36 ± 1.15 years (Table 2).

Table 1 shows that the correlation of mode of feeding in infancy was found to be significantly correlated ($P < 0.05$) with age of post menarcheal and inversely correlated with the age of non menarcheal girls ($P < 0.05$). It is noted from the table that the youngest menarcheal girls (age 10) were only bottle

Table 1: Relationship of Mode of Feeding in Infancy and Age According to Menarcheal Status

Age (yrs)	Menarcheal						Non-menarcheal					
	Bottle Fed	%	Breast fed (total)	%	Total	%	Bottle fed	%	Breast fed (total)	%	Total	%
10	8	2.0	-	-	8	2.0	65	21.7	43	14.3	108	36.0
11	22	5.5	11	2.8	33	8.3	39	13.0	44	14.7	83	27.7
12	43	10.8	15	3.8	58	14.5	31	10.3	28	9.3	59	19.7
13	59	14.8	30	7.5	89	22.3	10	3.3	19	6.3	29	9.7
14	66	16.5	33	8.3	99	24.8	6	2.0	15	5.0	21	7.0
15	61	15.3	52	13.0	113	28.3	-	-	-	-	-	-
Total	259	64.8	141	35.3	400	100	151	50.3	149	49.7	300	100
$\chi^2 = 12.64$ df 5 ; $P < 0.05$						$\chi^2 = 11.6$ df 4 ; $P < 0.05$						

Table 2: Correlation Between Age at Menarche and Mode of Feeding in Infancy

Age at menarche (years)	Mean age at menarche	Mode of feeding in infancy		Total
		Bottle fed	Breast fed (Exclusive)	
9.6 – 11.5	10.81	75 (18.8%)	28 (7.0%)	103 (28.8%)
11.6 – 13.5	12.59	169 (42.3%)	66 (16.5%)	235 (58.0%)
13.6 – 15	14.08	15 (3.8%)	47 (11.8%)	62 (15.5%)
Total	12.36	259 (64.8%)	141 (35.3%)	400 (100%)

χ^2 – 52.90 at df 2; p < 0.01.

fed. Also the number of breast fed girls increased linearly with increasing age of menarcheal girls.

Table 2 shows the distribution of exclusively breast fed and bottle fed girls according to age at menarche. It is clear from the table that among the total population the percentage of bottle fed girls was found higher (18.7 %) in the early maturing age group (9.6 – 11.5) than the late maturing population (3.7 %). Simultaneously, the number of totally breast fed girls was higher (11.7%) among the late matures as compared to 7.0 % early matures.

On analyzing percentages for each age group separately it is clear that the percentage of bottle fed girls show a steady decrease with increasing age at menarche from 72.8% to 71.9% followed by only 24.2%. On the other hand the percentage of totally breast fed girls increased with increasing age at menarche from 27.1% girls (age group 9.6yr – 11.5yr)

to 28.1% (age group 11.6yr – 13.5yr) up to 75.8% girls (age group 13.6 yr – 15 yr), showing a positive correlation ($P < 0.001$) between exclusive breast feeding and age at menarche. On applying chi square– test, P value was found to be < 0.001 which was highly significant ($\chi^2 = 52.9$ at df 2).

According to Table 3, results of the study show that mode of feeding in infancy was insignificantly correlated ($P > 0.05$) with Body Mass Index. Although it was noted from Table to that the number of overweight girls was more among bottle fed as compared to the exclusively breastfed girls. Also Among the total 5 overweight girl the majority (i.e. 4) were found to be bottle fed.

Table 4 revealed that the mode of feeding in infancy was significantly correlated with the socio economic status ($P < 0.05$). The number and percentage of bottle fed girls increased from 130 (31.7%) to 175 (42.6%) in

Table 3: Correlation of BMI and Mode of Feeding Infancy

BMI (wt/ht ²)	Mode of feeding in infancy	
	Bottle fed	Breast fed (Exclusive)
Under weight	240 (58.5%)	186 (64.2%)
Normal	166 (40.4%)	103 (35.5%)
Over weight	4 (1%)	1 (0.4%)
Total	410 (100%)	290 (100%)

Pearson's correlation χ^2 – 2.914 at df 4; p > 0.05.

Table 4: Correlation of Income Group and Mode of Feeding in Infancy

Income group	Mode of feeding in infancy		Total
	Bottle fed	Exclusively Breast fed	
LIG	130 (31.7%)	113 (39%)	243
MIG	105 (25.6%)	88 (30.34%)	193
HIG	175 (42.6%)	89 (30.7%)	264
Total	410 (100%)	290 (100%)	700

Pearson's correlation χ^2 – 14.5 at df 4; p < 0.05.

Table 5: Correlation between Education of Mother and Mode of Feeding in Infancy

Education of mother	Mode of feeding in infancy		Total
	Bottle fed	Exclusively Breast fed	
Illiterate	8	2	10
Literate	21	29	50
SSC	78	74	152
SSSC	83	38	121
UG	128	103	231
PG	58	38	96
Professional	34	6	40

χ^2 – 28.4 at df 6; $p < 0.001$.

accordance to the rising income level. On the other hand the number of exclusively breast fed girls decreased from 113 (39%) to 89 (30.7%) with rising income of group. Also the number of bottle fed girls was highest in the High Income Group (HIG; ie.42.6%) and the number of exclusive or totally breastfed girls was highest in Low Income Group (LIG ie 39%) showing a positive correlation between the two.

According to Table 5, educational qualification of mothers was also found to be significantly correlated ($p < 0.001$) with exclusive breast feeding. Study also showed that the high percentage of highly qualified mothers used bottle feeding. Literacy level of mothers was found to be higher as the study was not community based.

DISCUSSION

The present study aimed to explore the association of breastfeeding with menarcheal age. After adjustment for potential confounders of the association of breastfeeding with age at menarche, exclusive breastfeeding duration retained an independent and significant association with age at menarche. Results suggest that nutrition in early development and childhood plays an important role in determining the timing of menarche. Breastfeeding in early life may prevent or delay weight gain during childhood [18-20]. According to a study conducted on Danish cohort, longer durations of any breastfeeding decreased the weight gain during the first year of life [18]. Babies breastfed for less than 20 weeks gained 317.4 g more during the first year of life than those who breastfed for more than 40 weeks [18]. As explained by Ong *et al.* [19], the growth patterns for 3-month-breastfed infants were slower than those for formula-fed infants for the first 5 years of life. Rapid weight gain during infancy

has also been shown to increase the risk of attaining earlier menarche [3, 21]. Using the same data set as the present study, Adair [3] revealed that faster growth in weight and/or length at 6 months of age also predicted young menarcheal age.

The results of the present study are in accordance with some other studies. According to Schneider A. P. (1987) [23], “breast feeding should be added to the list of factors that decrease ovulatory age and thereby decrease the risk of ovarian cancers”.

Although the mechanism explaining the link between infant weight gain and age at menarche is still unclear, it has been speculated that a rise in leptin among rapid weight gainers triggers the onset of puberty. Similarly, the increased concentration of insulin like growth factor I due to weight gain during infancy may also promote the initiation of puberty [22].

According to another study by Ginna Wall, M. N. (2007) [24], “breast feeding lowers the risk of obesity, which in turn affects the age at menarche”. They showed prevalence of obesity as 10.7% in breast fed girls in comparison with 47% of bottle fed girls. However, there is lack of available literature to date showing the extent to which breast feeding or bottle feeding during infancy affects the age at menarche. Therefore the present study covers the aspects which still need much attention in developing countries like India.

SUMMARY

Mode of feeding in infancy was found to be significantly correlated ($P < 0.05$) with age at menarche, whereas mode of feeding in infancy was affected by socio economic status and mother education level. The present study showed no significant correlation

($P > 0.05$) between BMI and mode of feeding in infancy contrary to the studies by Novotny R (2003) [5] and Ong KK, (2009) [19]; showing a positive correlation between formula feeding and Body Mass Index.

Although no study has previously investigated the association between breastfeeding and menarcheal age as its primary objective, 3 studies examined this association as part of determining the predictors of menarche [5, 26, 27]. One of these studies by Novotny *et al.* [5] revealed that formula-fed girls were 2.7 (95% confidence interval: 1.12, 6.38) times more likely to attain early menarche than breastfed babies. The other 2 studies, however, failed to detect significant associations between breastfeeding and menarcheal timing [26, 27]. Several notable limitations such as small sample size, study design, long-term recall, and inconsistency in breastfeeding definitions limit the generalizability of these findings.

Mode of feeding in infancy i.e. breast feeding versus bottle feeding, is an important as well as the least explored factor especially from a country like India as well as abroad, probably due to the population biasing. According to the studies done on factors associated with age at menarche it is concluded that mode of feeding in infancy affects the adolescent weight and age of attainment of puberty signs, but there are limited researches showing any direct relationship with age at menarche, thus this area needs further in depth research. Results of this study could help promote breast feeding among young mothers through nutritionists and health workers, which has a lifelong effect on child's health and thus would greatly help to develop a healthy nation.

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