

Relation between Employment Workload and Pregnancy Outcome A Prospective Clinical Study

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Abstract

Background: Pregnancy should not be viewed as a disease or a job restriction. But a pregnant woman who works might be exposed to specific risks that could have a negative impact on her or the fetus's pregnancy. It has been reported that physical activity during pregnancy is linked to unfavorable pregnancy outcomes, including spontaneous abortion, stillbirths, preterm labor, low birth weight, and congenital malformations.

Aim of Study: Study the relation between workload and some adverse pregnancy outcomes among a representative sample of women living in Tawilla village in Dakhliya governorate in Egypt.

Patients and Methods: The current study included 300 pregnant females who were classified into two equal groups; group A (working females) and group B (non-working females). The participants were subjected to obtaining full history and assessment of the working conditions. The following questionnaires were obtained from the included participants, physical activity questionnaire, The Perceived Stress Scale Questionnaire and Workplace Stress Survey. The participants were followed-up to document the outcomes including incidence of preterm, small for gestational age and still birth.

Results: The incidence of preterm infants, small for gestational age and still birth were statistically significantly higher in the working females group as compared to the non-working group. The incidence of preterm and small for gestational age were statistically significantly higher in the active females, high stress females as compared to inactive/moderately active females and average stress/poor stress respectively.

Conclusion: The work of females during pregnancy is associated adverse pregnancy outcomes. Furthermore, the incidence of adverse pregnancy outcomes is associated with the increased physical activity, workload and stress during working.

Key Words: Employment — Workload — Maternal Outcomes — Neonatal outcomes.

Introduction

THE prenatal period is a time of rapid development, when a multitude of psychological and physiological changes occur for both mother and fetus [1].

During pregnancy, maternal physiology undergoes continual adaptation. These, often interlinked, changes affect all the body systems and are effected by the hormonal influences of the placenta and mechanical adaptations required to accommodate the growing fetus [2].

Physical activity (occupational, sports, conditioning, household or other activities) is defined as any body movement produced by skeletal muscles that results in energy expenditure. Exercise, on the other hand, is a subcategory of physical activity, and is a planned, structured, repetitive activity to improve or maintain physical fitness [3,4].

Physical activity (PA) as a modifiable health risk factor has been shown to contribute to the maternal health of women and their offspring. It has been reported that the benefits of PA and exercise during pregnancy, which include reduced risk of excessive gestational weight gain, decreased risk of gestational diabetes, and reduced risk of preeclampsia [5].

Working during pregnancy may play an important role in adverse obstetric, perinatal, and children's outcomes [6]. Most pregnant workers are exposed to some physical activity at work. Several lines of evidence suggest that work itself does not increase the risks of pregnancy complications, although long working hours, prolonged standing, heavy lifting, or unusual workloads may pose a threat to pregnant workers [7].

Pregnant women are protected by laws to safeguard maternal health. However, if a particular

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workplace does not have an atmosphere that allows both pregnancy and work, a pregnant woman may be advised to leave the workforce at the time of pregnancy [8]. Psychological and physical stress, such as maternity harassment and the physical strain inherent in pregnancy, can lead to reduced job performance or sick leave due to work overload [9].

There is lack of studies about the effect of work on pregnancy outcomes, so the current work was to study the relation between workload and some adverse pregnancy outcome among a representative sample of women living in Tawilla village in Dakhliya governorate in Egypt.

Patients and Methods

This is a prospective case-control observational study that was conducted at Primary health care office at Tawilla village in Dakhliya governorate.

The current study included 300 married females with a current pregnancy in the age between 18 and 40 years. The participants with the following criteria were excluded; maternal age less than 18 and more than 40, medical disorders, multiple pregnancy and pregnancy via ART.

There were classified into two groups according to the working state; group A (included 150 working females) and group B (Included 150 non-working females).

The study follows 2013 Helsinki Standards [in The institutional review board, Faculty of Medicine, Mansoura University, approved the study, and the included participants gave written informed consent.

All participants were interviewed by trained personnel using a predesigned questionnaire that included the following data; personal information (date of the first antenatal care visit, educational level, Special habits, contact information such as address; phone no etc) and obstetric history (duration of pregnancy at the first antenatal care visit, expected date of delivery, history of present and past conceptions if any. Number of children, previous adverse pregnancy outcome adverse pregnant outcomes).

Occupational history: For working participants, work characteristics were included type of work, number of working hours/ day, work pattern (day-time work or shift work), duration of work in years, prolonged physical strain or fatigue, exposure to potential occupational hazards as radiation, chemical exposure, biological agents.

Type and nature of work was then categorized into 5 main groups (Clerical workers, Elementary occupations, Health Professionals, Teaching Pro-

fessionals, Technicians) according to (International Standard Classification of Occupations [11].

The main outcomes assessed during follow-up included perinatal death (abortion, still birth or early neonatal deaths), preterm delivery (delivery of the fetus before 37 completed week of gestation) and small for gestational age (SGA (birth weight below the 10th for a given gestational age).

Physical activity questionnaire:

General Practice Physical Activity Questionnaire (GPPAQ) was used as a validated short measure of physical activity based on type and amount of physical activity involved during work. It is a questionnaire designed by WHO for surveillance of physical activity for adults. It has been designed to identify the level of physical activity in different domains "Work, Transport and Recreation time". It was translated into Arabic [14

It generates a simple - 4-level Physical Activity Index (PAD - categorizing subjects as: Active, Moderately Active, Moderately Inactive, and Inactive.

The perceived stress scale questionnaire:

It was measured using the validated Arabic version of Cohen Perceived Stress Scale 10 [PSS] [13]. It is a broadly used psychological tool to measure the degree to how circumstances in one's life are identified as stressful. The Arabic version of PSS 10 was validated and Cronbach's alpha value was 0.836 [14].

The scale comprised ten items; with a 5-point Likert scale for a final score [0 = Never, 1 = Rarely, 2 = Sometimes, 3 = Fairly often, and 4 = Always]. Items 4, 5, 7, and 8 are positively stated and reverse scored [e.g., 0 = 4, 1 = 3, 2 = 2, 3 = 1 and 4 = 0].

Subsequently, the scores were added together to obtain a total score between 0 and 40 with higher scores signifying higher levels of perceived stress.

Stress was classified as follows: Scores ranging from 0 to 13 were considered low-stress level, 14 to 26 as moderate stress, and 27 to 40 as high perceived stress. Both moderate and high stress levels were merged as having stress while Low-stress level considered as having no stress [15].

Workplace stress survey:

MS has created a job stress survey that can help reveal employee stress levels. Survey participants are asked to assign a number from one to 10 statements that describe amount of work stress and work satisfaction.

According to this questionnaire, three levels of work stress were identified, mild stress (A score of 10-30), moderate stress (A score of 40-60) and severe stress (A score of 70-100).

Statistical analysis:

SPSS 26 for Windows@ program was used to code, process, and analyze the data. Number (frequency) and percent qualitative data was presented. The Chi-Square (or Monte-Carlo) test compared groups. Kolmogorov-Smirnov tested quantitative data for normality. The data was presented as mean \pm SD and range.

To compare two groups with normally distributed quantitative variables, independent samples t-test was used and Mann Whitney Test (U-test) if the data were abnormally distributed. Spearman correlation correlated two sets of numeric data. p-values <0.05 are considered significant.

Results

The current study included 300 pregnant females at the reproductive age who living in Tawilla village in Dakhlia governorate. There were classified into two groups according to the working state; group A (included 150 working females) and group B (Included 150 non-working females).

As shown in Table (1), there was no statistically significant difference between the two groups regarding the age ($p=0.534$), BMI ($p=0.534$), gravidities ($p=0.081$) and parities ($p=0.765$). The median number of previous abortions was statistically significantly higher in the working group ($p=0.011$).

Table (1): Analysis of the demographic data in the two study groups.

Variables	Group A (Working females) (N=150)	Group B (Non-working females) (N=150)	P-value
Age (Years)	28.56 \pm 5.75	28.14 \pm 5.92	0.534
BMI (Kg/m ²)	30.07 \pm 5.29	29.46 \pm 5.40	0.325
Gravidity	3 (1-6)	3 (1-6)	0.081
Parity	1 (0-5)	1 (0-4)	0.765
Abortion	0 (0-3)	0 (0-2)	0.011

As shown in Table (2), the mean number of working hours was 47.04 \pm 12.66 per week and the median number was 48 hours/week (range 30-72 hours/week).

Regarding the type of work, there was 16% clerical workers, 30% elementary occupation, 28% health professionals, 10% teaching professionals and 16% technicians. According to general practice physical activity questionnaire (GPPAQ), there was 18% inactive, 34% moderately inactive, 18% moderately active and 30% active females.

Also, according to Perceived Stress Scale questionnaire, there was 36% with poor stress, 51.3% with average stress and 12.7% with high stress. Ac-

cording to Workplace Stress Survey, there was 30% with mild stress, 42% with moderate stress and 28% with severe stress.

Table (2): Work, physical activity and stress related data in the working females group.

Variables	Group A (Working females) (N=150)	
Hour of work (/week)	Mean \pm SD	47.04 \pm 12.66
	Median	48 (30-72)
	(min-max)	
<i>Type of work:</i>		
- Clerical workers	24	16.0
- Elementary occupation	45	30.0
- Health professionals	42	28.0
- Teaching professionals	15	10.0
- Technicians	24	16.0
<i>General practice physical activity questionnaire (GPPAQ):</i>		
- Inactive	27	18
- Moderately inactive	51	34
- Moderately active	27	18
- Active	45	30
<i>Job stress questionnaire:</i>		
- Poor stress	54	36
- Average stress	77	51.3
- High stress	19	12.7
<i>Workplace Stress Survey categories:</i>		
-Mild stress	45	30
- Moderate stress	63	42
- Severe stress	42	28

As shown in Table (3), the incidence of preterm infants ($p=0.007$), SGA ($p=0.003$) and still birth ($p=0.042$) were statistically significantly higher in the working females group as compared to the non-working group.

Table (3): Analysis of the outcomes in the two study groups.

Variables	Group A (Working females) (N=150)		Group B (Non-working females) (N=150)		P-value
Preterm	36	24%	18	12%	0.007
SGA	30	20%	12	8%	0.003
Still birth	15	10%	6	4%	0.042

Table (4) shows that the incidence of preterm and SGA were statistically significantly higher in the active females (according to general practice physical activity questionnaire) as compared to the inactive females, moderately inactive females and moderately active females ($p<0.001$). However, there was no statistically significant difference regarding the incidence of still birth ($p=0.062$).

Table (4): Relation between general practice physical activity questionnaire (GPPAQ) categories and outcomes in the working females group.

Variables	Inactive (N=27)		Moderately inactive (N=51)		Moderately active (N= 27)		Active (N=45)		P ^r value
Preterm	3	11.1%	6	11.8%	3	11.1%	24	53.3%	<0.001
SGA	3	11.1%	6	11.8%	0	0%	21	46.7%	<0.001
Still birth	3	11.1%	3	5.9%	3	11.1%	6	13.3%	0.662

Table (5) shows that the incidence of preterm and SGA were statistically significantly higher in the high stress females (according to Perceived Stress Scale questionnaire) as compared to the females with average stress and poor stress ($p=0.010$). However, there was no statistically significant difference regarding the incidence of still birth ($p=0.927$).

Table (6) shows that the incidence of preterm and SGA were statistically significantly higher in the severe stress females (according to Workplace Stress Survey) as compared to the females with moderate stress and mild stress ($p=0.010$ and <0.001 respec-

tively). However, there was no statistically significant difference regarding the incidence of still birth ($p=0.642$).

This table shows that the mean number of working hours was statistically significantly higher in the working females who had preterm deliveries ($p<0.001$) compared to females with full term. The mean number of working hours was statistically significantly higher in the working females who gave birth to SGA ($p<0.001$). There was no statistically significant difference in the mean number of working hours between the females with without still birth.

Table (5): Relation between Perceived Stress Scale questionnaire categories and outcomes in the working females group.

Variables	Poor stress (N=54)		Average stress (N=77)		High stress (N=19)		P ^r value
Preterm	6	11.1%	22	28.6%	8	42.1%	0.010*
SGA	3	5.6%	15	19.5%	12	63.2%	<0.001*
Still birth	6	11.1%	7	9.1%	2	10.5%	0.927

Table (6): Relation between Workplace Stress Survey categories and outcomes in the working females group.

Variables	Mild stress (N=45)		Moderate stress (N=63)		Severe stress (N=42)		P ^r value
Preterm	6	13.3%	3	4.8%	27	64.3%	0.010
SGA	0	0%	3	4.8%	27	64.3%	<0.001
Still birth	0	0%	9	14.3%	6	14.3%	0.642

Table (7): Relation between outcomes and working hours in the working females group.

Variables	Working hours	p-value
Preterm:		
No (n=114)	43.16±9.53	<0.001
Yes (n=36)	59.33±13.59	
SGA:		
No (n=120)	44.05±11.58	<0.001
Yes (n=30)	59±9.42	
Still birth:		
No (n=135)	46.58±12.51	0.181
Yes (n=15)	51.20±13.71	

Discussion

The current study included 300 pregnant females at the reproductive age who living in Tawilla village in Dakhlia governorate. There were classified into two groups according to the working state; group A (included 150 working females) and group B (Included 150 non-working females).

In the current study, there was no statistically significant difference between the working and non-working group regarding the age, BMI, gravidity and parity.

This agreed with Vrijkotte et al. [16] who included pregnant women from the Amsterdam Born

Children and their Development study, two weeks after first prenatal screening (singleton liveborn, n=7561). Working conditions were working hours/week, standing/walking hours/week, physical workload and job strain. The results reported that there was no statistically significant difference in the basic data (age, BMI gravidity and parity) between the working and non-working groups.

This was also in the same line with Hathout et al. [17] who included 500 pregnant women who were visiting the antenatal care clinic at Beni-Suef university hospital were our target group. They were interviewed using predesigned questionnaire, Physical activity questionnaire, Job Stress Questionnaire There was no statistically significant difference between the working and non-working females regarding the age categories, BMI categories, residence or the educational level.

In the current study, the median number of previous abortions in the working group was 0 (range 0-3) while in the non-working group the median number of previous abortions was 0 (range 0-2). The median number of previous abortions was statistically significantly higher in the working group ($p=0.011$).

In the current study, the mean number of working hours was 47.04 ± 12.66 per week and the median number was 48 hours/week (range 30-72 hours/week). Regarding the type of work, there was 16% clerical workers, 30% elementary occupation, 28% health professionals, 10% teaching professionals and 16% technicians

In the study conducted by Kusuma Naik et al. [18] that included 100 pregnant working women, who were visiting the antenatal care unit and labour room. They reported that among the 5 working categories under which the women were classified, 50% of them were tailors which involves a strenuous work pattern, 15% of them were health professionals which included staff nurses and doctors, 15% technician which involves prolonged standing at workplace, 17% of them were clerical workers involving prolonged sitting. The mean of 47hrs/week of working hours, 5.4hrs of sitting/day and 2.5hrs/day of standing with standard deviation of 2.8hrs.

In the current study, according to Perceived Stress Scale questionnaire, there was 36% with poor stress, 51.3% with average stress and 12.7% with high stress. According to Workplace Stress Survey, there was 30% with mild stress, 42% with moderate stress and 28% with severe stress.

Kusuma Naik et al. [18] showed that by stress level at work place among the studied women, 68% of them belonged to the category moderately well i.e, with a score in b/w 40-60 these employees are handling the stress moderately well at work place and 72% of them had some complications during

their course of pregnancy, 19% of them handled stress very well, 13% of them experienced problems at their work place and all of them had some complications during their pregnancy and delivery.

In the current study, the incidence of preterm infants was statistically significantly higher in the working females group as compared to the non-working group (24% versus 12% respectively ($p<0.007$)).

This partially agreed with Khojasteh et al. [19] who showed that, regarding the frequency distribution of employment status in terms of gestational age, it showed 24.8% of employed women and 15.1% of housewives had preterm deliveries, but this was not significant.

In the current study, the incidence of still birth was statistically significantly higher in the working females group as compared to the non-working group (10% versus 4% respectively ($p=0.042$)).

This agreed with Hathout et al. [17] who showed that perinatal death was reported in 11.5% vs. 6% for working compared to non-working subjects ($p<0.035$).

This finding is consistent with that of Banerjee [20] who found an increase in the perinatal mortality rate among employed women with reported significant work factors that correlated with miscarriage and/or perinatal death included: Fewer household helpers, standing, working in hot environments, walking, carrying, and lifting heavy weight at work.

In the current study, the incidence of preterm and SGA were statistically significantly higher in the active females (according to general practice physical activity questionnaire) as compared to the inactive females, moderately inactive females and moderately active females ($p<0.001$). However, there was no statistically significant difference regarding the incidence of still birth ($p<0.062$).

This agreed with the results of a meta-analysis by Cai et al. [21] who reported that a heavy physical workload was associated with increased odds of preterm delivery (OR: 1.23, 95% CI: 1.07 to 1.41, $I^2=32\%$), and having a low-birth-weight neonate (OR: 1.79, 95% CI: 1.11 to 2.87, $I^2=87\%$).

In the current study, the incidence of preterm and SGA were statistically significantly higher in the high stress females (according to Perceived Stress Scale questionnaire) as compared to the females with average stress and poor stress ($p=0.010$). Also, the incidence of preterm and SGA were statistically significantly higher in the severe stress females (according to Workplace Stress Survey) as compared to the females with moderate stress and mild stress ($p<0.010$ and <0.001 respectively).

This copes with the study of Hathout et al. [17] who reported that the prevalence of SGA was significantly higher among those with severe work stress.

In a cross-sectional design by Widowti et al., [22] the participants were 92 pregnant women who worked at a footwear manufacturer at Banten, Indonesia. Half of the participants worked less than 40 h per week and the other half worked 40h or more per week. The assumed correlation between gestational age and work stress level was supported in this study. Increasing gestational age was associated with advancing pregnancy-related stress and anxiety.

Maternal prenatal stress developed along with U pattern, in which the stress level of pregnant women high in the first trimester and became lower in the second trimester and reached a high level again in their third trimester [23].

Consequently, the risk of delivering a birth a small-for-gestational-age infant was in accordance with the increasing work stress found in pregnant women [24]. A similar result informing the association between work stress and small-for-gestational-age [25].

In the current study, the mean number of working hours was statistically significantly higher in the working females who gave birth to SGA ($p < 0.001$).

This disagreed with Khojasteh et al. [19] who showed that there was no significant difference between pregnant women in mean daily working hours and standing hours in terms of placenta previa, placental abruption, reduced amniotic fluid, gestational age, or LBW. Cesarean section was 47.6% in women with less than 8 hours of daily standing, and 100% in those with more than 8 hours of standing. The difference may have been due to employment, higher education, and greater tendency toward elective cesarean.

In the current study, the mean number of working hours was statistically significantly higher in the working females who had preterm deliveries ($p < 0.001$) compared to females with full term.

This agreed with Vrijkotte et al. [16] who showed that prolonged standing/walking during first trimester was associated with an increased risk for total PTB (OR=1.5; 95% CI 1.0-2.3, after adjustments). Other working conditions were not related to total PTB.

This agreed with the meta-analysis by Cai et al. [26] that systematically reviewed the association between work requiring high physical demand, such as heavy lifting intensity greater than or equal to 11 kg at a time, heavy lifting volume greater than or equal to 100kg/day, prolonged standing greater than or equal to 4 hours per day, heavy physical work

load, and prolonged bending greater than or equal to 1 hour per day, with the same prespecified adverse pregnancy outcomes. The authors demonstrated a significant association between lifting greater than or equal to 100kg per day with preterm delivery (OR, 1.31).

Our data also confirmed the findings of a previous meta-analysis by Beukering et al., [27] which reported an increased risk of PTD with prolonged standing and heavy physical workloads.

Conclusion:

There is a correlation between women working while pregnant and unfavorable outcomes for the pregnancy. In addition, the incidence of unfavourable outcomes for the pregnancy is associated with the increased physical activity, workload, and stress during working hours.

Conflict of Interest:

Authors declare no conflicts of interest.

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التأثير المحتمل لعبء العمل على نتائج الحمل

المقدمة: إن المرأة الحامل التي تعمل أثناء فترة الحمل قد تتعرض لمخاطر محددة قد يكون لها تأثير سلبي على حملها أو على جنينها. من التأثيرات السلبية للحمل الإجهاض التلقائي، والإملاص، والولادة المبكرة، وانخفاض الوزن عند الولادة، والتشوهات الخلقية.

الهدف من العمل: دراسة العلاقة بين عبء العمل وبعض نتائج الحمل الضارة لدى عينة من النساء اللاتي يعشن في قرية الطويلة بمحافظة الدقهلية في مصر.

طريقة البحث: شملت الدراسة الحالية ٣٠٠ أنثى حامل تم تصنيفهن إلى مجموعتين متساويتين؛ المجموعة أ (الإناث العاملات) والمجموعة ب (الإناث غير العاملات). تم إخضاع المشاركين للحصول على تاريخ كامل وتقييم لظروف العمل، وتم الحصول على الاستبيانات التالية من المشاركين المشمولين، استبيان النشاط البدني، استبيان مقياس الإجهاد المدرك، ومسح الإجهاد في مكان العمل. وتمت متابعة المشاركين لتوثيق النتائج الخاصة بالحمل والمواليد.

النتائج: كانت نسبة حدوث الخدج، الصغار بالنسبة لعمر الحمل والذين ولدوا ميتين أعلى بشكل ملحوظ إحصائياً في مجموعة الإناث العاملات مقارنة بالمجموعة غير العاملة. كانت نسبة حدوث الخدج والصغيرة بالنسبة لعمر الحمل أعلى بشكل ملحوظ إحصائياً في الإناث النشطة، الإناث ذات الضغط العالي مقارنة بالإناث غير النشطات/النشطات باعتدال ومتوسطات التوتر/الإجهاد الضعيف على التوالي.

الاستنتاج: عمل الإناث خلال فترة الحمل يرتبط بنتائج الحمل السلبية. علاوة على ذلك، يرتبط حدوث نتائج الحمل الضارة بزيادة النشاط البدني وعبء العمل والإجهاد أثناء العمل.