

# Pregnancy and predisposition to striae: correlation with the skin's biomechanical properties

*Gestação e predisposição ao aparecimento de estrias: correlação com as propriedades biomecânicas da pele*

## ABSTRACT

**Introduction:** Striae in pregnancy are caused by the rupture of collagen and elastic fibers, due to the distension of the skin. The dermal structures that allow the skin to expand – being responsible for the biomechanical properties of the skin such as firmness and elasticity – when ruptured, cause striae. Since pregnancy seems to change these properties in order to facilitate skin distension, there is a correlation between those parameters and the occurrence of striae during pregnancy.

**Objective:** To investigate the correlation between the occurrence of striae and the skin's capacity to increase its elasticity.

**Methods:** Skin firmness and elasticity was measured with a Cutometer MPA 580® device in order to investigate the occurrence of striae in 60 pregnant women.

**Results:** A positive correlation between increased elasticity and the absence of striae was observed.

**Conclusions:** There is a possible correlation between the occurrence of striae and the skin's capacity to increase dermal elasticity.

**Keywords:** pregnancy; dermis; relaxin.

## RESUMO

**Introdução:** O aparecimento de estrias na gestação está relacionado à ruptura de fibras colágenas e elásticas, devido à distensão da pele. As estruturas dérmicas que promovem a distensão e se rompem causando o aparecimento de estrias são também as responsáveis pelas propriedades biomecânicas da pele, como firmeza e elasticidade. A gestação parece propiciar a modificação desses parâmetros, com a finalidade de facilitar a distensão da pele, gerando, portanto, correlação entre esses parâmetros e a possibilidade de formação de estrias durante a gravidez.

**Objetivo:** Detectar a correlação entre a ocorrência de estrias e a capacidade de aumentar a elasticidade dérmica.

**Métodos:** Foram acompanhadas 60 gestantes visando investigar o aparecimento de estrias, bem como medir a firmeza e elasticidade da pele com o equipamento Cutometer® MPA 580.

**Resultados:** Foi observada correlação positiva entre o aumento de elasticidade e a não ocorrência de estrias.

**Conclusões:** Existe possível correlação entre o aparecimento de estrias e a capacidade de aumentar a elasticidade dérmica.

**Palavras-chave:** gravidez; derme; relaxina.

## Original Article

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**INTRODUCTION**

Pregnancy striae (*striae gravidarum*) are a common physiological occurrence that occurs in up to 90% of pregnant women, with variable extension and intensity, and is sometimes disfiguring. The occurrence of striae in pregnancy is a multifactorial phenomenon, possibly linked to some constitutional predisposition, the amount of gain of weight, and age.<sup>1,2</sup>

Striae are linear lesions that are initially rose-coloured, and flatten over time and develop a pearlescent appearance. The number of lesions, as well as their width and length, can vary considerably – even in different pregnancies of the same patient. In the initial phase, local itching, possibly related to dermal inflammation, is commonly reported.<sup>3</sup> While more common in the abdomen, striae can also occur in the breasts, axillae, gluteus, and internal inguinal area and thighs, mainly in the last trimester, when the skin reaches its maximum degree of distension rapidly.

There are few studies on the condition’s physiopathology; Cordeiro and Moraes’ systematic revision<sup>4</sup> of striae demonstrates that the mechanical factor is the most studied. The occurrence of striae, however, seems to primarily involve the dermal connective tissue, where the cleavage and separation of collagen fibers take place.<sup>5</sup> The objective of this study is to measure the possible correlation between the skin’s distension capacity and the occurrence of striae .

**METHODS**

This was an observational, transversal, descriptive, and comparative study of 60 primiparae with no previous history of abdominal striae. These patients were invited to take part in the study at the end of their first trimester (14 6 2 weeks), and were followed up until the end of the third trimester, just before the birth (37 6 2 weeks). Patients without prenatal follow up, with hormonal pathologies, or those using oral or topical corticosteroids, or any other type of hormone were excluded. Data were collected after the approval of the independent ethics committee, by interview and physical pre-examination, after the term of free and informed consent was signed. The study was conducted between June 2008 and December 2009, in a private clinical research laboratory, in the city of Osasco, in São Paulo State, Brazil.

Firmness and elasticity were measured and evaluated at the end of the first and third trimesters (the latter being the final evaluation) using the Cutometer MPA 580 device (Courage + Khazaka electronic GmbH, Köln, Germany).<sup>6</sup> This equipment employs a standard suction pump and software to determine the resistance to the stimulus (firmness) and the speed of return to the previous state after suction (elasticity). Each patient was measured three times; the simple mean of such measurements was used in the study.

The cutometric measurements were collected from two standardized and previously delimited areas: one that was expected to distend (abdomen, inferior right quadrant), and another (internal face of the right forearm) for control purposes.

Patients were instructed not to apply any type of topical product on the areas being evaluated. They were, however, allowed to use a control emulsion – with no active ingredients – on the remaining areas of the skin, to avoid discomfort resulting from possible dryness.

**RESULTS**

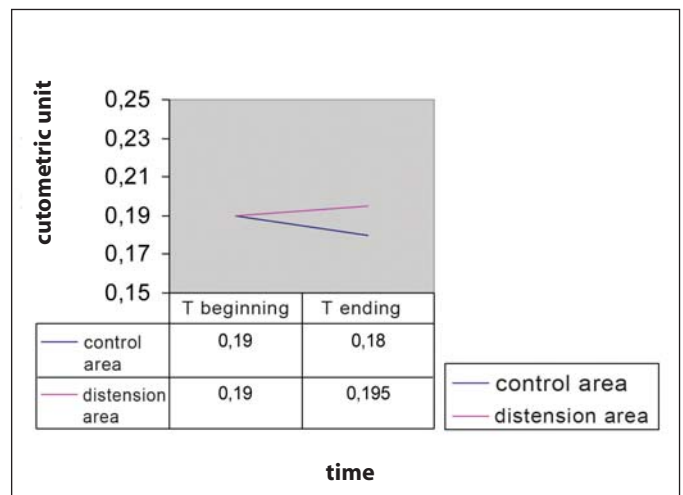
Of the 60 pregnant women that were selected and followed up, 56 completed the study. Three patients could not attend the final measurement appointment, and another was disqualified after being instructed to ingest corticosteroids. All volunteers received prenatal care and gave birth to a single child. None of the volunteers presented weight gain that was considered excessive by the assistant obstetrician. Patients' ages ranged from 20 to 31 years (mean 25.03 years).

To assess the correlation between the occurrence of striae and the firmness and elasticity parameters, the 56 volunteer pregnant women were divided into Group 1 (44 (78.5%) patients who did not develop striae during the study period) and Group 2 (12 (21.4%) patients who were clinically evaluated in the final visit with striae). There was no significant between group difference in ages (mean 24.9 and 25.13, respectively).

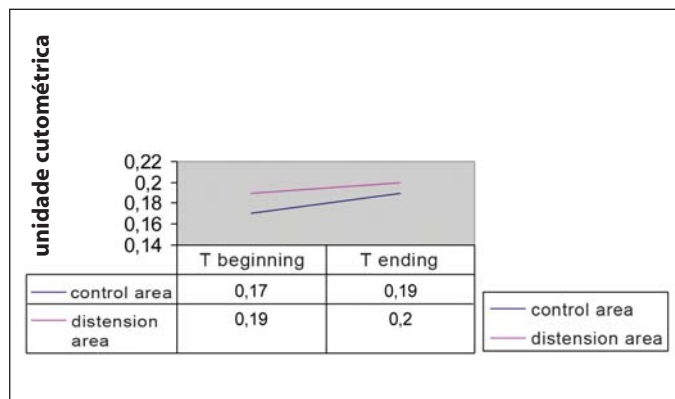
**FIRMNESS**

The parameter firmness (R0 in the Cutometer) was evaluated according to the ease with which the skin yields to the device’s suction – the more the skin yields to the equipment’s suction force, the less firm it is, and the greater the value of the measurement. As a consequence, lower values correspond to a higher firmness.

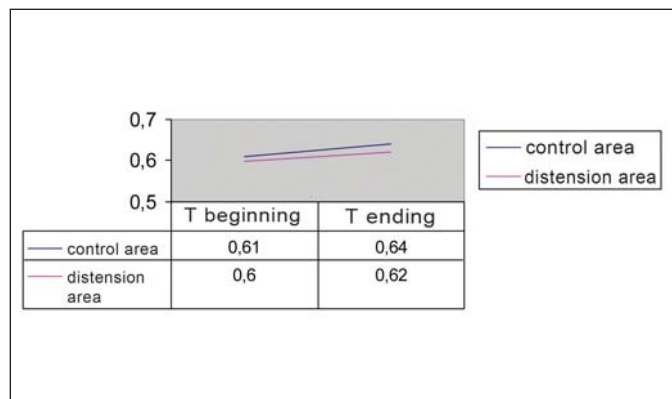
Graph 1 displays the firmness measurements collected in the initial and final visits in the control and distension (abdomen) areas for Group 1. Although firmness increased slightly in the control area and decreased in the distension area, there was not a significant difference over time or between the areas analyzed ( $p < 0.05$ ).



Graph 1 – Firmness: measurements evolution (Group 1)



Graph 2 – Firmness: measurements evolution (Group 2)



Graph 4 – Elasticity: measurements evolution (Group 2)

Graph 2 shows the firmness measurements of the control and abdominal areas for Group 2. A slight reduction in firmness in both areas was observed over time, however the change was not statistically significant. No differences between the groups were verified.

**ELASTICITY**

The parameter elasticity (R7 in Cutometer) represents the distensibility of the skin. Higher values represent more elastic skin. Graph 3 presents the results over time for the control and distension areas. The elasticity measurements increased significantly in both areas, according the student t test ( $p < 0.05$ ); the mean increases were 19.8% and 17.7% in the control and distended areas, respectively. There was no significant difference between measurements in those areas.

Graph 4 shows the elasticity measurements for Group 2. There was an increase in elasticity in both areas over time (4.7% in the control area and 3.3% in the distended area), however no statistical significance was verified ( $p < 0.05$ ).

Therefore, Group 1 (*without striae*) maintained the same measurements for firmness and increased elasticity measure-

ments during the study period, with no difference between the control and distension areas. In Group 2 (with striae) firmness measurements behaved similarly, with no significant variation, while elasticity measurements increased – not significantly – as they did in Group 1.

**DISCUSSION**

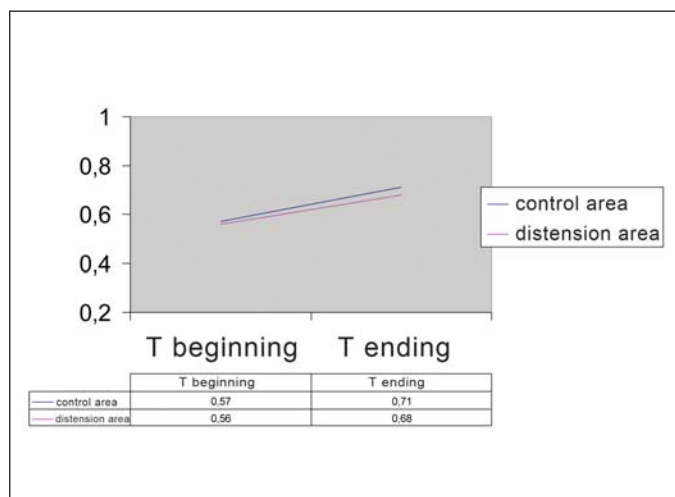
Striae result from the distension of the fibers of the dermal connective tissue. However, not all pregnant women present striae – and in those who develop the condition, the quantity and size vary considerably, even in women with a similar history of weight gain.<sup>7</sup> These facts suggest that the skin’s capacity to distend without tearing – which can be defined as elasticity – is a decisive factor for the occurrence of the striae.

Several factors, such as weight gain during pregnancy, weight of the newborn and the pregnant woman’s age group, have been linked to the occurrence of striae; older women have been found to develop striae less frequently.<sup>8</sup>

In 1974, Liu<sup>4</sup> described the possible role of relaxin, combined with corticosteroids and estrogen, in the formation of striae. This association would increase the proportion of mucopolysaccharides, the retention of which would act in the tension among collagen fibers, causing the cleavage of the latter. A recent study of 32 pregnant women found that the occurrence of striae in pregnant women seems to be linked to lower serial levels of relaxin, which would interfere in the reduction of the elasticity of the connective tissue and, consequently, in its rupture.<sup>9</sup>

Relaxin is the generic name for a group of hormones produced during pregnancy that relate to the softening of the pubic symphysis and the inhibition of uterine contractions, and interfere in collagen synthesis. A study with mice demonstrated that the presence of relaxin modulated the catabolism of collagen during pregnancy.<sup>10</sup> Other important pregnancy hormones – such as glucocorticoids – also seem to have some role in the formation of striae.

A recent study has demonstrated a significant increase in the expression of receptors for glucocorticoids, estrogens, and androgens in areas of the skin presenting striae compared with



Graph 3 – Elasticity: measurements evolution (Group 1)

normal skin, in individuals who are not pregnant.<sup>11</sup> The role of glucocorticoids in the formation of striae is classically linked to an antiproliferative effect, inhibiting the formation of collagen and potentiating the atrophy after the inflammation.<sup>12</sup>

## CONCLUSIONS

Although the sample size in this study did not allow between group comparisons, the evaluation of the women who did not develop striae suggests a greater capacity for cutaneous distension based on elasticity measurements. The capacity to increase elasticity seems to be present in the whole tegument – in both the distended and control areas. These data are corroborated by studies that demonstrate higher levels of relaxin, a hormone associated with the distensibility of the connective tissue during pregnancy. ●

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