

## Maternal Dental Health and Low Birth Weight among Term Deliveries

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**Abstracts: Background:** Giving birth to infants of low birth weight (LBW) (less than 2,500 grams) is a major public health problem worldwide. In an attempt to identify modifiable risk factors for LBW in Saudi Arabia, the present research was undertaken to investigate a potential association between maternal dental health and dental care during pregnancy with LBW due to fetal growth retardation. **Material & Methods:** A case-control study was conducted on a group of post partum mothers, at two major hospitals, in Jeddah city. The case group (47 women) is defined as those mothers who delivered an infant weighing <2500g and born at term (i.e.  $\geq 37$  weeks of gestation), while the control group (58 mothers) were defined as women who delivered at term infants weighing  $\geq 2500$ g. Data on previous and current known risk factors and dental care services were obtained from the patients' medical records and interviews. Maternal anthropometric data and DMFT scores were taken. **Results:** The selected case and control groups were relatively homogenous, based on their demographic, social and anthropometric data. However, there were significant differences between the groups in the distribution of some variables which could be associated with LBW in the study population. These include decrease in the gestational age; parity; previous delivery of LBW as well as maternal hypertension and anemia. Although the mothers in both groups had high unmet dental care needs, neither the DMFT scores nor the utilization of different dental treatments and radiographs were found to have a possible role in LBW; ( $P$ -value  $>0.05$ ). **Conclusion:** The data of the present study showed no association between maternal dental health or dental care with LBW due to intrauterine growth retardation.

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### 1.Introduction

Giving birth to infants of low birth weight (<2,500 grams) is a major public health problem worldwide. Fifteen per cent of the global births have low birth weight, 96.5% of whom are in developing countries. Its significance being due to its association with immediate as well as late complications (**United Nations Children's Fund and World Health Organization, 2004; Blanc and Wardlaw, 2005**); Low birth weight (LBW) occurs when a baby is born at < 37 weeks (known as preterm birth) and/or being born too small for gestational age due to intrauterine growth retardation (IUGR) (**United Nations Children's Fund and World Health Organization, 2004**). Three maternal factors were associated mostly with the preterm or LBW deliveries: poor maternal nutritional status before pregnancy, short stature and poor nutrition during pregnancy (**Han, et al., 2012; Liu, et al., 2012**). Other factors include: parity, birth interval, previous complications, antenatal care, hypertension, infections, cervical incompetence, smoking, alcohol intake and stress ( **Valero De Bernabe, et al., 2004; Erickson and Arbour, 2012; Kramer, 2013**). However, some LBW cases are of unknown etiology (**Kramer, 2013**).

The association between the oral health status and a variety of systemic conditions has received

worldwide attention (**Manjunath, et al., 2011**). Since long time many investigators have looked into the association between the oral health status of pregnant women and pregnancy outcomes from different perspectives. For instance, several studies ( **Offenbacher, et al., 1996; Dasanayake, et al., 2001; Lopez, et al., 2002; Kothiwale, et al., 2014**) and systematic reviews found a consistent association between periodontitis and premature birth and/or LBW (**Chambrone, et al., 2011; Baskaradoss, et al., 2012**). Although some researchers found that early treatment of periodontal disease during pregnancy reduced rates of preterm and LBW babies (**Lopez, et al., 2002; Offenbacher, et al., 2006**), others failed to report such an effect with nonsurgical periodontal treatment (**Michalowicz, et al., 2006**). From another aspect, a case control study related the low birth weight to dental radiography and they reported a strong association for low birth weight with exposures higher than 0.4 mGy, accusing the thyroid exposure of the mother as being the potential etiology for low birth weight (**Hujoel, et al., 2004**). Because of the mercury in the dental amalgam, which in an animal study was associated with fetal growth retardation (**Gale and Ferm, 1971**), dentists were advised in many European countries not to use amalgam fillings during pregnancy (**Anderson, et al.,**

1998). However, Hujoel et al from a retrospective data couldn't find an increased risk for LBW in women who received amalgam fillings during pregnancy (Hujoel, *et al.*, 2005). Up to our knowledge, no published report has yet investigated the relationship of maternal dental health or dental caries and preterm/ low birth weight rates. If it is proved to be true, a new intervention strategy to reduce the incidence of LBW will be found, as long as the dental diseases are preventable and readily managed.

In Saudi Arabia, several studies have investigated the LBW predictors (Hisham and Moawed, 2000; Abdelmoneim, 2004; El-Gilany and Hammad, 2010), however, the studies that explored the role of oral health in the pregnancy outcome were scanty and all focused on periodontal disease (Al-Attas, 2004; Mokeem, *et al.*, 2004). Because women's child bearing behavior is culturally-bound, regional rather than universal data should be available to explain such health issue in our country. Thus data is indeed essential in the design of interventions and evaluation of programs targeted to reduction of the incidence of LBW regionally or locally. The aim of the present study was to assess the relationship between maternal dental health and dental care during pregnancy with LBW in term deliveries in Jeddah city, Saudi Arabia.

## 2. Material and Methods

A case-control cross sectional study was conducted on a group of post partum mothers. The study population included a multi-ethnic group of women, who gave single live birth at two major hospitals: Maternity and Children and King Abdulaziz University Hospitals in Jeddah city. All mothers were selected and enrolled into the case or control groups within three days of delivery. The case or patients group is defined as those mothers who delivered an infant weighing less than 2500g and born at term (i.e. > 37 weeks of gestation), while the control group mothers were defined as women who delivered at term infants weighing 2500g or more. All mothers in the patients' and control groups were in good physical and psychological health and matched within the groups by race and age. All subjects in both groups gave informed signed consent prior to participation in the study. Demographic data of the participants as well as the detailed information about previous and current pregnancies and known risk factors for LBW were collected from the medical files whenever available and from interviewing questionnaire. The latter included also information regarding the use of vitamins, iron supplements, medical and dental care services during the current pregnancy. All mothers voluntarily underwent

conventional oral examination and anthropometric data measuring by a single calibrated examiner (the author). The anthropometric data included mother's height, weight and body mass index (BMI). The maternal weight and height were recorded in kilograms and centimeters respectively according to the standard methods, when the mothers were wearing light clothes and barefooted. The BMI was calculated as maternal weight in kilograms divided by maternal height in square meters. Dental examination was performed in the maternity ward with mothers lying flat, under the daylight and illumination of torch light source using dental probe and mouth mirror. The dental examination were done according to the criteria and recommendations of the World Health Organization in 1997, using the decayed missing filled teeth (DMFT) index (World Health Organization, 1997). The ethics committee of the KAU, Faculty of Dentistry approved the study protocol.

### Statistical analysis:

Descriptive statistics such as frequency and percentages were used using SPSS, version 16.0 (SPSS Inc., Chicago, Illinois, USA). Continuous variables were compared by the independent t-test while the categorical variables were compared by the chi-square, Fisher's exact or Monte Carlo exact tests when applicable. To control possible confounding effects, multiple logistic regression analysis and odd ratios with 95% confidence intervals were calculated. Statistical significance was defined as  $P < 0.05$ .

## 3. Results

The study population comprised 47 cases and 58 controls. The population in this study was relatively homogenous, based on their demographic and socio-economic status; table (1). The mothers were married and originated from five different countries but Saudi origin was the dominating (52.3%). The mean ages of the mothers in the case and control groups were  $26.74 \pm 6.250$  and  $27.36 \pm 6.365$  years respectively. The majority of the mothers were housewives (91.2%) and 41% had a high school education level or beyond and 42.9% were with 3000-6000 Saudi Riyals monthly income. All mothers in both groups had an average of 3 kids (parity) and 3 previous pregnancies (gravidity); table (2). Four (3.8%) mothers in the study group were tobacco users; one of them was a regular cigarette smoker, while the rest were muasel "hubble-bubble" users. Interestingly, mothers in the groups not only shared the same demographic characteristics, but also the anthropometric data (maternal weight, height and BMI); where the difference was statistically insignificant ( $P > 0.05$ ). Tables (2 and 3) summarize some known LBW maternal risk factors among the

case and the control groups. As it has been shown in table (2), mothers' age, parity, gravidity as well as anthropometric data were not associated with LBW;  $P$ -value  $>0.05$ . However, the mean of gestational age was statistically significantly lower in the LBW groups compared to the controls; 38.87 versus 39.50 weeks. In addition, the results revealed that, the mothers' hemoglobin level during delivery, history of genitourinary tract infections and utilization of medical antenatal care as well as the use of vitamins and iron supplements were all not associated with LBW;  $P$ -value  $> 0.05$ . However, the positive history of previous delivery of LBW babies and hypertension were strongly associated with LBW among the studied sample, the odds ratios were 8.31 and 9.98 respectively. The status of dental health as well as the dental care during the pregnancy were evaluated among the groups and assessed in relation to the LBW. The former was evaluated based on the DMFT index and the latter were inquired in a structured questionnaire. Almost similar prevalence rates of caries were found among the case and control groups (78.7% and 79.3% respectively). The mean DMFT scores in the case and control groups were not statistically different ( $6.26 \pm 4.739$  and  $6.71 \pm 5.442$

teeth respectively). Also was the prevalence of the missing and filled teeth among the LBW and the control groups,  $P$ -value  $> 0.05$ ; table (4). The results of the oral care questionnaire are illustrated in table (5). Worth notice was that, although the mothers in both groups had high levels of dental disease and treatment needs based on DMFT index, the results showed low utilization of the dental services among the groups. Only 9 (19.1%) women in the patients' group in contrast to 7(12.1%) in the control visited the dentist during current pregnancy. Restorative and endodontic treatments were the main cause of the dental visit among the case group, similarly were the reasons in the control group beside the periodontal treatment. Overall, neither the DMFT scores nor the utilization of the different dental treatments and radiographs seemed to have a possible role in LBW;  $P$ -value  $> 0.05$ . To find the adjusted odds ratio as well as to control cofounders; a multiple stepwise logistic regression model was performed. Again, the results confirmed that those which had association with LBW in univariate analysis, were also found to have a  $P$ -value  $< 0.05$  in the model plus the parity and presence of anemia (hemoglobin level  $<9$  grams per deciliter); table (6).

**Table 1: Demographic data of the study population**

Participants characteristics						Chi-square	P-value
		Patients(47)		Controls(58)			
Nationality	Saudi	24	51.1%	31	53.4%	0.38	0.984
	Yemeni	13	27.7%	14	24.1%		
	Indian	6	12.8%	9	15.5%		
	African	3	6.4%	3	5.2%		
	Palestinian	1	2.1%	1	1.7%		
Age(years)	<20	7	14.9%	9	15.5%	0.61	0.895
	21-25	17	36.2%	17	29.3%		
	26-35	19	40.4%	27	46.6%		
	>36	4	8.5%	5	8.6%		
Occupation	Yes	5	10.6%	4	6.9%	0.46	0.496
	No	42	89.4%	54	93.1%		
Education Level	Uneducated	8	17.0%	13	22.4%	7.5	0.186
	Primary	11	23.4%	10	17.2%		
	Middle	9	19.1%	11	19.0%		
	High school	8	17.0%	18	31.0%		
	Diploma	3	6.4%	0	0.0%		
	University	8	17.0%	6	10.3%		
Income (Saudi Riyals per month)	Less 1500	9	19.1%	6	10.3%	5.05	0.283
	1500-3000	14	29.8%	14	24.1%		
	3000-6000	18	38.3%	27	46.6%		
	6000-1000	2	4.3%	8	13.8%		
	>10000	4	8.5%	3	5.2%		

Table 2: Assessment of LBW maternal risk factors (continuous variables)

Variables	Group	N	Mean	±Std. Deviation	t	P-value
Age	Patient	47	26.74	6.250	-.498	<b>.619</b>
	Control	58	27.36	6.365		
Children numbers	Patient	47	2.74	1.775	-1.463	<b>.147</b>
	Control	58	3.36	2.411		
Previous pregnancy numbers	Patient	47	3.51	2.439	-1.188	<b>.851</b>
	Control	58	3.60	2.582		
Gestational age	Patient	47	38.87	1.227	-2.850	<b>0.005 **</b>
	Control	58	39.50	1.030		
Mother weight	Patient	47	61.88	13.529	-3.396	<b>.693</b>
	Control	58	62.90	12.700		
Mother height	Patient	47	154.62	5.951	-1.020	<b>.310</b>
	Control	58	155.76	5.497		
Body mass index	Patient	47	25.80	4.982	-.018	<b>.986</b>
	Control	58	25.82	4.611		
Hemoglobin level	Patient	47	10.8596	2.11919	-.401	<b>.690</b>
	Control	58	10.9998	1.45766		

\*Statistically highly significant

Table 3: Assessment of LBW maternal risk factors (categorical variables)

		Group				Odds Ratio	95% Confidence Limits	
		Patient (47)		Control (58)		OR	LL	UL
		No.	%	No.	%			
Smoking habit	No	43	91.5	58	100.0	<b>12.10</b>	0.63	230.79
	Yes	4	8.5	0	0.0			
Utilization of Antenatal visits	Yes	33	70.2	41	70.7	<b>1.02</b>	0.44	2.38
	No	14	29.8	17	29.3			
Iron supplements	Yes	8	17.0	9	15.5	<b>0.90</b>	0.32	2.54
	No	39	83.0	49	84.5			
Vitamins supplements	Yes	16	34.0	19	32.8	<b>0.94</b>	0.42	2.13
	No	31	66.0	39	67.2			
Hypertension	Yes	7	14.9	1	1.7	<b>9.98*</b>	1.18	84.27
	No	40	85.1	57	98.3			
Infections	Yes	3	6.4	0	0.0	<b>9.20</b>	0.46	182.77
	No	44	93.6	58	100.0			
Previous LBW	Yes	23	48.9	6	10.3	<b>8.31*</b>	2.99	23.04
	No	24	51.1	52	89.7			

\*Statistically significant

Table 4: Comparison of D, M, F and DMFT index in patients and control groups

	Group	N	Mean	±Std. Deviation	t	P-value
Decayed teeth	Patient	47	3.89	3.552	-.275	<b>.784</b>
	Control	58	4.10	4.132		
Missing teeth	Patient	47	1.13	1.715	.132	<b>.895</b>
	Control	58	1.09	1.490		
Filled teeth	Patient	47	1.23	2.139	-.638	<b>.525</b>
	Control	58	1.52	2.356		
DMFT index	Patient	47	6.26	4.739	-.448	<b>.655</b>
	Control	58	6.71	5.442		

**Table 5: Dental care and treatment during current pregnancy**

Visiting Dentist	Patients (47)		Control (58)		P-value
	No.	%	No.	%	
Once	6	12.8	3	5.2	<b>0.615</b>
Twice	2	4.3	2	3.4	
Three times	1	2.1	2	3.4	
No dental visit	38	80.9	51	87.9	
<b>Visiting Reason</b>					
Restorative treatment	4	8.5	2	3.4	<b>0.369</b>
Periodontal treatment	0	0.0	2	3.4	
endodontic treatment	2	4.3	2	3.4	
Examination	0	0.0	1	1.7	
Extraction	1	2.1	0	0.0	
TMJ treatment	1	2.1	0	0.0	
More than one answers	1	2.1	0	0.0	
No dental visit	38	80.9	51	87.9	
<b>Radiography</b>					
Yes	0	0.0%	1	1.7	<b>1.000</b>
No	47	100.0%	57	98.3	
<b>Visiting time</b>					
1st trim	4	8.5	3	5.2	<b>0.735</b>
2ed trim	1	2.1	2	3.4	
3ed trim	3	6.4	2	3.4	
1st & 2ed trim	1	2.1	0	0.0	
No dental visit	38	80.9	51	87.9	

*P = Fisher's exact P (2 categories) or Monte Carlo exact P (more than 2 categories)*

**Table 6: Logistic Regression Model taking all factors**

	P-value	Odds Ratio	95% Confidence Limits	
			Lower	Upper
<b>Previous LBW</b>	.000	<b>12.41</b>	3.49	44.05
<b>Anemia</b>	.027	<b>8.46</b>	1.28	56.10
<b>Hypertension</b>	.043	<b>18.02</b>	1.09	297.29
<b>Gestational age</b>	.024	<b>1.68</b>	1.07	2.63
<b>Parity</b>	.011	<b>1.46</b>	1.09	1.94
<b>Constant</b>	.001	<b>.00</b>		

*Anemia = Hb < 9*

#### 4. Discussion

In developed countries half of the LBW births are preterm (<37 wk gestation), while most LBW babies in developing countries are born at term and are affected by intrauterine growth restriction (United Nations Children's Fund and World Health Organization, 2004; Blanc and Wardlaw, 2005). In an attempt to identify modifiable risk factor for LBW, the present research was undertaken to investigate a potential association between maternal dental health and dental care during pregnancy with LBW due to fetal growth retardation in Jeddah

population, the second city of Saudi Arabia. Different incidence rates of LBW have been reported in Saudi Arabia with the highest rate of 13.6% and 18.8% in El-Taif (Madani and Nasrat, 1995) and Abha (Ismaeil, et al., 2012) cities respectively, which may be attributed to hypoxia of high altitude. Since long time, it was suggested that oral infections negatively affect the general health (Offenbacher et al., 1996). Though the systemic effects of periodontal diseases have been extensively studied (Chambrone, et al., 2011; Baskaradoss et al., 2012), little has been mentioned about the systemic effects of dental caries.

Actually, similar results could be expected as both are chronic infectious diseases. The systemic inflammatory responses to dental caries have been described by De Soet *et al.* (2003). Moreover, some authors found that kids with early childhood caries exhibited growth retardation compared to the controls, and they had a “catch-up growth” with dental rehabilitation (Acs *et al.*, 1992). So it can be hypothesized that maternal tooth decay could affect the offspring growth directly; through the inflammatory response, or indirectly; through the toothache. The latter could alter the eating and sleeping patterns as well as dietary intake of the pregnant mothers leading to fetal malnutrition and growth retardation.

The current study was conducted among mothers randomly selected from the same wards at the same time. The groups selected were almost homogenous, based on their demographic, social and anthropometric data. However, there were significant differences between the groups in the distribution of some variables which may be associated with LBW in the study population. These include decrease in the gestational age; parity; previous delivery of LBW as well as maternal morbidity during pregnancy including hypertension and anemia. These risk factors are in accordance with those reported in several other national ( Rasheed and Rahman, 1995; Ismaeil, *et al.*, 2012) and international (Valero De Bernabe, *et al.*, 2004; Kramer, 2013) studies. However, the present work failed to find any association between LBW and dental health or dental care visits. Approximately 80% of the mothers among the LBW and control groups have dental caries, with mean DMFT scores of 6.26 and 6.71 respectively. There is a lack of consistent data on the caries prevalence among Saudi population, but according to the recent systematic review (Al Agili, 2013) and a meta analysis study (Khan, *et al.*, 2013); the prevalence of dental caries is high across Saudi Arabia and varies by geographic location. Our data is comparable to Farsi results, who reported mean DMFT of 7.59 among Jeddah population (Farsi, 2008). It might be due to the high caries prevalence rates recorded in both patients’ and control groups as well as the small sample size; we failed to find an association between caries and the IUGR in the current research. Additionally, we could not find any published report of such sort of study for comparison. Although some researchers reported a relationship between the growth retardation and dental caries among children (Acs, *et al.*, 1992), a randomized controlled trial showed no significant improvement in children growth over 3 years with dental intervening treatment (van Gemert-Schriks, *et al.*, 2011). Also, a local report indicated that the permanent teeth of

the children with stunted growth had low caries prevalence (Abolfotouh, *et al.*, 2000). Unfortunately such data is further confusing and thus further multicentre research with large sample is needed to pros or cons such a relation between the IUGR and dental caries. The current results indicated that the average tooth loss among the case and control groups were 1.13 and 1.09 respectively and it increased with higher age groups. This result is in agreement with a local report, which covered ten regions in Kingdom of Saudi Arabia, and indicated that the average tooth loss was 1.24 at 20 to 29 years age group and it increases with age (Al Shammery, *et al.*, 1998). The D and M components are the major indicators of unmet dental treatment needs. Unfortunately, the results showed that, a majority of the mothers had more decayed than treated teeth, reflecting a low restorative care level. Surprisingly, even with the mothers’ high dental treatment needs, more than 80% of the studied mothers did not visit dentist during current pregnancy. It is noteworthy that, dental care in pregnancy is often overlooked and underestimated by pregnant women locally (Assery and Al-Saif, 1993; Al-Attas, 2007) and globally (Lydon-Rochelle, *et al.*, 2004; Keirse and Plutzer, 2010). Again, we could not find any relationship between the IUGR and the dental visits, types of dental treatment or utilization of dental radiography in any trimester of the current pregnancy. The possible explanation is attributed to the small sample size and small number of the mothers that visited the dentist during pregnancy. Thus, we cannot rely on the current results and further research in this area is justified, particularly with respect to the effect of different types of dental treatment and dental radiography. Knowing the type of dental care is important, because we knew that preventive care to women makes them less likely to develop periodontal disease, and protects them against adverse birth outcomes (Lopez *et al.*, 2002; Offenbacher, *et al.*, 2006), but what about other treatment modalities?. The need for epidemiological studies to establish evidence-based guides on the use of dental materials during pregnancy is frequently expressed in different countries (Hujoel, *et al.*, 2005). Both mercury (Gale and Ferm, 1971) and Resin-based (Rubin, *et al.*, 2001) dental filling materials in animal models have been associated with adverse pregnancy outcomes. Nevertheless, Hujoel *et al.* investigated the mercury and resin dental fillings and other eight different non restorative types of dental care performed during pregnancy for possible increase in the LBW risk. In accordance with our work, their results showed that none of the investigated variables increased the LBW risk, and they also recommended further studies to establish evidence based guidelines for the dental

materials use during pregnancy (Hujoel, *et al.*, 2005). However, the same authors reported a strong dose dependant correlation between dental radiography and term LBW, mostly during the first trimester (Hujoel, *et al.*, 2004). Unfortunately, we could not investigate such a relation as none of the mothers in our sample had dental radiography except one in the control group, so we can speculate that; the best strategy would be to have dental radiographs when it is necessary during pregnancy with proper shielding, until further multicentre longitudinal studies prove otherwise.

Overall, pregnant women usually demonstrate an increased need for oral health care during pregnancy due to different hormonal and physiological processes (Barak, *et al.*, 2003). A small sample size and the use of self-reported data on some of the variables are among the limitations of this study. Despite these limitations, our results illustrate to health care providers and policy makers that Jeddah pregnant women have high unmet dental care needs. These data which are preliminary at the best and need cautious interpretation lend further studies to assess the association between dental health status as well as dental care and IUGR (LBW).

### Conclusion

Until evidence is found to the contrary, data of the present study showed no association between maternal dental health and dental care during pregnancy and LBW due to intrauterine growth retardation.

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