Cellulite Study –
The Efficacy of Masai Barefoot Technology as an Auxiliary Therapeutic Measure for Cellulite.

A study carried out in collaboration with

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1. INTRODUCTION

1.1. Background

Women everywhere are talking about cellulite. 80% of women suffer from this condition, also known as orange-peel skin (www.lipoclinic.ch/cellulite/cellulite.htm; 20050531). Cellulite is a weakness of the connective tissue that appears on the legs, upper arms and hips (www.gesundheitkompakt.de/126.html, 20050531). There is an increase in fat cells in the subcutaneous fatty tissue, accompanied by an increased fluid content in the bundle-shaped fat cell nests, which are pushed upwards through the slackened connective tissue (www.lipoclinic.ch/cellulite/cellulite.htm, 20050531). There are visual changes in the form of what is called the mattress phenomenon (orange-peel skin) and dimples. Due to their looser connective tissue, thinner epidermis and dermis and larger fat cells, it almost exclusively affects women. (www.gesundheitkompakt.de/126.html, 20050531).
The medical community regards cellulite as a cosmetic problem. Many women therefore feel that doctors do not take their problem seriously enough, and that they are left on their own with a seriously reduced quality of life.
The causes are manifold. Apart from gender, nutrition and body weight also play a crucial role. Being overweight, for example, results in an increased percentage of fat in all tissues, especially in the problem areas stomach, legs and buttocks. Lack of movement is another reason for the development of overweight and cellulite. Daughters of parents with pronounced cellulite run a high risk of developing cellulite even in their youth (www.lipoclinic.ch/cellulite/cellulite.htm, 20050531).
If you search the internet for the term "Cellulite", you will find many different approaches to treatment. Some of the more important methods will be outlined below.
Medical treatments include endermology, Beauty Tec, Hydrofor, wraps, mesotherapy, Vacustyler, vibration plates and fat burning methods. As to nutrition, the HCG diet can be used. In principle, a diet rich in protein with lots of fruit and vegetables, little fat and with carbohydrates characterised by a low glycaemic index is crucial. These measures should always be accompanied by endurance sports with an aerobic energy supply (e.g. walking, jogging, bicycle riding, swimming) (www.lipoclinic.ch/cellulite/cellulite.htm, 20050531).

1.2. What is MBT?

MBT (Masai Barefoot Technology®) is a revolutionary footwear that restores our natural movements, such as those made while walking and standing barefoot on natural surfaces.
MBT mimics the terrain of the Masai tribe and transforms the hard, flat surface on which we walk everyday into soft and natural ground. Consequently, our muscles are better trained, and they perform the natural balance movements they were originally designed to.

1.2.1. Lifestyle

In contrast to traditional shoes with heels, the unique sole construction with heel sensor forces us to constantly balance our bodies and maintain an upright posture. The resulting upright gait not only enhances our posture and appearance, we also move in a more natural and thus healthier way.
By using MBT, the following effects can be achieved:
+ Toning of legs, abdomen and buttocks
+ Weight reduction
+ Improvement of posture and gait

1.2.2. Medical

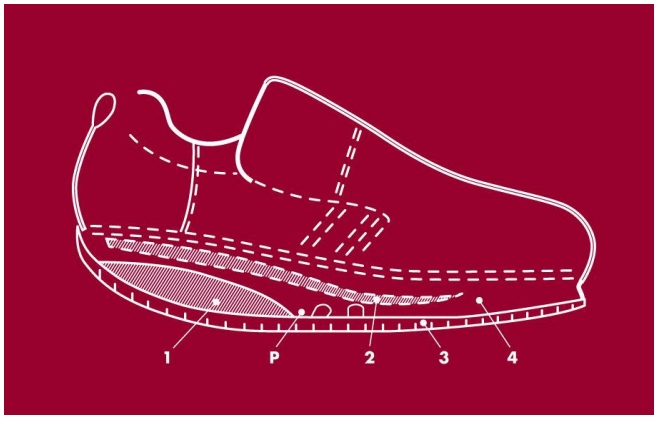
MBT was originally developed as a medical training device and is an authorised Class I Medicinal Product in Switzerland and the EU.
It has been recommended by leading doctors and physiotherapists worldwide as an auxiliary therapy for indications such as:
+ Back, hip, leg or foot problems
+ Joint, muscle and tendon injuries

1.2.3. Sports

We all know how it feels to run barefoot along a sandy beach. Soft, pleasant, yet requiring effort. The mechanism of action of MBT can be compared to this particularly active form of running. With the help of the soft heel sensor and the roll-off movement, your muscles have to work harder.
Moreover, muscles are activated that are normally neglected.
Thus the following effects can be attained with MBT:
+ training of insufficiently exercised muscles
+ improved coordination and trunk stability
+ improved running technique
+ prevention of injuries and faster recovery

1.2.4. Construction of MBT

1 – Heel sensor
2 – 3D-formed fibreglass / synthetic panel, both sides hand-coated with special textile
P – Balancing area with integrated skew footfall for a proprioceptive pressure on the muscle chains
3 – Rubber sole
4 – Swiss Masai® PU-middle sole



1, 2 and P compose the system of MBT and are the result of 10 years of research and development efforts aimed at enhancing the muscles and the body's natural biomechanical mechanisms. The multi-layer construction ensures that the MBT can withstand the physical impact of millions of movements.

1.3. Background of MBT

In the US and UK, MBT started as a lifestyle product. Soon, various press reports were published in which MBT shoes were referred to as "cellulite busters" (The Sunday Times), "calorie-burning shoes" (London Magazine) or "muscle-toning shoes" (Rocky Mountain Sports, January 2005). In addition, MBT became a best-seller among celebrities. Well-known actresses began buying their "anti-cellulite shoe" in England.
Based on the various press reports, a cellulite project was initiated in cooperation with the Lipoclinic Swiss, which eventually produced this study.

2. METHODOLOGY

2.1. Hypothesis

H1: The Masai Barefoot Technology has a positive influence on the status of the cellulite.

2.2. Subjects

Via the Lipoclinic Swiss, potential participants were contacted by mail and selected for the study. A total of 23 women were recruited. The inclusion criterion was cellulite on the buttocks and/ or thighs and little to no exercise.
Personal data were compiled using the cellulite questionnaire.

2.3. Test methods

2.3.1. Bioelectric Impedance Analysis (BIA)

BIA is not only a method for measuring fat. Apart from body fat, important parameters, such as body water, lean body mass (fat-free mass) and muscle and organ mass (BCM) are measured as well. This determines body composition and allows conclusions to be drawn about people's nutritional status.

Measuring principle
Measurements of electrical resistance through the human body are carried out using two electrodes attached to hand and foot. This involves creating a weak, unperceivable electrical field in the body. Two different types of electrical resistance are measured:

- Water resistance (determination of body water, lean body mass and body fat)
- Cell resistance (determination of muscle and organ mass)

(www.date-input.de/_site/german/g_methoden.html, 20050601)

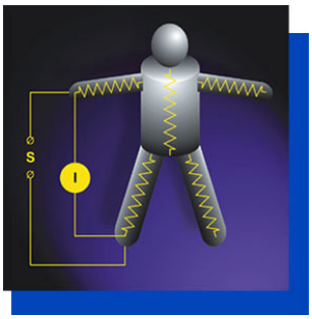


Figure 1: Measuring principle (www.data-input.de/_site/german/g_methoden.html, 20050601)

Measurement
In the study, the measuring device B.I.A. 2000/s was used. The measurements were made at the beginning and at the end of the study under the same conditions. The subjects had to undress sufficiently to allow the electrodes to be attached to hand and foot. Measuring was conducted while the subjects were lying down and took approx. 2-3 minutes.

Using the software accompanying the measuring device, a data timeline could be produced for each participant, which served as basis for the statistical analysis.

2.3.2. Photos

Photos of the women's buttocks and back side of the thighs were taken at the start and at the end of the study using an EOS Canon 500d camera. The pictures were taken at the beginning and end under the same conditions, in the same room and with the same lighting conditions.

2.3.3. Cellulite questionnaire before/ after

The cellulite questionnaire was specially developed for this study. Apart from personal questions, general questions regarding localisation, visibility and painfulness of the cellulite, body weight and movement behaviour, the questionnaire also included a number of scales (1 = very poor to 10 = very good) regarding tissue condition, general well-being, quality of life and mobility for which the subjects were asked to assess themselves.
The post-questionnaire included additional questions to determine whether the MBT had helped the subjects.

2.3.4. MBT introduction

All participants took part in an introductory course, in which they learnt how to use MBT and were informed about the duration of use. It was recommended to wear the MBT daily and to work towards wearing it all day long.

2.3.5. Research procedure

During an initial appointment, personal data were collected, the cellulite questionnaire was filled out, the photos were taken and the BIA performed, and all subjects were introduced to using MBT. Each woman received an MBT and the training diary.
After four weeks, a second visit was scheduled, during which the cellulite questionnaire, photos and the BIA were taken again and the training diaries were collected.

2.3.6. Statistical methods

Personal data, the data of the cellulite questionnaire and the BIA were calculated and analysed using the statistical programme SPSS Version 10 for Windows. Apart from counting frequencies, calculation of normal distribution and comparisons of means were also performed to evaluate statistical significance.
The levels of significance (sl) were defined as follows:
$p > 0.05$ = not significant - ns
$p < 0.05$ = significant - *
$p < 0.01$ = very significant - **
$p < 0.001$ = highly significant - ***
(from BÜHL u. ZÖFEL 2000, 100)

3. RESULTS

3.1. Subjects

At the start of the study, 23 women participated. The initial data of these women are available. Because of incorrectly completed questionnaires and erroneous BIA measurements, in some cases four and in some cases five subjects were excluded. This has to be kept in mind when looking at the statistical calculations in the before-after comparison.
In Table 1, maximum, minimum and mean of age, height and body weight, respectively, are listed.

	Age in years	Height in cm	Body weight
Maximum	53	174	75
Minimum	21	157	50
Mean	32.91	166.5	59.77

Table 1: Age, height and body weight; n= 23

Cellulite has been present in the subjects for an average of 16.05 years. 36.4 % answered the question "Apart from cellulite, are you overweight" with yes, 63.6 % with no. 15 subjects reported that they were not taking any medication, four subjects were on the pill, one subject was on cortisone and 2 subjects were taking other medication.

3.2. Test methods

3.2.1. BIA

BIA data were initially tested for normal distribution using the Kolmogorov-Smirnov test. All samples were normally distributed. Subsequently, a t-test for paired-samples could be performed to calculate a comparison of means between the first and second survey. In addition, arithmetic means, standard deviations and maximum/ minimum values were calculated.
The Bioelectrical Impedance Analysis focused on the following parameters:

- **Body fat**

With BIA, the body fat is measured in kg. In the following table, the results before and after the intervention are compared.

Table 2: Body fat in kg

		Start test	End test
n		18	18
x		17.21	15.91
SD		4.9	4.58
Min/Max		10.60/30.20	10.3/25.90
T-Test	p	0.003	
	sl	**	

n – Sample size, x – Mean, SD – Standard deviation,
Min – Minimum, Max – Maximum, p –probability of error,
** - very significant

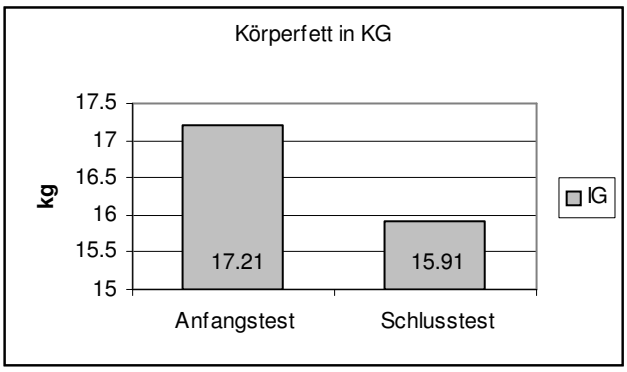


Figure 2: Body fat in kg

[Initial test Final test]

- **Body water**

Table 3: Body water in litres

		Initial test	Final test
n		18	18
x		31.2	32.06
SD		2.23	2.27
Min/Max		26.5/35.5	28.4/35.8
T-Test	p	0.012	
	sl	*	

n – Sample size, x – Mean, SD – Standard deviation,
Min – Minimum, Max – Maximum, p –probability of error,
* - significant

- **Muscle and organ mass (BCM)**

BCM determines the proportion of muscle and organ mass and is stated in kg (www.data-input.de/_site/german/g_methoden.html, 20050602).

Table 4: Muscle and organ mass (kg)

		Start test	End test
n		18	18
x		22.28	22.52
SD		2.12	2.68
Min/Max		19.2/28.0	19.6/28.5
T-Test	p	0.727	
	sl	ns	

n – Sample size, x – Mean, SD – Standard deviation,
Min – Minimum, Max – Maximum, p –probability of error,
ns- not significant

- **Body Mass Index (MBI)**

BMI is a globally valid index for differentiating between overweight, normal weight and underweight (*BIA-Cordula Stegen*).

BMI is calculated by dividing bodyweight (kg) by the square of body height (m^2). The unit of BMI is thus kg/ m^2.

BMI classification (according to DGE):

Classification	Male	Female
Underweight	< 20	< 19
Normal weight	20-25	19-24
Overweight	25-30	24-30
Obesity	30-40	30-40
Massive obesity	> 40	> 40

Table 1: BMI classification

(http://www.uni-hohenheim.de/~wwwin140/info/interaktives/bmi.htm; 20050602)

Table 6: Body Mass Index (BMI)

		Initial test	Final test
n		18	18
x		21.65	21.46
SD		2.04	1.79
Min/Max		18.1/25.9	17.9/25.5
T-Test	p	0.215	
	sl	ns	

n – Sample size, x – Mean, SD – Standard deviation,
Min – Minimum, Max – Maximum, p –probability of error,
ns- not significant

3.2.2. Photos

Here, only selected photos are shown. Obvious changes were seen in almost all photos.

Figure 3: Status before wearing MBT

Figure 4: Status after wearing MBT

3.2.3. Cellulite questionnaire

Personal data are provided in chapter 3 under 3.1 Subjects. At first, the two questions referring to appearance and painfulness of the cellulite are shown.

- **Question 1**:
  Start: "When pushing the skin together, does orange-peel skin appear?"
  End: "Has your cellulite improved when pushing the skin together?"

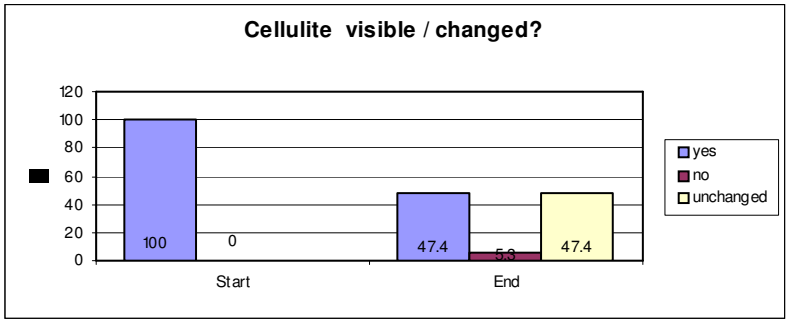


Figure 5: Orange-peel skin visible/change in %
n Start: 22; n End: 19

- **Question 2**:
  Start: "Pinch test with thumb, index and middle finger? Is there pain?"
  End: "How is the pain now during the pinching test with thumb, index and middle finger?"

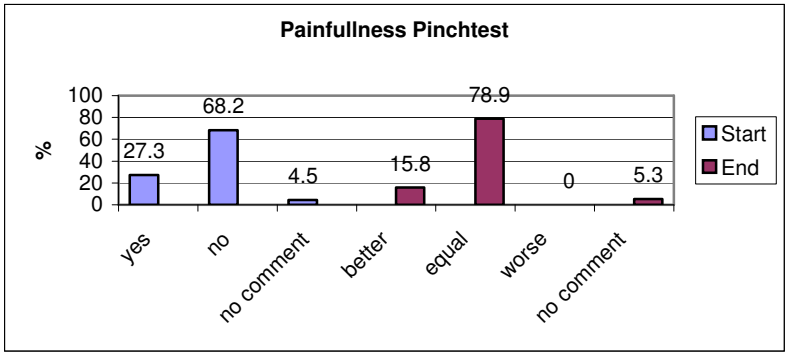


Figure 6: Painfulness pinch test
n Start: 22, n End: 19

- Question 3:
  "On a scale from 1-10, how would you (3a) now after the study) rate your tissue condition?"

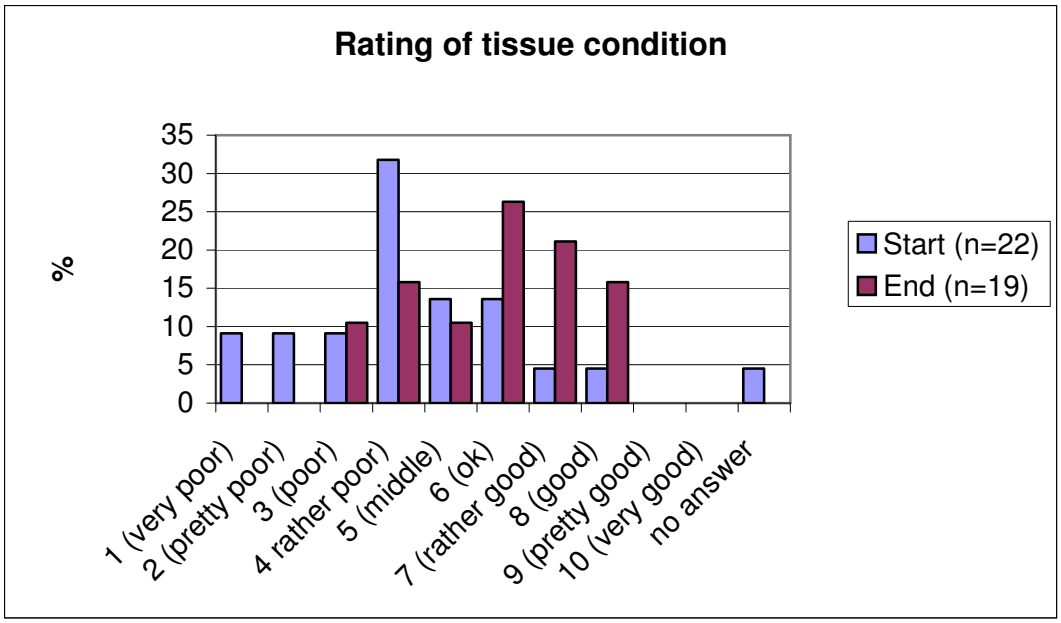


Figure 7: Rating of tissue condition

Table 7: Rating of tissue condition

	Start (n=22)	End(n=19)
1 (very poor)	9.1 (2)	0
2 (pretty poor)	9.1 (2)	0
3 (poor)	9.1 (2)	10.5 (2)
4 (rather poor)	31.8 (7)	15.8 (3)
5 (middle)	13.6 (3)	10.5 (2)
6 (it's ok)	13.6 (3)	26.3 (5)
7 (rather good)	4.5 (1)	21.1 (4)
8 (good)	4.5 (1)	15.8 (3)
9 (pretty good)	0	0
10 (very good)	0	0
no answer	4.5 (1)	0

- **Question 3b End**:
  Has it improved by wearing MBT?
  Of the 19 women, 63.2 % answered with "yes" and 36.8 % with "no".

- **Question 4**:
  "On a scale of 1 to 10, how would you rate your well-being (4a) after the study)?"

  Table 8: Rating of well-being

	Start (n=22)	End (n=19)
1 (very poor)	0	0
2 (pretty poor)	0	5.3 (1)
3 (poor)	4.5 (1)	0
4 (rather poor)	4.5(1)	0
5 (middle)	18.2 (4)	5.3 (1)
6 (it's ok)	22.7 (5)	0
7 (rather good)	9.1 (2)	15.8 (3)
8 (good)	36.4 (8)	21.1 (4)
9 (pretty good)	4.5 (1)	42.1 (8)
10 (very good)	0	10.4 (2)

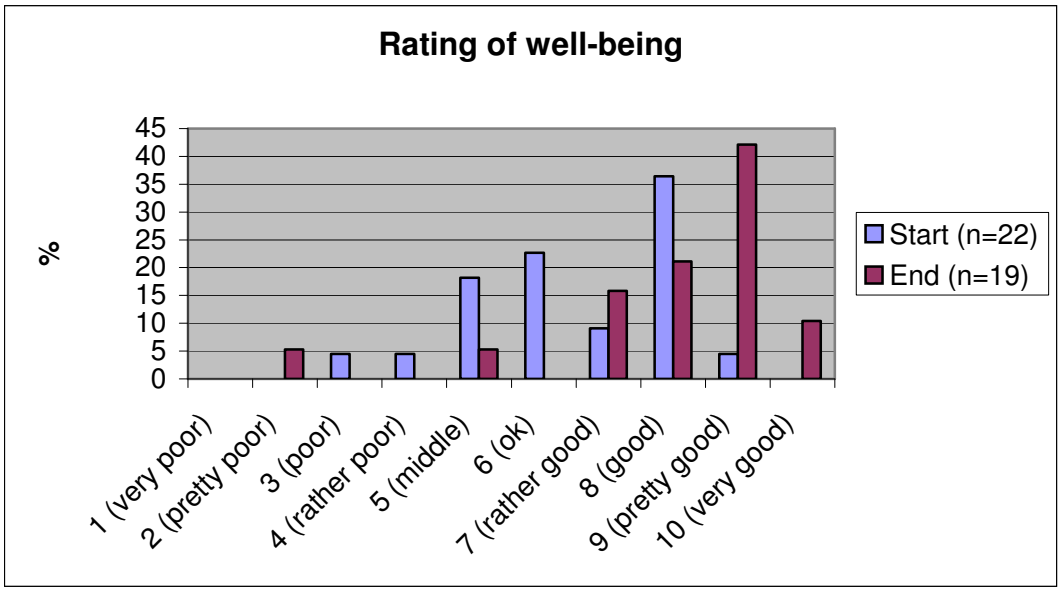


Figure 8: Rating of well-being
[blue = Start, purple = End]

- **Question 4b End**:
  "Has your well-being improved by wearing MBT?
  Here 68.4 % answered with "yes" and 36.8 % with "no" (n=19).

- **Question 5**:
  "On a scale of 1 to 10, how would you rate your quality of life (after the study)?"

Table 9: Rating of quality of life

	Start (n=22)	End(n=19)
1 (very poor)	0	0
2 (pretty poor)	0	5.3 (1)
3 (poor)	9.1 (2)	0
4 (rather poor)	0	0
5 (middle)	13.6 (3)	5.3 (1)
6 (it's ok)	22.7 (5)	0
7 (rather good)	9.1 (2)	21.1 (4)
8 (good)	22.7 (5)	21.1 (4)
9 (pretty good)	18.2 (4)	42.1 (8)
10 (very good)	4.5 (1)	5.3 (1)

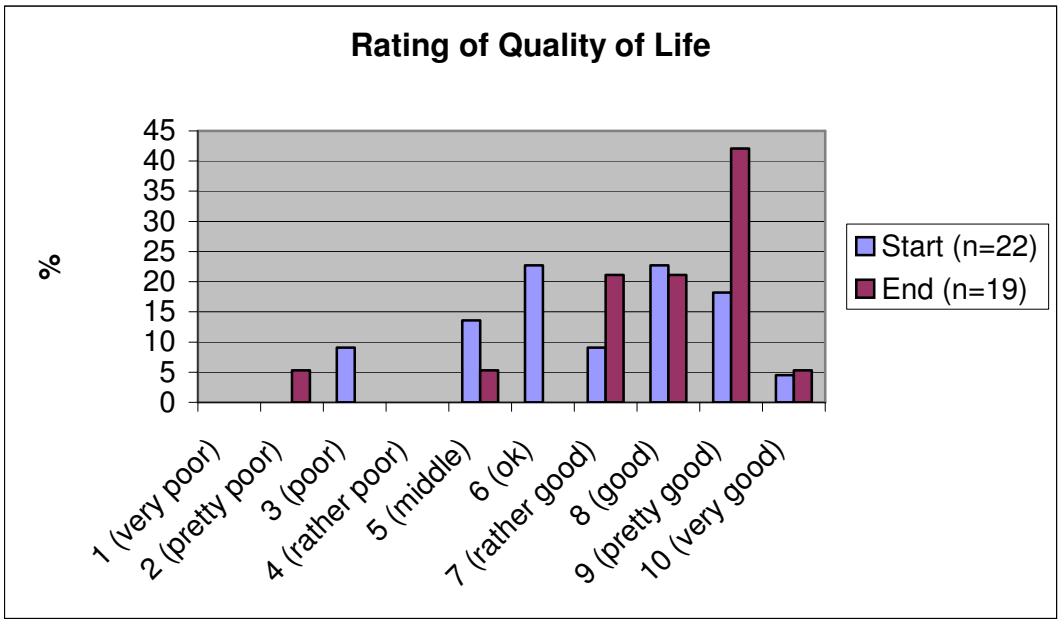


Figure 9: Rating of quality of life

- **Question 6**:
  Start: "Do you do sports or gymnastics?" End: "Do you do sports or gymnastics more frequently – with MBT?"
  Hours per week?

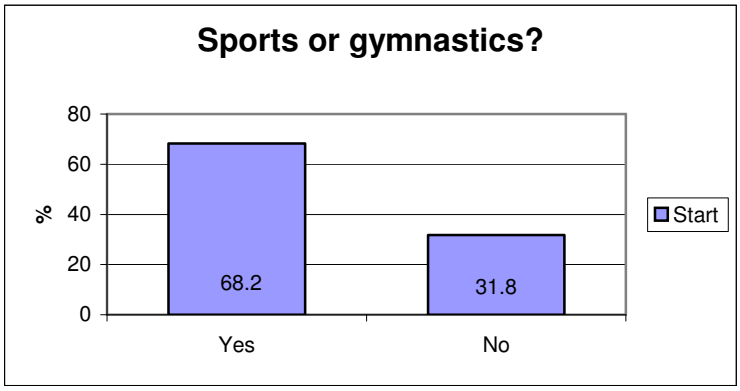


Figure 10: Start: Sports or gymnastics

(n=22) [yes no; Start]

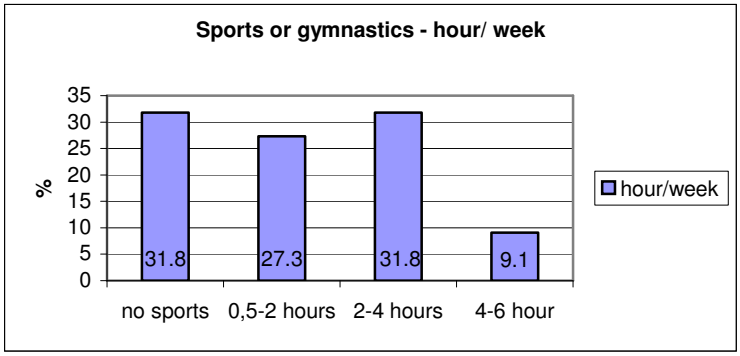


Figure 11: Start: Sport or gymnastics – hours/ week (n=22)

- Question 7:
  "On a scale of 1 to 10, how would you rate your mobility (at the end of the study)?"

Table 10: Rating of mobility

	Start (n=22)	End(n=19)
1 (very poor)	0	0
2 (pretty poor)	0	5.3
3 (poor)	4.5	0
4 (rather poor)	4.5	0
5 (middle)	9.1	5.3
6 (it's ok)	27.3	10.5
7 (rather good)	22.7	31.6
8 (good)	22.7	31.6
9 (pretty good)	4.5	10.5
10 (very good)	4.5	5.3

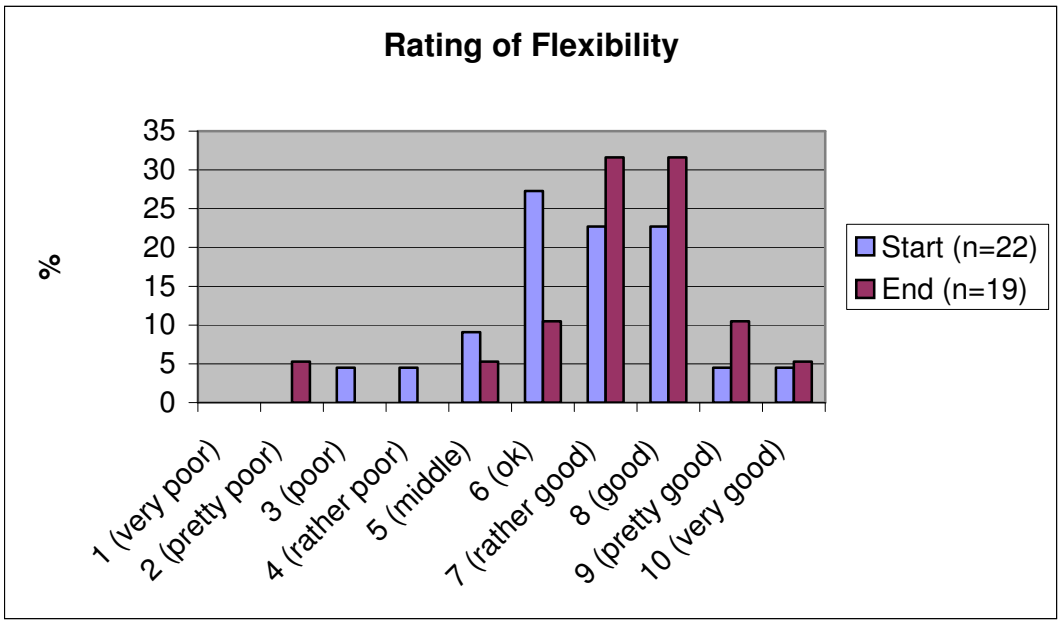


Figure 12: Rating of flexibility

- **Question 8 End**:
  "Has their been a toning effect on your buttocks and thighs by wearing MBT?" "If yes – can you see the difference?"

Table 2: Toning of buttocks and thighs by wearing MBT (n=19)

	Toning?	Toning visible?
Yes	42.1	36.8
I do not notice any difference	57.9	
No		26.3
No answer		36.8

- **Question 9 End**: "What were the benefits of MBT for you?"

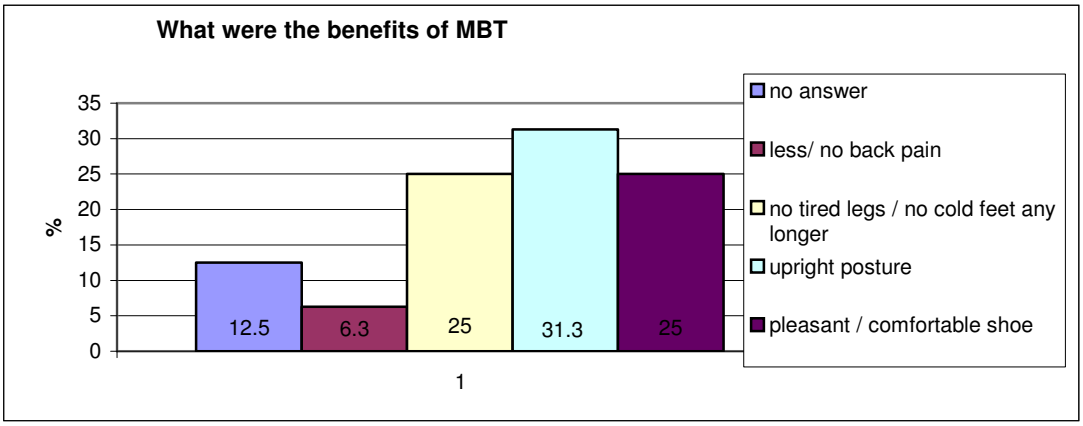


Figure 13: What were the benefits of MBT for you?

- **Question 10 End**
  "Would you recommend MBT for cellulite to your best friend?
  In total, 19 women answered the final questionnaire. 63.2 % answered the question with "yes", the remaining 36.8 % with "maybe". The answer "rather not" was not ticked (0%).

4. DISCUSSION AND SUMMARY

While MBT is firmly established in the European market as a so-called health shoe for leg and back problems, it is popular in the Anglo-Saxon world as an anti-cellulite lifestyle shoe. Because of press reports in major, well-known magazines and due to celebrities wearing MBT, MBT is considered the latest secret weapon in the fight against cellulite. The time was therefore ripe to conduct an initial study on the subject, either to provide evidence for this effect or to reject the claim.

In this initial study, subjects were selected who exercised little or not at all and worked in sedentary occupations (office work). The participants were asked to integrate MBT into their daily lives. A total of 23 subjects were selected for the study. After an initial examination and introduction into the use of MBT, the women received their MBT. They were asked to wear it daily and for as long as possible, including at work. In addition, they monitored the effect of their MBT on their cellulite in the buttocks-thigh region. In the context of this study, it was not possible to standardise individual lifestyles. Thus, caution is advised when interpreting the results.

Surprisingly, the average proportion of fat (Body Impedance Analyse) decreased significantly ($p = 0.003$) during the short wearing period of only 4 weeks. Similarly, body weight and body mass index tended to decrease during the study (not highly significant). These pleasant results parallel the experiences of many MBT wearers and those made and published by Anglo-Saxon journalists. Whether this effect can be fully attributed to the increased muscular activity that has been documented for Masai Barefoot Technology, or if the subjects were motivated by their MBT to increase running performance and movements, cannot be conclusively answered at present. However, the results are very interesting and motivating.
Interestingly, about 2/3 of the subjects reported a markedly improved tissue condition in the area of the cellulite. Furthermore, increased well-being and an improved quality of life were found. Almost 63% would recommend MBT for the treatment of cellulite to their best friend.
In contrast to the positive reactions expressed with regard to tissue condition, very few of the subject noticed a visual improvement when she had to evaluate herself in the mirror – this was the case even though the before-after photos showed a very different, clearly improved, skin tissue. A likely explanation for this phenomenon is that, on the one hand, it is not easy to visually assess the region of one's own buttocks and thighs in the mirror and, on the other hand, it is difficult to notice changes when these occur gradually and in small steps. The objective inspection of the pictures showed that visually a marked improvement of the skin condition had occurred. Of course, complete disappearance of the cellulite during this short study period could not be achieved.

The other, long-established phenomena of MBT, such as enhanced mobility and posture were once again confirmed by the subjects. Moreover, improvements of

concomitant symptoms, such as back pain, were confirmed as well. Tired and cold feet also showed marked improvements.

In summary, MBT appears to achieve definite improvements in the treatment of cellulite within a short period of time. The hypothesis H1 is thus confirmed.

5. PERSPECTIVES

It would be interesting to carry out a follow-up study, for example after, three to six months, to re-evaluate the positive trend in this study on cellulite.
According to occasional reports by some subjects, there seems to be a marked further improvement if MBT is worn over a prolonged period of time.
A further, detailed study with standardised lifestyle parameters should be carried out that collects objective data to more closely study this aspect of MBT for women as a new approach in the treatment of cellulite.
An interesting aspect of cellulite treatment with MBT are exercises for the buttocks-leg region, which specifically strengthen and tone the muscles. For a further study, a research concept is conceivable in which a specifically-developed exercise programme with MBT in addition to wearing MBT in daily life in one study group is compared to exclusively wearing MBT in daily life in another study group, plus a control group without MBT.
MBT: soon no longer just a health shoe but a lifestyle tool for fitness and beauty ?