Correlation between Duration of the Second Stage and Pelvic Floor Muscle Strength in Primiparous Women Following Vaginal Delivery and Caesarean Section

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Abstract

Introduction: Women underwent caesarean section tend to have higher pelvic floor muscle strength;however, pelvic floor muscle strength in women underwent caesarean section in the second stage of labor have not been widely studied. This study aimed to assess correlation between duration of the second stage of labor with pelvic floor muscle strength in primiparous women underwent vaginal delivery and caesarean section.

Materials and Method: In this prospective study, 58 primiparous women underwent vaginal delivery and second–stage caesarean section were recruited from hospitals affiliated with Hasanuddin University in Makassar, Indonesia. Pelvic floor muscle strength was measured at 6 weeks following delivery. Correlation analysis was performed to estimate the correlation between pelvic floor muscle strength and duration of the second stage.

Results: Demographical characteristics were similar between groups. Primiparous women in caesarean section group had longer duration of second stage than women in vaginal delivery group(206,38 + 107,66 minutes versus 61,89 + 36,67, $P < 0.001$). Mean pelvic muscle floor strength in primiparous women underwent second stage caesarean section were similar to women underwent vaginal delivery(41,99 + 8,59 cm H_2O versus. 41,83 + 12,44 cm H_2O, $P = 0.954$). Duration of the second stage had no correlation with pelvic floor muscle strength in both vaginal delivery (r= 0,248; $P = 0.195$) and caesarean section (r = -0,083; $P = 0.669$).

Conclusion: Duration of the second stage may not alter pelvic floor muscle strength regardless of mode of delivery.

Keywords: *Pelvic floor muscle strength, duration of second stage, vaginal delivery, caesarean section.*

Introduction

Pelvic floor is an important structure that serves as mechanical and functional support of pelvic organs[1,2]. Damage to pelvic floor muscles may lead to increased morbidity associated with pelvic organ dysfunction such as urinary incontinence, anal incontinence, and pelvic organ prolapse[3]. Delivery and aging are both known as significant risk factors that may contribute to pelvic floor dysfunction[3].

Pelvic floor integrity is provided by coordinated mechanism from pelvic muscles, nerves, and connective tissues. Pelvic connective tissue may become principal support system when damage occur to pelvic floor muscles and eventually lead to pelvic organ dysfunction[4].

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In many studies, pregnancy and childbirth were the main risk factors for decreased pelvic floor muscle strength and function through stretch and denervation mechanisms[5–7]. Numerous studies have demonstrated that vaginal delivery was considered as the main risk factor for developing pelvic floor dysfunction compared with caesarean delivery[8–10]; however, the studies did not specifically compare the second–stage caesarean section and vaginal delivery in primiparous women.

Prolonged second stage of labor is still widely found in our regions especially at primary health center. Complicated geographic and administrative system may delay referral process and management, thus lead to extremely prolonged second stage of labor.

The current study was undertaken to find correlation between duration of second stage of labor and pelvic floor muscle strength in vaginal delivery and second – stage caesarean section. Besides, we also would like to find if there had been any difference in pelvic floor muscle strength between two groups.

Materials and Method

This study was an observational prospective study conducted in several regional hospitals affiliated with Hasanuddin Univeristy in Makassar, Indoensia between February 2019 – February 2020. Primiparous women underwent vaginal delivery and second – stage caesarean section were recruited by consecutive sampling. Inclusion criteria of this study were primiparous woman with a history of term delivery, 20–35 years old, birthweight from 2500 g–4000 g, no prior gynecologic surgery and troublesome systemic illnesses, and without third to fourth degree perineal tear.

Ethical and research approval for this study were obtained from Hasanuddin University Ethical Committee. All participants were provided by written informed consent. Eligible participants were then evaluated at 6 weeks following delivery. Pelvic floor muscle strength was measured by Peritron perineometer 9300 V. The device consists of a 28 mm diameter – compressible vaginal probe connected to microprocessor. Pelvic floor muscle strength was measured in cm H_2O following insertion into vagina. The measurement are reliable and reproducible as demonstrated by previous studies[11,12].

Before performing measurement, pelvic muscle contraction was ascertained by digital palpation into vagina. Participants were then instructed to contract their muscles as they were trying to hold in gas. Contraction of the abdominal and gluteal muscles had to be excluded in this maneuver. Participants were requested to contract their pelvic muscles as strong as possible, and maintain their contraction as long as possible. Pelvic muscles were than allowed to relax after contraction. After confirming correct pelvic contraction, the probe, covered with condom, was inserted into vagina and three contractions were measured, with a 10 second rest interval. Pelvic floor muscle strength was averaged over the three recorded contractions.

Demographical and clinical data were mainly acquired from medical record. Pelvic floor dysfunctions such as urinary incontinence, anal incontinence, and pelvic organ prolapse were assessed concomittanly with pelvic floor strength measurement. We used Questionnaire for Urinary Incontinence Diagnosis (QUID) to identify any postpartum urinary incontinence following delivery[13]. Anal incontinence was assessed by Wexner scoring system[14]. Pelvic organ prolpase was assesed by Pelvic Organ Prolaps Quantification system (POP-Q)[15].

Demographical and clinical characteristics, such as age, occupation, antenatal care frequency, education, maternal body mass index, active phase progression, and birthweight were analyzed by Pearson chi square or Fisher's exact test. Duration of second stage and pelvic muscle floor muscle strength in both groups were tested for normality by Shapiro Wilk normality test. Independent *t* test or Mann Whitney test were used to compare pelvic floor muscle strength and duration of the second stage between groups. Spearman rank test was used to estimate the correlation between duration of the second stage and pelvic floor muscle strength in both groups. Data regarding urinary incontinence between groups which assessed by Questionnaire for Urinary Incontinence Diagnosis was analysed by Mann–Whitney test after performing Shapiro Wilk normality test. Fisher's exact test was used to analyse Wexner score and POP-Q system between groups.

All data analyses were performed using SPSS 24 statistical software. Statistical significance for all analysis was defined at 5% significance level.

Results

This study focused on primiparous women underwent vaginal delivery and second – stage caesarean section. Secod–stage caesarean section is not as common

as other caesarean sections performed before entering second – stage caesarean section; however, we were able to evaluate 29 participants in this group. Moreover, in our region the duration of the second stage of labor may be extremely long as demonstrated in our study which revelaed the longest duration of second stage of labor was 450 minutes.

Of 58 participants fulfiled eligibility criteria of our study, demographical and clinical characteristics such asmaternal age, occupation, educational level, number of antenatal care visits, neonatal birthweight, and active phase progression were analysed as summarized in Table 1. Primiparous women in vaginal delivery group tended to be younger (P = 0.061). Both groups were likely to have a role as housewife at evaluation (P = 0.256). Educational level was not different between groups (P = 0.083). Almost all women in both second – stage caesarean section and vaginal delivery group had more than 4 times antenatal care visits during pregnancy (89.7% versus 96.8%). All demographical characteristics did not show any significant association with mode of delivery (P> 0.05).

Twenyty–one women (72.4%) women in both groups had normal body mass index (P = 0.771). Abnormal body mass index was not likely to be found in our study population. Twenty–one women (72.4%) in second – stage caesarean section group had neonatal birthweight > 3000 g compared with only 14 women (48.3%) in vaginal delivery group. Women underwent vaginal delivery were more likely to have lower neonatal birth weight even if it was not statitically significant (P = 0.060). Of 29 women in second–stage caesarean group, 21 women (72.4%) had slower progression of active phase of labor, whereas only 13 (44.8%) women in vaginal delivery had this progression abnormality (P = 0.033).

Mean duration of the second stage of labor in women underwent caesarean section was 206.38 + 107.66 minutes. This finding was extremely different with mean duration of the second stage of labor in vaginal delivery group, which was 61.89 + 36.67 minutes (P< 0.001) as shown in table 2. The longest duration of the second stage of labor in caesarean section and vaginal delivery were 450 minutes versus 180 minutes. Mean pelvic floor muscle strength in second – stage caesarean section and vaginal delivery group were similar (41.83 + 12.44 cm H_2O versus 41.99 + 8.59 cm H_2O, P = 0.954). One women in second – stage caesarean section had lowest mean pelvic floor muscle strength among all participants, which was 14.9 cm H_2O. The comparison is shown in figure 1.

Our main goal in this study was to determine if there was any correlation between duration of the second stage of labor and mean pelvic floor muscle strength in both groups (Table 3). We found there was no correlation between duration of the second stage and pelvic floor muscle strength in (r = – 0.083, P = 0.669). Moreover, duration of the second stage and pelvic floor muscle strength in vaginal delivery group also did not show any correlation (r = 0.248, P = 0.195). These correlations are depicted in figure 2a and 2b.

Postpartum urinary incontinence was assessed by Questionnaire for Urinary Incontinence Diagnosis (QUID) as shown in table 4. Stress urinary incontinence was more prone to occur in second – stage caesarean group than vaginal delivery (0.34 + 0.18 versus 0.24 + 0.51 P = 0.044). Maximum QUID stress score in second – stage caesarean was 2.0. QUID urge scores were similar between second – stage caesarean section and vaginal delivery (0.17 + 0.47 versus 0.10 + 0.40, P = 0.410).

Anal incontinence was assessed by Wexner score. Score of zero means perfect anal continence, whereas score equal to or more than 1 indicates any anal incontinence. There was no woman in vaginal delivery group that had experienced any episodes of anal incontinence (Table 5). Three women (10.3%) in second – stage caesarean group had experienced some episodes of anal incontinence, all of which were flatal incontinence. However, they did not have persistent symptom at 6 weeks following delivery. Ultimately, anal incontinence had no associations with mode of delivery (P = 0,237).

Anterior pelvic organ prolpase was found in 2 women (6.9%) in both groups. Uterine prolapse occured in 2 women in second – stage caesarean group and 1 women in vaginal group. In contrast to 2 women (6.9%) with posteior pelvic organ prolapse in second – stage caesarean section, there was no posterior pelvic organ prolapse found in vaginal delivery group. Pelvic organ prolapse and mode of delivery did not show any significant association (p > 0.05).

Discussion

We determined all primiparous women in the main

inclusion criteria as to avoid any confounding variables that may be found in multiparous women. In addition, nulliparous women are considered to have higher mean pelvic floor muscle strength[16]. There were no significant differences in sociodemographic characteristics between groups in our study ($P > 0.05$)

Women lived in rural areas were at increased risk to have prolonged second stage of labor due to referral delays. This may be caused by geographical and administrative obstacles. In addition, women underwent second – stage caesarean section were more likely to have prolonged active phase of labor as reflected by previous study[17]. In our study, we may not be able to identify the exact cause of prolonged second stage as we did not rule out cephalopelvic disproportion as our exclusion criteria.

Our findings suggest that there is no correlation between duration of the second stage of labor and pelvic floor muscle strength in both groups when measured at 6 weeks following delivery. Previous study demonstrated that prolonged second stage may confer greater risk to have decreased pelvic floor muscle strength but the study did not specify delivery method and duration of the prolonged second stage[18]. Fetal head compression at second – stage of labor may incite high pressure to birth canal[19]. This process may severely injure pelvic floor muscles especially in prolonged second stage of labor. This effect may not be accurately determined because most women with prolonged second stage would eventually end up in caesarean section, as demonstrated in our study.

Duration of the second stage in our study was extremely different between groups. Mean duration of the second stage in second – stage caesarean was 206.38 + 107.66 minutes, meanwhile in vaginal delivery group the second stage duration was 61.89 + 36.67 minutes. Difference between groups may result from prolonged length of time to find referral facilities, differences in response time between hospitals, and the ability of health care provider to assess labor progression.

Prolonged second stage of labor which dominantly managed by caesarean section is not likely to decrease pelvic floor muscle strength. There was no difference in pelvic floor muscle strength between groups in our study. We were not able to find primiparous women underwent vaginal delivery with remarkable prolonged second stage of labor as in caesaren section. This limitation did hinder us to find the exact relationship between prolonged second stage of labor and vaginal delivery. Nonetheless, we are still able to infer that prolonged second stage may not have detrimental effect on pelvic floor muscles when managed by caesarean section.

Mean pelvic floor muslce strength in primiparous women underwent vaginal delivery did not differ significantly with second – stage caesarean group (41.99 + 8.59 cm H_2O vs 41.83 + 12.44 cm H_2O). This findings differ from previous study demonstrated that mean pelvic floor muscle strength in women underwent vaginal delivery with episiotomy was 32.71 + 14 cm H_2O and without episiotomy was 53.88 + 20.9 cm H_2O [16]. In addition, the study also found that mean pelvic floor muscle strength in women underwent elective caesarean section was 52.9 + 21.29 cm H_2O and in emergency caesarean section was 48 + 21.04 cm H_2O. Another study found that mean pelvic floor muscle strength in women underwent vaginal delivery and second – stage caesarean section were 27 cm H_2O versus 36.5 cm H_2O, though the study did not performed exclusively for primiparous women[18]. Different results between studies may result from distinct subject characteristics, as well as time interval between delivery and pelvic floor evaluation in which we performed at relatively shorter duration following delivery.

Our study demonstrated that there was no significant difference in pelvic floor muscle strength between groups. This may result from full recovery of pelvic floor muscle that may take place at 6 weeks following delivery. However, a study has stated that restoration of pelvic floor muscle strength may be achieved at 8 weeks following vaginal delivery. Moreover, pelvic floor damage exclusively occurs in a woman with a history of vaginal delivery[5]. This may confirm similarities of pelvic floor muscle strength between groups in our study in which no extensive pelvic damage occured in second – stage caesarean section and full restoration of pelvic muscle did take place in vaginal delivery.

Women in second – stage caesarean section group were more likely to experieced stress urinary incontinence as evaluated by *Questionnaire for Urinary Incontinence Diagnosis* (QUID). In contrast to our study, some studies described that women underwent vaginal delivery were more prone to have stress urinary incontinence compared with women underwent caesarean section[19,20]. The difference with our study may result from special population enrolled in our study, which limited to second

– stage caesarean section. In addition, our study suggests that stress urinary incontinence was more likely to occur in older women and women with a history of prolonged second stage. Another study demonstrated that there was no relationship between duration of the second stage of labor and urinary incontinence occurence[21]. However, the study did not specify the mode of delivery. All women with episodes of stress urinary incontinence had neonatal birthweight more than 3000 g. This finding is different with previous study demonstrated that there was no association between birth weight and stress urinary incontinence; nevertheless we did not estimate this association as the number of subjects with stress urinary incontinence were ultimately low[22].

In contrat to stress urinary incontinence, urge urinary incontinence tend to occur in younger women with normal body mass index. Many studies suggest that urge urinary incontinence is not associated with mode of delivery and may occur sporadically following delivery[23]. Although urge urinary incontinence was more likely to occur in women with second – stage caesarean section, we were not able to determine if it was a true urge urinary incontinence as we did not perform urinalysis examination to rule out genitourinary tract infection. Our study suggests that both stress and urge urinary incontinence may occur transiently following delivery as none of our participants had persistent symptoms.

Perfect anal continence was found in all women underwent vaginal delivery, whereas 3 women in second – stage caesarean group had experienced some episodes of anal incontinence following delivery. This findings may indicated that second – stage caesarean section may confer greater risk to have anal incontinence especially in prolonged second stage of labor. Prevalence of anal incontinence following delivery is extremely small and flatal incontinence is the most frequent type occur following delivery[24,25]. Moreover, postpartutm anal incontinence tends to occur sporadically without identifiable risk factors as shown in our study[26].

Pelvic organ prolapse occurences were low regardless of mode of delivery. A previous study described that about 18% primiparous women underwent vaginal delivery and 7% women underwent caesarean section would eventually have second stage pelvic organ prolapse when evaluated at 6 months following delivery[9]. The study may indicate mode of delivery as a risk factor for pelvic organ prolapse; however, the study did not specifically conducted in second – stage caesarean section[27]. Another study found that only 11% women would eventually have pelvic organ prolapse regardless of the mode of delivery[18].

In our study, prolonged second stage and vaginal delivery may not be a risk factor for developing pelvic organ prolapse; however, we were not able to estimate the effect of extremely prolonged second stage in vaginal delivery. Previous study suggested that prolonged second stage of labor may increase the risk of levator anii muscle damage about 5.32 times, but he did not specify the duration of the second stage[28]. However, even if damage occurs in levator ani muscle, it may eventually recovered following delivery.

Limitations to our study were that there was siginificant difference of the duration of the second stage of labor between groups. This would impede our ability to predict the correlation between groups accurately. Nevertheless, we are able to infer that even extremely prolonged second stage would not cause extreme detrimental effect on pelvic floor muscle strength when managed by caesarean section. Relatively low sample size in our study may serve as a model for further study to be conducted in larger sample size and longer duration for evalution following delivery.

Table 1. Demographical and clinical characteristics

Variable	Caesarean section (n = 29)	Vaginal delivery (n = 29)	P
Age			
20 - < 25 years	10 (34.5%)	19 (65.5%)	0.061*
25 - < 30 years	11 (37.9%)	6 (20.7%)	
30 – 35 years	8 (27.6%)	4 (13.8%)	

Variable	Caesarean section (n = 29)	Vaginal delivery (n = 29)	P
Occupation			
Housewife	19 (65.5%)	24 (82.8%)	0.256*
Low workload	9 (31.0%)	5 (17.2%)	
High workload	1 (3.5%)	0 (0%)	
Educational level			
Primary school	4 (13.8%)	2 (6.9%)	0.083*
Juniro high school	8 (27.6%)	3 (10.3%)	
Senior high school	7 (24.1%)	16 (55.2%)	
Undergraduate or higher	10 (34.5%)	8 (27.6%)	
Antenatal care visits			
< 4x	3 (10.3%)	1 (3.4%)	0.611**
≥ 4x	26 (89.7%)	28 (96.6%)	
BMI (Kg/m^2)			
<18,5	2 (6.9%)	4 (13.8%)	0.771*
18,5 – 24,9	21 (72.4%)	21 (72.4%)	
25 – 29,9	4 (13.8%)	3 (10.3%)	
30 – 34,9	1 (3.4%)	1 (3.4%)	
35 – 39,9	1 (3.4%)	0 (0%)	
Neoantal Birthweight (g)			
< 3000 g	8 (27.6%)	15 (51.7%)	0.060*
≥ 3000 g	21 (72.4%)	14 (48.3%)	
Active phase progression			
Normal	8 (27.6%)	16 (55.2%)	0.033*
Prolonged	21 (72.4%)	13 (44.8%)	

* Chi Square test, ** Fisher's Exact test

Table 2. Comparison of duration of the second stage of labor and mean pelvic floor muscle strength between caesarean section and vaginal delivery

Group	n	Duration of second stage (min)			P	*P****
		Min	Max	Mean ± SD		
Second – stage Caesarean section	29	60	450	206,38 ± 107,66	<0.001*	0, 007
Vaginal delivery	29	10	180	61,89 ± 36,67		0,007
Mean pelvic floor muscle strength (cm H_2O)						
Second – stage Caesarean section	29	14,9	68,3	41,83 ± 12,44	0.954**	0,568
Vaginal delivery	29	28,5	63,9	41,99 ± 8,59		0,550

*Mann – Whitney test, ** Independent t test, ***Shapiro – Wilk normality test

Table 3. Correlation between duration of second stage and pelvic floor muscle strength in second stage Caesarean section and vaginal delivery.

	Group	Pelvic floor muscle strength (cm H_2O)	
		r	*P**
Duration of second stage (min)	Caesarean section	-0,083	0,669
	Vaginal delivery	0,248	0,195

*Spearman's rank correlation

Table 4 . Comparison of Questionnaire for urinary incontince (QUID) in second stage Caesarean section and vaginal delivery

Group	n	QUID (stress)			*P**
		Min	Max	Mean ± SD	
Second stage Caesarean section	29	0,0	2,0	0,24 ± 0,51	0.044
Vaginal delivery	29	0,0	1,0	0,03 ± 0,18	
		QUID (urge)			
		Min	Max	Mean ± SD	
Second stage Caesarean section	29	0,0	2,0	0,17 ± 0,47	0,410
Vaginal delivery	29	0,0	2,0	0,10 ± 0,40	

*Mann – Whitney test

Table 5. Comparison of Wexner score and POP-Q with mode of delivery

Variables		Caesarean section (n = 29)	Vaginal delivery (n = 29)	*P**
Wexner score 0		26 (89,7%)	29 (100,0%)	0,237
Wexner score≥1		3 (10,3%)	0 (0,0%)	
Prolapse	**Stage**			
Anterior	0	27 (93,1%)	27 (93,1%)	1,000
	1	2 (6,9%)	2 (6,9%)	
Uterine	0	27 (93,1%)	28 (96,6%)	1,000
	1	2 (6,9%)	1 (3,4%)	
Posterior	0	27 (93,1%)	29 (100%)	0,491
	1	2 (6,9%)	0 (0%)	

*Fisher's exact test

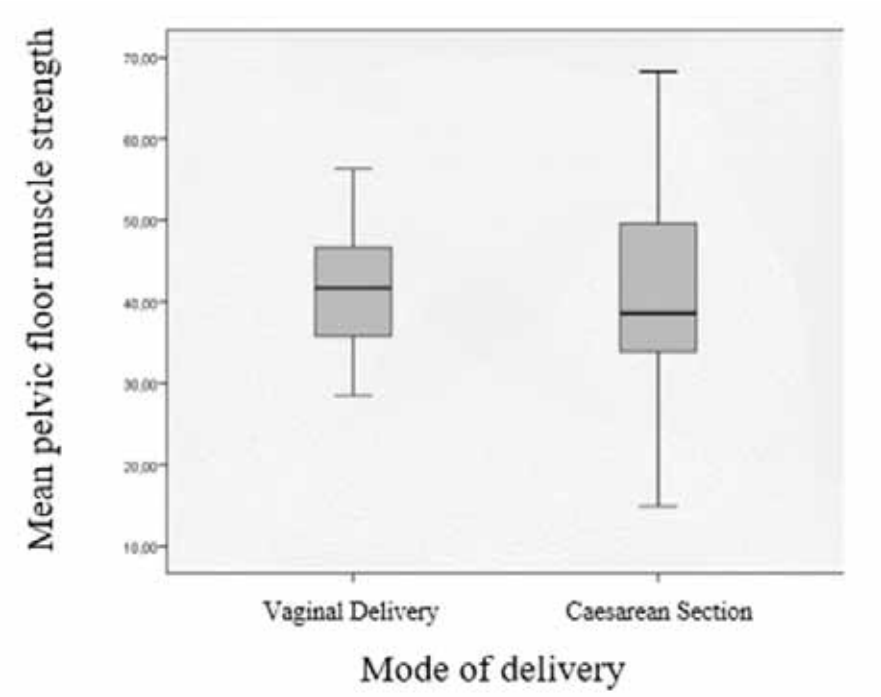
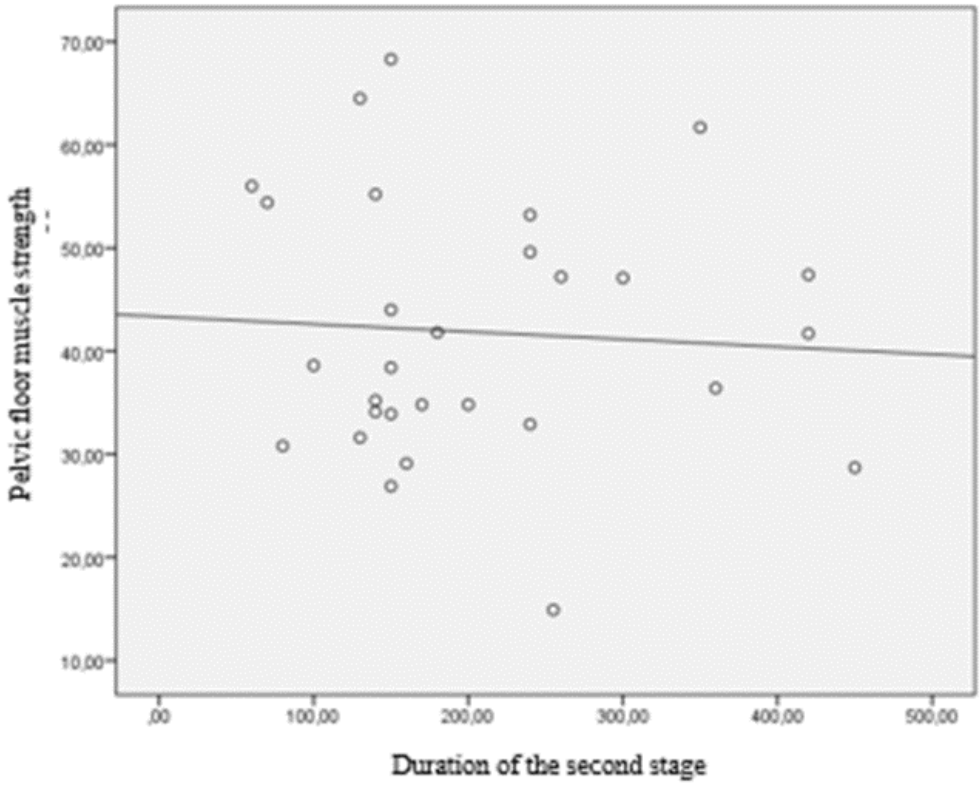
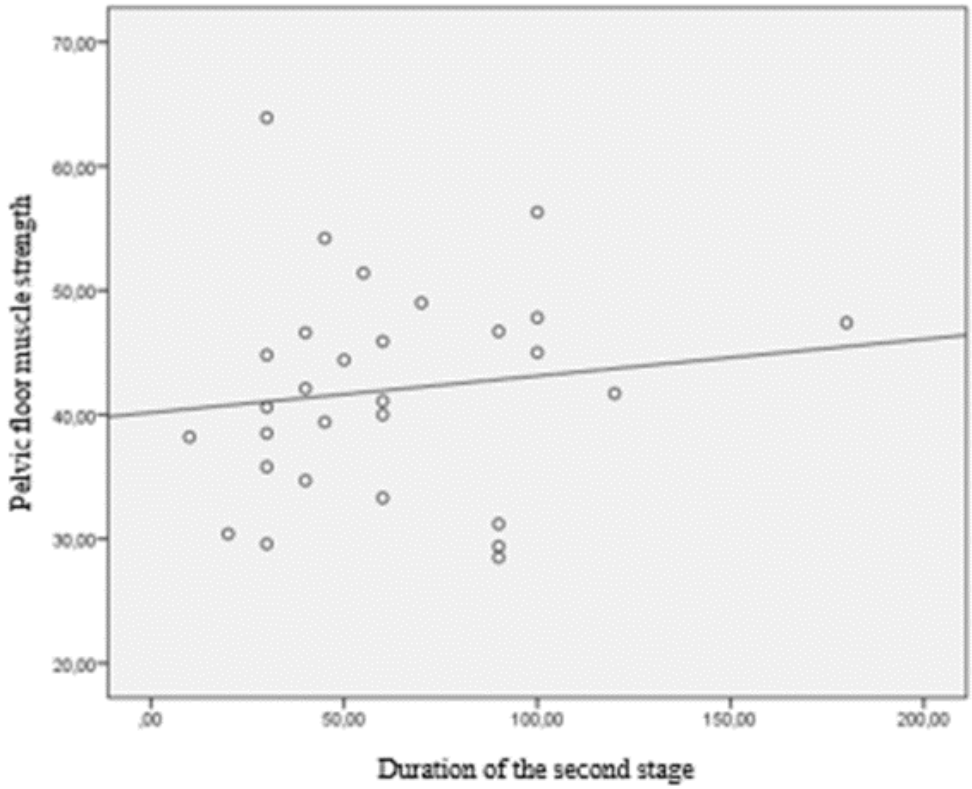


Figure 1. Comparison of mean pelvic floor muscle strength between caesarean section and vaginal delivery.



(a)



(b)

Figure 2. Correlation between duration of second stage and pelvic floor muscle strength in caesarean section (a) and vaginal delivery (b).

Conclusions

Pelvic floor muscle strength in primiparous women underwent second stage Caesarean section and vaginal delivery did not differ significantly after evaluation in 6 weeks following delivery. Duration of the second stage between groups was extremely different. Moreover, there were no correlation between duration of second stage and pelvic floor muscle strength on both groups. There were no differences in pelvic organ dysfunction between groups.

Ethical Clearance: No ethical approval is needed.

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Conflict of Interest: Nil

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