

# Effect of Structured Pelvic Floor Exercise Protocol during Pregnancy on Labor Progress

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**Abstract:** Pelvic floor muscles exercise during pregnancy can produce strong and well controlled muscles that facilitate labor progress. The purpose of the study was to assess the effect of structured pelvic floor exercise protocol during pregnancy on labor progress. **Methods:** A quasi-experimental design was utilized. **Sample:** A purposive sample of 74 pregnant women in the third trimester of pregnancy. **Setting:** The study was carried out at Maternal and Child Health Centers (Qibli and Bahari), University and Teaching Hospital at Shebin El-Kom. **Instruments:** An interviewing questionnaire, an antenatal follow up assessment tool, pelvic floor muscle exercise checklist and partograph. **Results:** There was a highly statistically significant difference and improvement in terms of better labor progress and short labor duration between the study and the control group. **Conclusion:** Pelvic floor exercise protocol during the third trimester of pregnancy is effective in the improvement of labor progress and short labor duration. **Recommendations:** Pelvic floor muscle exercise training should be incorporated as an essential part of routine antenatal care during the third trimester of pregnancy.

**Keywords:** Pelvic floor muscle training exercise, 3rd trimester of pregnancy, Labor progress.

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## 1. INTRODUCTION

Normal delivery is the best end of pregnancy for both the mother and the newborn from the physical, psychological and sociological point of view. It needs more physical and emotional preparation for the pregnant women as the main target of pregnancy for the future mothers, families and the health care system that supports the mothers and the families before and during labor (Manzanares, 2017). Physical preparation of the pregnant women includes some types of antenatal exercises such as the pelvic floor muscles exercise. Pelvic floor muscles exercise is designed to strengthen pelvic floor muscles through pelvic floor muscles contraction and relaxation several times during the day with a specific duration for each time (Anna, 2015).

Pregnancy and vaginal delivery appear to contribute to long-term pelvic floor dysfunction in later life due to the hormones of pregnancy. These hormones have been associated with relaxation and structural effects on the connective tissue of the pelvic floor during the third trimester and childbirth. These effects reduce the strength of the pelvic floor which facilitates the birth process. Evidence showed that certain obstetrical factors may increase the risk of partial damage of pelvic floor nerve especially the pudendal nerve that also leads to pelvic floor muscles weakness. These factors include grand multipara, previous episiotomy, prolonged second stage of labor and perineal lacerations (Ahlund et al., 2015).

Leticia et al., (2015) showed that the proper pelvic floor muscles exercise during pregnancy prevent poor labor progress which leads to primary caesarean sections, instrumental vaginal deliveries, obstructed labor, uterine rupture and associated complications. A study conducted by Aran et al., showed that reduced strength of the pelvic floor muscles was associated with an abnormally prolonged first stage of labor. Strong pelvic floor muscles might preclude the descent or rotational movements of the fetal head (Aran et al., 2015). Also, Salvesen and Morkved, (2015) proposed that the practice of pelvic floor muscle training at 20 and 36 weeks of gestation can speed up the active phase of the first stage of labor, thereby reducing the total duration of labor.

**Significance of the study:**

Maintaining of a good pelvic floor function during pregnancy is one of the factors that affect the maternal co-morbidity rate. The number of maternal deaths, as a result of obstructed labor, varies between 4% and 70% of all maternal deaths worldwide, accounting to a maternal mortality rate as high as 410/100,000 live births (Neilson, 2015). Obstructed labor accounts for 8% of maternal mortality and is considered one of the three leading causes of perinatal mortality with the case fatality rate of 87-100% in developing countries (Usharani & Bendigeri, 2017). The incidence of obstructed labor is 3% in Egypt (Bulletin, 2015).

Based on reviewing literature, Lixu et al., 2015 found that women who apply pelvic floor muscle training during pregnancy had a lower rate of prolonged second stage of labor and incidence of episiotomy. Meanwhile Cambell, Glazener & Hunter, (2015) reported that pelvic floor muscles exercise may decrease the need for cesarean section, request for epidural and forceps application during labor. Also the researcher found that there are many studies on assessing the effect of pelvic floor muscles training exercise on urinary incontinence, but to the researcher's knowledge, there are few studies about its effect on labor progress especially in Egypt. So the researcher tried to fill in such a gap of knowledge by conducting this study.

**Purpose of the Study:**

The study aimed to assess the effect of structured pelvic floor exercise protocol during pregnancy on labor progress.

**Research Hypotheses:**

- 1- Pregnant women who follow pelvic floor exercise protocol experience better progress of labor than those who don't follow such exercise.
- 2- Pregnant women who follow pelvic floor exercise protocol obtain shorter duration of labor than those who don't follow such exercise.

## 2. METHODS

**Research design:**

The quasi experimental design (comparative study) was utilized in this study.

**Setting:**

The study was carried out at Maternal and Child Health Centers (Qibli and Bahari) at Shebin El-Kom in Menoufia Governorate for selecting all cases. Then the cases were followed up at the labor rooms at University Hospital and a Teaching Hospital at Shebin El-Kom in Menoufia Governorate to complete the course of the intervention. These centers have high flow rate of mothers (785 pregnant women per year in MCH Qibli and 655 pregnant women per year in MCH Bahari) who attend these centers and hospitals from the different surrounding cities and villages. These centers also provide services to the community including maternal and child health services, antenatal, natal, postnatal, vaccination during pregnancy and family planning services. The University Hospital has a key role in undergraduate education for the healthcare professionals. It provides free and paid services during pregnancy, labor, postpartum and miscarriage. It also provides fertility treatment and gynecological care for public clients. The flow rate of normal deliveries in this hospital was 722 cases annually. The Teaching Hospital is affiliated to the Ministry of Health and Population. It provides similar free services to public clients and provides care for women during pregnancy and labor, as well as for infertility and gynecological problems, in addition to family planning services. The flow rate of normal deliveries is approximately 1063 cases annually.

**Sampling:**

A purposive sample of 74 pregnant women (44 pregnant women from MCH in Qibli and 30 pregnant women from MCH in Bahari) who met the inclusion criteria was selected, including the pregnant women (Multigravida) during the third trimester, single pregnancy, fetal cephalic presentation and normal pregnancy with no medical or obstetric complications such as preeclampsia, preterm labor and premature rupture of membranes as these complications need physical restrictions that can affect the results of the study. The cases were then randomly assigned into two groups (study and

control group). This took place through asking each of the 74 women to pick a piece of paper containing a number. Those who selected number 1 were assigned to the study group and those who selected number 2 were assigned to the control group. This technique helped in avoiding sample contamination and bias.

**Sample size:** The sample size was calculated by using the following formula

$$n = \left[ \frac{2(Z_{Power} + Z_{1-\alpha})}{2(\mu_1 - \mu_2)/\delta} \right]^2$$

The sample size assumes that the expected effect size is 1.98 and the standard deviation of outcome variable is 2.5, to achieve 90% power to detect this difference with a significance level of 5%. It is estimated that 34 participants% a total of 37 subjects per group will be recruited leading to a total required sample size of 74 participants.

### Instruments:

**Instrument I: An interview questionnaire:** the researcher developed the interview questions based on an extensive literature review. It consisted of four parts: the first part contained questions related to the socio-demographic characteristics, the second part contained data related to the previous obstetric history, the third part contained data related to the past medical and family history and the fourth part contained data related to the current pregnancy.

**Instrument II: An antenatal follow up assessment tool:** the tool was adopted from Goda, (2015). It was used in this study to assess the health condition of the pregnant women during pregnancy till labour for the study group. It included follow up of the present pregnancy encompassing: date of visit, expected date of the delivery (EDD), weight, vital signs and abdominal examination for detecting gestational age and the fetal heart rate (FHR).

**Instrument III: Pelvic floor muscle exercise checklist:** it was adopted from Goda, (2015) to assess the accuracy of applying the pelvic floor exercise and follow up of the exercise application. The instrument consisted of the following two parts:

**Part I:** Follow up of the exercise application: which included the number of weeks of the exercise application, the frequency of the exercise per day and the duration of each contraction and relaxation.

**Part II:** Checklist for the exercise application: it contained 8 items to assess the accuracy of applying the antenatal pelvic floor exercise protocol. The researcher used this instrument for the pregnant women in the study group for each follow up visit (4 weeks).

### Scoring of the pelvic floor muscle exercise checklist:

Pelvic floor muscle exercise checklist was assessed through 8 questions that were scored as follows: A score of zero (0) indicates not done, a score of (1) indicates done but not accurate while a score of (2) indicates done and accurate. The total score of the pelvic floor muscle exercise checklist questions ranged from 0-16 and was categorized into four levels as follows (Goda, 2015): Poor application of the pelvic floor muscle exercise < 4 scores - fair application of the pelvic floor muscle exercise from 4- 8 scores -good application of the pelvic floor muscle exercise from 9-12 scores and excellent application of the pelvic floor muscle exercise from 13-16 scores. These scores were recorded after each follow up visit for the pregnant women in the study group and the women who scored less than (8) were excluded from the study because they did not apply the exercise well until the time of delivery

**Instrument IV: The partograph:** This instrument is a standardized one designed by the World Health Organization (2000) to help in the management of labor. It had been used for collecting the data related to the labor progress. It included three main parts: the first part contained data related to the fetal condition, the second part contained data related to the labor progress and the third part contained data related to the maternal condition.

### Validity and reliability

For validity purposes, the researchers conducted an extensive literature review and developed the questionnaire from the previously used instruments and reviewing pertinent studies. Instrument 1 was designed by the researchers and validated by five experts in the field of maternal and newborn health nursing in the Faculty of Nursing of Menoufia University ( for

content validity), while instruments II, III and IV were adopted from the previous studies. The interview questionnaire underwent some modifications according to the panel of judgment regarding the clarity of sentences and appropriateness of content. Test-retest reliability was used to estimate reliability.

**Administrative Approvals:** An official letter was taken from Dean, Faculty of nursing, Menoufia University and submitted to the director of MCH centers, chairperson of obstetrics and gynecology department of University Hospital and Shebin- Elkom Teaching Hospital to carry out the study. Official permission was obtained to from the directors of the above mentioned setting carry out the study.

#### **Ethical Consideration:**

An approval from the committee of hearing and ethics was obtained from Faculty of Nursing, Menoufia University on 12/7/2017. Approaches to ensuring ethics were considered in the study regarding confidentiality and informed consent. Confidentiality was achieved by the use of closed sheets with the names of the participants replaced by numbers. All participants were informed that the information they provided during the study would be kept confidential and used only for statistical purpose and after finishing the study, the findings would be presented as a group data with no personal participant's information remained.

#### **Pilot study**

A pilot study conducted to test the feasibility, applicability and understandability of the tools. It was conducted on 10% of the total sample (7 pregnant women) according to the selection criteria. All pregnant women participated in the pilot study excluded from the study sample because the researcher made some modification of the instruments.

#### **Field work:**

The current study was carried out on four phases:

##### **1- Preparatory phase:**

The researcher prepared the educational sessions as well as the pelvic floor exercise training protocol booklet which included three chapters to provide the pregnant women with the information about the pelvic floor muscle exercise and its effect on labor progress.

##### **2. Interviewing phase:**

The researcher collected the data from the pregnant women in both groups (study and control groups) through an interview and physical assessment.

##### **3) Implementation phase (for the study group only):**

The researcher provided the instructions to the pregnant women about the pelvic floor muscles exercise training through four weeks:

**I- The first week:** It started immediately after the assessment and contained two educational sessions, each session took about 30 minutes and there are 15 minutes break between the two sessions: The researcher explained to the pregnant woman how to detect the right muscles group for applying the pelvic floor exercise by instructing the pregnant women to enter the bathroom to make urination, and in the middle of the urine flow. The pregnant women should try to stop the flow of urine when she is sitting on the toilet, she should experience the feeling of squeezing and lifting at the same time. If she could do this, then, the woman was using the right muscles and know how to apply the pelvic floor muscles exercise during pregnancy accurately and safely by using the pelvic floor exercise training checklist. At first, the researcher provided the instructions to the pregnant women such as breathing normally during the exercise, taking a deep breath before the exercise, not contracting or moving the leg, buttock, or abdominal muscles during the exercise. She also advised to pull up the rectum and vagina during the contraction, empty the bladder before the procedure for giving better results and to relax for a period equal to the period of contracting the pelvic floor muscle and increase the number of the contractions and the duration of holding gradually from week to another. The researcher told the pregnant women that she could apply this procedure at any position she liked, such as watching TV, sitting with the children, sitting on the toilet and lying on the bed. After that, the researcher taught the pregnant women to contract the pelvic floor muscles as she is trying to stop the flow of urine through counting for three (3 seconds) and relaxing for another three seconds. They should contract and relax 5 times and repeat this 5 times per day (25 contractions each day) for the first week.

**II- The second week:** This week included two sessions; in the first session the researcher assessed the health condition of the pregnant women such as vital signs, weight, and performed abdominal examination. In the second session, the researcher assessed the accuracy of applying the pelvic floor exercise training for the last week by using a follow up checklist instrument. After that, the researcher provided the new instructions for the pregnant women to increase the duration of contracting the pelvic floor muscles to 6 seconds and increase the number of the contractions and the relaxations to 10 times, and repeat that 5 times per day (50 contractions each day) for the second week .

**III- The third week:** The same action should occur as the second week. After that, the researcher provided the new instructions for the pregnant women to increase the duration of contractions to 9 seconds and increase the number of contractions and the relaxations to 15 times, and repeat that 5 times per day (75 contractions each day) for the third week.

**IV- The fourth week:** The same action should occur as the third week. After that the researcher provided the new instructions for the pregnant women to increase the duration of contractions to 12 seconds and increase the number of contractions and relaxations to 20 times, and repeat that 5 times per day (100 contractions each day). The number of contractions and relaxation should be followed till delivery. The researcher was met each pregnant woman in the study group for four weeks to ensure their compliance (check how to apply the pelvic floor exercise and take feedback) by using the follow up checklist. After that, the researcher followed the pregnant women up weekly by phone to check the compliance of them, each assessment took about 15 min for each pregnant woman.

**5) Evaluation phase:**

The researcher attended in the labor unit and the delivery room to follow up the women in both groups in relation to the duration of the second stage of labor. The researcher instructed the pregnant women in the study participants to call the researcher to attend the labor. The pelvic floor muscle training exercise was carried out for the women in the study group whereas routine care was given to the control group. The researcher assessed the labor progress by plotting the partograph immediately after the admission of mother for the labor. The researcher assessed the fetal head descent (station), the cervical dilatation, the effacement, the uterine contractions progress, the duration of the first, the second and the third stages of labor. This assessment was repeated according to the phase of the first stage of labor, it was done every 30 minutes in the latent phase (cervical dilatation 4-7 cm) and every 15 minutes in the active phase (cervical dilatation 8-10 cm). The researcher found that the study group had better labor progress than the control group through the mean duration of the first, the second and the third stages of labor. Also the cervical dilation, effacement and frequency of uterine contractions were faster in the study group than the control group.

**3. STATISTICAL ANALYSIS**

**Data analysis**

The collected data were scored, tabulated and analyzed using (SPSS) version 22. Descriptive as well as nonparametric statistics were utilized to analyze the data pertinent to the study. The level of significance was set at  $p < 0.05$ . Chi square test, Independent sample t-test, Fischer exact test (FE), Mean and Mann-Whitney test (nonparametric test) were used to analyze the data.

**4. RESULTS**

**Table (1): Socio-demographic characteristics of the study participants (N =74)**

Variables	Study group (N=37)		Control group (N=37)		Total (N=74)		$\chi^2$	P value
	No.	%	No.	%	No.	%		
<b>Age ( years)</b>								
• 20-24 years	13	35.1	11	29.7	24	32.4	3.19	0.526
• 25-29 years	19	51.4	20	54.1	39	52.7		
• 30-35 years	3	8.10	6	16.2	9	12.2		
• 35-40 years	2	5.40	0	0.00	2	2.70		
<b>Age (years)</b> <b>Mean±SD</b>	24.74±1.93		24.71±1.29		24.72±1.63		t-test 0.073	0.942

Educational level									
• Illiterate	2	5.40	2	5.40	4	5.4	0.355	0.986	
• Read and write	3	8.10	4	10.8	7	9.45			
• Basic education	7	18.9	6	16.2	13	17.6			
• Secondary school	4	10.8	5	13.5	9	12.2			
• University	21	56.8	20	54.1	41	55.4			
Occupation									
• Housewife	27	73.0	28	75.7	55	74.3	0.071	0.790	
• Working	10	27.0	9	24.3	19	25.7			

Table (1) shows the socio-demographic characteristics of the study participants. As inferred from the table, the mean age of the study group was 24.74±1.93 and the control group was 24.71±1.29 respectively. About 56.8% of the study group had university education compared to 54.1% in the control group. The majority of the study group (73.0%) and the control group (75.7%) were housewives respectively.

Table (2): Obstetric History of the Studied Participants (N =74):

Variables	Study group (N=37)		Control group (N=37)		Total (N=74)		$\chi^2$	P value
	No.	%	No.	%	No.	%		
<b>Gravidity</b>							1.11	0.576
• Twice	5	13.5	8	21.6	13	17.6		
• Three times	27	73.0	23	62.2	50	67.6		
• More than 3 times	5	13.5	6	16.2	11	14.8		
<b>Parity</b>							0.784	0.676
• Once	6	16.2	9	24.3	15	20.3		
• Twice	26	70.3	23	62.2	49	66.2		
• Three times	5	13.5	5	13.5	10	13.5		
<b>Complications in previous pregnancy</b>							FE 0.730	0.394
• Yes	2	5.40	4	10.8	6	8.10		
• No	35	94.6	33	89.2	68	91.9		
<b>Types of complications</b>	N=2		N=4		N=6		FE 0.375	0.540
• Premature rupture of membrane	1	50.0	3	75.0	4	66.7		
• Post term labor	1	50.0	1	25.0	2	33.3		
<b>Duration of first stage of last labor</b>							2.13	0.144
• 6 – 8 hours	16	43.2	10	27.0	26	35.1		
• More than 8 hours	21	56.8	27	73.0	48	64.9		
<b>Duration of second stage of last labor</b>							4.58	0.101
• Half an hour	30	81.1	35	94.6	65	87.8		
• More than half an hour	3	8.10	2	5.40	5	6.80		
• Less than half an hour	4	10.8	0	0.00	4	5.40		
<b>Duration of third stage of last labor</b>							4.53	0.104
• 15 min	24	64.9	29	78.4	53	71.6		
• More than 15 min	4	10.8	0	0.00	4	5.40		
• 5 – 10 min	9	24.3	8	21.6	17	23.0		
<b>Mode of pervious delivery</b>							0.949	0.330
• Vaginal	15	40.5	11	29.7	26	35.1		
• Vaginal with episiotomy	22	59.5	26	70.3	48	64.9		

<b>Complications in previous delivery</b>								
• Yes	14	37.8	12	32.4	26	35.1	0.240	0.626
• No	23	62.2	25	67.6	48	64.9		
<b>Types of complications</b>	N=14		N=12		N=26			
• Vaginal tear	8	57.1	6	50.0	14	53.8	0.619	0.431
• Cervical tear	6	42.9	6	50.0	12	46.2		

FE: Fisher exact test \*significant

**Table (2)** represents the obstetric history of the study participants. According to gravidity, 73.0 % of the study group were pregnant for three times. Also, 70.3% of the study group had delivered twice before. The majority of the study group (94.6%) did not have any complications in previous pregnancy. Only 50% of the study group and the control group had post term labor and another 50% had premature rupture of membrane respectively. In relation to the duration of the first stage of labor, 56.8% of the study group continued more than 8 hours in the last first stage of labor compared to 73.0% of the control group. Also, 81.1% of the study group continued half an hour in the last second stage of labor compared to 94.6% of the control group and 64.9% of the study group continued 15 minutes in the last third stage of labor compared to 78.4% of the control group. About 59.5% of the study group had previous vaginal delivery with episiotomy compared to 70.3% of the control group. More than half of the study and the control groups did not have any previous delivery complications. Only 57.1% of the study group had vaginal tear in the previous delivery compared to 50.0 % of the control group. Also, 42.9 % of the study group had cervical tear in previous delivery compared to 50.0% of the control group.

**Table (3): Pelvic Floor Muscles Exercise Checklist among the Study Group (Number of exercise frequency per day) (N =37):**

Variables		Study group (N=37)	
No of exercise frequency per day		No.	%
First week	10 – 15 times /day	5	13.5
	15 – 20 times/day	17	45.9
	20 – 25 times /day	15	40.6
Second week	30 - 40 times /day	3	8.1
	40 – 45 times / day	18	48.7
	45 – 50 times / day	16	43.2
Third week	60 – 65 times / day	2	5.4
	65 – 70 times / day	20	54.1
	70 – 75 times / day	15	40.5
Fourth week	85 – 90 times / day	2	5.4
	90 – 95 times / day	9	24.3
	95 - 100 times / day	26	70.3

**Table (3)** represents the number of exercise frequency per day among the study group. The table shows that about half of the study group (45.9%) performed pelvic floor muscles exercise 15-20 times per day in the first week. About, 48.7% of the study group performed pelvic floor muscle exercise 40-45 times per day in the second week. In the third week, more than half of the study group (54.1%) performed pelvic floor muscles exercise 65-70 times per day where as in the fourth week, the majority of the study group (70.3%) performed pelvic floor muscles exercise 95-100 times per day.

**Table (4): Pelvic Floor Muscles Exercise Checklist among the Study Group (Duration of pelvic floor muscles contraction and relaxation) (N =37)**

Variables		Study group (N=37)	
Duration of each contraction and relaxation		No.	%
First week	2 seconds / times	1	2.7
	3 seconds / times	36	97.3
Second week	4 seconds /times	6	16.2
	5 seconds / times	5	13.5
	6 seconds / times	26	70.3

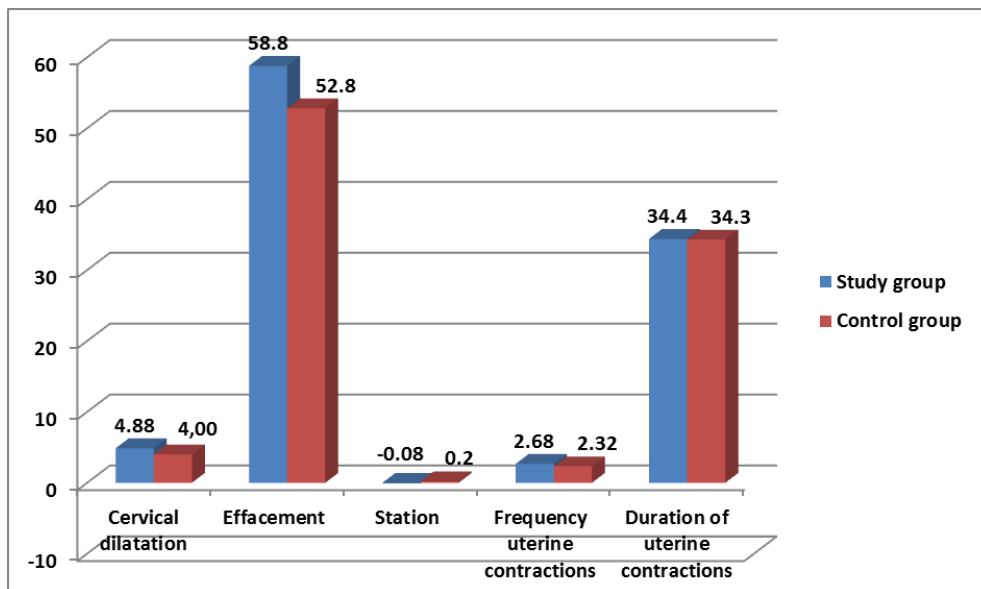
Third week	7 seconds / times	1	2.7
	8 seconds / times	7	18.9
	9 seconds /times	29	78.4
Fourth week	10 seconds / times	7	18.9
	12 seconds / times	30	81.1

**Table (4)** represents the duration of pelvic floor muscles contraction and relaxation among the study group. As inferred from the table, the majority of the study group (97.3%) performed pelvic floor muscle exercise contractions and relaxation 3 seconds per time in the first week. About 70.3% performed this contraction and relaxation 6seconds per time in the second week. Where as in the third and fourth weeks, about 78.4% of the study group performed pelvic floor muscles exercise contractions and relaxation 9 seconds per time in the third week and 81.1% of the study group perform pelvic floor muscles exercise contractions and relaxation 12 seconds per time in the fourth week.

**Table (5): Pelvic Floor Muscles Total Score among the Study Group (N =37):**

Variables	Study group (N=37)								$\chi^2$	P value
	First week		Second week		Third week		Fourth week			
	No.	%	No.	%	No.	%	No.	%		
Poor <4	5	13.5	2	5.40	0	0.00	0	0.00	25.5	0.002**
Fair 4 – 8	10	27.0	9	24.3	6	16.2	3	8.10		
Good 9 – 12	9	24.3	9	24.3	5	13.5	6	16.3		
Excellent 13 - 16	13	35.2	17	46.0	26	70.3	28	75.6		

**Table (5)** represents pelvic floor muscles total score among the study group. The table shows that there was statistically significant difference regarding pelvic floor muscles total score among the studied group from the first to the fourth week (P= 0.002).



**Figure (1): Labor Progress on Admission among the Study Participants (N =74)**

**Figure (1)** represents labor progress on admission to the labor unit among the study participants. The figure shows that there was a highly statistically difference between the study and the control groups related to the progress of the cervical dilatation on admission to the labor unit (P=0.001). There was a highly statistically difference between the study and the control groups related to the progress of the cervical effacement on admission to the labor unit (P=0.001). There was no statistical difference between the study and the control groups related to progress of the station on admission to the labor unit (P=0.175). There was no statistical difference between the study and the control groups related to the mean



duration of uterine contractions of the study participants on admission to the labor unit ( $P=0.015$ ). There was a statistical difference between the study and the control groups related to the mean frequency of uterine contractions of the study participants on admission to the labor unit ( $P=0.909$ ).

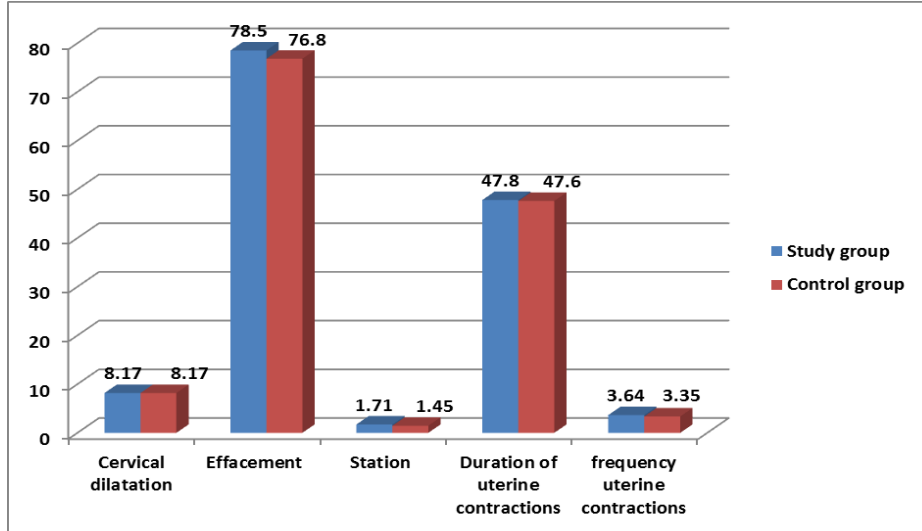


Figure (2): Labor Progress during the First Stage of Labor (Five hours from admission) among the Study Participants (N =74)

Figure (2) represents labor progress on the first stage of labor among the study participants. The figure shows that there was no statistical difference between the study and the control groups related to the progress of the cervical dilatation throughout the first stage of labor ( $P=1.00$ ). There was a highly statistical difference between the study and the control groups the related to progress of the cervical effacement throughout the first stage of labor ( $P=0.001$ ). Also, there was a highly statistical difference between the study and the control groups related to progress of the station throughout the first stage of labor ( $P=0.030$ ). There was no statistical difference between the study and the control groups related to the mean duration of uterine contractions of the study participants throughout the first stage of labor ( $P=0.291$ ). There was a statistical difference between the study and the control groups related to the mean frequency of uterine contractions of the study participants throughout the first stage of labor ( $P=0.014$ ).

Figure (1 and 2) answered the first research hypotheses stating that pregnant women who follow pelvic floor exercise protocol experience better progress of labor than those who do not.

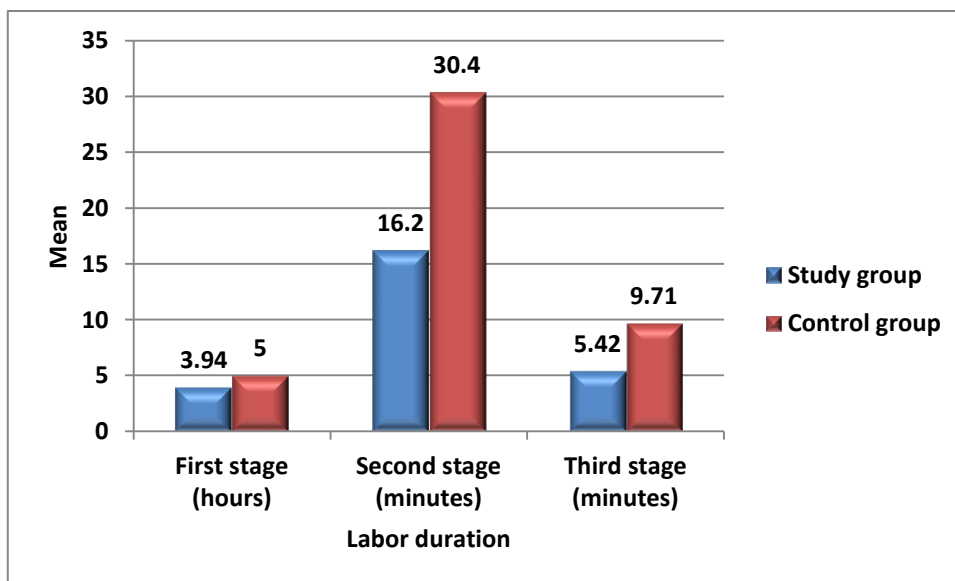


Figure (3): Mean Duration of Labor throughout the Three Stages of Labor among the Study Participants (N=74)

**Figure (3)** displays the mean duration of labor throughout the three stages of labor. The figure shows that there was a highly statistically differences between the study participants regarding the duration of first, second and third stages of labor ( $P < 0.001$ ).

Figure (3) answered the second research hypothesis stating that pregnant women who follow pelvic floor exercise protocol have shorter duration of labor than those who do not.

## 5. DISCUSSION

The findings of the current study revealed that both research hypotheses were supported. The findings are discussed in the following sequence: 1-general findings “socio-demographic data” 2-findings related to pelvic floor muscles exercises checklist among the study participants 3-findings related to the partograph.

As for age, the majority of the study participants for the present study ranged between twenty to twenty nine years old because that age is mid fertility years in which the women are more likely to have more children and become multipara. This finding is supported by **Goda, 2015** who reported similar sample age group (20 – 30) years old in a study titled “effect of pelvic floor muscle exercise training protocol during 3rd trimester of pregnancy on labor duration”. The researcher supported the fact that woman had higher fertility rate and became multipara. In contrast with **Muchailh, (2016)** who conducted a study titled “Comparison of pelvic floor muscle strength evaluations in nulliparous and primiparous women: a prospective study”. The findings revealed age group between 20 – 25 years. The researcher selected this age group because the study participants was healthy nulliparous women.

According to educational level, the findings of the current study showed that the majority of the study participants had university education for that the study participants completed all educational sessions due to the high level of education .This was predictor of high exercise participation during pregnancy and better labor progress. The researcher’s point of view is supported by **Rezaeyan et al., (2016)** who investigated “Effects of education on exercise (physical activity) performance of pregnant women”. The findings revealed that women with high educational level had more understanding type of exercise and exact effect on the women’s health. In contrast, **El-Shamy, (2017)** selected low educational level in a study entitled” Effect of antenatal pelvic floor muscle exercise on mode of delivery”. The findings revealed that the pregnant women with low educational level had poor knowledge about the importance of exercise on the health of the woman and the fetus where as low education should be engaged in scientific research.

As for gravidity and parity, the results of the current study showed that the majority of the study participants were multigravida and multipara because pelvic floor muscles injury and weakness increase with the increasing number of vaginal delivery. Also, pregnancy hormones, maternal body mass and gravid uterus increase pressure on the pelvic floor muscles. The researcher encouraged multipara women to be engaged in pelvic floor muscle exercise to regain the strength of pelvic floor muscle and have better labor progress. This is supported by **Petricelli et al., (2014)** in a study entitled “Dispensability and strength of the pelvic floor muscles of women in the third trimester of pregnancy” who selected multipara women as study group. The findings revealed that strength of the pelvic floor muscles of the multiparous women were damaged during the third trimester. The findings of this study disagreed with **Wang, X., (2014)** who selected nulliparous women as study group and mentioned that nulliparous women also had greater muscle contractility than the multiparous women in a study titled “ Pelvic floor muscle training as a persistent nursing intervention: Effect on delivery outcome and pelvic floor myodynami”.

Body mass index is one of the important factors that influence the performance of pelvic floor muscle contraction and relaxation, range of body mass index of the study participants was 25-30 kg/m<sup>2</sup>. The majority of women in the present study had normal body mass index (BMI not exceeding 30) because maternal body mass and gravid uterus increments increase the pressure on the pelvic floor muscles (PFM) predisposing to pelvic dysfunction which leads to incorrect pelvic floor muscle contraction and relaxation. These findings are agreed upon by **Bozkurta, (2014)** who studied “Pelvic floor dysfunction and effects of pregnancy and mode of delivery on pelvic floor” and selected pregnant women with normal body mass index (BMI not exceeding 30) as one of the main inclusion criteria of the study .This is also ascertained by **Szanton et al., (2011)** who studied “effect of pelvic floor muscles training on labor and birth”.

As for gestational age, the results of the current study showed that all women included in the study were in the third trimester (29 weeks gestation) as one of the main inclusion criteria of the sample. This is in accordance with **Li Y& Liu H, (2010)** who conducted a study about the “Effect of functional exercise of prenatal pelvic floor muscles on pregnancy

outcome". They selected the pregnant woman at 29 weeks to perform pelvic floor muscles exercise as a method for strengthening pelvic floor muscles during pregnancy and developing the ability to relax and control the muscles in preparation for labor and birth. This resulted in better labor progress because the pelvic floor muscles during that time are overstretched and weakened resulting from the weight of the gravid uterus. On the contrary; these findings were not in accordance with those of **Zhou YH, (2011)** who conducted a study titled "Do antenatal pelvic floor training affect the outcome of labor? A randomized controlled trial" and selected pregnant women at 16 weeks until 30 weeks gestation. The researcher's point of view was that the earlier starting pelvic floor exercises, if taught correctly, the better the likelihood of success with pelvic floor strength before the progress of pregnancy on pelvic floor.

Regarding the current pregnancy course, the results of the current study showed that all women included in the study were low risk pregnant women as it is one of the main inclusion criteria of the participants. This finding was supported by **El-Shamy, (2017)** who investigated "Effect of antenatal pelvic floor muscle exercise on mode of delivery" and selected low risk pregnancy (singleton pregnancy, cephalic presentation, no medical or obstetric history) as a study participants because high risk pregnancy needs physical restrictions that can affect the results of the study.

In the current study the researcher instructed the pregnant women about pelvic floor muscle contraction and relaxation through four weeks. Regarding the frequency of exercise per day in the first week, the results of the current study showed that the study group performed pelvic floor muscle exercise through five sets of five contractions per time (25 contractions per day). Each contraction and relaxation lasts 3 seconds. This is in accordance with a study by **Ko PC et al., (2011)** about "A randomized controlled trial of antenatal pelvic floor exercises to prevent and treat urinary incontinence". This findings showed that the study group performed pelvic floor muscles contraction and relaxation through three repetitions of eight contractions each held for 3 seconds, with 2 min rest between repetitions.

Regarding the frequency of exercise per day in the second week, the results of the current study showed that the study group performed pelvic floor muscle exercise through five sets of ten contractions per time (50 contractions per day). Each contraction and relaxation lasts 6 seconds. This finding is supported by **Dias et al., (2011)** who studied "Effect of pelvic floor muscle training on labor and newborn outcomes". They reported that pelvic floor muscles exercise program contained five sets of ten contractions sustained for 6–8 seconds with an interval of 6 seconds between each contraction.

As for the frequency of exercise per day in the third week, in the present study, the researcher mentioned that pelvic floor muscle exercise protocol in the third week was five sets of fifteen contractions per time (75 contractions per day). Each contraction and relaxation lasts 9 seconds. Similar study findings are revealed by **Goda, (2015)** who studied "Effect of pelvic floor muscle exercise training protocol for pregnant woman during 3rd trimester on labor duration". The study reported that the duration of pelvic floor muscle holding was 9 seconds and the number of pelvic floor muscle contractions and relaxations was 15 times, and this was repeated 5 times per day (75 contractions each day). The current study showed that the frequency of exercise per day in the fourth week was 100 contractions per day through five sets of twenty contractions per time with an interval of 12 seconds between contractions. In the same line **Wang, (2014)** conducted a study entitled "Effect of pelvic floor muscle training on delivery outcome and pelvic floor myodynamia". The study stated that alternative pelvic floor muscle contraction and relaxation could be conducted 150 to 200 times per day at any time.

As for labor progress on admission to the labor unit, the current findings revealed that there was statistically significant differences between the study and the control groups regarding cervical dilation, effacement and frequency of uterine contractions on admission to the labor unit as pelvic floor muscle exercise help the elastic stretching of the cervix and effective contraction and retraction of the uterine muscles. These findings were supported by **Goda, (2015)** who studied "effect of pelvic floor muscle exercise training protocol during 3rd trimester of pregnancy on labor duration". The study stated that pelvic floor muscle exercise has a positive effect regarding cervical dilation, effacement and frequency of uterine contraction on admission to labor unit. This is because the exercise increases the circulating level of norepinephrine which has been shown to increase both the strength and the frequency of uterine contractions via alpha receptors in the uterine smooth muscles which lead to effective cervical dilation.

As for labor progress throughout the first stage of labor, the current findings revealed that there were statistically significant differences between the study and the control group regarding station, effacement and frequency of uterine contractions throughout the first stage of labor. This is seen to be due to antenatal pelvic floor muscle training results in

improved muscle control and strong flexible muscles, which may contribute to the descent or rotational movements of the fetal head. In the same line **Li Xu et al., (2015)** who studied “The effect of antenatal pelvic floor muscle training on labor and delivery outcomes” and reported that there was positive correlation between pelvic floor muscle exercise and station, effacement and frequency of uterine contraction throughout first stage of labor as antenatal pelvic floor muscle exercise improves flexibility, strength, and motor control, facilitating the first stage of labor and decreasing the need for operative delivery and caesarean section.

As for labor duration, the current findings showed that pregnant women in the study group had better labor progress than those in the control group as related to labor duration. The findings showed that the mean duration of the first, second and third stages of labor were shorter in the study group as compared to the control group. This is seen to be due to the fact that this exercise is very important to improve pelvic floor muscles strength. This helps the muscles to be able to do internal rotation during the second stage of labor and improve the elasticity of pelvic floor muscles and facilitate easy passage of the fetus without or with minimal tear or trauma.

These findings are supported by **Salvesen & Morkved, (2013)** who studied “Does pelvic floor muscle training during pregnancy have an effect on labor ? ”. They proposed that the practice of pelvic floor muscle training at 20 until 36 weeks of gestation can speed up the active phase of the first stage of labor, thereby reducing the total duration of labor. Moreover, **Lixu, et al., (2015)**, stated that antenatal pelvic floor muscles exercise significantly shortens the first stage of labor. This means that the first stage of labor in the PFMT group was reduced by 59 minutes on average compared to the control group in the study entitled “The effect of antenatal pelvic floor muscle training on labor and delivery outcomes”. In accordance, the findings of this study agreed with those of **Gavard & Artal, (2008)** in the study entitled “Effect of exercise on pregnancy outcome”. They stated that pelvic floor muscle training exercise for low risk woman during pregnancy leads to good outcome for the mother and fetus and improves overall maternal fitness and wellbeing.

Also, **Elnahas, (2013)** who conducted a study entitled “influence of antenatal and postnatal Kegel's exercises on pelvic floor muscles strength and thickness”. The findings revealed that the application of antenatal pelvic floor muscles exercise significantly lowered the duration of the second stage of labor and also facilitated labor and decreased labor pain.

Also, **Yihui, (2015)** showed that antenatal PFMT significantly shortens the second stage of labor which means that the second stage of labor in the PFMT group was diminished by 15.41 minutes on average compared to the control as pelvic floor muscle exercise improves muscle control and contributes to the descent or rotational movements of the fetal head in a study entitled “Regular exercisers have stronger pelvic floor muscles than non-regular exercisers during labor”.

On the contrary; these findings were not in accordance with those of **Leticia, et al., (2011)** who studied the effect of pelvic floor muscle training exercise through randomized controlled trial. The findings revealed that, there was no difference between the training group and the control group regarding to the duration of the second stage of labor or the total length. Also, the findings of this study disagreed with **May & Agur, (2014)** who studied “Does antenatal pelvic floor muscle training affect the outcome of labor” and revealed that, there was no significant difference in the duration of the second stage of labor between the two groups or in the need for instrumental delivery. It is also revealed that PFME does not appear to facilitate or obstruct labor itself.

As for mode of delivery, the current findings showed that the majority of the study group underwent spontaneous vaginal delivery rather than vaginal delivery with episiotomy. These findings were supported by **El-Shamy, (2017)** who reported that there was a significantly higher rate of vaginal delivery in mothers performing antenatal PFM exercise compared to the control group in the study entitled “Effect of antenatal pelvic floor muscle exercise on mode of delivery”. These findings are in agreement with **Goda, (2015)** who reported that antenatal PFM exercise may improve flexibility, strength, and motor control, facilitating the second stage of labor and decreasing the need for operative delivery and episiotomy. Moreover, **Clapp and Lopez, (2011)** conducted a study entitled “ neonatal behavioral profile of the offspring of women who continued to exercise regularly throughout pregnancy”. The findings revealed mentioned that pregnant women who participated in an exercise program for at least 1 hour twice a week for a minimum of 12 weeks were also more likely to have a spontaneous vaginal delivery than their non-athletic controls. In contrast, **Toozs-Hobson, (2015)** who investigated “the effect of mode of delivery on pelvic floor functional anatomy” and stated that PFM training had no effects on mode of delivery. This is due to that the participants with a low socioeconomic status are more likely to receive insufficient prenatal care and to suffer from more violence, poor diet, and urinary tract infection during pregnancy

## 6. CONCLUSION

Based on the results of the present study that assessed the effect of structured pelvic floor exercise protocol during pregnancy on labor progress, it could be concluded that: There was better labor progress among the pregnant women who followed the pelvic floor exercise protocol. This proved the first research hypothesis that pregnant women who follow pelvic floor exercise protocol experienced better progress of labor than those who do not follow. This is because the studied group who applied pelvic floor muscle exercise had strong pelvic floor muscles which helped in elastic stretching of the cervix and effective contraction and retraction of the uterine muscles. This leads to increase the frequency of uterine contraction, effective cervical dilation and effacement in the study group than the control group.

Also, the current study showed that there was short labor duration among the pregnant women who followed the pelvic floor exercise protocol. This proved the second research hypothesis that pregnant women who follow pelvic floor exercise protocol had shorter duration of labor than those who do not follow. The proper application of antenatal pelvic floor muscle exercise in the study group speed up the active phase of the first stage of labor, contributed to the descent or rotational movements of the fetal head which facilitated the easy passage of the fetus. This reduces the duration of the first, second and third stages of labor in the study group than the control group.

## 7. RECOMMENDATIONS

In light of the study findings, the following recommendations are proposed: Encourage the pregnant women to perform pelvic floor muscles exercise during the third trimester to have better labor progress, short labor duration and decrease incidence of episiotomy and cesarean section. Also, pelvic floor muscle exercise training should be added as an essential part of the routine antenatal care during the third trimester of pregnancy.

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