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Impact of maternal and environmental factors in infant birth weight in Sidi Bel Abbes region(west of Algeria)

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Abstract

Exposure to pollutants during pregnancy has been related to adverse birth outcomes. Fetal weight at birth is a major determinant of survival, physical growth and mental development of an infant. A multifactorial inter-relationship exists between the environment in which pregnant mothers live and the growth of the fetus. Amongst these, cigarette smoking during pregnancy has been the leading environmental factor for adverse pregnancy outcome. Cigarette Smoking during pregnancy continues to be a significant public health concern. Studies on birth weight in Algeria have focused mainly on the biomedical risk factors and have largely ignored the influence the socio-cultural environment which encompasses maternal knowledge, beliefs, and practices during the prenatal period. Objective of this study is to examine the effects of maternal, socio cultural and environmental factors on the birth weight of infants in west Algeria. Logistic regression was used to estimate the effect of each factor. Low birth weight was defined as less than 2500 g. The sample included a total of 1640 data from December 2017 to March 2018 in Oran and Sidi Bel Abbes region (West of Algeria). We identified 492 newborns (30% of the sample) with low birth weight. Results showed that smoking negatively affected birth weight data showed that means of birth weight is lower for active smoker women (p=0.0004). The study identified a number of maternal, socioeconomic and environmental factors that significantly influence low birth weight and suggested actions that would help reduce the risk factors of low birth weight.

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Introduction

Birth weight, like growth, is determined by the complex interplay of genetic and environmental factors. The proportional contribution of these influences is unclear. However, birth weight varies within genetically similar populations suggesting that environmental factors play a significant role. Secular changes in birth weight also suggest an environmental influence (Spencer NJ *et al.,* 1991).

Birth weight also shows a reverse social gradient such that increasing disadvantage is associated with decreasing birth weight. Environmental factors with a known association with birth weight are nutrition, smoking, maternal ill health, and genital infection. The association of other factors such as stress and exposure to some types of work during pregnancy remains unproven (Mackenbach JP., 1992; Hoffman S, Hatch MC.1996).

The purpose of this study is to identify the epidemiological factors affecting birth weight and also to know the relationship of environmental tobacco smoke, socio economic, obstetric and anthropometric factors of mother with LBW.

Materials and methods

Total of 1640 participants were recruited in this study, from December 2017 to March 2018 from Oran and Sidi Bel Abbes region (West of Algeria). Birth records were obtained from the Medical Birth Registry.

The following characteristics were also extracted: sex of the child (boy; girl), parity (0; 1; ≥2), and mother's age at birth (years). Questionnaire information was used to determine maternal education, maternal smoking exposures during pregnancy, and maternal weight at the beginning of pregnancy (kg), maternal height (cm).

The data collected during the research were analyzed using the statistical software (Spss version 22). To report the results we used a descriptive analysis method, calculating the means and standard deviations for the continuous data, the means were then compared using the Student's Test.

Linear and logistic regression models were used to analyses the associations between environmental tobacco smoke exposures, socio economic, obstetric and anthropometric factors of mother and birth outcomes.

Results and discussion

In this study, the percentage of LBW was 30% from the 1640 live births included in the two region (Sidi Bel Abbes-Oran).

At the national level (Algeria), the LBW level is estimated to be 7% according to the UNICEF report with an estimated mortality rate of 34 ‰. While in Tunisia, it accounted for 7% with an estimated mortality rate of only 20 ‰ (Hoffman and Hatch., 1996; Homer CJ *et al.*, 1989).

On the other hand, this level of LBW is almost three times lower compared to Mali and Sierra Leone where than what was found in Algeria. However this number is much higher than those found in developed countries: 6% in Spain and 6% in France (UNICEF. 2006; UNICEF/WHO., 2004; Frank R *et al.*, 2001).

The average birth weight of our cohort is 2759.05 ± 749.64 g, which is almost similar to what Razafitsalama and all found in their study.

On the other hand, it is lower than birth weight of the developed countries which vary from 3460 to 3486 g (Mabiala-Babela JR. and *al.,* 2004).

When comparing the number of low birth weight between the two town of Sidi Bel Abbes and Oran while also estimating the difference of the number of low birth weight for the years 2017 and 2018 the result showed difference in the percentage of low birth weight for the 2 years, the number of low birth weight have gone up in a year for the two town with a higher increase for the town of Sidi Bel Abbes (Table 1).

Table 1. LBW Parameters according to the town of residence and the year of study (2017 and 2018).

Parameters / Town	Years	No. of cases	Normal birth weight		Low birthweight	
			Cases	%	Cases	%
Sidi Bel Abbes	2017	406	290	71.42	116	28.57
	2018	419	275	65.63	144	34.36
Oran	2017	400	289	72.25	111	27.75
	2018	400	274	68.5	126	31.5

According to table 1, there is not much difference in the evaluation of LBW in the maternity of Sidi Bel Abbes and that of Oran during the years 2017 and 2018. Many anthropometric and obstetrics maternal factors have been found to be highly connected to low birth, the mother's age showed a statistically significant relationship with birth weight P=0,027, mother with less than 20 years had in average a newborn with a weight of 2527 g (Table 2).

Table 2. Maternal anthropometric and obstetrics factors, and birth weights.

Maternal anthropometric and obstetrics factors, and birth weights		Means ± SD	%	p
Birth weight / Mother's ages (years)	<20	2527.411±652.260	3.476	0.0278
	20 à 30	2755.640±694.897	47.683	0.0158
	31 à 40	2778.607±798.442	43.171	0.0463
	>40	2778.054±848.322	5.671	0.5565
Birth weight / Mother's weight (kg)	<2500	75.882±13.017	30.17	0.7230
	≥2500	75.480±13.582	69.83	
Birth weight / Mothers height (m)	<2500	163.525±5.228	30.17	0.2260
	≥2500	162.761±8.236	69.83	
Birth weight / Pathology associated with pregnancy	High blood pressure	2566.469±865.705	17.630	<0.0001
	Gestational Diabetes	3530.000±960.257	2.840	<0.0001
	Anemia	2748.500±875.198	2.155	0.0004
	RPM	2651.707±601.885	12.439	<0.0001
	RCIU	2128.305±712.006	5.779	0.0016
	Other	2783.507±743.418	59.158	<0.0001
Birthweight / Obstetrical history	Abortion	2730.816±744.028	51.429	0.6417
	stillbirth	2687.866±820.675	15.619	0.6320
	LBW	2691.009±704.807	20.762	0.2452
	Premature	2611.746±573.240	12.190	0.9765
Birth weight / Mode of delivery	Normal	2770.334±657.388	39.085	0.6316
	C-section	2752.007±803.018	60.061	0.8644
	Forceps	2735.714±886.243	0.854	0.9357
Birth weight / Pregnancy monitoring	Monitored	2825.335±700.135	72.256	<0.0001
	monitored badly	2518.114±854.552	17.256	0.0388
	Not monitored	2699.559±810.767	10.488	0.0118
Birth weight / Type of Pregnancy	Unique	2794.145±749.976	92.866	<0.0001
	Multiple	2306.726±581.311	7134	
Birthweight / Mother's BMI	<2500	28.310±4.658	30.17	0.9121
	≥2500	28.351±4.382	69.83	

This study showed that age is one of the factor highly correlated with LBW, 70% of women with LBW were under 20 years of age (p = 0.027). Age is a factor favoring or even predisposing to the occurrence of low birth weight (Letaief M. and Al., 2001; Breno A., Tanaka C. 2007). Others have identified it as a risk factor for prematurity (Astolfi P. and Al., 2005; Bobossi-Serengbe G., and Al., 2000). While Bobossi considered it a risk factor for Intrauterine growth retardation(Wang CS., Chou P., 2001;Dedecker F. *et al.* 2005). Almost all authors have considered that an age of a women under 18 years as being a risk factor for LBW, prematurity or IUGR, all of which is similar to our study (Camara B. and Al., 1996). Other author have demonstrated that younger women had more risk of prematurity and the results of Dedecker, showed that the age of less than 16 multiplies the risk of prematurity by three(Isaranurug S. and al, 2007; Gold F. And Al, 1993). Concerning the upper age limit considered as a risk factor, most authors noted that an age greater than 35 years was a major risk factor (Villar J, Belizán JM.1982; Tietche F. and Al., 1998; Kayastha S., Tuladhar H. 2007; Prazuck T. and Al., 1993).

Table 3. Gestational factors and birth weight.

Gestational factors and birth weight		Means ± SD	%	P
Gestational Age (GA)/	<28	1685.294±1098.666	2.073	0.0643
birth weight	28 à 32	1913.253±667.002	10.366	<0.0001
	33 à 37	2728.173±674.563	46.890	<0.0001
	>37	3059.375±595.392	40.671	<0.0001
Uterine Height (cm) /	<2500	29.873±3.870		<0.0001
birth weight	≥2500	31.666±3.176		
Parity /	Nullipare	2653.639±699.805	45.549	<0.0001
birth weight	Primipare	2884.284±731.324	25.732	0.0003
	Multipare	2814.078±818.688	28.720	0.1612
Gestity /	Nulligeste	2570.603±647.782	3.537	0.3285
birth weight	Primigeste	2670.737±701.744	37.317	0.0112
	Multigeste	2826.439±777.179	59.146	<0.0001
Intergenic interval(years) /	<2500	3.057±1.965		0.0740
birth weight	≥2500	3.331±2.264		

On the contrary, in this study we did not find any significant relationship between higher age and LBW, and therefore there is no correlation between this age group and the LBW with a p = 0.55.

Others factors influencing birth weight were some pathology that were associated with pregnancy in the population analyzed, pregnancy monitoring and the type of pregnancy, however no relation have been found between mother's weight obstetrical history mode of delivery and BMI with birth weight (Table 2).

Some Pathologies occurring during pregnancy were significantly associated with LBW, 17.63% of mothers with hypertension and 5.77% of women with IUGR have a newborn with LWB and those result were statically significant (p = 0.0001),. Hypertension and IUGR have been identified as risk factors for the occurrence of low birth weight in several studies (Rahman LA and Al., 2008).

According to this study, no correlation was found between history of low birth weight (p = 0.2452), stillbirth (p = 0.6320) and the occurrence of LWB. This contrasts with results found by Stevens-Simon and Dumont who found that women with an obstetric history of prematurity or low birth weight are at higher risk of having a LWB newborn with OR = 3 (Steyn K.,and Al., 2006; Dumont M., Mazuez M. 1985).

Breno considered the low weight antecedent as a significant risk factor for very low birth weight (p = 0.0001), (Breno A., Tanaka C. 2007). While Bobossi and Letaief noted that the history of LBW in women and the occurrence of the same situation again In future pregnancy had an OR (= 6.78), (Klosowski S.,and Al., 2000; Ericson A and Al.,1984).

Our result showed some gestational factors and their relationship to birth weight, results indicate the existence of a statistically significant relationship between gestational age and birth weight, the mean of birth weight goes down as the gestational age is lower, uterine height parity and gestity have also demonstrated a significant relationship with birth weight, however concerning the intergenic interval no relationship were found (Table 3).

It was found that gestational age below 37 week is one of the factors most strongly associated with low birth weight (p <0.0001). The Results shows that the mean weight of the newborn increases with increasing gestational age. All newborns from pregnancies of less than 37 weeks were low birth weight (p = 0.0001). After 37 weeks, only 10.4% of newborns are affected.

Those results are comparable to what is found in the literature (Paneth Nigel S. and Al., 1995.; Olausson PO., and Al., . 1999). In this regard, we note that low birth weight results either from premature birth (delivery before the 37th week of amenorrhea) or from fetal growth retardation of children born at term. However, in countries where the incidence of low birth weight is found to be higher (in developing countries), the latter is mainly due to fetal growth retardation. In regions with low incidence (case of developed countries), the first cause of LBW is premature birth (EtukSJ.,.,Oyo-Ita AE. 2005; Simpson WJ.1957)..

This study also showed that primiparity and large multiparity and LBW promote the occurrence of low birth weight, in the population studies it was found that 45.54% of primiparous women had a LBW (p = <0.0001) and therefore it is retained as a risk factor. This has been observed by several authors (Main DM and Al., 1991; Vahdaninia M. and Al., 2008; Stevens-Simon C., and Al., 2002). Others have cited just primiparity (Dumont M., Mazuez M. 1985; Alexander JM., and Al., 1997). In contrast Kayastha showed that only multiparity was considered a risk factor (Haldre K. and Al., 2007).

Prazuck found a close association between primiparity (OR = 2.88, p = 0.03) and prematurity Prazuck T. and Al., 1993). While other authors have noted that, there is no association between multiparity and prematurity (Mafina-Mienandi, and Al., 2002).Isaranurug found that women with more than two children had a high risk of having an LBW newborn in subsequent pregnancy (Isaranurug S. and al, 2007). However, Vahdaninia reported a lack of relationship (p = 0.84) between parity and LBW (Vahdaninia M. and Al., 2008). This is similar to the results of Main *et al* which showed no parity effect on birth weight (Torres-Arreola LP.,and Al., 2005; Al-Dabbagh S., Al-Taee WY. 2006).

Results have shown that maternel lifestyle and sociodemographic characteristics do have a impact on birth weight as exposed in *Table 4*, socio economic level was found to be highly related to birth weight, with weight going up for mother with high soci economic level, smoking negatively affected birth weight data showed that means of birth weight is lower for active smoker women, finally place of residence also seem to have a impact on the birth weight (P= 0,0169) all those relationship have been found to be statistically significant, mother's occupation didn't affect the birth weight according to result found in this study housewife or working women have in average newborn with similar birth weight (P=0,9737) in Table 4.

In our series, the occupation of the mother's was not a risk factor of LBW because the majority of women did not work (p = 0.9737). On the other hand, other studies found that all housewives had a significant risk of LBW (Eades S. And al. 2008; Heilbronner C. 2005).

Table 4. Sociodemographic characteristics, maternal lifestyle and birth weight.

Sociodemographic characteristics, maternal lifestyle and birth weight		Means ± SD	%	P
birth weight / Socio-economic level	Low	2515.921±918.155	4.701	0.0054
	Medium	2760.388±734.955	90.171	0.0001
	Hight	2973.810±777.450	5.128	0.0109
birth weight / Mother's occupation	Housewife	2759.359±744.190	79.878	0.9737
	Working	2759.829±772.065	20.122	
birth weight / Smoking	Active	2572.778±804.668	02.196	0.0004
	Passive	2689.257±766.365	44.173	0.0482
	Negative	2823.840±727.884	53.630	0.3613
birth weight / Place of residence of mother	Oran	2845.736±765.392	24.924	0.0169
	SBA	2719.978±730.330	28.580	0.0136
	Rurale	2735.887±749.880	46.496	0.7195
birth weight / Years	2017	2786.927±733.571	50.365	0.1342
	2018	2731.209±746.793	49.635	

Mafina showed that housewives were at higher risk for intrauterine growth retardation, however, according to Torres-Arreola, women who work are more at risk of developing LBW, but it is important to note that the intense physical effort and activity is really what can causes LBW (Takimoto H and Al., 2005; Burguet A and al. 2004).

Low socio-economic level is retained as a risk factor for the LBW in this study, the result is statistically significant with (p = 0.0001). Several authors have considered low socio-economic level as a risk factor for LBW. They explained the impact of the low socioeconomic level on the rise in the LBW rate by the inaccessibility to health's cares units by fault of means (Chiolero A. and Al., .2005. Perriot J. 2005; Fang *J., Madhavan S., Alderman MH. 1999).* Other authors have shown that the LBW was a consequence of an unfavorable economic situation but without making statistical analyzes to confirm that it was a risk factor (Odell CD. and Al., 2006.; Myles W.and Al., 2004). Breno and Isaranurug found that poverty was a risk factor for very low birth weight. However, Etuk and Haldre noted that the influence of social class was not a significant risk for LBW (Rahman LA and Al., 2008).

Active smoking was found to be a considerable a risk factor for low birth weight (p = 0.0004), as well as passive smoking (p = 0.0482).

Simpson found that the birth weight of mothers who smoked during pregnancy declined by an average of 200 g stopping smoking as early as possible in pregnancy prevents the dose-dependent effect of exposure to tobacco on birth weight. The influence of paternal smoking on the birth weight of the child has also been reported and confirmed (Takimoto H and Al., 2005). Vahdaninia and Eades considered it to be one of the determinants of LBW.Several authors have studied the relationship between maternal smoking during pregnancy and prematurity and IUGR. They all retained it as a risk factor. Chiolero has shown that it increases the risk of IUGR by 2.4 and prematurity by 1.4 (Chiolero A. and Al., .2005).

According to Heilbronner and Perriot, maternal smoking during pregnancy was associated with a moderate increase in the risk of preterm delivery with a dose-effect relationship. Steyn have also noted that this association causes a harmonious IUGR (Rahman LA and Al., 2008).

Results of the study indicate existence of relationship between birth weight and some anthropometric factors, BIP was highly related to birth weight the

study showed a statistical significant relationship between the two factors (<0.0001), same thing have been found with the Apgar score, newborn condition and the presence of fetal malformation (<0.0001), however result of the study didn't show a statistically significant difference between birth weight of boy or girl, on average their birth weight were similar (P=0,1016), (Table 5).

Table 5. Anthropometric factors of the newborn.

Anthropometric factors of the newborn		Means ± SD	%	P
Birthweight (g)	<1000		3.39	
	1000-1499		14.97	
	1500-2499		81.63	
BIP (mm) /	<2500	81.769±7.618	30.170	<0.0001
Birthweight	≥2500	88.627±3.539	69,830	
Birth weight (g) / Apgar score (5minute)	<3	1809.140±440.881	5.685	<0.0001
	3 à 7	2250.021±111.815	15.037	<0.0001
	>7	2920.954±670.933	79.279	<0.0001
Birth weight (g) /	Female	2729.923±61.001	51.893	0.1016
New born Sexe	Male	2790.923±73.042	48.107	
Birth weight (g) /	Alive	2814.930±967.618	94.319	<0.0001
Newborn condition	Dead	1847.312±149.981	5.681	
Birthweight (g) /	Presence	2249.592±1064.156	3.110	<0.0001
Fetal malformation	Absence	2774.891±732.535	96.890	

Conclusion

The association of smoking with a reduction in birth weight is well established in this study. In addition, maternal ill health has been associated with reduced birth weight.

This study made it possible to show that, in addition to the non-modifiable physiological determinants, certain important determinants remain accessible. Well-targeted and coordinated education and awareness-raising actions on early pregnancy and the feeding of women of reproductive age in general and pregnant women in particular could have a positive impact on improving the rate of normal weight newborn. However, a prospective complementary study in the general population would be necessary in order to study other factors and to better study the mechanisms by which the various factors are linked.

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