Original Article | JOGCR. 2023; 8(1): 68-75

Journal of Obstetrics, Gynecology and Cancer Research | ISSN: 2476-5848

Maternal Health Literacy and Pregnancy Outcomes: Does any Association Exist?

Fahimeh Ghotbizadeh[1*], Zahra Panahi[1], Azam Tarafdari Manshadi[1], Saeed Soltani[2], Razieh Akbari[1], Mahdieh Parsapur[1]

1. *Department of Obstetrics and Gynecology, Imam Khomeini Hospital, Tehran University of Medical Sciences, Tehran, Iran*
2. *Tehran University of Medical Sciences, Tehran, Iran*

Article Info

10.30699/jogcr.8.1.68

Received: 2022/01/18
Accepted: 2022/05/23
Published Online: 2022/12/27

Use your device to scan and read the article online

Corresponding Information:
Fahimeh Ghotbizadeh
Department of Obstetrics and Gynecology, Imam Khomeini Hospital, Tehran University of Medical Sciences, Tehran, Iran
Email: f-ghotbizadeh@sina.tums.ac.ir

ABSTRACT

Background and Objective: Social factors which are integrated with health status are considered crucial in pregnancy morbidity. Mothers with a developed level of health literacy (HL) experience a lower risk of preterm delivery. This study aimed to evaluate the relationship between maternal HL and prenatal care and pregnancy outcome.

Methods: The research was a cohort study. A total of 323 participants were selected from prenatal clinics. The women were followed until delivery. Women who had gestational diabetes or preeclampsia or gestational hypertension during pregnancy were omitted. Data were collected with a survey.

Results: The result found 34.1%, 33.1%, 23.8%, and 9% were categorized as having inadequate, problematic, sufficient, and excellent maternal HL. Women with sufficient and excellent literacy were meaningfully better in having earlier and more frequent antenatal care, earlier folic acid consumption, and exercise before and during pregnancy, pregnancy alarm sign awareness, neonatal birth weight, and breastfeeding.

Conclusion: The results proposed that sufficient and excellent HL among women is related to good pregnancy outcomes and poor HL causes a poor chance to gain a positive pregnancy outcome. A cooperative work to grow maternal HL by considering HL levels, revision of educational materials into plain language, and provision of pregnant women with verbal and video instruction in addition to written materials are highly recommended.

Keywords Health Literacy, Pregnancy Outcome, Preterm Labor, Low Birth Weight, Social Determinants of Health

Introduction

Each year all over the world, more than 20 million neonates are born with low birth weight (LBW) which the proportion in developing countries is 95.6% **(1)**. Evaluating the prevalence of low birth weight in Iran reveals an increasing trend which is reported in various cities **(2,3)** LBW is not only correlated with a higher rate of mortality, but also with neonatal infections, limited cognitive-thriving development and chronic disease in adulthood. LBW has always been a critical feature in general population health evaluation **(4,5)**.

The second important effective cause of neonatal death is preterm delivery. Notably, the prevalence of preterm delivery has an increasing trend globally which is 5% in developed and 25% in developing countries **(6,7)**. However, in Iran, the prevalence of preterm delivery was reported between 5.6 to 13.4 % **(8)**.

Several factors such as a history of preterm delivery, level of education in mother, maternal literacy level, family economic level, pregnancy interval duration, pregnancy cares, history of LBW in previous children, infection during pregnancy and inadequate gestational weight gain are more likely related to LBW and preterm delivery **(9)**.

Social factors that are integrated with health status are considered crucial in pregnancy morbidity. Key factors in this field are; education, income, ethnicity, food and nutrients accessibility, psychological and

behavioral features. These factors are affecting each other and correspondingly affecting health status. For example, the level of literacy and health education is one of the important social determinants affecting health status. Health education is an upgradeable feature to enhance access to health information, ways of communication with health providers, and coordination toward the health care system **(10)**.

Various research have demonstrated the effects of mothers' HL on pregnancy critical variables and also on pregnancy outcomes via enhancing the quality of health services during pregnancy. Mothers with a higher level of HL experience have a lower risk of preterm delivery and a higher rate of neonates born with appropriate weight **(11,12)**.

HL in mothers is strongly relevant to maintaining healthy behaviors and understanding teratogenic behaviors during pregnancy **(13)**. Also, health education in mothers has a significant correlation with time of initiating pregnancy cares, amount of visits and cares done during pregnancy, adherence to health providers advice, neonatal death, and rate of cesarean section **(14)**.

Despite the increasing trend in the influence of HL on enhancing the level of health in the general population and level of health in mother and child, there are only a few studies in this country emphasizing this issue. The research was designed to evaluate the level of HL and associated demographic factors in mothers and finally investigate any possible relation with pregnancy outcomes in this country.

Materials and Methods

This cross-sectional study was performed on This cohort study was conducted through a survey research design that was performed among pregnant women who were referred to Imam Khomeini, Baharlu, and Ziaeian hospitals (TUMS) between March 2018 and March 2019. Participants were selected using simple random sampling. A questionnaire was designed to collect the data. Questionnaires were distributed based on completely voluntary and optional participation without any obligation.

According to the latest study, HL among pregnant women in Tehran province was reported insufficient (30%), borderline (24.6%), and sufficient (45.4%) **(15)**. Accordingly, using a 95% confidence interval with a standard error of below 5%, and 10% possibility of sample loss, the sample size was calculated, 323 individuals.

Inclusion criteria were pregnant women with normal first-trimester screening, aging from 18 to 40, absence of chronic diseases like diabetes, hypertension, collagen-vascular, cardiopulmonary disease and renal disease and also not studying in any medical-related fields, parity 1-4, without a history of preterm birth, and not being smoker neither alcohol drinker. Meanwhile, exclusion criteria were experiencing gestational diabetes, preeclampsia, or gestational hypertension.

HLS-EU-16 (HL Survey-Europe-16questions) which its validity and reliability were confirmed already by Tavakolikia, was used in this study (16). This questionnaire contains 16 questions in 3 fields of HL using Likert scale. The participants were scoredfrom 1= very difficult, and 5= very simple. Afterward, using the designed formula in the main study revealed each participant's score in HL:

Index = (mean (per Item) -1) * 50/3

According to this formula, the index is assigned to calculated HL scores for specific participants. Mean is the average of all scores calculated in the questionnaire. The minimum possible amount of mean is 1 which leads to 0 as an index score. The range of mean would be 3, since 5 and 1 are the highest and the lowest amount of possible mean respectively and 50 would be the highest total index score in the questionnaire. Correspondingly, the most and least scores acquired would be 50 and 0 respectively in this study. Based on original designers of this questionnaire using cut points, the level of HL in participants can be divided into four groups: 0 to 25 (insufficient), 25 to 33 (approximately insufficient), 33 to 42 (sufficient), and 42 to 50 (excellent).

The data related to the first trimester of pregnancy like weight, height, and hemoglobin of mothers were gathered by an obstetrician. In the following, further data including time of initiating first pregnancy care, time of initiating folic acid, regular using of folic acid, using iron, arbitrary medication, exercise before pregnancy, exercise during pregnancy and the number of warning signs (such as headache, epigastric pain, vaginal bleeding, and …) during pregnancy were declaired by mothers themselves.

Perinatology clinic and labor ward files of pregnant women who were referred to educational hospitals of TUMS were used to access data like weight and age of neonates, type of delivery, and breastfeeding.

To implement this study, perinatology clinics of three educational hospitals of TUMS were selected. Within 12 months, among pregnant women being reffered to the perinatology clinics, who were also eligible for inclusion in this study, samples were selected and after completing HL questionnaire by pregnant women and gathering pregnancy-related data by justified obstetricians, participants were followed till the time of labor and data related to pregnancy outcome were gathered from their hospital file. Also, data of mothers who were not laboring within selected hospitals were gathered via making phone calls.

Of all samples, 50 were gathered from Imam Khomeini hospital, 50 from Ziaeian hospital, and 280 from Baharlu hospital, and also 54 samples were excluded due to exclusion criteria, and eventually, 323 samples remained appropriate for statistical analysis.

For statistical analysis, SPSS version 21 software was used. Descriptive statistics and also inferential statistics (Chi-square test and Kruskal-Wallis) were applied.

Ethical considerations were observed precisely via saving the privacy of participants, keeping participants' information confidential, performing tests conservatively to limit any psychological collateral side effects on participants, and also running the whole process optional and voluntary.

Ethical circumstances were approved by the ethics committee (IR.TUMS.IKHC.REC.1397.018) and also were licensed by the vice chancellor for research in TUMS.

Results

The mean age of women in this study was 28 years, with minimum and maximum of 18 and 40 years respectively. The majority of them had a high school diploma (57.9%) and a middle school license (17.6%). 97.2% were housewives and 2.8% were employed. Most participants had an income of 50.000.000 - 100.000.000 Rials (38.4%), and 100.000.000 - 150.000.000 Rials (32.8%) per month.

The mean HL index was 29.1 out of 50 with the minimum and maximum of 1.2 and 50 respectively. However, 34.1% of participants had insufficient HL, 33.1% had approximately insufficient HL, 23.8% had sufficient HL, and 9% had excellent HL.

The mean body mass index (BMI) was 25.34 with the maximum and minimum of 41.5 and 15.99 respectively. Most of the participants had normal BMI (43.1%) or were overweight (37.1%). The frequency of not using folic acid or iron was 10.55% and 8% respectively. The majority of participants had initiated folic acid supplements within the first month of pregnancy (36.5%) and only 24.8% had started taking it before pregnancy.

About 39% of participants were nulliparous. A significant proportion of participants (46.4%) had initiated pregnancy care during the first month of pregnancy and only 23.8% of them had experienced first pregnancy care visits before pregnancy. 19% of women had an interval of fewer than 2 years between current and previous pregnancy. 36.4% of participants were aware of only one warning sign during pregnancy and only 13% of them were fully alert to 13 pregnancy warning signs. 44.9% mentioned taking arbitrary medication. Of all participants, 41.8% before gestation and 53.8% during the gestation period had regular exercise.88.2% of participants who had exercised before gestation continued exercising within the gestation period.

The prevalence of anemia was 5.9% among participants. Also, the prevalence of low birth weight and preterm delivery was 10.8% and 3.8% respectively. Furthermore, the rate of abortion was 18.2%, breastfeeding 59.4%, and cesarean delivery was 53.9%. The relation between HL and demographic variables revealed that there was no statistically significant relationship in HL level with age (P= 0.16), and education level (P= 0.076), but there was a significant correlation with income (P= 0.008) (Table 1).

The relation between HL and pregnancy variables showed that there was no statistically significant relationship in HL level with BMI (P= 0.29), anemia (P= 0.56), folic acid usage (P= 0.65), Iron usage (P= 0.65), parity (P= 0.8), abortion (P= 0.93), and pregnancies interval (P= 0.46); but there was significant correlation with first prenatal visit (P= 0.011), time to initiate taking folic acid (P= 0.024) arbitrary medication (P= 0.001), count of taking arbitrary medication (P= 0.003), exercise before pregnancy (P= 0.005), and exercise during pregnancy (P= 0.001) (Table 2).

Table 1. Relation between HL and demographic variables

Variable	Scale	HL level				p
		Insufficient	Approximately insufficient	Sufficient	Excellent	
Age(Years)	Under 20	8.2	5.6	0	10.3	0.16
	20-25	15.5	22.4	23.4	20.7	
	25-30	30.9	37.4	28.6	37.9	
	35-40	31.8	29	35.1	17.2	
	40-45	13.6	5.6	13	13.8	
Education level	Literacy level	0.9	0	1.3	0	0.076
	Elementary	12.7	3.7	6.5	10.3	
	Middle school	26.4	15	10.4	13.8	
	High school diploma	48.2	65.4	63.3	55.2	
	Bachelor of Science	10.9	15	19.5	17.2	
	Master of Science and PhD	0.9	0.9	0	3.4	
Income	Less than 5000 Rials	14.5	6.5	9.1	13.8	0.008
	50 -100M Rials	47.3	35.5	28.6	41.4	
	100.1-150M Rials	27.3	39.3	39	13.8	
	150.1-200M Rials	8.2	17.8	19.5	27	
	More than 200M Rials	2.7	0.9	3.9	10.3	

Chi-square was used in this statistical analyze with the significance level of 0.05

Table 2. Relation between HL and pregnancy variables

Variable	Scale	HL level				P
		Insufficient	Approximately insufficient	Sufficient	Excellent	
BMI	Less than 18.5	5.5	2.8	5.2	10.3	0.29
	18.5-25	43.6	43	44.2	34.5	
	25-30	35.5	38.3	40.3	37.9	
	30-35	11.8	15	7.8	10.3	
	35-40	3.6	0.9	2.6	3.4	
	More than 40	0	0	0	3.4	
Anemia	Yes	8.2	3.7	5.2	6.9	0.56
	No	91.8	96.3	94.8	93.1	
First prenatal visit	Before gestation	10.9	20.6	27.3	27.6	0.011
	1st month	35.5	51.4	41.6	51.7	
	2nd month	37.3	21.5	26	10.3	
	3rd month	11.8	2.8	3.9	6.9	
	4th month	2.7	1.9	1.3	3.4	
	5th month	1.8	1.9	0	0	
Folic acid usage	Yes	86.4	89.7	90.9	93.1	0.65
	No	13.6	10.3	9.1	6.9	
Time to initiate taking folic acid	Before gestation	12.7	26.6	33.8	31	0.024
	1st month	31.8	40.2	36.4	41.4	
	2nd month	37.3	18.7	23.4	17.2	
	3rd month	10	7.5	2.6	3.4	
	4th month	3.6	4.7	2.6	6.9	
	Not used	4.5	2.8	1.3	0	
Iron usage	Yes	91.8	89.7	94.8	93.1	0.65
	No	8.2	10.3	5.2	6.9	
Arbitrary medication	Yes	69.1	41.1	26	17.2	0.001
	No	30.9	58.9	74	82.8	
Count of taking arbitrary medication	1	43.4	72.7	85	80	0.003
	2	34.4	18.2	0	0	
	3	15.8	6.8	5	0	
	4	5.3	0	5	0	
	5 or more	1.3	2.3	5	20	
Exercise before pregnancy	Yes	33.6	37.4	50.6	65.5	0.005
	No	66.4	63.6	49.4	34.5	
Exercise during pregnancy	1-2 times	24.5	32.7	40.3	48.3	0.001
	3-4 times	7.3	15	15.6	17.2	
	5 times or more	2.7	5.6	14.3	27	
	Not exercising during pregnancy	19.1	15.9	14.3	0	
	Not exercising at all	45.5	27.1	13	10.3	
Parity	0	40	39.3	36.6	41.4	0.80
	1	34.5	37.4	37.7	31	
	2	16.4	15	16.9	17.2	
	3	8.2	4.7	9.1	10.3	
	4	0.9	3.7	0	0	
Abortion	Yes	17.3	17.8	28	17.2	0.93
	No	82.7	82.2	79.2	82.8	
Pregnancies interval	Less than 2 years	23.1	12.9	19.6	25	0.46
	More than 2 years	76.9	87.1	80.4	75	

The relation between HL and postpartum related variables found that there was statistically a substantial association in HL level with the mode of delivery (P= 0.001), breastfeeding (P= 0.001), and birth weight (P= 0.001), but there was no meaningful association with gestational age (P= 0.33) (Table 3).

Table 3. Relation between HL and related variables

Variable	Scale	HL level				p
		Insufficient	Approximately insufficient	Sufficient	Excellent	
Mode of delivery	NVD	60.9	42.1	32.5	58.6	0.001
	Cesarean	39.1	57.9	67.5	41.4	
breastfeeding	Breast feeding	28.2	67.3	83.1	86.2	0.001
	Infant formula	65.5	23.4	13	10.3	
	Both	6.4	9.3	3.9	3.4	
Birth weight (gr)	under 2500	21.8	7.5	1.3	6.9	0.001
	above 2500	78.2	92.5	98.7	93.1	
Gestational age at delivery (week)	under 37	6.4	2.8	1.3	3.4	0.33
	above 37	93.6	97.2	98.7	93.6	

Discussion

According to the WHO statement, HL plays a key role in determining health inequalities **(17)**. HL is an important element that can potentially make women able to enhance their health. In this study, the association between HL level in pregnant women and health behaviors, teratogenic behaviors, and pregnancy outcomes were evaluated. According to our results, the rate of sufficient HL or above was 32.8%. In other studies, rate of sufficient level of HL was varying between 18 and 58% among pregnant women which may be related to the type of questionnaire used and the sample that was studied so that in a study which was using TOFHLA questionnaire among pregnant women, sufficient HL rate was reported between 48% and 58% **(18,19)**.

Results of a study that took place in 8 European countries indicated that there is a substantial association between the level of HL and economy level, sex, age, and education level **(20)**. Although 73.7% of participants had a high school diploma or above, only 32.8% of participants had a sufficient level of HL. This is suggesting that even though general education and literacy is a significant antecedent index in the level of HL, but HL is more complex and seems to have a lower level comparing to general literacy **(21)**.

However, with increasing the years of education, the level of HL also increased which is confirmed by various studies. According to the latest systematic review around HL implemented by Agency for Healthcare Research and Quality (AHRQ), having a low level of HL is considerable in the USA which is more sensible especially in people with the educational level of a high school diploma or less. Based on this study, years of education are considered a strong predictor in the field of HL, but in this study, there was no important association between HL and level of education **(22)**.

In this study, there was no meaningful association between age and HL. McLaughlin *et al.*, and also Endres *et al.*, revealed the same conclusion in their studies around the association between age and HL in pregnant women. a number of research also noted the same results studying the association between age and HL in pediatric care from 5 to 7 months old **(17,23,24)**.

In this study, a connection was observed between family income and HL. Results were indicating that an increase in family income in participants with insufficient or approximately insufficient HL could decrease the level of HL while participants with sufficient HL were reverse. Lower HL levels in women with lower income may be possibly related to having lesser years of education. Ferguson *et al.*, noted that various studies have indicated a correlation between low educational level and low income. Reasonably, people with lower levels of education have less chance for occupations with a better income. Approximately, it has been shown that with every year added to years of education, income would increase 10-20% which is assisting correlation noted above **(25)**.

Some authors believe that pregnancy care could potentially decrease pregnancy mortality and morbidity and initial care should take place as soon as menstruation delay is observed and otherwise it is considered as insufficient pregnancy care **(9)**. Based on results, HL level is related to the time of initiating first prenatal care and number of cares done so that only 10% of participants with insufficient HL level initiated first prenatal care before gestation while this rate in participants with sufficient level of HL and above was 59%. Also, all participants with observing less than 9 prenatal care were having an insufficient level of HL. Kohan *et al.*, also noted the same significant association between the level of HL and time of initiating first prenatal care **(11)**.

This study is also indicating that while there is no significant connection between folic acid consumption and HL level, but the time of initiating folic acid usage is related significantly so that only 13.3% of women with an insufficient level of HL initiated taking folic acid before gestation while this rate was 64.8% among participants with sufficient level of HL or above. About 33% of women with a low level of HL started taking folic acid at the beginning of pregnancy while this rate was 65% among

sufficient level of HL **(24)**. Kohan *et al.*, also mentioned that time of initiating folic acid usage is strongly related to HL level (48% among women with a satisfying level of HL and 27% among non-satisfied) **(11)**. According to our results, Iron usage was not reasonably related to HL level which was likely similar to the results of Kohan and coworkers **(11)**. In this study, there was no meaningful relation between anemia and HL level, while Kohan *et al.*, demonstrated a significant connection **(11)**. This difference could be the result of the difference in time of anemia evaluation. In this study, evaluation of anemia took place in the first trimester, while Kohen and coworkers used the third trimester for evaluation of anemia.

About 45% of women mentioned taking arbitrary medication. Arbitrary medication and the number of a repetition taking arbitrary medication was significantly related to HL level so that among participants with insufficient and sufficient or above level of HL, 26% and 17% respectively noted taking arbitrary medication. Lupattelli *et al.*, also indicated the same relation. Participants with a higher level of HL had more clear insight on taking medication and following doctor's orders within this field **(13)**.

Rahimi *et al.*, aiming awareness and performance of pregnant women towards exercise during pregnancy revealed that 40% of pregnant women didn't have any exercise during pregnancy and 53% were poorly aware of exercise during pregnancy **(26)**.

The prevalence of C-section among participants was 53% which was meaningfully correlated with HL level. With an increasing level of HL, the rate of C-sections increased the same manner and the considerable difference was observed between participants with insufficient and sufficient levels of HL but this rate decreased in an excellent level of HL group comparing to sufficient (41% comparing to 74%). Kohen *et al.*, also noted the same correlation between HL level and prevalence of C-section (65% in the satisfied level of HL and 35.8% in not-satisfied) **(11)**.

The rate of breastfeeding in this study was 59.4%. Based on family health office and community of breastfeeding promotion, the rate of exclusive breastfeeding within the first 4 months after birth is 68% in Iran. Also based on a national study, the rate of breastfeeding during the first 4 months after birth is 56.8%. In this study, breastfeeding was correlated with socioeconomic and educational variables so that exclusive breastfeeding in the first 4 months was higher in participants with higher education and economic level but this rate also decreases until month 6 which may be related to a higher rate of employment within this group **(27)**. Ibanez *et al.*, reported that highest rate of breastfeeding among developed countries is observed in Norway (99%), Denmark (98.7%), Japan (98.3%) and lowest rate is observed in the United Kingdom (70%), the United States (69.5%), and France(62.6%) and also, low rate of breastfeeding is mostly reported in individuals with lower socioeconomic and education level **(28)**. Correspondingly, there was a significant correlation between HL and type of breastfeeding so that with increasing level of HL, the rate of breastfeeding also increased which was coincidental with Kohen and coworkers **(11)**.

The prevalence of LBW was 10.8% which was significantly related to HL level so that rate of LBW(<2500g) was 21% among the insufficient level of HL and 1.3% among sufficient level of HL and this was also relevant to Kohen and coworkers **(11)**.

Preterm delivery is considered as one of the important elements involved in neonates' mortality. The prevalence of preterm delivery is increasing all over the world. The rate of preterm delivery is 5% in developed countries and 25% in developing countries. In Iran, this rate was reported varying from 5.6% to 13.4%. The prevalence of preterm delivery in this study was 3.5% which wasn't significantly related to HL. In other studies, also there was no significant relationship between HL and preterm delivery which may be due to lower prevalence of preterm delivery in the studied population and size of the sample **(11,12)**.

Conclusion

In summary, according to the results of this study, level of HL in pregnant women was significantly related to birth weight, time of initiating folic acid, time of first prenatal care visit, arbitrary medication, exercising before pregnancy, exercising during pregnancy, level of awareness towards pregnancy warning signs, and type of breastfeeding. Considering the importance of HL in mothers in developing health in family and society and role of structured education in enhancing the level of HL in mothers, and also considering HL being related to pregnancy outcomes, health and teratogenic behaviors during pregnancy, the necessity of education in large scales using various methods in pregnant women to enhance pregnancy cares and neonates weight birth is comprehended more than ever.

Acknowledgments

None.

Conflict of Interest

None.

Funding

The authors did not receive any financial support.

Ethical circumstances were approved by the ethics committee (IR.TUMS.IKHC.REC.1397.018) and also were licensed by the vice chancellor for research in TUMS.

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How to Cite This Article:

Ghotbizadeh F, Panahi Z, Tarafdari Manshadi A, Soltani S, Akbari R, Parsapur M. Maternal Health Literacy and Pregnancy Outcomes: Does any Association Exist?. J Obstet Gynecol Cancer Res. 2023; 8(1):68-75.