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Original Article

Photobiomodulation Therapy for Improvement of Body Contour: A Retrospective Study on Middle Eastern Participants

*Seyed Ebrahim Eskandari [1], Aniseh Samadi [1], Sina Kardeh [2], Yahya Dowlati [1], Hasti Ahmadian Yazdi [1], *Alireza Firooz [1]*

1. *Center for Research & Training in Skin Diseases & Leprosy, Tehran University of Medical Sciences, Tehran, Iran*
2. *Department of Surgery, Centeral Clinical School, Monash University, Melborne, Vic, Australia*

***Corresponding Author:** Email: firozali@tums.ac.ir

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Abstract

Background: The rising demand for body contouring and concerns about side effects of invasive surgical procedures have led to advances in providing new non-invasive alternative methods for weight reduction. The current retrospective study investigated the safety and efficacy of photobiomodulation technology in reducing local obesity in Middle Eastern participants.

Methods: Providing data about body circumferences of 30 participants, with body mass index (BMI) >28 and localized obesity in the abdomen, thighs, buttocks, or arms were included in the final data synthesis. All the records were received at least 4 treatment sessions with the photobiomodulation technology (Volcano device) in Center for Research and training in Skin Diseases and Leprosy (CRTSDL) during June 2022-September 2022 Reductions in body standing circumferences as well as reported adverse effects and participants' satisfaction were retrospectively evaluated and reported. .

Results: The extricated data included 30 females participants aged 42.06 ± 11.6 years and localized obesity in the abdomen (15 cases), thighs (7 cases), hip (one case) and arms (7 cases). While BMIs were not significantly different from the baseline, abdominal, arm and tight circumferences showed a significant decline after receiving 4 and 6 treatment sessions (P<0.01).. There was no report of adverse effect and overall satisfaction was an "excellent" grade

Conclusion: This study demonstrated the effectiveness and safety of photobiomodulation in reduction of circumferential size in abdomen, buttock, thigh, and arm areas in Middle Eastern participants with high patient satisfaction and acceptable safety profile.

Keywords: Photobiomodulation therapy; Middle East; Body

Introduction

The prevalence of obesity, especially in the abdominal area, has increased worldwide in recent decades. Research has shown that an increase in abdominal and waist adiposity is associated with chronic morbidities including cancer, diabetes, and cardiovascular disease, and negatively affects health and life span (1).

Though compared to abdominal obesity, increased circumference in the lower part of the body (buttocks, thighs) has lower long-term health risks, there is evidence that these types of local obesity may result in the accumulation of fat around the blood vessels, which increases the risk of vascular disease, metabolic syndrome, and cancer. In addition, individuals with obesity are also more susceptible to psychological problems associated with dissatisfaction with body contour and decreased self-esteem. Regular physical activity and diet adjustment for example by lowering the consumption of carbohydrates have been traditionally used to decrease local obesity and overall weight (2). However, lifestyle approaches can decrease weight only by temporary changes in adipocyte cell volume (3, 4). The rising demand for body contouring in the past two decades and also concerns about side effects of invasive surgical procedures have led to advances in providing new non-invasive alternative methods for weight reduction such as cryolipolysis, radiofrequency (RF), and focused ultrasound (5) . The use of low-dose light/laser therapy (LLLT) termed photobiomodulation (PBM) has gained much recent attention. Photobiomodulation therapy is defined as a form of light therapy that utilizes non-ionizing light sources, including lasers, light emitting diodes, and/or broadband light, in the visible (400 – 700 nm) and near-infrared (700 – 1100 nm) electromagnetic spectrum (8).

Despite having gained popularity in clinical practice there are controversies in treatment protocols for using LLLT in body countering, depending on the adipose makeup on the patient (9). 6-12 treatment sessions of LLLT with varying frequencies, (1, 2, or 3 times per week) have been used for body countering in different studies. A large amount of data is related to 12 treatment sessions, which showed the greatest improvement in reducing the waist circumference (10). However shorter treatment protocols are still interesting for the participants while the scientific studies supporting this protocols as a suitable method for fat reduction are still scarce (6, 7). There are even more limitation in case of participants with skin type 3 and 4 skin prototypes. Volcano device (Medaria Co., Iran) uses the PBM technology, consists of radiofrequency, micro vibro-percussion and hybrid LED diodes technology.

We investigated the safety and efficacy of 6 treatment sessions with the Volcano device in reducing local obesity in the abdomen, arms, thighs, and buttocks in Middle Eastern participants.

Methods

Study design

It was a retrospective study on participants' records, with body mass index (BMI) >28 and localized obesity in the abdomen, thighs, buttocks, or arms who were received at least 4 treatment sessions with the Volcano device in the Center for Research and Training in Skin Diseases and Leprosy, Tehran, Iran (CRTSDL) during June 2022-September 2022.

According to the medical records, all participants maintained normal activity, lifestyle, and diet during the study. None of the participants used any medication or non-invasive methods for weight reduction prior to therapy or during the treatment sessions.

The study was approved by institutional review board of CRTSDL (number of approval: 1401/5).

Photobiomodulation technology

Volcano device (Medaria Co., Iran) was the used PBM technology in reviewed records. It consists of radiofrequency, micro vibro-percussion and hybrid LED diodes technology.

Each diode emits 532 nm (green) laser light. Each diode generates a 17-mW output. The following variables were extracted: sex and age of the participants, body mass index (BMI), number and duration of the received treatment sessions, body standing circumference (abdomen, arms, hip and tights) before treatment and after 4th and 6th treatment sessions, reported side effects during treatment and satisfaction of the participants in the last treatment session.

Statistics

Data analysis was conducted via SPSS software version 22 (IBM Corp., Armonk, NY, USA) using

the paired sample *t*-Test (Version 20, IBM, USA). Descriptive data are presented as mean ± SD. *P* value less than 0.05 was considered statistically significant.

Results

The extricated data included 30 females participants aged 42.06 ± 11.6 years (range 20-61 years) with BMI >28 and localized obesity in the abdomen (15 cases), thighs (7 cases), hip (one case) and arms (7 cases).

Patient's age and average circumference size before the first session categorized by treatment area are summarized in Table 1.

Table 1: The patient's age and average circumference size before the first session categorized by treatment area

Area	*Frequency*	*Age (yr) Mean ± SD*	*Baseline size (cm) Mean ± SD*
Abdomen	15	42.06 ± 11.6	103.63 ± 9.01
Hip	1	32	111.50
Thigh	7	33.83 ± 9.83	64.16 ± 6.02
Arm	7	35.28 ± 9.83	36.78 ± 4.48

The mean weight, height, and BMI of participants at baseline were 76.12 ± 12.77 kg, 163.16 ± 5.76 cm, and 28.16 ± 3.04, respectively. At weeks four and eight, the mean BMIs were 28.53 ± 2.65 and 28.17 ± 2.81, respectively, which were not significantly different compared with the baseline (*P*=0.96 and 0.92, respectively).

In 7 participants, the average size of the arm circumference decreased by 1.86 and 3.28 cm after the 4th and 6th treatment sessions, respectively. In 7 participants, the average size of thigh circumference decreased by 1.75 and 3.50 cm after the 4th and 6th treatment sessions, respectively. In 15 participants, the average size of the abdominal circumference decreased by 2.10 and 3.57 cm after the 4th and 6th treatment sessions, respectively. In one participant the average size of the hip circumference decreased by 2.5 and 4.5 cm after the 4th and 6th treatment sessions (Fig. 1). All the reductions were statistically significant at both times (*P* value < 0.01).

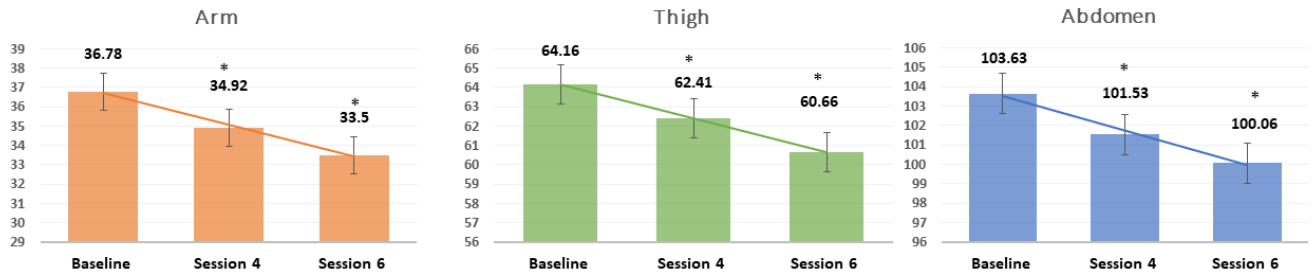

Fig. 1: Significant improvement of body contour following Photobiomodulation therapy

The average satisfaction of patients with regard to "feeling of comfort during treatment", "vitality after each treatment session", "usefulness of treatment", "efficacy of the device on overall health"

and "effectiveness of the device on body contouring" in the abdomen, hip, thigh, and arm was 10, 10, 9.83 and 9.83 out of 10 respectively.
There was no reports of skin inflammation and burns, pressure pains, electrocution of the patient or the operator, and frequent contact of the device with the operator. Overall satisfaction of the device operator based on the questionnaire was an "excellent" grade.

Discussion

LLLT or PBM mechanisms focused on red and near-infrared light, which can modulate the mitochondrial enzymes and cytochrome C oxidase and lead to higher ATP/ADP ratios and reduced oxidative stress. It can also induce cellular proliferation, migration, apoptosis inhibition, and intense protein and nucleic acid synthesis through activation signaling cascades (12).
The potential of LLLT for using in fat and cellulite reduction is suggested already (11), while according to a recent critical review, there is still no consensus of the PBM effect alone on the lipid profile. It should be associated with techniques that promote beta-oxidation, such as physical exercise and vibration platform (13).
There are even a few LLLT based devices with FDA market clearance for circumferential reduction of the waist, hips, and thighs (12). However there are different treatment protocols for using LLLT in body countering and in current study we used the shortest one including 6 treatment sessions.
Our results showed that 6 treatment sessions with a PBM-based device significantly decreased local obesity in abdomen, buttock, thigh, and arm areas in Middle Eastern participates without significant change in BMI.
In a study, obese and hyperglycemic mice were treated with six irradiation sessions using PBM with an 843 nm LED (5.7 J cm–2 at 19 mW cm–2 per session) and their body mass, glycemia as well as inflammatory infiltrate of abdominal adipose tissue were evaluated. The group submitted to PBM treatment presented significant reduction in blood glucose levels and inflammatory infiltrate areas within abdominal adipose tissue almost five times smaller in comparison to control group (14).
A retrospective study supported the significant weight reductions of 86 subjects after 6 LLLT sessions as well as the concomitant reduction of -1.12 inch (2.84 cm), -0.769 inch (1.95), and -1.17 inch (2.97), in waist, hips and thighs circumstance respectively (15**)**.
Another study showed the significant effect of a semiconductor- based, low-level laser therapy device on almost 1 inch (2.54 cm) waist loss in 40 participants after 4 weeks of eight treatments sessions (16).
Another report in concurrence with current study reported 1.14 in (2.89 cm) and 0.57-inch (1.44 cm) circumferential reduction for the waist and thighs after six LLLT treatments across 2-weeks (17).
The results of our study clearly confirmed the mentioned reports and showed reduction that is even more significant in waist and thighs circumstances. (3.57 and 3.5 cm in waist and thighs respectively). It could be due to using the different PBM -based device that also consists of radiofrequency and micro vibro-percussion. Recruiting the dissimilar study subjects, with different race, lifestyle and body mass index (>28 compared to >30 in similar studies), could also explain the better efficacy results in current study.
More over this paper is one of the few publications reporting the efficacy of PBM based device in reducing the arm circumference while in similar studies, arms were dedicated as non-treated anatomical regions and the relative reduction in their circumference was the result of systemic effect of the treatment (17).
The results from LLLT appear earlier compared to other methods, there is a higher chance for fat deposition to recur as this method does not cause necrosis or apoptosis (18). Low-level laser therapy does not deliver high energy to skin and muscle layers, which can minimize the risk of damaging adjacent tissues (19, 20).
The study had apparently some limitations. It was a retrospective study with relatively low sample size however to the best of our knowledge; this

study is the first report on assessment of non-invasive LLLT in Middle Eastern subjects with skin type III and IV. Further interventional study with larger sample size and longer follow up would be necessary for valid clinical judgment.

Conclusion

This study demonstrated the effectiveness and safety of low-dose light/laser therapy termed photobiomodulation in reduction of circumferential size in abdomen, buttock, thigh, and arm areas with high patient satisfaction and acceptable safety profile.

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Conflict of Interest

The authors declare that there is no conflict of interests.

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