

The Relationship between Gynecologic Age and Maternal/Fetal Weight Gain in Adolescent Pregnancies

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Abstract

Background: There are so many studies with controversial results focusing on pregnancy outcomes in adolescents. Gynecologic age (GA)- the time between menarche and chronological age at the first pregnancy- has been considered as a physiological maturity indicator with a lower GA assumed as a risk factor for pregnancy outcomes in adolescents. The present study aimed to investigate the relationship between GA and maternal/fetal weight gain in adolescent pregnancies. **Methods:** This is an analytical study in which 275 primiparous women aged 20 to 29 years, were compared with two groups of adolescent women: GA ≤ 3 (n=141) and GA > 3 years (n=131) in terms of weight gain during pregnancy, anemia and birth weight of newborns. All women were married and had been admitted to the health centers of two cities in south west Iran in 2017. **Results:** Inadequate/excessive weight gain in adolescents who had a GA ≤ 3 was significantly more than that in adult group (p=0.04). There was no significant difference among three groups in terms of anemia and birth weight (p> 0.05). **Conclusion:** The association was revealed only between the GA ≤ 3 years and increased risk of undesirable weight gain. Including only married adolescents, is the main difference between this study and other studies.

Keywords: pregnancy in adolescence, gynecologic age,

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pregnancy outcomes, menarche.

Introduction

Adolescent pregnancy is one of the challenges many countries including developed, underdeveloped and developing countries, with different cultures face (Aliyu et al., 2010). Early marriage, early puberty, and lack of knowledge on contraceptive methods in adolescence are among the factors influencing adolescent pregnancy (Perez-Lopez et al., 2011). In some countries, adolescent pregnancy before marriage, is associated with lack of psychosocial and economic support of the family (Medhi et al., 2016; Sina, Iyabo and Ayodele, 2014). In addition to legal, emotional, financial and social outcomes, pregnancy in adolescence has been reported to be associated with an increase in perinatal risks such as maternal mortality (Lee et al., 2016; Nove et al., 2014), preterm delivery (Lee et al., 2016), low birth weight (Masyitah and Kusharisupeni, 2018), preeclampsia (Abalos et al., 2014), neonate death (Parra-Pingel et al., 2017), increased rate of cesarean delivery (Weiss, 2012), and anemia (Gupta, Kiran and Bhal, 2008).

There is evidence that pregnancy outcomes are affected by the biological maturity and various social and demographic variables (Sina, Iyabo and Ayodele, 2014). In this regard, the menarche is the most important stage in biological development and to achieve reproductive capacity (Prevalence of Teenage Pregnancy, 2015). Puberty time is different throughout the world and it has changed over time due to environmental changes, including ethnicity, geography, economics, social, chemical and household changes and genetic predisposition (Wood, 2017). The average age of menarche in the world is estimated to be 14 years. Girls living in most developed and modern urban areas, experience menarche under the age of 14 years, and girls living in developing countries experience the first menstruation above the age of 14 years (Cherry, 2014). The mean age of menarche is 12.16 years (Juil et al., 2006) in the United States, 13.8 years (Cho et al., 2010) in Korea, 13.02 years (Goon et al., 2010) in Nigeria, 12.81 years in Iran, 12.6 years in Tehran city (Bahrami et al., 2014), and 11.8 years in Ahvaz (Sharifi et al., 2014).

Chronological age has been used in many studies on the adolescent pregnancy, while less attention has been paid to the age of biological maturity (Zlatnik and Burmeister, 1977). Biological maturity is a series of physiological and anatomical processes, influenced by the environment. It enables adolescents physically for reproduction through releasing the gonadotropin hormone in the hypothalamus and secreting sexual steroids (Grumbach, 1998).

Gynecologic age (GA) –chronological age at first pregnancy minus menarche age- is a direct indicator of physiological maturation (Zlatnik and Burmeister, 1977; Koffman, 2012), so that the woman's pelvic structure to reach the adequate maturity two years after the onset of menstruation requires time, in which the diameter and height of the uterus reach maturity. Hence, a period of about two years, when the pelvis reaches adequate maturity, is used for gynecologic age (Gibbs et al., 2012). Several studies have been carried out on the importance of the gynecologic age and its difference with the chronological age regarding the incidence of pregnancy outcomes.

Studies have indicated that low birth weight (LBW) is one of the most important outcomes in adolescent pregnancies (Phipps and Sowers, 2002). It has been also reported that the rate of low birth weight is higher in adolescent pregnant women with a gynecologic age less than 3 years compared to that with a gynecologic age more than 3 years. While the chronological has been found to be a risk factor for low birth weight, it seems that the gynecologic age is a more important determining factor. In previous studies, it has been reported that the age group of 12-14 years increases the risk of LBW by 2 times due to lack of adequate maturity of pelvic (Scholl et al., 1989). Pregnancy outcomes in adolescents aged less than 15 years are important risk factors for low birth weight and preterm births due to gynecological age less than 3 years old (Phipps and Sowers, 2002). In addition, adolescent pregnancy can cause low birth weight through a direct negative effect on the growth of the fetus owing to high nutritional requirements of the mother (Phipps and Sowers, 2002). The results of a recent study showed that low birth weight, necessary for hospitalization in neonatal care unit, and intrauterine growth restriction are more in pregnant adolescents with a gynecologic age of less than three years compared to those in pregnant adolescents with more than three years of age and adult mothers (Kaplanoglu et al., 2015).

While several studies have been conducted on the outcomes of pregnancy in adolescents, few studies have examined the biological problems of pregnancy in adolescents, including gynecologic age. Most of the studies have used a chronological age for adolescent pregnancy outcomes. Little is known about the role of gynecologic age in adolescent pregnancy. The aim of this study was to evaluate the relationship between pregnancy outcomes and gynecologic age in adolescents.

Methods

This is a cross-sectional study in which the research population included all married women, who had given their first birth and

admitted to the health centers of Ahvaz and Dezful, the two largest cities in Khuzestan province. A total of 272 married adolescent women aged 13 -19 were included in the adolescents group (gynecologic age), divided into two groups of gynecologic age \leq 3 (141), and gynecologic age $>$ 3 years (131). 275 adult married women aged 20-29 were included in the control group. The inclusion criteria were having a health medical record in pregnancy, the exact date of the first day of the last menstruation or a sonography during the 16th to 18th week of pregnancy. The exclusion criteria were history of abortion, underlying diseases in pregnant women, the history of previous surgery, elective cesarean delivery, and the defect in the health medical records. The research project was approved at the Ethics Committee of Ahwaz Jundishapur University of Medical Sciences (grant No: RHPRC-9614 and the Ethics Code of IR.AJUMS.REC.1396.973). The study objectives and information on the way of data collection were explained for the participants and they were ensured that their information would remain confidential. Then informed consent was obtained.

Data collection sources included interview with women, maternal health and medical records, routine tests and sonography during pregnancy period, medical records related to delivery and neonate after birth. Demographic information, information on medical conditions including anemia, total weight gain during pregnancy, sonography during the 16th - 18th and 31st-34th weeks of pregnancy, BMI in the first trimester of pregnancy and routine tests. The third part of the questionnaire was information on delivery and neonate. The allowed weight gain during pregnancy was determined based on the pre-pregnancy BMI as well as a Z-scores table for adolescents and standard curves for adults. Hemoglobin less than 11 in the first and third trimester and less than 10.5 in the second trimester was considered as anemia. The validity of the research tool was confirmed by ten faculty members of Nursing and Midwifery School. The reliability of the research tool was confirmed by test-retest method with 2-week interval. The Chronbach alpha correlation coefficient of the questionnaire was found to be higher than 86% .

Data were analyzed using SPSS software version 20 and descriptive statistics including mean and standard deviation, frequency, as well as inferential statistics, including Chi-square and Fisher's exact test. To obtain the maximum information, three groups were compared in pairs.

Results

The mean and standard deviation of the age of the adult women was 23.22 years (\pm 2.47). Data on age, gynecologic age and age of the menarche of the two adolescent groups were shown in Table 1. The variables of ethnicity, maternal education, the spouse education, spouse job, housing status, economic status and marriage age were significantly different in the three groups (Table 2).

There were no significant differences among three groups in terms of anemia and birth weight. However, inadequate/excessive weight gain in adolescents with a gynecologic age of \leq 3 years

was significantly higher than that of the adult group ($p=0.04$) (Table 3). Logistic regression showed that gynecologic age is not related to any of the demographic factors ($p>0.05$).

Discussion

The aim of this study was to investigate the relationship between gynecologic age and maternal/fetal weight gain in adolescent pregnancies. This study showed that adolescent with gynecologic age of less than three years have an increased risk of undesirable weight gain compared to adults. No other pregnancy outcomes such as anemia during pregnancy, and low birth weight was found to be related to gynecologic age.

The majority of adolescent mothers were Arab; so that there was a significant difference between adolescents and adult groups in this regard. As the marriage age is lower in Arabs, the rate of pregnancy in Arab ethnicity is more (Alsaïdi, 2015).

As expected, higher education and income, having a job, independent housing, were significantly more frequent in adult mothers. Occupation is also dependent on the age and education of individuals (Sina, Iyabo and Ayodele, 2014). Moreover, in adult group, mothers have more opportunities for higher education, so will have more financial independence. Although education can act as a moderating factor in some outcomes of pregnancy, logistic regression indicated no confounding effect for demographic variables.

In Arab ethnicity, living with parents in the early years after marriage, is common. Families support their married children especially during pregnancy (Lee et al., 2016). The rural population was higher in adolescent mothers with a gynecologic age of three years or less. The possibility of receiving social support, is higher in rural society, especially during pregnancy. It may compensate some adverse outcomes of adolescent pregnancy. Moreover, in recent decade, the family physician program in Iran has increased access to health services, especially for rural pregnant mothers, leading to an increase in prenatal care, use of supplements and preventing anemia as well as the promotion of safe motherhood and normal delivery.

Our findings revealed no significant difference among three groups in terms of anemia and birth weight. Unlike to our findings, a study in Turkey showed that low birth weight was significantly higher in adolescents with GA less than three years (Kaplanoglu et al., 2015). A recent study showed that the gynecologic age less than four years increases the risk of low birth weight by four times and age of less than 16 years increases this risk by two times. Authors concluded that gynecologic age is a better predictor compared to chronological age (Masyitah and Kusharisupeni, 2018). In contrast, Felice et al. showed that there was no significant difference between the two groups in terms of low birth weight by comparing the chronological age and gynecologic age (Felice et al., 1984). In addition, Ash et al. found that the rate of low birth weight in adolescents were lower than that in adults (Ash and Ogakwu, 2014). The reason for this difference might be attributed to ethnicity and race. In the present

study, most of the adolescent mothers belonged to Arab ethnic group, while most of the adult mothers belonged to Persian ethnic group. In Arab ethnicity, marriage and early pregnancy are accepted and considered as common (Alsaïdi, 2015). It causes pregnant adolescent to receive adequate care and support, leading to reduced undesirable outcomes in these people. It should also be noted that some unmarried adolescent were included in other studies. While this phenomenon is considered normal in other communities and cultures (Ash and Ogakwu, 2014), these mothers might receive less social, financial, and emotional support, making them more vulnerable to undesirable outcomes (Ngowa et al., 2015).

Results of this study show that inadequate/excessive weight gain in adolescents with a gynecologic age of 3 years or less was significantly higher than that of adults. It suggests that undesirable weight gain in adolescent pregnancy, could be due to inadequate physical capacity in adolescents, especially with lower gynecologic age, to achieve adequate weight (Taylor et al., 2010). Moreover, adolescents might have less responsibility to their health and not fully understand the importance of proper nutrition and its effect on pregnancy health (Ramakrishnan et al., 2012), leading to an inadequate weight gain. Unlike our findings, a study in Turkey revealed that weight gain during pregnancy was not associated with gynecologic age (Kaplanoglu et al., 2015).

Although this study revealed no relationship between some pregnancy outcomes and gynecologic age in adolescents, adolescent pregnancy is still considered as a concern in terms of psychosocial and social preparedness and emotional relationship between mother and child

This study is the first research on the gynecologic age in Iran, however some limitations may affect findings; for example, the gynecologic age was considered as ≤ 3 and >3 years. Some other studies considered it as ≤ 2 and >2 years. This is probably the reason for affecting more pregnancy outcomes in some previous studies. As expected, group with lower gynecologic age were younger, indicating the interaction effect of age and gynecologic age in the incidence of pregnancy and childbirth outcomes in adolescents (Kaplanoglu et al., 2015).

Conclusion

Although most studies report that adolescent pregnancy is a major risk factor for some pregnancy complications, this study showed association only between the gynecologic age of less than three years and increased risk of undesirable weight gain, probably due to including married adolescents only. Future prospective studies are recommended to examine the relationship between other outcomes of pregnancy in adolescents and gynecologic age, considering the underlying moderating and confounding factors such as ethnicity, access to health services, as well as controlling the various social, economic, psychological and family conditions.

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Table 1: Mean and standard deviation of chronological, gynecologic and menarche age

variable	Teenage (13-19 year)	
	GA ≤3 (n=141)	GA >3 (n=131)
Age (Mean±SD)	15.65 ±1.17	18.23 ±0.77
Gynecologic Age (Mean±SD)	2.17 ±0.44	5.33 ±1.04
Menarche Age (Mean±SD)	12.91 ±0.91	12.49 ±0.94
Percent (Mean±SD)	25.8	23.9

Table 2: demographic characteristics of the three groups

Variable		Teenage (13-19 year)				adults (20-29 year)		Total		P value
		GA ≤3 (n=141)		GA >3 (n=131)		N	%	N	%	
		N	%	N	%					
Ethnicity	Fars	17	12.1	18	13.7	75	27.3	110	20.1	<0.0001*
	Arabic	65	46.1	62	47.3	33	12	160	29.3	
	Lor	48	34	34	26	116	42.2	198	36.2	
	Bakhtiari	11	7.8	17	13	51	18.5	79	14.4	
Education	≤ 5	108	76.6	59	45	82	29.8	249	45.5	<0.0001**
	6-12	33	23.4	72	55	190	69.1	295	54	
	≥ 13	0	0	0	0	3	1.1	3	0.5	
Husband Education	≤ 5	52	36.9	32	24.4	38	13.8	122	22.3	<0.001**
	6-12	86	61	97	74	234	85.1	417	76.2	
	≥13	3	2.1	2	1.6	3	1.1	8	1.5	
Job	housewife	141	100	130	99.2	274	99.6	545	99.6	0.48**
	Employed	0	0	1	0.8	1	0.4	2	0.4	
Husband Job	worker	102	72.9	89	68.5	219	80.2	410	75.5	0.01**
	Employee	1	0.7	6	4.6	2	0.7	9	1.7	
	Self-employment	37	26.4	35	26.9	52	19	125	22.9	
Housing situation	rental	15	10.6	24	18.3	56	20.4	95	17.4	0.019*
	Personal	5	3.5	12	9.2	23	8.4	40	7.3	
	With family	121	85.8	95	72.5	196	71.2	410	75.4	
Residency	Rural	115	81.6	81	61.8	198	72	394	72	0.001
	Urban	26	18.4	50	38.2	77	28	153	28	
Economic status	Weak	80	56.7	48	36.6	45	16.4	173	31.6	<0.001*
	medium	51	36.2	75	56.3	166	60.4	292	53	
	Good	10	7.1	8	6.2	64	23.4	82	15	
Marriage age	<14	16	11.3	0	0	0	0	16	2.9	<0.0001*
	14-17	113	80.1	29	22.1	0	0	142	25.9	
	17-20	12	8.5	102	77.9	31	11.3	145	26.5	
	20-23	0	0	0	0	127	46.2	127	23.2	
	>23	0	0	0	0	117	42.2	117	21.4	

* Chi-square test, ** Fischer's exact test

Table 3: obstetrical characteristics and outcomes in three groups

Variable		adolescents (13-19 year)				adults (20-29 year)		Total		P value
		GA \leq 3 (n=141)		GA >3 (n=131)						
		%	N	%	%	N	%	N	%	
BMI	underweight	5	3.5	4	3.1	17	6.2	26	4.8	1) 0.355 2) 0.001 3) 0.072
	normal	102	72.3	84	64.1	142	51.6	328	60	
	Overweight	26	18.4	36	27.5	89	32.4	151	27.6	
	Obese	8	5.7	7	5.3	27	9.8	42	7.8	
Weight Gain	Inadequate/excessive	42	29.8	50	38.2	111	40.4	203	37.1	1) 0.291
	Optimal	99	70.2	81	61.8	164	59.6	344	62.9	2) 0.04 3) 0.829
Anemia	Yes	21	14.9	14	10.7	47	17.1	82	15	1) 0.319
	No	120	85.1	117	89.3	228	82.9	465	85	2) 0.58 3) 0.291
Weight of newborn at birth	2500 >	10	7.1	4	3.1	13	4.7	27	4.9	1) 0.172
	2500 \leq	131	92.9	127	96.9	262	95.3	520	95.1	2) 0.366 3) 0.598
* gynecologic age ¹ . GA \leq 3 vs GA >3 ² . GA \leq 3 vs adults ³ . GA >3 vs adults										

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