

Can Pilates Exercises and Diet Reduce the Appearance of Cellulite?

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BASI CTTC 2018
Windhoek, NA
23 April 2019

Abstract

At least 80% of women worldwide are affected by cellulite to some degree. Despite the statistics, a limited number of research papers have been published on this topic. There was little done to find an effective solution.

There is a variety of treatments currently available, but none of them conclusively proven to be effective in the long run.

Still there is no consensus between scientists and cosmetologists on the understanding of what cellulite is, its causes, classification and treatments. However, some do agree on the factors that might aggravate this condition and steps taken in slowing it down.

Those who claim to be able to reduce the appearance of cellulite had addressed the issue for about 2 years through diet and physical activities.

My question is - can Pilates exercise program built according to the BASI Block System together with the correction of diet reduce appearance of the cellulite?

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What is cellulite?

Cellulite is an alteration of the skin architecture, accruing mainly in women's buttocks, hips and thighs, sometimes in the lower abdominals [3, 7, 15] and upper arms. [5] Cellulite is different to cellulitis, which is an inflammation of the adipose tissue. [11] It is characterised by a padded or dimpled look of the skin, resembling an "orange peel". [3, 6] Although cellulite is not a disease [2, 5] and considered a normal physiological condition [3, 4, 8], at some stages it can cause a discomfort and even pain. [7, 16]

The term "cellulite" first appeared in 1920s. [7] Today, among other names, it's also called "gynoid lipodystrophy", "nodular liposclerosis", "oedemato-fibrosclerotic panniculopathy". [7, 11]

Cellulite can begin to affect women from adolescence onward [7], irrespective of race [8]. At least 80% of woman suffer from this condition worldwide. [8, 10, 11] A small number of studies is available on the topic with opposing conclusions on understanding the aetiology of this condition. [4, 6, 9] While the reasons for developing cellulite are still debated, there are observations that may help in understanding this condition.

Although cellulite is not caused by obesity, incipient amount of cellulite is present even in lean women [6, 9], nevertheless weight gain makes its appearance more obvious. [5, 6, 9]

Figure 1 shows that subcutaneous adipose thickness layer (inner layer) is similar between women without cellulite and men, but much thicker in women with cellulite.

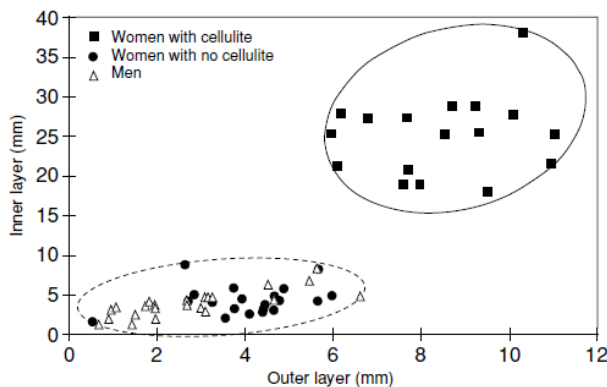


Figure 1 New characteristic marker of cellulite. Magnetic resonance imaging shows that women with cellulite have a much greater increase in the thickness of the deep inner adipose layer compared with women without cellulite or men. From Querleux et al. [13].

In Figure 2 a schematic diagram explains how the appearance of the skin is changed by indentations of the subcutaneous adipose tissue lobules from hypodermis into the dermis.

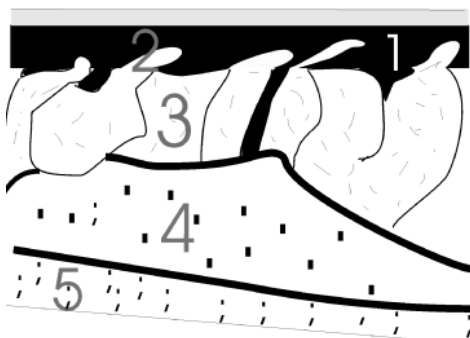


Figure 2 A schematic diagram of skin structure showing five zones. The grey layer is the surface of the skin called epidermis. Zone 1 is the dermis. Zone 2 is the extrusion of the hypodermis into the dermis. Zones 3-5 are the upper, middle, and lower parts of the hypodermis. From Mirrashed et al. [12].

Figure 3 below highlights a possible correlation between the thickness of the hypodermis and cellulite grade.

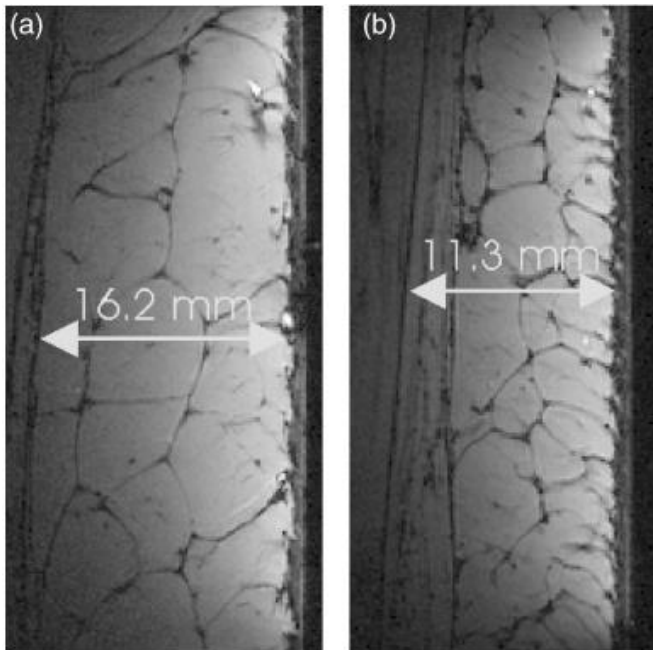


Figure 3 Skin of two females both from low BMI group: (a) cellulite grade = 2.5, hypodermis 16.2 mm; and (b) cellulite grade = 0.0, hypodermis 11.3 mm. From Mirrashed et al. [12].

A number of approaches exist to describe stages and types of cellulite. It can be classified by grade. Below is a grade scale used by Perin.

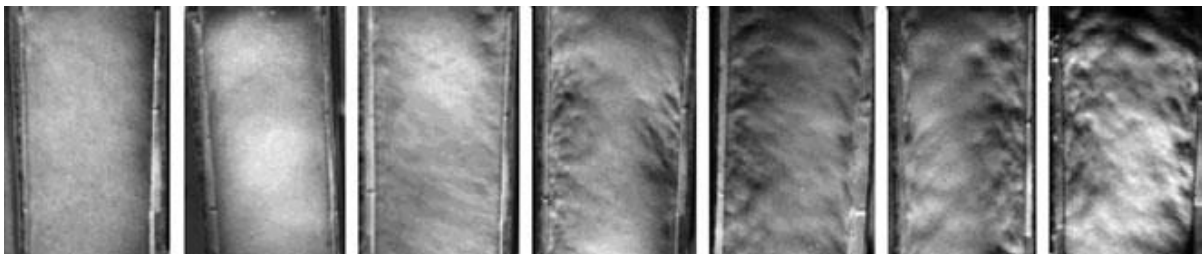
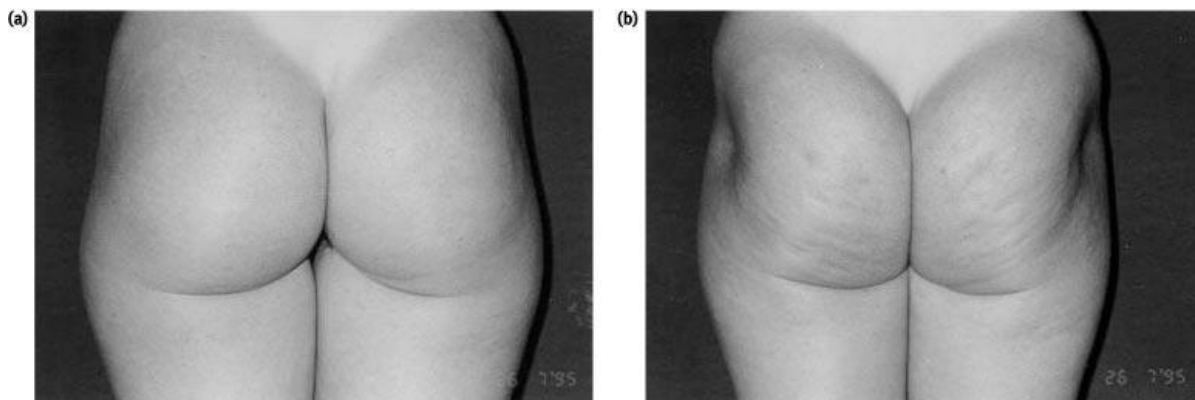
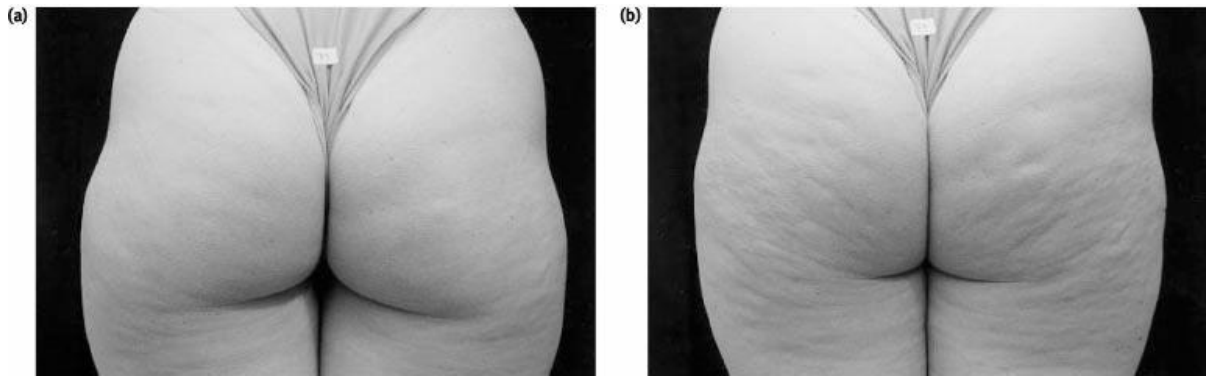


Figure 4 Photonumerical scale representative of the different grades of cellulite on compressed thighs: from no cellulite (left) to very severe signs of cellulite (right). From Perin et al. [1].

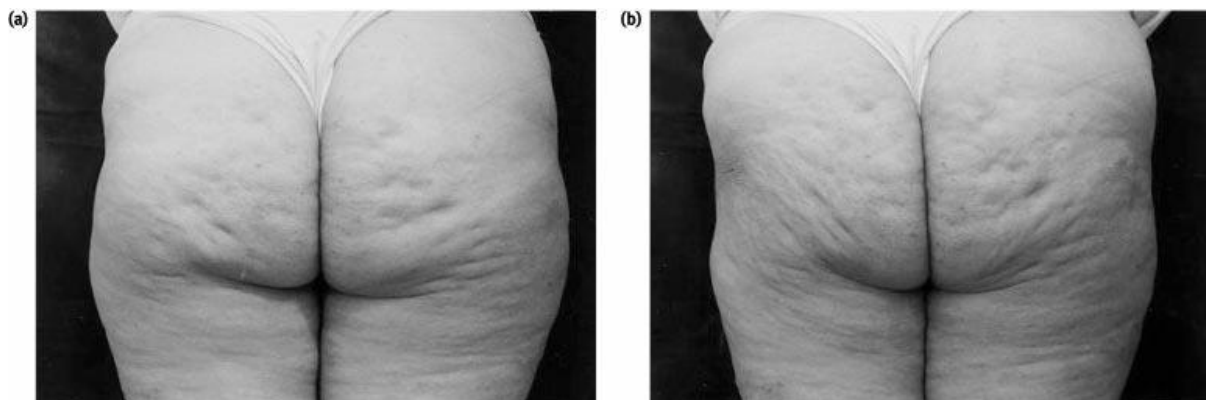
Rossi and Vergnanini used a four grade classification. In Grade I there are no clinical alterations [7].



Grade II (a) at rest and (b) after gluteal contraction From Rossi and Vergnanini [7].



Grade III (a) at rest and (b) after gluteal contraction. From Rossi and Vergnanini [7].



Grade IV (a) at rest and (b) after gluteal contraction. From Rossi and Vergnanini [7].

Rossi and Vergnanini further classified cellulite by skin pattern into hard, flaccid, oedematous and mixed. [7] Hard cellulite is most common among teenagers who perform regular physical activities. It looks firm and compact, and shape is consistent in different positions, for example in standing or lying. When the skin is pinched, the padded appearance is obvious.

Flaccid cellulite is observed in women who are physically inactive and in women who suddenly lost weight. It is common after age 40 and is associated with decreased muscle tone. The “orange peel” appearance is evident and changes according to different positions of the body.

Oedematous cellulite establishes when the volume of the whole lower limb is increased, and the deformation of the skin caused by fingertip palpation stays even after the finger is removed. It is accompanied by heaviness and soreness in the legs. Although being a rare type, it is also the most severe.

Generally, a same woman will have a mixed type of cellulite, when more than one of the above patterns is present.

Very little progress has been made by medical science in finding an effective solution. [4] Different cellulite treatments are currently available ranging from surgical to topical and oral [3, 4, 9], however their efficacy has not been proven in the long run. [5, 9, 11, 15]

A few factors thought to aggravate the appearance of cellulite: hormonal changes [10, 16], age [8, 16], genetics [8, 10,16], diet [7, 8, 10, 16], sedentary lifestyle [8] and lack of movement [10, 16], excess weight [8, 16], quick gain and loss of the weight [16], stress [8, 10, 16], excessive consumption of coffee and alcohol [8] and poor blood circulation. [4, 16]

It is suggested that although cellulite can't be completely eliminated, it is possible to slow down its development and reduce its appearance. Better still, not to let cellulite progress from one stage to another. [16] It is advised to address the problem with a multi-disciplined program, which includes increasing regular physical activities and correcting diet as an initial step. [5, 10, 14, 16] Further it is suggested to incorporate other treatments like massage [5, 10, 16, 25] and dry brushing [14] in order to improve blood circulation in the problematic areas. Among recommended physical activities mentioned brisk walking [16], cycling [14, 16], hiking [14], running [14, 16], playing tennis and volleyball, jogging and aerobics [16]. A few agree that a combination of diet and regular exercise could help in treating the condition [3, 9, 10, 14, 16, 25,], however diet alone will not be successful. [16]

Regarding specific diet recommendations there are different opinions. One study proposed to exclude all processed foods, reduce intake of alcohol and coffee and increase intake of fruit, vegetables and fish, eat grains cooked with water, legumes and plant based oils. [16] Another study suggested to follow a protein-rich, low carbohydrate, and low-fat diets. [14] Some insist on following a low-calorie diet [5] and others suggest that a plant based diet could be beneficial. [26]

One of the studies established that women with cellulite have less of the hormone "adiponectin" in the affected areas compared to women with no cellulite. Switching to a vegetarian diet seems to increase the level of adiponectin by up to 19%. Further it was proposed that a plant based diet could potentially help treating cellulite due to its ability to decrease subcutaneous fat, however this supposition has not yet been tested. [26]

Those who claim to achieve significant improvement in appearance of cellulite with correction of the diet and increasing physical activities have been treating the condition for about 2 years. [16, 25]

Case study

I used myself in this case study. Firstly because I have cellulite, which encouraged me to start exercising regularly to begin with. Secondly, I believe that if it is possible to reduce the appearance of cellulite through diet and exercise, the change will not happen overnight. It would require a lot of dedication and motivation, ability and availability to adopt, probably, a completely new lifestyle over a prolonged period of time.

This case study started in February 2018 and continues until today, April 2019. It included Pilates sessions, correction of the diet and full body dry brushing. No other topical, manual or oral treatments were used. I have never addressed the condition prior to this attempt.

At that time I was 34 years old, slim but physically unfit (BMI 19.3, body fat about 25%)¹. My weight was always quite consistent and I was never overweight. First signs of cellulite were notices at the age of 16, which gradually became more obvious in my 20s. It then worsened in my late 20s and further more in my 30s. Cellulite affected thighs and buttocks. On the front area of the left thigh there is a large padded patch of approximately 13cm x 8cm, big and small dimples are clearly visible during a slight contraction of the muscles. On the back and sides of the thighs, all the way down to the knees, the “orange peel” is evident without any contraction. The most affected area is buttocks, which shows deep padding of the skin in a relaxed position, approximately 2/3 of the area is affected.

There was no clinical evaluation, and I wouldn't be able to establish the grade of the cellulite, but it is most probably a mixture judging by a difference in the appearance and the depth of the dimples in different areas. Cellulite in all of the affected areas suits the description of the flaccid pattern, it could be a mixed pattern as well.

Throughout teens my physical activities were limited to about 2 hours a week of running and playing ball games during PT classes at school. In my 20s I had moderate physical activities involving walking and occasional gym classes. In late 20s and early 30s, I had mostly a sedentary lifestyle, with probably only 20 - 40 minutes walking a day and, when I had a chance, practicing yoga on an average 3-4 times a week. Before this experiment I had no regular physical activities for about 8 month, and was sitting for at least 12-14 hours a day at the office, while driving a car and at home.

First I adopted a Mediterranean diet with limited amount of animal protein, excluding dairy products and processed foods, as well as refined grains, alcohol and any kind of natural or artificial sweeteners. There were occasional cheat meals, no more than once a week. I gradually progressed into Whole Food Plant Based diet and eventually excluded all types of animal protein, eating fruits, vegetables, legumes and whole grains. Time spent sitting was significantly reduced during the year, so was the amount of stress.

Pilates sessions started with mat classes followed by a combination of equipment and mat sessions, working from fundamental through the advanced BASI repertoire. In total 70+

¹ Body composition analysis were provided by InBody 370

hours of mat and 220+ hours of equipment work, on average 5 hours of Pilates exercises a week. I began the program with mat sessions only due to my training: I started my Mat BASI Certification in February 2018 before joining BASI Comprehensive Training in September 2018.

My goal was to use BASI Block System to tone and strengthen the gluteal muscles and muscles acting on the hip joint (hip flexors, hip extensors, hip adductors and hip abductors), and increase the blood circulation through the movement. I tried to include in each session a variety of exercises with legs being raised to encourage more blood flow to the affected areas. I did not plan sessions solely around the Leg Work. Although at first I considered it to be possibly beneficial to spend more time working directly on the muscles of the areas affected by the cellulite. I quickly realised that many exercises in other BASI Blocks already include hip flexors, hip extensors, hip adductors and hip abductors in their Muscle Focus and / or Objectives. Further I encouraged additional activation of these muscles through cueing and sometimes by using assists. Keeping the pelvis in the correct position helped to avoid compensations and recruit targeted muscle more efficiently.

Diversity of the BASI repertoire allows to build a complete session around hip flexors, hip extensors, hip adductors and hip abductors while addressing the body as a whole.

I took Side Kick Kneeling exercise as an assessment tool to measure my fitness level progress (Muscle Focus: hip abductors; Objectives: Hip flexor control and stretch and Hip extensor control and stretch). In the beginning I was not able to lift my leg higher than ½ of the hip height, and struggled to hold the leg for more than a few seconds, thus was not able to swing it. These muscles were extremely weak.

Below are examples of the exercises used in Fundamental through Advanced Mat and Equipment sessions, which were built according to the BASI Block System while targeting relevant muscles and muscle groups. Additional cues were used to activate hip flexors, hip extensors and hip adductors, while the original Muscle Focus and Objectives² were kept and prioritised in the execution of each of the exercises without any alterations.

² Please refer to BASI Movement Analysis Workbooks by Rael Isacowitz mentioned in bibliography

Progressive full body Mat and Equipment conditioning program utilizing the BASI Block System for toning and strengthening thigh muscles and buttocks

Mat Fundamental Session		
BASI Block	Exercise	Relevant Muscle focus (M) / Objective (O) / Cue (C)
Foundation	Pelvic Curl	M: hamstrings; C: activation of the glutes at the top
	Spine Twist Supine	C: squeeze the legs together (hip adductors activation)
	Chest Lift	Yoga block or magic circle can be used between the knees to activate hip adductors
	Chest Lift with Rotation	Yoga block or magic circle can be used between the knees to activate hip adductors
	Leg Circles	C: maintain dorsi flexion for hamstring stretch, pull the kneecap to activate the quads
Abdominal Work	Hundred Prep	C: squeeze the legs together for hip adductors activation and lift kneecaps to activate the quads
	Roll UP	C: squeeze the legs together (hip adductors activation); lifting knee caps to activate quads
Spinal Articulation	Spine Stretch	O: hamstring stretch
Bridging	Shoulder Bridge Prep (Intermediate)	M: hamstrings; O: hamstring strength; C: activation of the glutes at the top
Leg Work (Comprehensive Program – Gluteals Side Lying Series)	Gluteals Side Lying Series (Side Leg Lifts; Forward and Lift; Forward with drops)	M: gluteus medius; O: hip abductor strength; C: maintain neutral spine and stability in the pelvis, and keep the leg and foot relaxed (to avoid compensation and load gluteus medius)
Lateral Flexion / Rotation	Side Lifts	C: squeeze the legs together (hip adductors activation)
Back Extension	Back Extension	

Mat Intermediate Session (additional exercises to the Fundamental session)		
BASI Block	Exercise	Relevant Muscle focus (M) / Objective (O) / Cue (C)
Foundation	Same as in Fundamental Session	
Abdominal Work	Hundred	C: activation of adductors by squeezing the legs together and quads by lifting the knee cap
	Double Leg Stretch	C: activation of adductors and quads
	Single Leg Stretch	C: activation of quads by reaching legs long and lifting the kneecap
	Criss Cross	
	Hamstring Pull 1	O: hamstring stretch
	Teaser Prep	C: activation of adductors
Spinal Articulation	Roll Over	O: hamstring stretch
	Open Leg Rocker	C: straighten the legs and reach long and away, activate quads
Bridging	Leg Pull Front	M: hip extensors; O: hip extensor control

	Shoulder Bridge Prep	M: hamstrings; O: hamstring strength
	Leg Pull Front	M: hip extensors; O: hip extensor strength
Leg Work (Comprehensive Program)	Sitting Series (Ankles; Below Knees; Above Knees)	M: hip adductors; O: hip adductor strength
Lateral Flexion / Rotation	Saw	M: hamstring; O: hamstring stretch
	Corkscrew	O: hip flexor control
	Side Kick	O: hip flexor / hip extensor control and strength
Back Extension	Double Leg Kick	O: hamstring control
	Swimming	O: hip extensor control
	Rocking prep	O: Hip flexor stretch / hip extensor control

Mat Advanced Session (additional exercises to the Fundamental and Intermediate sessions)		
BASI Block	Exercise	Relevant Muscle focus (M) / Objective (O) / Cue (C)
Foundation	Same as in Fundamental Session	See above
Abdominal Work	Teaser 1	O: hip flexor control
	Neck Pull	O: hamstring stretch
Spinal Articulation	Control Balance	M: hip extensors; O: hip extensor control
	Jack Knife	M: hip extensors; O: hip extensor strength
Bridging	Scissors	M: hip flexors / hip extensors; O: hip flexor / hip extensor control
	Bicycle	
	Shoulder Bridge	M: hamstring; O: hamstring strength / hip flexor control and stretch
Leg Work (Comprehensive)	Gluteals Kneeling Series (Hip Extension Bent Knee; Hip Abduction Bent Knee; Hip Extension Straight Leg)	M: hip extensors; O: hip extensor strength
	(Hip Abduction Bent Knee)	M: hip abductors; O: hip abductors strength
Lateral Flexion / Rotation	Corkscrew Advanced	O: hip flexor control
	Side Kick Kneeling	M: hip adductors; O: hip flexor / hip extensor control and stretch
Back Extension	Rocking	M: hip extensors; O: hip extensor control
	Swan Dive Prep	O: hip extensor control

Equipment Fundamental Session		
BASI Block	Fundamental Session	Relevant Muscle focus (M) / Objective (O) / Cue (C)
Warm Up	Fundamental WU: Pelvic Curl; Spine Twist Supine; Chest Lift;	Same as mentioned above

	Chest Lift with Rotation	
Foot Work	Reformer Foot Work	M: hamstrings / quadriceps; O: hip extensor strength / knee extensor strength
Abdominal Work	Reformer: Hundred	C: squeeze the legs together to activate hip adductors and lift kneecaps to activate the quads
	Auxiliary: Chest Lift	C: squeeze the legs together to activate hip adductors
Hip Work	Cadillac: Basic Leg Springs	M: adductors / hamstrings; O: adductor strength / hip extensor strength / hip adductor control / hip extensor control
Spinal Articulation	Reformer: Bottom Lift	M: hamstrings; O: hip extensor control
Stretches	Ladder Barrel: Gluteals	M: gluteals; O: gluteal stretch
	Hamstrings	M: hamstrings; O: hamstrings stretch
	Adductors	M: adductors; O: adductor and hamstring stretch
	Hip Flexors	M: hip flexors; O: hip flexor stretch
Full Body Integration F/I	Reformer: Scooter	O: hip extensor control and strength, knee extensor control and strength
Arm Work	Ped-A-Pul Series by Cadillac	C: bend the knees, tuck pelvis slightly and hold the body still while working the arms to activate leg muscles
Leg Work	Wunda Chair: Leg Press Standing	M: hamstrings; O: hip and knee extensor control
Lateral Flexion / Rotation	Auxiliary: Side Lift	C: keep reaching top leg away activating the leg muscles
Back Extension	Ladder Barrel: Swan Prep	C: squeeze legs together to activate adductors, keep the legs strong and activate glutes

Equipment Intermediate Session		
BASI Block	Fundamental Session	Relevant Muscle focus (M) / Objective (O) / Cue (C)
Warm Up	Intermediate WU: Roll Up; Spine Twist Supine; Double Leg Stretch; Single Leg stretch; Criss Cross	Same as mentioned above
Foot Work	Wunda Chair Foot Work	M: hamstrings / quadriceps; O: hip extensor control / knee extensor strength
Abdominal Work	Reformer: Abdominals Legs in Straps Series (Double Leg, Double Legs with Rotation)	O: hip flexor strength
Hip Work	Reformer: Extended Frog, Extended Frog Revers)	M: hip adductors; O: hip adductor stretch and strength
Spinal Articulation	Reformer: Short Spine	O: hamstring stretch

	Long Spine	M: hamstrings; O: hip extensor control
Stretches	Reformer: Hamstring Stretch Group (Kneeling Lunge)	M: hip flexors / hamstrings; O: hip flexor and hamstring stretch
Full Body Integration F/I	Cadillac: Sitting Forward Thigh Stretch with Roll Up Bar	O: hamstring stretch M: quadriceps; O: quadriceps stretch and strength
Arm Work	Cadillac: Arm Standing Series	C: activate leg muscles and glutes
Full Body Integration A/M	(Intermediate) Reformer: Up Stretch Group (Long stretch)	C: activate leg muscles and glutes
Leg Work	Reformer: Single Leg Skating	M: gluteus medius; O: hip abductor strength, knee extensor strength
Lateral Flexion / Rotation	Reformer: Short Box Group (Side Over on Box)	C: reach the top leg long and away, keep leg muscles active
Back Extension	Avalon: High swan	M: hip extensors; O: hip extensor strength

Equipment Advanced Session		
BASI Block	Exercise	Relevant Muscle focus (M) / Objective (O) / Cue (C)
Warm Up	Intermediate WU	Same as mentioned above
Foot Work	Cadillac Foot Work Hip Opener	M: hamstrings; O: hip extensor strength and stretch / knee extensor strength; M: hip external rotators; O: hip external rotator control/ adductor control and stretch / hip extensor control and stretch
Abdominal Work	Cadillac: Breathing with Push Through Bar Teaser 1	C: squeeze legs together to activate adductors O: hip flexor control
Hip Work	Cadillac: Single Leg Supine Series (Frog; Circles; Hip Extension; Bicycle)	M: hamstrings / adductors; O: hip extensor control / knee extensor control / adductor control / hip extensor strength
Spinal Articulation	Wunda Chair: Jack Knife	O: hip extensor control; C: activate adductors; when reaching legs towards the ceiling activate leg muscles
Stretches	Reformer: Hamstring Stretch Group (Full Lunge)	M: hip flexors / hamstrings; O: hip flexor and hamstring stretch
Full Body Integration F/I	Reformer: Stomach Massage Series (Round Back, Flat Back, Reaching)	O: knee extensor strength; C: keep squeezing the heels together to activate adductors

Arm Work	Reformer: Arm Sitting Series	C: while keeping the back straight and engage the legs by pressing the back of the knees into the carriage
Full Body Integration A/M	Reformer: Long Back Stretch	O: hip extensor control
Leg Work	Wunda Chair: Lunge Group (Forward Lunge)	M: hamstrings; O: hip extensor, hip abductor and knee extensor strength
Lateral Flexion / Rotation	(Intermediate) Ladder Barrel: Side Overs	C: keep bottom leg engaged
Back Extension	Cadillac: Hanging Back	C: engage leg muscles and glutes

Conclusion

After about 14 months of regular Pilates exercises, following a mainly plant based diet and occasional full body dry brushing it is safe to say that there is a definite reduction in the appearance of cellulite on my skin.

There was a slight decrease in BMI from 19.3 to 18.3, and a drop in the body fat from 25% to 16.9%.³ These measurements may not be 100% precise, however there was probably some reduction in the percentage of the body fat.

The padded patch on the front area of the left thigh has been reduced from about 13cm x 8cm to about 5cm x 2cm. There are now a few shallow dimples which are visible only when the muscles are in intense contraction.

The skin on the back and sides of the thighs appears much smoother. I would say it looks uneven rather than padded, as it was before.

The size of the area affected on the buttocks has been significantly reduced. A number of deep and shallow dimples are visible on the 1/3 of the area during contraction. The cellulite is not that apparent when the muscles are relaxed.

Despite the “orange peel” still being visible in all the affected areas when the skin is pinched, the improved appearance of the skin and reduction in visible cellulite on my body is obvious to me.

Today when performing the Side Kick Kneeling, I am able to lift my leg in line with the hip. There is a small drop in the height accruing while swinging the leg forward and back. My hip abductors, hip flexors and extensors are much stronger now.

Again, there was no clinical assessment done to establish the degree of the condition, neither was a precise scientific analysis conducted to conclude the effectiveness of the treatment. If I was to measure the improvement according to my own scale, I would say that I come from being highly conscious of the problem and extremely uncomfortable wearing clothes higher than knee length. Today I am quite confident wearing a bikini on the beach.

³ Body composition analysis were provided by InBody 370

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