

The Relationship Between Mothers' Biological and Psychological Characteristics and Their Babies' Levels of Low Birth Weight

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Abstract: Background and Aim: Low birth weight is one of the main health indices being used for the evaluation of pregnancy period care and as such, it is so important to identify the factors involved in it. The present research has aimed at exploring the relationship between mothers' psycho-biological variables and their newborn babies' levels of low birth weight. **Materials and Method:** The research is a correlation research being done as a field study. A sample of 168 subjects was selected through a simple random sampling procedure out of all low birth weight newborn babies being born at 20 hospitals or maternity centers located in Guilan province, Iran in the period between January 2008 and November 2009 along with their mothers. The mothers replied to a general health questionnaire with a reliability of 0.82, a sensitivity of %83.3 and a specificity of %76. The gathered data were analyzed in terms of a Pearson's coefficient analysis and a multi-variable regression through the SPSS software. **Results:** There is a meaningful relationship between the mother's age, general (psychological) health condition, anxiety, and depression with low birth weight ($p < 0.01$). In addition, there is a meaningful relationship between the baby's low birth weight and the length of interval period between the mother's last two pregnancies as well as her disturbance in social and physical performances ($p < 0.05$). However, there is no meaningful relationship between the mother's height at pregnancy period and her baby's low birth weight ($p = 0.447$). **Discussion and Conclusion:** The results obtained indicate that it is possible to predict the babies' levels of low birth weight on the basis of biological risky factors such as the mothers' ages at the time of pregnancy and their psychological problems during pregnancy.

Key words: Low birth weight, biological characteristics, psychological characteristics.

INTRODUCTION

The term "low birth weight babies" applies to those newborn babies who weigh less than 2500 grams at the birth time. Weight is a major health indicator because low weight infants are much more vulnerable to dying or suffering disabilities (CDC, 2011). Low weight infants die 40 times more than those with normal weight (Alexander, 2007). Low birth weight is an important factor involved in the emergence of physical, mental and movement disorders so that a considerable percentage of infants suffering from central palsy (CP) have had weights lower than 2500 grams (Afrooz, 2006). Research findings have shown that there is a negative relationship between the babies' cognitive development and their levels of low birth weight (Kitsantas, 2006). Moreover, low birth weight may be related to such disorders as ADHD (David, 2008), low educational progress (Verena, 2009) and movement problems (Kari, 2009) during the development period. Therefore, low birth weight is regarded as an important health indicator in all countries and as a factor involved in the normal development and survival of newborn babies.

On an annual basis, 15.5% of babies who are born all over the world (i.e. more than 20,000,000 babies) have low birth weight problems. The relevant percentages for different regions are as follows (United Nations Children's Fund, 2004): Africa (14.3%), Asia (18.3%), Europe (6.4%), Latin America and Caribbean Region (10%), North America (7.7%), and Oceania (10.5%). According to the results of a research project, the prevalence rate of low birth weight in Iran has been 11.56% for the year 2003 and 8% for the year 2007, while in Isfahan province, it has been 9.5% for the year 2009 (Talebian, 2010).

Low birth weight is also regarded as an important indicator of pregnancy health care and as a criterion for determining the health of newborn babies in a given community and as such, it seems to be necessary to identify, manipulate or control the risky factors related to low birth weight in order to prevent it. Several factors

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have already been identified as being related to low birth weight among which the roles played by biological factors such as the mother's age and height at the time of pregnancy, health care considerations, nutrition, drugs consumption, the length of interval period between the last two deliveries, and the mothers' psychological health are of much more importance.

According to the biostatistics published in the USA during the years 1995-2007, the frequency of low birth weight babies for mothers under 20 has been 3.9%, for mothers between 20-39 years old, 2.5%, and for those above 40, 3.1% and therefore, it can be concluded that there is a relationship between the mother's age and her baby's level of low birth weight. Moreover, the findings of a research done on the impacts of risky factors of pregnancy period on babies' weights show that low birth weight has significantly related to the mother's age at pregnancy time, her weight and her height (Eshraghian, 2008). The results of a comparison between a group of 150 mothers with low birth weight babies and another group consisting of 150 mothers with normal weight babies have shown that there is a relationship between low birth weight and the mother's low body mass index (BMI), the mother's age, and the shortness of the interval period between the mother's last pregnancies (Kidanto, 2009). Furthermore, the findings of another comparative study show that the average values for ages, weights and the length of interval period between the last two pregnancies in mothers with low birth weight babies have been significantly lower than in those mothers who have born normal weight babies (Eghbalian, 2007). Another research has indicated that the mother's age at the birth time, her low height, her bad delivery background, her low body mass index and an insufficient interval period between her last two pregnancies are all effective on the low birth weight (Velankar, 2009).

In addition to biological factors affecting the babies' levels of low birth weight, the mother's psychological characteristics during the pregnancy period are also effective. While the problems with pre-birth psychological health have been studied in more than 90% of developed countries, the research coverage rate for mid-income countries as well as poor countries has been only 10% (World Bank List of Economies, 2007). These studies indicate a high prevalence of psychological disorders in the pregnancy period such as depression and anxiety in poor or mid-income countries (Patel, 2002; Rochat, 2006; Adewuya, 2007).

The consequence of psychological problems with such mothers will be the birth of babies with decreased movement developments, changed behaviors, digestive problems and postponed developments (Field, 2003). The most important consequence of psychological disorders in pregnant mothers may be the birth of low birth weight babies (Rahman, 2007; Patel, 2004; Patel, 2006). If pregnant mothers suffer from negative emotions and sentiments and experience a high level of anxiety and depression, the biological development of their fetuses will be damaged and they will be more likely to bear low birth weight babies (Gracka, 2010). Other psychological factors significantly involved in the low birth weight include stress and psychological pressures during pregnancy. In line with this, a research was done in Bosnia and Herzegovina on a sample of 108316 babies being born between 1988 and 2009 along with their mothers with the sample being divided into pre-war, during-the-war, and post-war periods. The findings of this research indicated that 7.5% of the babies born during the war had low birth weight while the percentage for pre-war and post-war periods had been 3.6% and 2.8%, respectively (Fahrija, 2010).

In another research, in addition to such variables as the mother's age, the number of pregnancies and the family's economic conditions, the relationship between psychological diseases and low birth weight was studied through a General Health Questionnaire (GHQ). According to the results obtained, there has been a significant relationship between the questionnaire scores and the babies' weights at their birth time (Vikram, 2006).

In general, the results obtained in different research works show that stress, anxiety and psychological diseases during pregnancy have negative impacts on the embryo/fetus and that they are highly correlated with low birth weight (Mansour, 2011; Holland, 2009).

The biological variables being investigated in this research include the mothers' age (in terms of years) and height (centimeters) at the birth time as well as the length of interval period between their two last pregnancies (in terms of years). The psychological variables to be studied under the title "general (psychological) health" include the scores resulted from the mothers' replies to the general health questionnaire in respect of such scales as physical problems, anxiety, disturbance in social performance, depression and the total score of the subject's general (psychological) health. The variable "weight" has been based upon the criterion provided by the World Health Organization (WHO) whereby a weight less than 2500 grams is regarded as a low weight.

Taking into consideration the importance of low birth weight in the death of newborn babies and the emergence of physical, movement and cognitive diseases, since the identification of risky factors connected to the low birth weight is assumed to be a function of biological, psychological and social parameters, the present research has been aimed at exploring the relationship between the mothers' biological and psychological characteristics and their newborn babies' levels of low birth weight.

Research Methodology:

The present research is a correlation research being done as a field study. The statistical population includes all low birth weight newborn babies who have been born between December 22, 2008 and January 20, 2010 in Guilan province, Iran along with their mothers. A sample of 168 subjects along with their mothers were selected through a simple random sampling procedure. The weight figures of the selected subjects were extracted from their health files and the data of maternal variables were gathered from the mothers' replies to the Psychological (General) Health Questionnaire including questions on their age and height at the time of pregnancy as well as the length of interval period between their two last pregnancies. The questionnaire consists of 28 items developed by Goldberg and Hillier with 4 different scales each consisting of 7 questions (Abolghasemi, 2006). The first 7 questions are intended to measure the mothers' physical problems, the second 7 items are assumed to measure their anxiety levels, the third 7 question are supposed to measure the mothers' disturbance in their social performance and the last 7 items are aimed to measure the mothers' depression. The questionnaire scoring is in the form of Likert scale whereby each item is scored at a scale ranging from 0 to 3 (i.e. 0, 1, 2 or 3).

Goldberg has mentioned that the reliability coefficient of this questionnaire is 0.80 (Abolghasemi, 2006). In a meta-analysis being done on 30 research works, the mean sensitivity of the above-mentioned questionnaire was 84% and its average specificity was 82%. In Hooman's study, the reliability of the questionnaire being calculated through internal consistency was 0.82, its sensitivity was 83.3% and its specificity was 76% (Abolghasemi, 2006). Bearing in mind the research aims, we resorted to the calculation of correlation coefficient in order to determine the relationship between the mothers' biological and psychological variables and their babies' levels of low birth weight. Then, to a stepwise multivariable regression analysis was used to forecast the variable of low birth weight. All analyses were done by the version 16 of the SPSS software.

Research Findings:

In this research, 168 low birth weight newborn babies were studied along with their mothers. The babies' mean weight was 2.05 kg where the standard deviation was 0.4. The correlation coefficient among the variables in question has been reported in table (1):

Table 1: Mutual correlation coefficients between the mothers' biological and psychological variables and their babies' weights (N=168).

	1	2	3	4	5	6	7	8
baby's weight	-0.492* *	0.10	0.144* *	-0.173* *	0.344* *	-0.19* *	0.606* *	0.442* *
1) age	-	-0.003	0.668* *	0.156* *	0.183* *	0.162* *	0.27** *	0.267* *
2) height	-	-	0.048	-0.073	-0.027	0.124* *	-0.055	-0.009
3) length of interval period between the last two pregnancies	-	-	-	0.064	0.119	0.239* *	0.168* *	0.207* *
4) disturbance in physical performance	-	-	-	-	0.421* *	0.244* *	0.277* *	0.717* *
5) anxiety	-	-	-	-	-	0.311* *	0.482* *	0.777* *
6) disturbance in social performance	-	-	-	-	-	-	0.246* *	0.652* *
7) depression	-	-	-	-	-	-	-	0.67** *
8) general health (total score)	-	-	-	-	-	-	-	-

P* < 0.05, P** < 0.01

The results reported in table (1) indicate that there is a significant relationship between low birth weight and all the mothers' biological and psychological variables except for their height. The highest correlation coefficient obtained is that of the relationship between low birth weight and depression ($r = -0.606$) while the lowest correlation coefficient is that of the relationship between low birth weight and the length of interval period between the two last pregnancies ($r = 0.144$).

A summary of the stepwise regression analysis being run to forecast low birth weight on the basis of the mothers' biological and psychological variables has been demonstrated in table (2):

Table 2: Summary of the regression analysis being run to forecast low birth weight.

Step	forecasting variable	R	R ²	SED
1	depression	0.606	0.367	0.33
2	mother's age	0.695	0.483	0.30
3	length of interval period between the two last pregnancies	0.735	0.541	0.28

The results reported in table (2) indicate that the model has entered the score of *depression* at the step 1 and that this variable has been capable of determining about 37% of the variance of low birth weight ($R^2 =$

0.367). Having added the variable *age* to the model in the step 2, the variance has increased up to 11% ($R^2 = 0.48$) and at the end, the final model in the step 3 has covered the score of the *length of interval period between the two last pregnancies* resulting in a further increase of 6% in the variance obtained. Thus, 54% of the total variance of low birth weight has been explained by these three variables. It is worth mentioning that other variables have not been entered into the model. The results obtained from the model variance analysis are shown in table (3):

Table 3: Results of variance analysis resulted from running the regression.

model	sources of changes	sum of squares	degree of freedom	mean of squares	F	P
1	regression	10.669	1	10.669	96.1	0.000
	error	18.429	166	0.111		
2	regression	14.056	2	7.028	77.096	0.000
	Error	15.041	165	0.091		
3	regression	15.732	3	5.244	64.346	0.00
	error	13.366	164	0.081		

The results reported in table (3) indicate that all three variance analyses are significant at the level of 0.000. The results for determining the regression analysis, for determining the significant power to forecast the variable low birth weight, and for regulating the regression equation have been reported in table (4):

Table 4: Coefficients of stepwise regression for forecasting low birth weight on the basis of the variables depression, age and the length of interval period between the last two pregnancies

model	variable	B	SED	Beta	t	P
1	fixed number	3.087	0.108		28.463	0.000
	depression	-0.114	0.0112	-0.606	-9.803	0.000
2	fixed number	3.605	0.13		27.746	0.000
	depression	-0.096	0.011	-0.510	-8.771	0.000
	age	-0.024	0.004	-0.354	-6.096	0.000
3	fixed number	3.899	0.139		28.065	0.000
	depression	-0.095	0.010	-0.506	-9.197	0.000
	age	-0.038	0.005	-0.571	-7.840	0.000
	interval between the last two pregnancies	0.085	0.019	0.323	4.535	0.000

Due to the significance of *F* in table (3) and *t* in table (4), the related regression equation can be written as follows:

$$\text{Low birth weight} = 3.087 - 0.114 (\text{depression})$$

The above equation shows that the more depressed the mother might be during her pregnancy, the higher low birth weight level can be predicted for the baby. Taking into account the model (2) being reported in table (4), *depression* with a standard coefficient of -0.510 and *age* with a standard coefficient of -0.354 are significantly capable of predicting low birth weight levels and this finding leads us towards an equation like this:

$$\text{Low birth weight} = 3.605 - 0.096 (\text{depression}) - 0.024 (\text{age})$$

According to the above equation, the more depressed and older the mother might be during her pregnancy, the higher low birth weight level can be predicted for the baby. Taking into account the model (3) being reported in table (4), having added the variable the *length of interval period between the two last pregnancies* to the already existing variables of depression and age, there will be still a significant capability for predicting low birth weight levels according to the following regression equation:

$$\text{Low birth weight} = 3.899 - 0.095 (\text{depression}) - 0.038 (\text{age}) + 0.085 (\text{length of interval period between the last two pregnancies})$$

The above equation indicates that with an increase in the mother's depression and age and a decrease in the length of interval period between her last two pregnancies, a higher level of low birth weight in her baby can be predicted.

Discussion:

The results obtained in this research show that there is a significant diverse relationship between the babies' low birth weight levels and the mothers' ages as well as their general psychological health conditions during pregnancy along with their scales including disturbance in physical performance, anxiety, disturbance in

social performance and depression. That is to say, the more values a mother might have for these variables during her pregnancy, the worse low birth weight baby would be predicted.

Moreover, there is a significant direct relationship between low birth weight and the length of interval period between the two last pregnancies which means that with a decrease in the length of interval period between the two pregnancies, there will be an increase in the probability of low birth weight.

However, the research results show that there is no significant relationship between the mother's height at the time of pregnancy and her baby's low birth weight. This finding is not in line with the results obtained in the works of Eshraghian *et al* (2007), Eghbalian (2007) and Velankar (2009) wherein they all stress the existence of a relationship between the mothers' heights and their babies' levels of low birth weight. Each of these studies has been done in a different geographical area of the country and, therefore, different results obtained can be attributed to racial differences among women of different geographical origins.

Another finding of our research is the existence of a significant relationship between low birth weight, on one hand, and the mother's age at the time of pregnancy and the length of interval period between her last two pregnancies, on the other. The results obtained in this respect have supported those of Centers for Disease Control and Prevention (2010), Kidanto (2009), Velankar (2009), as well as those obtained in the Iranian research works.

As for the mother's age, it should be said that virtually, an increase in the mother's age will result in a decrease in her health. As an instance, blood pressure is now more frequent than it was before and this may result in immature childbirths. Moreover, the mother's age is often mutually connected with such factors as the number of previous pregnancies, the size of family, the baby's birth order, and the mother's economic-social status; all these factors negatively affect the mother's nutrition, health and treatment care during her pregnancy as well as the psychological-social supports to be received by her and, in turn, they may increase the possibility of limited development of the embryo/fetus.

Regarding the length of interval period between the two pregnancies, one may say that generally speaking, a mother's pre-delivery general conditions will be different from her post-delivery conditions but more specifically, if her next pregnancy occurs within a short time after her current delivery, or if she has experienced several deliveries, then her physical power will decrease and the quality and quantity of feeding the embryo/fetus through the umbilical cord lowers and this, in turn, may lead to cases of preterm or immature delivery and low birth weight.

The present research shows that there is a significant negative relationship between low birth weight and the mother's psychological characteristics during pregnancy including depression, anxiety, other types of stress, and undesirable emotions and sentiments. The above finding supports the results obtained in other countries. To explain this finding, one may suggest that pre-delivery psychological health problems may typically be attributed to such risky factors as pregnancy in adolescence, divorce, involuntary pregnancies, one's experience of miscarriage, poverty or the shortage of financial resources, the unavailability of sufficient supports, pregnancy resulted from being raped, forced family marriages, violence in the family, natural disasters, biological factors including the hormone changes and neuro-chemical changes and even the individual's ways of thinking. All these factors may lead to disorders in the mother's sleeping and nutrition resulting in low birth weight and the birth of an immature baby. Moreover, the abovementioned factors may influence on the individual's life style and derive her to use cigarettes, alcohol and other drug in order to decrease or relieve the stresses and all these behavior may result in insufficient care of the embryo/fetus and end in the embryo damages, immature childbirth, low birth weight and other disorders. As an example, a depressed mother may ignore necessary pregnancy cares and precautions as a result of using anti-depression drugs, being pessimist and disappointed towards the future, and having low levels of energy, she may use cigarettes and alcohol which obviously result in the low birth weight. Furthermore, there are other factors including family violence, as well as physical emotional or sexual misconduct which all considerably increase the risks of pre-delivery bleedings and, as a result, restrict the embryo/fetus development and may, in turn, end in the low birth weight.

Concluding Remarks:

Since low birth weight increases the probability of death, disablement and many kinds of diseases in the childhood, it is very important to get familiar with the factors involved in it. Findings of the present research show that in addition to biological factors such as the mothers' age and the length of interval period between their two last pregnancies, their psychological problems during pregnancy including anxiety and depression may negatively affect the development of the embryo/fetus and as such, one may predict the probability of the occurrence of low birth weight on the basis of these parameters. Thus, in addition to taking into account the mothers' biological health and treatment, it is recommended to pay special attention to their psychological health during pregnancy and even before that period. To do this, we should be attentive to the women's social problems and their marital problems; we should link them to active social groups; we should develop required supporting laws in accordance with their needs; we should help them with managing sadness and grief and with having a sense of deservedness and competence.

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