MATERNAL SMOKING AND MATERNAL EXPOSURE TO PASSIVE SMOKING DURING PREGNANCY AS A RISK FACTOR OF HEALTH HAZARDS AFFECTING NEWBORNS

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ABSTRACT

Background: Exposure to tobacco smoke during pregnancy , whether as active smoking or by exposure to secondhand smoke (SHS), is associated by adverse pregnancy outcomes including low birth weight (LBW) , small for gestational age newborns due to the effect of tobacco on the anthropometric measurements of the fetus. Other more serious birth defects such as cleft palate and heart problems. The objectives of this study were to estimate the effect of maternal smoking or exposure to SHS on the anthropometric measurements and the prevalence of respiratory distress syndrome (RDS) and some birth defects among term newborns.

Methods: Data were collected from women in the obstetric ward of Suez Canal University hospital following delivery .One hundred and twenty full terms were divided into 2 groups: group (A) neonates whose mothers were smokers or exposed to SHS and group (B) as control group whose mothers were not smokers and were not exposed to SHS. After receiving medical history from parents, all neonates were subjected to clinical examination including neonatal reflexes and anthropometric measurements. Data analysis was performed using SPSS Version 15.

Results: Group A neonates whose mothers were smokers or exposed to SHS had significantly reduced weight than control group (group B) and there was no significant difference between 2 groups regarding length and head circumference measurements. Significant higher rates of LBW (low birth weight) and respiratory distress needed further assessment and higher rates of stillbirth were shown in group A.

Conclusion: Exposure to SHS and maternal smoking were associated with reduced birth weight in fullterms and increased frequency of LBW respiratory distress and stillbirth.

BACKGROUND

Maternal smoking during pregnancy is the most common preventable cause of health hazards to the fetus **(Salmasi et al., 2010)[1].** Maternal smoking or exposure to tobacco smoke during pregnancy is carrying a range of serious health risks for the unborn fetus including fetal mortality, low

birth weight, premature birth and serious birth defects such as cleft palate, club foot/feet, heart problems and behavioral disorders in childhood **(Hayashi et al., 2011)[2]**. Possible adverse effect of maternal tobacco exposure is that on birth weight and anthropometric measurements of the newborn leading to high prevalence of low birth weight and small for gestational age infants **(Wahabi et al., 2013 and Chiolero et al., 2005)[3,4]**. Even infants of normal birth weight, who have been exposed to tobacco smoke, still suffer the adverse effect of exposure as demonstrated by studies which showed that the mortality curve of infants exposed to smoking at any measure of birth weight was higher than for unexposed infants**(Voigt et al., 2011)[5]**. Children whose mothers smoked during pregnancy have an increased risk of SIDS (sudden infant death syndrome) **(Hogberg and Cnattingius, 2007)[6]**. The few published reports about tobacco use and SHS exposure during pregnancy in the Arab World are limited by either the small number of participants **(Watanabe et al., 2010)[7]**or the difference in culture and social norms between geographical areas which limit generalization of results**(Chaaya et al., 2003)[8]**. The only published study from Saudi Arabia regarding prevalence of tobacco use in pregnancy, showed that despite the low prevalence of active smoking among Saudi women, more than 30% of Saudi pregnant women were exposed to SHS, with evidence of adverse effects on the newborn's weight and head circumference **(Wahabi et al., 2013)[3]**. Egyptian smokers as males represent 86.12% and females represent only 13.88%, however the proportion of smoking women are rising in Egypt **(Hassan et al., 2011)[9]**.

The Aim of our work was to estimate the effect of maternal smoking during pregnancy or exposure to second hand smoke (SHS) on the anthropometric measurements of their full term newborns and effect on prevalence of congenital defects among them.

METHODS

This study was a cross-sectional study performed in Suez Canal University Hospital, delivery rooms of Obstetrics Department.

One hundred and twenty neonates were included. *Inclusion*

criteria: all neonates, delivered at 37 to 40 weeks gestational age, whose mothers were exposed to passive smoking or those who smoked any type of smoking during pregnancy were included. *Exclusion criteria:* neonates-at delivery whose mothers had any chronic diseases, repeated abortions, history of hormones, medications or drug addiction were excluded. Neonates with positive parental consanguinity, infants of diabetic mothers and newborns whose mothers were exposed to irradiation during pregnancy were also excluded from our study.

Neonates-at delivery in our study were divided into two groups: Group A (neonates): Sixty neonates-at delivery whose mothers involuntarily inhaled tobacco smoke present in the air (were exposed to passive smoking) during pregnancy or actively smoked during pregnancy. Group B (controls): Sixty neonates-at delivery whom mothers did not smoke during pregnancy and were not exposed to passive smoking during pregnancy, were evaluated as well.

After verbal consent from the parents of all neonates, all mothers at delivery were subjected to full maternal past history and clinical history taking from mother, her husband or close relatives, with special emphasis on parents age and socioeconomic standard according to **Park classification in 1997**[10]. Gestational age and smoking habits (who was the active smoker, duration of smoking, number of cigarettes smoked per day and how many hours was the pregnant mother exposed to smoking) were reported in a questionnaire. After dealing with neonates, thorough clinical examination was done including general and systemic examinations and anthropometric measurements for gestational age, (Weight, Length and Head circumference plotted against corresponding standard centile charts).

Sample size was calculated by the following equation:

$n = [(Z_\alpha + Z_\beta)/(P_1 - P_2)]^2 (P_1q_1 + P_2q_2)$; $Z=1.96$ for $\alpha= 0.5$; n = Number in each group

P_1=prevalence of neonatal health hazards among neonates delivered to nonsmoking and non-passively smoking mothers. P_2=prevalence of neonatal health hazards among neonates delivered to smoking or

passively smoking mothers.q_1=1-p_1 and q_2=1-p_2.

The questionnaire was designed in Arabic to be suitable for our people and was tested on (10%) 12 deliveries to test the relevancy of the questionnaire to the aim of the work, and determine clarity of the questionnaire to respondents, then to perform any modifications needed.

Statistical analysis

The data were coded, entered and processed on computer using Statistical Package for the Social Science (SPSS version 15). The level $p< 0.05$ is considered the cut-off value for significance.

- Chi-Square test (X^2) was used to test the association variables for categorical data.
- Fisher exact test was performed in table containing value less than 5.
- Student's t-test is used to assess the statistical significance of the difference between two population means in a study involving independent samples.
- The Mann-Whitney U test, nonparametric test was used to assess the statistical significance of the difference between two population means in this study involving independent samples.
- The Kruskal-Wallis H test, an extension of the Mann-Whitney U test, was used as the nonparametric analog of one-way analysis of variance and detects differences in distribution location. And Spearman's rank correlation coefficient or Spearman's rho as a nonparametric measure of correlation.

RESULTS

Our study comprised 120 neonates-at delivery, grouped into two groups *Group A* (neonates) included 60 neonates-at delivery whose mothers were exposed to passive smoking or actively smoking during pregnancy. And *Group B (control*) included 60 neonates-at delivery whose mothers did not smoke and were not exposed to passive smoking during pregnancy. Numbers of mothers in group (A) who were actively smoking during pregnancy are eleven mothers and numbers of mothers in group (A) who were exposed to passive smoking during pregnancy were forty-nine mothers .

Maternal age ranged from 20-35 years in group(A) and 22-35 years in group(B) while paternal age ranged from 29-38 years in group (A) and 25-38 years in group (B). 40% of the group (A)and 53% of group (B) were middle socioeconomic standards[10]. 63.3% of group (A) and 76.7% of group (B) were delivered normally and 36.7% of group (A) as well as 23.3% of group (B) delivered by caesarian section.

From anthropometric measurements, only the weight measured in gram was statistically significantly affected in group (A) compared to group (B) (table 1).

Table (1): Anthropometric measurement among group (A) and group (B).

Anthropometric measurements	**Group(A) (n = 60)**	**Group(B) (n = 60)**	**t**	**p**
Weight (gm)				
Mean ± SD	2850 ± 700	3300 ± 470	2.25	**0.012**
Range	1400-3900	2300-3900		(S)
Length (cm)				
Mean ± SD	49.5 ± 2.5	50.2 ± 2.26	1.6	0.11
Range	44-52	42-53		(NS)
Head circumference (cm)				
Mean ± SD	34.9 ± 2.1	35.3 ±1.1	1.39	0.16
Range	30-38	33-37		(NS)

We did not find any significant difference between both groups regarding the presence of congenital malformations (birth defects) when compared to controls ($p > 0.05$). In group (A) 2 neonates had cleft lip and palate, one neonate had spina bifida occulta and 1 neonate had polydactyly and 1 neonate had exomphalous major). The case in group (B) had hypospadias. Regarding heart defects, arrhythmias or abnormal neonatal reflexes indicating probable central nervous system diseases there was no statistically significant differences between both groups (table 2).

Table (2): Incidence of some neonatal defects among Group (A) and Group (B).

Neonatal defects	Group A		Group B		X^2	p
	No	%	No	%		
- AGA	48	80	56	93.3	4.61	**0.031 (S)**
- LBW	12	20	4	6.7		
- Length(5^{th}-95^{th} centiles)	47	78.3	53	88.3	2.16	0.14 (NS)
- Length < 5^{th} centile	13	21.7	7	11.7		
- HC (5^{th}-95^{th} centiles)	49	81.7	55	91.7	2.59	0.107 (NS)
- HC < 5^{th} centile	11	18.3	5	8.3		
- Congenital malformations	5	8.0	1	1.7	0.26	0.61 (NS)
- No congenital malformations	55	92.0	59	98.3		
- Normal Moro reflex	48	80	53	88.3	4.62	0.21 (NS)
- AbnormalMoro reflex	12	20	7	11.7		
- Deliveries at 37 weeks gestational age	13	21.7	4	6.7	5.55	**0.0018 (S)**
- Hernias (inguinal and umbilical) at birth	4	6.7	2	3.3	0.18	0.67 (NS)
- Respiratory distress signs needing NICU admission	12	20	4	6.7	4.62	**0.03** (S)
- Normal respiratory rate at birth (60/min)	48	80	56	93.3		

DISCUSSION

Smoking is a major public health issue due to its direct effect on health. Maternal smoking during pregnancy is a major risk factor for preterm delivery, low birth weight, intrauterine growth retardation and intrauterine death **(Chaaya et al., 2003)[8].**

Secondhand smoke clearly has very negative effects on unborn babies.It placed women at greater risk for preterm birth, and their newborns are more likely to have RDS, NICU admissions, and immediate newborn complications. This work was done to assess the serious health hazards of maternal smoking and pregnant exposure to passive smoke on neonates-at delivery **(Leonardi et al., 2008)[13].**

This cross sectional study was done at Suez Canal University Hospital and subjects were collected from the delivery rooms of Obstetrics Department from November 2012 to June 2013.

Results of our study confirmed that the effect of maternal smoking or exposure to second hand smoke had an effect on birth weight as well as risk of LBW among cases compared to controls. In addition we found a difference in birth length and head circumference measurements between the two studied group but statistically insignificant not matching with **Honein in 2008 and Wahabi in 2013**[3,11,13] which can be explained by the difference in maternal body mass index between different communities, however mothers in our study were from matching socioeconomic classes to eliminate possible discrepancy in their nutritional status and prevalence of maternal active or passive smoking.

It was evident from our results that there was increased risk of low birth weight (LBW)in mothers who were smoking or exposed to SHS and these findings are consistent with that of **Voigt et al in 2011**[14].

Our study showed also a more frequent respiratory symptoms and respiratory distress needing admission in neonatal intensive care unit (NICU) which came in agreement with **Ashford in 2010 and Leonardi-Bee in 2008**[12,13]. 4 neonates from group (B) were admitted to NICU with transient tachypnea of newborns, While 4 neonates from group(A) were admitted to NICU with congenital pneumonia, 2 neonates were diagnosed as respiratory distress syndrome and 6 neonates had transient tachypnea of newborns.

Regarding cardiovascular problems as presence of cardiac murmurs, arrhythmia or cyanosis as indicators of congenital cardiac defects 8 cases were suffering these symptoms compared to 4 controls with a non- statistically significant value, knowing that newborns whose mothers smoked were at about 50-70% greater risk for anomalies of pulmonary valves and arteries and 20% greater risk for holes between chambers as published by the **American Academy of Pediatrics** in 2013[15], we can explain our different results as due to small of sample size.

We are aware of the limitation of this study including lack of information on pre-pregnancy smoking and small sample size as the active smoking mothers were few represented; another limitation of the study is that the

exposure to SHS was based on the women's self-reporting without the use of biomarker to verify exposure ; additionally we did not quantify the exposure to SHS by the number of hours, hence we could not report a dose response relationship between exposure to SHS and pregnancy outcomes.

CONCLUSION

Exposure of some pregnant women to SHS and maternal smoking during pregnancy is associated with reduced birth weight and increased rate of LBW as well as respiratory distress.

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تدخين الأمهات و تعرضهن للتدخين السلبي أثناء الحمل كعامل مؤدي لمخاطر صحية جادة تؤثر على الأطفال حديثي الولادة

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يحمل تدخين الأمهات أثناء الحمل مجموعة من المخاطر الصحية للجنين و يشمل دلك وفيات الأجنة، انخفاض وزن المواليد،الولادة المبكرة و مجموعة من العيوب الخلقية كالشق الشفي والحلقي وعيوب القلب الخلقية. و من الملاحظ أن تعرض الأمهات للتدخين السلبي يسبب الطفرات الوراثية الدائمة في الأطفال حديثي الولادة و له نفس الآثار على الجنين مثل الأمهات المدخنات. كما يؤدي تدخين الأمهات إلى حدوث التهابات متكررة للجهاز التنفسي وحدوث اضطرابات سلوكية للأطفال.

الهدف من الدراسة هو رصد المخاطر الصحية التي يمكن أن تنتج عن تدخين الأمهات أو تعرضهن للتدخين السلبي أثناء فترة الحمل على الأطفال حديثي الولادة.

أجريت هده الدراسة على عدد 120 طفل حديثي الولادة بقسم النساء والتوليد بمستشفيات جامعة قناة السويس وقسم الأطفال إلى مجموعة (أ) وتشمل أطفال الأمهات المدخنات أو اللاتي تعرضن للتدخين السلبي أثناء الحمل وعددهم 60 طفلا ومجموعة (ب) وتشمل أطفال الأمهات غير مدخنات ولم يتعرضن للتدخين السلبي أثناء الحمل وعددهم 60 طفلا. تم أخذ التاريخ المرضي من الأمهات باستخدام استمارة استبيان وتم عمل فحص إكلينيكي شامل للأطفال.

خلصت الدراسة إلى أن تدخين الأمهات الحوامل وتعرضهن للتدخين السلبي يزيد من انخفاض وزن الأطفال (مجموعة أ) عند الولادة والولادة المبكرة (الخداج) وكذلك زيادة حالات متلازمة الضائقة التنفسية لهؤلاء للأطفال بشكل ملحوظ عن أطفال المجموعة ب. كما أن نسب حدوث العيوب الخلقية كانت أعلى في (مجموعة أ) عن (مجموعة ب) .

أوصت الدراسة بتوقف الأمهات الحوامل عن التدخين أو التعرض للتدخين السلبي أثناء فترة الحمل لسلامة الأم والطفل وحصول الطفل على نمو أفضل. وعمل الفحص الدوري والمنتظم للأمهات الحوامل وبالأخص المتعرضات للتدخين السلبي من أجل تقييم مستمر لنمو الجنين.