

# The Relationship between Perineal Trauma and Striae Gravidarum: A Systematic Review and Meta-Analysis

## Abstract

**Background:** Perineal trauma is a common problem seen after vaginal delivery, which has negative effects on different aspects of women's lives. Poor skin elasticity has been introduced as a predictor of perineal trauma, and the appearance of striae gravidarum is associated with poor skin elasticity. This review aimed to determine the association between perineal trauma and striae gravidarum through a systematic review and meta-analysis. **Materials and Methods:** We searched with MeSH terms ("Perineum" AND "Lacerations" OR "Rupture" AND "Striae Distensae") and their equivalents in databases PubMed, Scopus, Science direct, Web of Science, ProQuest, Scientific Information Database (SID), Magiran, and Google Scholar search engine without time and language restrictions from the beginning of May until the beginning of September 2020. After reviewing the inclusion and exclusion criteria, and quality evaluation, ten articles were included in the systematic review, and we analyzed data of 6 articles using Stata ver 11.2. **Results:** The results indicated that the rate and severity of perineal trauma were directly related to the severity of striae gravidarum (OR = 8.28, 95%CI = 2.49–27.54,  $I^2 = 86.64\%$ ). **Conclusions:** Based on the research results, the probability of perineal trauma was higher in individuals with moderate to severe striae than those with mild or without striae; therefore, we suggest evaluating striae score in the third trimester of pregnancy as a simple and noninvasive method to predict the risk of perineal trauma during childbirth. For reducing perineal injuries in women at risk, some supportive measures such as episiotomy and perineal massage are recommended.

**Keywords:** Delivery, meta-analysis, perineum, striae distensae

## Introduction

Perineal trauma is a common problem seen after vaginal delivery. Due to its complications in severe cases, it has negative effects on the physical, psychological, and social aspects of women's lives.<sup>[1]</sup> The prevalence of perineal laceration was 79.8% in the study by Lins *et al.*<sup>[2]</sup> (2019) in Brazil. In the study by Abedzadeh *et al.*<sup>[3]</sup> (2019) in Iran, it was reported to be 84.3%. Ruptures can occur spontaneously or by episiotomy.<sup>[4]</sup> Spontaneous ruptures vary from minor mucosal damages to severe injuries of the perineal and rectal muscles, ranging from grades 1 to 4.<sup>[4,5]</sup> Perineal trauma, especially in severe cases are along with short-term and long-term complications such as infection,<sup>[6]</sup> dyspareunia,<sup>[7]</sup> urinary problems,<sup>[8,9]</sup> anal sphincter injury,<sup>[10]</sup> rectovaginal fistula,<sup>[11]</sup> and fecal incontinence,<sup>[8]</sup> that affect women's health and quality of

life. The risk factors for perineal trauma include primiparity,<sup>[2,12]</sup> Asian race,<sup>[12-14]</sup> white women,<sup>[13]</sup> short perineal length,<sup>[15]</sup> operative vaginal delivery,<sup>[4,12,16]</sup> high birth weight,<sup>[4,17]</sup> higher maternal age,<sup>[17]</sup> epidural analgesia,<sup>[12]</sup> and shoulder dystocia.<sup>[14]</sup>

Despite paying attention to these risk factors and performing various clinical interventions to minimize perineal trauma during childbirth, there is a low ability to predict the risk of perineal trauma, and perineal damages continue during childbirth,<sup>[18]</sup> which is a major concern for women.<sup>[19]</sup> According to studies, the number of women who tend to have elective cesarean delivery due to perineal damages or unpleasant experiences in previous deliveries is increasing.<sup>[19]</sup> Therefore, better identification of women at the risk of perineal trauma is essential to improve the outcomes of vaginal birth.<sup>[1]</sup> Striae gravidarum, which usually occurs after

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24 weeks of gestation<sup>[20]</sup> and in more than 70% of pregnant women,<sup>[21]</sup> is considered reddish and slightly depressed streaks that are common on the skin of the abdomen and sometimes on the skin of breasts and thighs.<sup>[5]</sup> These lines increase in the third trimester<sup>[21]</sup> and are a sign of poor skin elasticity.<sup>[1,22]</sup> The etiology of striae gravidarum is unknown, but the combined effect of hormonal factors and skin stretching plays a key role in creating these lines.<sup>[21]</sup> Other factors such as low maternal age,<sup>[21,23]</sup> excessive weight gain during pregnancy,<sup>[21,23]</sup> sex of baby,<sup>[21]</sup> birth weight,<sup>[21,24,25]</sup> family history of striae gravidarum,<sup>[23-25]</sup> and socioeconomic status<sup>[21]</sup> are effective in causing the striae gravidarum. Poor skin elasticity has also been introduced as a predictor of perineal trauma,<sup>[1]</sup> and the occurrence of striae in pregnancy is associated with poor skin elasticity.<sup>[26]</sup> Striae gravidarum indicates the skin's ability to stretch and amounts of elastic fibers and collagen within it<sup>[27]</sup> and is caused by changes in connective tissue, and a decrease in amounts of elastin and fibrillin in the skin<sup>[24,25]</sup> is along with the influence of hormonal factors.<sup>[21,28,29]</sup> Numerous studies have investigated the relationship between the occurrence of striae gravidarum and an increase in perineal damages.<sup>[1,22,26,28,30,31]</sup>

Evaluation of striae gravidarum can be performed by staffs without any need for special equipment and invasive methods through a simple observation, based on Atwal and Davey tools.<sup>[1]</sup> If women at risk of perineal tears are identified, some preventive methods can be used to reduce these injuries.<sup>[32-34]</sup> Therefore, due to a high rate of perineal damages and negative effects of these injuries on various aspects of women's lives and similar mechanism of perineal trauma and striae gravidarum (poor skin elasticity), we performed the present systematic review and meta-analysis to investigate the relationship between perineal trauma and striae gravidarum.

## Materials and Methods

The present systematic review study was based on the proposed checklist of Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).<sup>[35]</sup> We searched with MeSH terms (“Perineum” AND “Lacerations” OR “Rupture” AND “Striae Distensae”) and also the title and abstract of the studies were searched for ([“perineal trauma” OR “perineal laceration” OR “perineal tear” OR “perineal damage” OR “perineal rupture” OR “perineal injury”] AND [“striae gravidarum” OR “stretch marks” OR “Striae Distensae”]) in databases, PubMed, Scopus, Science direct, Web of Science, ProQuest, Scientific Information Database (SID), Magiran, and Google Scholar search engine during the time periods covered by the related databases from the beginning of May until the beginning of September 2020 without time and language restrictions. Articles' references were also sought for further studies.

The main inclusion criteria in the present study were studies that examined the relationship between perineal

trauma and striae gravidarum. Review articles, duplicate articles, letter to the editor-in-chief, case report, and thesis were also excluded from study. The study selection process is shown in the PRISMA flowchart [Figure 1]. According to the reported results by the available studies, three different scenarios were considered for meta-analysis. In the first scenario, the odds of perineal trauma was assessed in women with moderate to severe striae in comparison to those with mild or without striae.<sup>[22,28,36]</sup> In the second scenario, the odds of perineal trauma occurrence was analyzed with increase in Striae Score.<sup>[1,30]</sup> In the third scenario, the odds of perineal trauma was calculated in individuals with moderate to severe striae by comparison with those with mild striae [Tables 1,2].<sup>[30,31]</sup>

To calculate the striae score based on Davey tool, the abdomen is divided into four parts using the midline and horizontal line through the umbilicus, and the number of striae in each section is calculated separately. Each section is given a score of 0 (no striae), 1 (moderate striae), and 2 (many striae) based on the number of striae. The total score varies from 0 to 8. The severity of striae is divided into three categories without striae (0), mild striae (1 to 2), and severe striae (3 to 8) (Yamaguchi as quoted by Buchanan).<sup>[37]</sup> In order to calculate the striae score based on Atwal instrument, the skin of 4 areas of the body (abdomen, thighs, breasts, and buttocks) is evaluated in terms of color and number of striae and 6 scores are assigned to each area; Total Striae Score (TSS) is the sum of striae scores based on Atwal instrument and it can be ranged from 0–24 and interpreted as follows: 0–3 (no striae), 4–9 (mild striae), 10–15 (moderate striae), and more than 15 (severe striae).<sup>[21]</sup>

We evaluated the reporting quality of articles imported in the systematical review using the

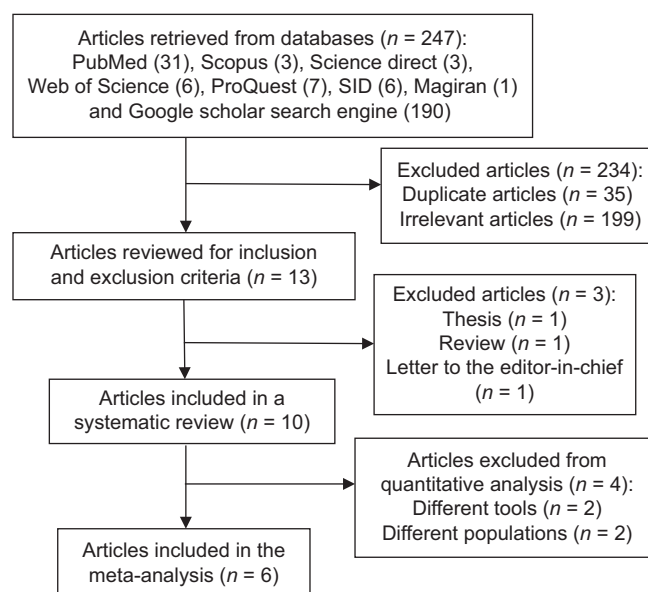


Figure 1: PRISMA flow chart of the study

Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist.<sup>[38]</sup> The STROBE checklist consists of six general sections: title and abstract, introduction, methods, results, discussion, and other information. Some of these titles are divided into other subsets that include a total of 22 items. In order to score the checklist, score 1 was given if any item was mentioned in the evaluation process, otherwise score 0 was considered, and the score ranged from 0–22 based on the checklist. Articles, which scored less than 6 in cross-sectional studies and less than 7 in cohort studies, were considered as low quality articles.<sup>[39]</sup> In order to evaluate the quality of article reporting, the full text of articles entered into the research was evaluated independently by two researchers (F.K. and S.E.) and discussed with the third researcher (V.G.) in the case of disagreement. Data extracted from the articles included the first author, year, place of study, study design, sample size, scale, results, and quality score [Table 1].

Odds ratios with 95% CI were used to assess the association of perineal trauma and striae gravidarum. When available, adjusted OR were selected over crude measures. Presence of statistical heterogeneity between studies was assessed using Q statistic with a significant level of  $p < 0.1$ . When heterogeneity between studies was not significant ( $p > 0.1$ ), a fixed-effect model was used to pool the data; otherwise, the DerSimonian and Laird random-effects model was applied.<sup>[40]</sup> To quantify the proportion of between-study variations attributable to heterogeneity, an I<sup>2</sup> statistic was calculated. All analyses were performed using Stata version 11.2 (Stata Crop, college station, Texas).

### Ethical considerations

The authors are committed to avoiding from redundant publication and plagiarism. Results that were not statistically significant were expressed and discussed without bias.

### Results

A total of 10 studies with a sample size of 3084 were reviewed, of which 6 studies were capable of meta-analysis; <sup>[1,22,28,30,31,36]</sup> the studies were conducted from 2000 to 2019. The research population consisted of primiparous and multiparous women in eight studies, but the primiparous women alone in a study by Bhujabal *et al.*,<sup>[41]</sup> and multiparous women alone in a study by Abbas *et al.*<sup>[31]</sup> In two studies, Davey instrument was used<sup>[18,26]</sup> to evaluate the severity of striae gravidarum, and Atwal instrument in another 8 studies.<sup>[1,22,27,28,30,31,36,41]</sup> the number of striae was examined in the latent phase of the first stage of labor and up to two days after delivery, and perineal trauma was reported based on grades one to four and in some studies as mild trauma (grades 1 and 2), and severe trauma (grades 3 and 4).<sup>[27,28]</sup> Table 1 presents the characteristics of studies included in the systematic review.

A meta-analysis of three studies by Kapadia *et al.*, Khrisnamurti *et al.*, and Patel *et al.*<sup>[22,28,36]</sup> (the first scenario) indicated that the striae gravidarum was associated with perineal trauma so that the odds of perineal trauma was 8.28 times more in those with moderate to severe striae comparing to those without and mild striae (OR = 8.28, 95%CI = 2.49–27.54, I<sup>2</sup> = 86.64%). In the meta-analysis of two studies by Halperin *et al.* and Banu *et al.*<sup>[1,30]</sup> (the second scenario), the striae gravidarum was associated with perineal trauma and the odds of having higher striae score was 1.04 times more in those with perineal trauma comparing to those without perineal trauma (OR = 1.04, 95%CI = 1.02–1.06, I<sup>2</sup> = 0.08%). Similarly in the meta-analysis of two studies by Abbas *et al.* and Banu *et al.*<sup>[30,31]</sup> (the third scenario), perineal trauma was 13.77 times more in those with moderate to severe striae comparing to individuals with mild striae (OR = 13.77, 95%CI = 1.87–101.49, I<sup>2</sup> = 92.89%) [Table 2].

Wahman *et al.*<sup>[26]</sup> (2000) introduced the striae gravidarum as a predictor for perineal trauma ( $p < 0.001$ ), and the moderate or severe striae was associated with a higher risk of perineal trauma. It was also reported that episiotomy was associated with a lower rate of perineal trauma ( $p < 0.001$ ). In the study by Sereshti *et al.*<sup>[18]</sup> (2013), the prevalence of striae gravidarum was 82.8%. In this study, the severity of striae gravidarum was higher in women with perineal trauma than a group without perineal trauma. There was also a significant relationship between breast striae gravidarum score and perineal ruptures during childbirth, and women with more striae on the breast were more likely to suffer perineal and vaginal tears ( $p = 0.021$ ).

In the study by Halperin *et al.*<sup>[27]</sup> (2017), who examined the relationship between striae gravidarum and severe perineal trauma, there was no statistically significant relationship between the severity of striae gravidarum and anal sphincter injury ( $p = 0.2$ ), but there was a significant relationship between the severity of striae gravidarum and severity of anal sphincter injury ( $p = 0.025$ ) so that TSS was higher in individuals with grades 3c and 4 perineal trauma compared to those with grade 3a and 3b trauma. In the study by Bhujabal *et al.*<sup>[41]</sup> (2019), the mean score of striae gravidarum was higher among women with perineal trauma than women without perineal trauma and the relationship was clinically significant, but not statistically significant ( $p = 0.634$ ). It is also reported that episiotomy was associated with a reduction in the perineal trauma ( $p < 0.001$ ).

### Discussion

In the present systematic review and meta-analysis, which aimed to investigate the relationship between perineal trauma and striae gravidarum, we reviewed nine studies with cross-sectional design and a study with cohort design. The results indicated that the rate and severity of perineal

**Table 1: Characteristics of studies included in the systematic review (2000-2019)**

Author/Year	Sample size	Study design	Scale	Results	Quality score
Wahman <i>et al.</i> (2000) <sup>[26]</sup>	168	Observational-prospective	Davey	Striae gravidarum is a predictor of perineal trauma ( $p<0.001$ ). The moderate or severe striae increases risk of perineal rupture.	15
Halperin <i>et al.</i> (2010) <sup>[1]</sup>	385	Cross-sectional	Atwal	TSS* was higher in women with perineal trauma due to the vaginal birth than those who did not experience perineal trauma (mean (SD) 3.60 (0.39) vs. 2.31 (0.23), $p=0.003$ ). According to the comparison of three groups, intact perineum, grade 1 rupture, and grade 2 rupture, there was a significant relationship between increasing the degree of rupture and TSS ( $F=2.94$ , $p=0.05$ ).	19
Sereshti <i>et al.</i> (2013) <sup>[18]</sup>	587	Cross-sectional	Davey	There was a significant relationship between striae score and perineal injuries so that the striae score was higher in cases in which there were simultaneous tear and episiotomy ( $p<0.001$ ). Furthermore, there was a significant relationship between breast striae gravidarum score and perineal ruptures during childbirth ( $p=0.021$ ).	17
Kapadia <i>et al.</i> (2014) <sup>[22]</sup>	300	Cross-sectional	Atwal	There was a significant relationship between perineal trauma and severity of striae gravidarum, so that perineal trauma was higher in those with moderate and severe striae than those without striae or with mild striae ( $p<0.05$ ). TSS* can be used as a valuable factor for predicting risk of perineal trauma.	15
Halperin <i>et al.</i> (2017) <sup>[27]</sup>	80	Cohort	Atwal	There was no significant relationship between severity of striae gravidarum and anal sphincter injury ( $p=0.20$ ), but there was a significant relationship between severity of striae gravidarum and severity of anal sphincter injury ( $p=0.025$ ).	18
Khrisnamurti <i>et al.</i> (2018) <sup>[28]</sup>	188	Cross-sectional	Atwal	Among individuals with moderate to severe striae, 33.40% experienced mild perineal trauma and 66% experienced severe perineal trauma. Moderate to severe striae is the most important determinants of severe perineal trauma.	15
Bhujabal <i>et al.</i> (2019) <sup>[41]</sup>	372	Cross-sectional	Atwal	There was a clinical relationship between TSS and perineal trauma, but the relationship was not statistically significant ( $p=0.634$ ).	13
Patel <i>et al.</i> (2019) <sup>[36]</sup>	394	Cross-sectional	Atwal	There was a significant relationship between perineal trauma and severity of striae gravidarum ( $p<0.001$ ).	13
Abbas <i>et al.</i> ** (2019) <sup>[31]</sup>	421	Cross-sectional	Atwal	The rates of perineal trauma were significantly higher in women with moderate to severe striae (TSS $\geq$ 12) than women with mild striae (TSS $\leq$ 12) ( $p<0.001$ ). TSS was significantly higher in women who experienced the perineal trauma than those without it ((mean (SD) 17.07 (3.56) vs. 7.93 (6.94), $p<0.001$ ).	8
Banu <i>et al.</i> (2019) <sup>[30]</sup>	189	Cross-sectional	Atwal	There was a significant relationship between perineal trauma and striae gravidarum ( $p<0.001$ ). The prevalence of perineal trauma was higher in individuals with moderate to severe striae than those with mild striae (43.40% vs. 11.60%).	12

\*Total Striae Score \*\*Although this study was presented in the form of an abstract as a poster, it contained the information we needed

trauma were directly related to the severity of striae gravidarum so that with increasing TSS, the degree of perineal rupture and its prevalence increases and the rate of perineal trauma was higher in individuals with moderate to severe striae than those with mild striae or without striae. Results of this meta-analysis and two studies by Sereshti *et al.* (2013)<sup>[18]</sup> and Wahman *et al.* (2000)<sup>[26]</sup> in the

systematic review also confirmed the relationship between perineal trauma and striae gravidarum.

Bhujabal *et al.*<sup>[41]</sup> (2019) examined the relationship between striae gravidarum and perineal trauma in primiparous women and the relationship was clinically significant, but not statistically significant, which is probably due to the

**Table 2: Pooled risk estimates for perineal trauma and heterogeneity analysis**

Scenario	No. of studies	OR (95% CI)	P
1	3	8.28 (2.49-27.54)	86.64%
2	2	1.04 (1.02-1.06)	0.08%
3	2	13.77 (1.87-101.49)	92.89%

fact that the research population consisted of primiparous pregnant women. In the study by Halperin *et al.*<sup>[27]</sup> (2017), who examined the relationship between the severity of striae gravidarum and severe perineal trauma (grades 3 and 4), the relationship was not significant, which may be due to the fact that the anal sphincter injury was associated with many factors; and striae gravidarum, which indicated the amount of collagen, was one of those factors. In their study, 80 individuals with severe perineal trauma were examined for striae gravidarum, but if they examined the severe perineal trauma in those with and without striae, the relationship could be significant. In this study, there was a significant relationship between severity of striae gravidarum and severity of anal sphincter injury ( $p = 0.025$ ), which is consistent with other studies in this systematic review and meta-analysis.

In the study by Omidi *et al.*<sup>[42]</sup> (2018), who examined the relationship between severity of striae gravidarum and premature rupture of membranes, it was reported that there was a relationship between severity of striae gravidarum and premature rupture of membranes, and the number of individuals with severe striae and premature rupture of membranes was higher than those with mild to moderate striae. Results obtained in this study were consistent with the present study probably due to the common mechanism of striae gravidarum formation, perineal trauma, and premature rupture of membranes.

Kurt *et al.* (2014)<sup>[43]</sup> and Mirrane *et al.* (2019),<sup>[44]</sup> who examined the association between striae and pelvic organ prolapse, reported striae as a predictor of pelvic organ prolapse, and individuals with prolapse of the pelvic organs were more likely to have striae than those without prolapse. Vulic *et al.*<sup>[45]</sup> (2011) also reported a reduction in collagen expression in the uterosacral ligament of individuals with pelvic organ prolapse. The consistency of the results of the above three studies with the results of this systematic review and meta-analysis was probably due to the similar physiopathology (reduction of tissue elasticity) of striae formation, pelvic organ prolapse, and perineal trauma.

Cakir Gungor *et al.*<sup>[46]</sup> (2014) conducted a study with an aim to determine the predictive value of striae gravidarum on intra-peritoneal adhesions and uterine scar thickness in women with a previous cesarean section. The results indicated that intraperitoneal adhesions and uterine scar thickness were higher in individuals with severe striae than those with mild or no striae. The consistency of these results with the results of this systematic review and

meta-analysis was due to changes in elastin and collagen in individuals with striae<sup>[24]</sup> and the protective effect of elastin on intra-peritoneal adhesions.<sup>[47]</sup>

The present study was the first systematic review and meta-analysis of the association between perineal trauma and striae gravidarum. In the present study, there was no linguistic and time limit, and we searched our keywords in various databases and thus it was tried to examine all the articles in this field. The research limitations included different methods of reporting the results and tools in the studies included in the systematic review, which did not allow the meta-analysis of every ten articles included in the systematic review. Also, among the six studies which were meta-analyzed, three studies were statistically analyzed together and another three studies were analyzed in two binary reviews due to different populations and different reported results as mentioned in the “materials and methods” and “results” sections of the present study.

## Conclusion

The research results indicated that increasing Total Striae Score (TSS) enhanced the risk of perineal trauma. The probability of perineal trauma was higher in individuals with moderate to severe striae than those with mild or without striae. This association is due to the similar mechanism of perineal trauma and striae gravidarum, which is poor skin elasticity. Therefore, we suggest evaluating TSS in the third trimester of pregnancy as a simple and noninvasive method to predict the risk of perineal trauma during vaginal delivery. After identification of women at risk of perineal tears, some supportive measures such as episiotomy, perineal massage before delivery and during the second stage of labor as well as using warm compress during the second stage of labor are recommended to reduce these injuries.

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## Conflicts of interest

Nothing to declare.

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