

# Commentary on cellulite: skin mechanobiology and the waist-to-hip ratio

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## Summary

Cellulite is a gender-related condition which is the clinical expression of conformational changes taking place in the fibrous strands partitioning the hypodermis. The affected skin areas are those where fat deposition is under the influence of estrogens. Some hypodermal fibrous strands become enlarged and others become loose and look similar to striae distensae. Cellulite is not a result of increased body mass, but its aspect may be influenced by the waist-to-hip ratio.

*Keywords:* cellulite, hypodermis, woman

## Introduction

Criteria of beauty and attractiveness may be difficult to define. Many of the characteristics vary according to ethnicities, civilizations, cultures, social groups, and individual perception of the ideal body image. Among the identified criteria is the waist-to-hip ratio.<sup>1–3</sup> It reflects the distribution of fat in the lower body relative to the amount of abdominal fat. In Caucasian women, the waist-to-hip ratio ideally ranges between 0.6 and 0.8.<sup>1</sup> These values are perceived as more attractive compared to figures depicting other waist-to-hip ratios. Beauty also requires smooth skin without any hint of genuine cellulite.

Cellulite is a physiological gender-linked condition. It is reported by many women who may psychologically suffer from the lumpy and dimpled aspect of the thighs, hips, and buttocks. Estrogens largely influence the anatomical accumulation and enlargement of adipocytes in women. As such, this hormone family is believed to play a key role in the development of cellulite.

## Genuine cellulite

Genuine cellulite in its incipient presentation is barely spontaneously visible. It is only recognized by a padded or “orange peel” aspect demonstrable by the pinch test.<sup>4,6,7</sup> Such a condition represents a gender-typical feature of the skin that may occur even when the waist-to-hip ratio is in the ideal range. However, a prominent gynoid aspect with reduced waist-to-hip ratio, or, conversely, overweight and obesity with increased waist-to-hip ratio may be additional features interfering with the global perception of the body image.<sup>4–6</sup>

Full-blown genuine cellulite is characterized by a mix of irregular dimpling and lumpy-bumpy cutaneous cobbles. It looks distinct from incipient cellulite on gross inspection of the skin. There is, however, clinical evidence that full-blown cellulite is related to the incipient cellulite condition, and there seems to be a spectrum of intermediate aspects between the two.<sup>4,7</sup> The areas where dimpling is evident are highly variable depending on the position of the individual lower extremity.<sup>5,6,8</sup> Body postures compressing the adipose tissue in a given area usually enhance the dimpling in that same area.

## Skin structure alterations in cellulite

Noninvasive skin imaging generally shows extrusions of adipose tissue into the dermis of affected women.<sup>9</sup> The

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standing lobules, called papillae adiposae, rise into pits and dells at the undersurface of the dermis.<sup>4,7</sup> They are typically seen in women,<sup>7</sup> but this undulating pattern of the dermo-hypodermal junction is not restricted to the areas of cellulite.<sup>10</sup>

Histological studies of cellulite are few but contradictory.<sup>4-7,10-12</sup> Globally, we view cellulite as the result of a combination of the gender-related dimorphism of the hypodermal connective tissue and the mechanobiological effects of tissue tensions inside this tissue.<sup>4</sup> The regional accumulation of fat in women's thighs induces vertical stretching of both the superficial fat lobules and their partitioning connective tissue strands. The unremitting hypodermal pressure likely participates in the modelling of the dermo-hypodermal interface. The outpouching of adipocytes into the thin hypodermal funnels normally present at the base of sweat glands could be at the origin of the formation of some papillae adiposae. The presence of incipient cellulite, even in very slender women, reflects this typical adipose tissue's conformational changes.

The standing uppermost fat lobules are probably enlarged during progression to full-blown cellulite. The size of the clinically perceived changes is far larger than that of single papillae adiposae. Indeed, any external compression forces the bulging of clusters of papillae adiposae and causes the overlying skin to protrude. The bumpy appearance of the skin surface results from the alteration of the network of connective tissue strands normally tethering the dermis to the deeper layers.<sup>7</sup> Some strands are enlarged and fibrosclerotic<sup>4,7</sup> whereas other strands become loose. At the latter sites, edema and deposits of proteoglycans may be present in association with alterations in the shape and pattern of distribution of the elastic fibers.<sup>4,7</sup> Such histological changes found in the hypodermis of cellulite are reminiscent of the dermal changes found in striae distensae.<sup>4,7,12</sup>

## Conclusion

Cellulite is a physiological condition that is much more prevalent in women than in men. Obviously, this physical feature has a negative impact on the perception of beauty. In the general population, there is some confusion and overlap between genuine cellulite and a waist-to-hip ratio outside the range perceived as an attractive physical trait.

Incipient cellulite recognized by a discrete padded look appears correlated with the presence of a network of focally enlarged fibrosclerotic strands partitioning the

hypodermis and serving as a physiological buttress limiting the outpouching of fat lobules on pinching the skin. This condition might represent a hormonal-dependent reactive process to sustained mechanical tensions caused by enlarging adipocyte lobules. Full-blown cellulite is recognized by a lumpy-bumpy and dimpled skin surface. It likely represents subjugation of the hypertrophic response of the hypodermal fibrous strands when their resistance is overcome by progressive fat accumulation. Histological aspects are then reminiscent of striae distensae within the hypodermal fibrous strands. Thus, mechanobiology plays a prominent role and the process is influenced by, although not directly dependent, on the waist-to-hip ratio.

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