

Estimated risk of adverse birth outcomes in relation to maternal work load in Damanhour, El-Beheira. 2021

Original
Article

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ABSTRACT

Aim: To assess the risk of adverse birth outcomes in broad categories of maternal occupations including farming, office, non-manual and housewives.

Methods: This Cross-sectional study was conducted in between January 2021 to December 2021 in Damanhur National Medical Institute (DNMI) El Behera Governorate, Egypt. Target women were Mothers admitted in DNMI, after giving birth to viable single neonates with or without adverse birth outcomes e.g.,) preterm birth, low birth weight, or congenital anomaly). Data on maternal occupation and occupational exposures included: duration of work and details on occupational exposure to stress factors, physical, chemical and/or biological hazards. Examination of newborn was done: weight (in grams), height (in cm), head circumference (in cm) and examination for any congenital anomalies.

Results: Working mothers had 1.44 times more risk to experience adverse birth outcomes compared to non-working mothers (95% CI= 0.55-3.77). There was a significant association between exposure to chemical risk factors and having adverse birth outcomes ($X^2 = 6.11$, $P = 0.03$). There was an insignificant association between exposure to hard physical work and having adverse birth outcomes ($X^2 = 1.81$, $P = 0.36$) However, standing for long hours during work was significantly associated with adverse birth outcomes ($X^2 = 5.69$, $P = 0.04$) Mothers who reported exposure to biological hazards had 2.25 times more risk compared to mothers who were not exposed to biological hazards (95% CI= 0.31-16.41).

Conclusions: Working mothers had more risk to experience adverse birth outcomes. Mothers who exposed to physical risk factors or biological hazards at work had more risk to have adverse birth outcomes. Furthermore, occupational exposure to chemical agents was significantly associated with adverse birth outcomes.

Key Words: Adverse birth outcomes, cross-sectional study, damanhour, damanhur national medical institute (DNMI), el-beheira, maternal work load.

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INTRODUCTION

During the previous four decades, the percentage of women employed during pregnancy has increased dramatically and they are working in a larger range of occupations than before. Traditionally, pregnant women have been encouraged to decrease physical activity and stop working, especially during the late months of pregnancy^[1]. There are accumulating evidences that the working environment and occupational exposures may have adverse effects on fetal development^[2]. Physical load And psychosocial stress occurring in workplace have been suggested to influence the risk of adverse pregnancy outcomes mainly; spontaneous abortion, low birth weight (LBW), preterm birth, congenital defects and still birth^[3].

Particular occupations, long hours on the job, irregular hours and shift work have been accused^[4]. Moreover, not all physical strain is equal. Type of physical exertion, amount and the context of the exertion are likely to be relevant to this topic. For example, energy expenditure averaged over tasks is not a relevant measure all the time. Peak energy expenditures such as lifting heavy objects may be more influencing than multiple averaged expenditures over longer periods of time^[5].

Exercise in the early weeks of pregnancy was traditionally considered to raise the risk of early pregnancy loss or preterm labor; may be by stimulating uterine activity. Another indirect theory suggesting that employment can affect the nutritional status of pregnant women. That

is; women who are employed may be at increased risk of inadequate meals intake because of lack of time for shopping and/or cooking. Working women who worked standing were less likely to eat three meals per day than those who worked sitting^[6].

Adverse birth outcomes represent a major public health problem worldwide. In developed countries, around 10% of all births are preterm and approximately 8% are low birth weight (LBW). Both are the most important risk factors for infant mortality and contribute to a group of lifelong effects, such as stunted growth, learning disabilities, obesity and diabetes^[7,8]. The aim of the present study was to assess the risk of adverse birth outcomes in broad categories of maternal occupations including farming, office, non-manual and housewives, in Damanhour city, Egypt.

METHODS

This is a Cross-sectional study that was conducted during the period from January 2021 to December 2021 for 12 months in Damanhur National Medical Institute (DNMI) in Damanhur, El Behera Governorate, Egypt. DNMI is an educational hospital which provides medical services to two nearby governorates (El-Beheira & Kafr El-Sheikh). The research got approved by Ethics Committee of Alexandria University. A written consent was obtained from all participants after explanation of the aim of the study.

Based on a related study^[3], and using margin of error 5% and alpha error of 0.05 the minimum required sample size calculated was 345 pregnant women.

Target women were Mothers admitted in DNMI, after giving birth to viable single neonates with or without adverse birth outcomes e.g., (preterm birth, low birth weight, or congenital anomaly). Exclusion criteria were: Parents with history of consanguinity, Smoking mothers, chronic medical conditions before and during pregnancy (such as renal disease, hypertension, heart disease, and diabetes mellitus). Data collection was done by history taking and record review of all participant women.

Personal and obstetric history were recorded, data of the current pregnancy and gestational age on time of delivery, Data on maternal occupation and occupational exposures. It included: duration of work (hours per week) and details on occupational exposure to stress factors, physical, chemical and/or biological hazards. Examination of newborn was done: weight (in grams) using a digital scale and rounded to the nearest 10 grams, height (in cm), head circumference (in cm) and examination for any congenital anomalies.

Statistical analysis

All data were entered into the computer using computer-based software for data-entry and analysis, the SPSS (Statistical Package for Social Sciences) version 20, the result was considered statistically significant when the significance probability was less than 5%.

RESULTS

Demographic characteristics of the studied sample

As regards age of the mothers, they had a mean age of 26.8 ± 5.7 years. The range of the age was from 15 to 45 years with median of 26 years. The years of marriage ranged from one to 21 years. About three quarters of the sample had less than 10 years of marriage.

Concerning education, only 8.4% of mothers graduated from university. About half of the sample completed secondary school. About 4% of mothers can barely read and write and 7.2% of them were illiterate. "Just enough" was the most frequent response to the question about the monthly income constituting 44.6% of the sample, 37.4% had enough income to save money and 18% didn't have enough income and had to loan.

Most of the sample participants (84.9%) were living in rural areas with household members number ranging from 2 to 14 with a median of 3, but the majority of the sample 79% had less than 5 members and only 5% had six or more. The crowding index of (1 to less than 2) was calculated for two thirds (66%) of the sample. About 28% of the sample had crowding index less than one & 5.5% had two or more.

Medical and obstetric history of mothers in the study sample

(Table 1) shows the medical and obstetric history.

Table 1: Distribution of the study sample according to medical and obstetric history (DNMI, 2021)

Medical and obstetric history	Num=345	%
Gravidity		
Primigravida	54	15.7
2-4	235	68.1
5+	56	16.2
Median		3
mode		2
Range		From 1 to 9
Parity		
Nullipara	75	21.7
Primipara	108	31.3
2-4	159	46.1
5	3	0.9
Median		1
mode		1
Range		From 0 to 5
History of Abortion		
None	237	68.7
Yes	108	31.3
Number of previous abortions	(n=108)	
One Abortion	70	64.8
Two or more Abortions	38	35.2
Reported medical problems		
Yes	210	60.7
No	135	39.3
If yes, n=210		95.7
Anemia	201	0.5
Malnutrition	1	3.8
anemia & hypotension	8	
Treatment received for anemia		
Iron capsules	93	44.3
Iron injection or blood transfusion	117	55.7

Maternal occupation

Regarding maternal occupation, (Table 2) reveals that the majority of the mothers in the sample (94.4%) were housewives. About thirty-seven percent of working mothers had professional work, twenty-one percent of the working mothers had elementary occupations including cleaners and helpers. Other 21% of the working mothers were service and sales workers including market salespersons, hairdressers and cashiers.

Table 2: Distribution of the study sample according to maternal occupation (DNMI, 2021)

Maternal occupation	Num=345	%
Mothers' occupation		
Housewife	326	94.4
Working mothers	19	5.6
Working mothers	n=19	
Professional work	7	36.84
Elementary occupations	4	21.04
In agriculture	1	5.3
Service & Sales workers	4	21.04
In medical field	3	15.78
Hours of Work per Week		
< 30	7	36.8
30 -	7	36.8
40 -	3	15.8
50 +	2	10.5
Mean±SD (Median)		33.5± 18.1 (30)
Range		From 4 to 84

About sixteen percent of the working mothers in the sample were in the medical field, they all were nurses. Only one mother was working in the agricultural field. The working hours ranged from 4 to 84 hours per week with a mean of 33.5± 18.1 hours per week and the median was 30 hours per week.

The adverse birth outcomes in the study sample

Table (3) show the Frequency of different Adverse Birth Outcomes in the study sample.

Estimation of risk in relation to general parameters related to maternal workload

Table (4) demonstrates the relation between adverse birth outcomes and general parameters related to maternal workload. Working mothers had 1.44 times more risk to experience adverse birth outcomes compared to non-working mothers (95% CI= 0.55-3.77). Those who worked for or more than 35 hours per week (full time) had 1.5 times more risk to have adverse birth outcomes compared to those who worked for less than 35 hours per week (part time) (95% CI= 0.22-10.2).

Standing for long hours during work was significantly associated with adverse birth outcomes ($X^2 = 5.69$, $P = 0.04$). Mothers who reported standing for long hours during work had 12.5 times more risk to have a baby with adverse birth outcomes than mothers who didn't report standing for long hours (95% CI= 1.34- 116.8).

There was a significant association between exposure to chemical risk factors like organic solvents, insecticides, and pesticides during work and having adverse birth outcomes ($X^2 = 6.11$, $P = 0.03$). There was a moderate but insignificant association between exposure to physical risk factors (hard physical work) and having adverse birth outcomes ($X^2 = 1.81$, $P = 0.36$). Regarding biological hazards, Mothers who reported exposure to biological hazards like blood or blood products, infectious diseases and animals or birds at work had 2.25 times more risk to have adverse birth outcomes compared to mothers who were not exposed to biological hazards (95% CI= 0.31-16.41).

Table 3: Frequency of different Adverse Birth Outcomes in the study sample (DNMI, 2021)

Adverse Birth Outcomes	Total Sample N=345		Males N=153		Females N=192		Test of significance
	No.	%	No.	% ^(b)	No.	% ^(b)	
1-low birth weight	N=80	23.19	33	(41.25%)	47	(58.75%)	
Mean ± SD for BW (median)	2112.59 ± 359.62 (2250)		2175.94 ± 281.77 (2260)		2068.11 ± 402.46 (2200)		t= 1.33
Range	From 800 to 2495		From 1540 to 2495		From 800 to 2480		p= 0.19
Mean ± SD for GA (median)	36.81 ± 2.43 (37)		36.73 ± 2.05 (37)		36.87 ± 2.68 (37)		t= -0.261
Range	From 27 to 41		From 31 to 40		From 27 to 41		p= 0.79
2-Preterm	N=37	10.72	16	(43.24%)	21	(56.76%)	
Mean ± SD for BW (median)	2023.24 ± 450.51 (2050)		2062.18 ± 374.06 (2075)		1993.09 ± 508.11 (2000)		t= 0.461
Range	From 800 to 3000		From 1540 to 2700		From 800 to 3000		P= 0.6
Mean ± SD for GA (median)	35.06 ± 1.65 (36)		34.38 ± 1.94 (35)		34.68 ± 2.13 (35)		t= 1.06
Range	From 31 to 36		From 27 to 36		From 27 to 36		P= 0.29
3-Small for gestational age	N=31	8.99	11	(35.48%)	20	(64.52%)	
Mean ± SD for BW (median)	2076.23 ± 384.85 (2220)		2105.18 ± 336.71 (2260)		2060.3 ± 416.45 (2152)		t= 0.306
Range	From 1100 to 2456		From 1550 to 2422		From 1100 to 2456		P= 0.7
Mean ± SD for GA (median)	38.48 ± 1.67 (39)		38.09 ± 1.58 (39)		38.7 ± 1.72 (39)		t= -0.97
Range	From 33 to 41		From 36 to 40		From 33 to 41		P= 0.34
4-Congenital anomalies	N=3	0.87	1	(33%)	2	(67%)	
Mean ± SD for BW (median)	2981.67 ± 452.56 (2780)						
Range	From 2665 to 3500						
Mean ± SD for GA (median)	38 ± 1.73 (39)						
Range	From 36 to 39						

Table 4: The risk of adverse birth outcomes in relation to general parameters related to maternal work load (DNMI, 2021)

Maternal work load	Normal N=244		Adverse outcomes N=101		Test of significance	OR	95%CI
	No.	%	No.	%			
	Working mothers						
No	232	95.1	94	93.1	X ² =0.556 P=0.46	1.44	0.55-3.77
Yes	12	4.9	7	6.9			
No. of hours at work per week	n=12						
< 35	8	66.7	4	57.1	X ² =0.172 P=1	1.5	0.22-10.2
35 +	4	33.3	3	42.9			
Standing for long hours							
No	10	83.3	2	28.6	X ² =5.69* P=0.04	12.5*	1.34-116.8
Yes	2	16.7	5	71.4			
Exposure to chemical risk factors							
No	12	100	4	57.1	X ² =6.11* P=0.03	-	-
Yes	0	0	3	42.9			
Physical risk factors							
No	12	100	6	85.7	X ² =1.81 P=0.36	-	-
Yes	0	0	1	14.3			
Biological risk factors							
No	9	75	4	57.1	X ² =0.652 P=0.61	2.25	0.31-16.41
Yes	3	25	3	42.9			

DISCUSSION

The theory of fetal origins of adult diseases states that some intrauterine exposures can affect the programming of fetal cells and this is presented by health consequences either at birth or later in life.

The gestational period and birth outcomes are considered as crucial determinants of infant's health and survival for years. Globally, 2.6 million infants die in the neonatal period every year. In 2015, Egypt was one of the 20 countries with the highest number of neonatal mortalities. Prematurity was the leading cause of neonatal death constituting 35% of all causes of neonatal death and congenital anomalies account for 11% of neonatal death. Worldwide, Low birth weight infants constituted 16% of total birth each year (22 million). In 2013, adverse birth outcomes, including low birth-weight, small for gestational age (SGA), and preterm birth, contributed to 60%–80% of infant mortality.

This cross-sectional study was conducted in Damanhur National Medical Institute (DNMI) in Damanhur, El Behera Governorate. The study Population included all admitted mothers in the postnatal ward of the obstetrics & gynecology department at DNMI, giving birth to viable single neonates with or without adverse birth outcomes (e.g., preterm birth, low birth weight, or congenital anomaly). Smoker mothers, parents with history of consanguinity, mothers with chronic medical conditions, and mothers reporting family history of genetic diseases were excluded from the study.

The percentages of all the adverse pregnancy outcomes among the sample was 29% of all newborns. Low birth weight was the most prevalent adverse birth outcome constituting about 23% of all newborns. Preterm birth was the second most common adverse birth outcome constituting about 11% of the total sample. About 9% of all newborns were small for gestational age, while congenital anomalies constituted 0.87%.

In this study, we found that Working mothers had 1.44 times more risk to experience adverse birth outcomes compared to non-working mothers (95% CI= 0.55-3.77). Those who worked for more than 35 hours per week (full time) had 1.5 times more risk to have adverse birth outcomes compared to those who worked for less than 35 hours per week (part time) (95% CI= 0.22-10.2). Also, mothers who reported standing for long hours during work had 12.5 times more risk to have a baby with adverse birth outcomes than mothers who didn't report standing for long hours (95% CI= 1.34-116.8).

A similar finding was reported in a study by Moussa 2015,^[9] in which pregnant women who were employed at the time of conception and pregnancy were at a significantly

high risk of having adverse birth outcomes (OR=2.73, 95% CI:1.76-3.20). In another study by Khader *et al.*, 2011;^[10] employed mothers had higher risk of preterm birth (OR= 1.87, 95% CI: 1.43-2.45). Also, maternal occupation during pregnancy was associated with higher risk of fetal death (Banerjee, 2009).^[11] Women who worked more than 40 hours a week had mild increase of the risk of preterm birth (Maisonneuve, 2016)^[12].

Long periods of standing and long working hours per week during pregnancy negatively affect intrauterine growth, Women exposed to long periods of standing had approximately 1 cm (3%) reduction of the average head circumference of their babies at birth. Snijder *et al.*, 2012^[13] Long standing hours and lifting heavy weight were insignificantly associated with pregnancy loss and PTB especially among malnourished mothers Banerjee, 2009^[11]

Chemical and biological agents in the workplace are absorbed into the body through inhalation, dermal absorption, or ingested food or drinks (Frazier, 2008)^[14]. Our results showed that occupational exposure to chemical agents like organic solvents, insecticides and pesticides was significantly associated with adverse birth outcomes ($X^2=6.11$, $P=0.03$).

Occupational exposure to chemicals such as pesticides, organic solvents, or heavy metals was associated with an increased risk of term LBW with a positive dose-response relationship (Birks *et al.*, 2016),^[15] orofacial defects (cleft lip & or palate) (Hao *et al.*, 2015)^[16] and SGA (Halliday-bell, 2015)^[17].

There was a moderate but insignificant association between exposure to physical risk factors (hard physical work) and having adverse birth outcomes ($X^2 =1.81$, $P=0.36$). This was consistent with Snijder *et al.*, 2012^[13] who reported no significant associations between physically demanding work during pregnancy and small for gestational age, low birth weight or preterm delivery. However, in other studies hard physical work during pregnancy was associated with higher risk of preterm birth (Maisonneuve, 2016),^[12] congenital anomalies (Ryznychuk *et al.*, 2018),^[18] and adverse birth outcomes in general (Banerjee, 2009)^[11].

In our results, Mothers who exposed to biological hazards like blood or blood products, infectious diseases and animals or birds at work had 2.25 times more risk to have adverse birth outcomes compared to mothers who were not exposed to biological hazards (95% CI= 0.31-16.41).

In a meta-analysis about occupational exposures and the adverse birth outcomes, pregnant nurses were found to be at high risk of adverse birth outcomes due to their exposure to different biological and chemical hazards in

the work environment (Quansah & Jaakkola, 2010).^[19] Newborns of mothers working with patients had increased risk of congenital anomalies than other newborns and those of mothers working with animals had higher risk of SGA than the others (OR=1.33, 95%CI: 1.07-1.59) (Morales-Suárez-Varela *et al.*, 2010)^[20].

CONCLUSION

Working mothers had 1.44 times more risk to experience adverse birth outcomes compared to non-working mothers. The risk was higher with women who worked for more than 35 hours per week and who worked standing for long hours. Mothers who exposed to physical risk factors or biological hazards at work had more risk to have adverse birth outcomes. Furthermore, occupational exposure to chemical agents was significantly associated with adverse birth outcomes.

CONFLICT OF INTERESTS

There are no conflicts of interest.

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