International Journal of PharmTech Research
CODEN (USA): IJPRIF, ISSN: 0974-4304
Vol.9, No.3, pp68-76, 2016

# Low Level Laser Therapy Versus Ultrasonic Cavitation in Abdominal Adiposity After Gastric Bypass in Female

**Saly Maher Ahmed Elkablawy[1], ZakariaMowafyEmam[2], SamahH. Nagib[2]**

[1]Physical Therapist, Egypt
[2]Physical Therapy Department for Surgery, Faculty of Physical Therapy, Cairo University, Egypt

**Abstract: The purpose** of this study was to investigate the effect of the ultrasonic cavitation versus low level laser therapy in the treatment of abdominal adiposity in female post gastric bypass. **Subjects**: Sixty female suffering from localized fat deposits at the abdomen area after gastric bypass were divided randomly and equally into three equal groups Group (1): were received low level laser therapy plus bicycle exercises and abdominal exercises for 3 months, Group (2): were received ultrasonic cavitation therapy plus bicycle exercises and abdominal exercises for 3 months, and Group (3): were received bicycle exercises and abdominal exercises for 3 months. **Methods**: data were obtained for each patient from waist circumferences, skin fold and ultrasonography measurements were done after six weeks postoperative (pre- exercise) and at three months postoperative. The physical therapy program began, six weeks post-operative for experimental group. Including aerobic exercises performed on the stationary bicycle, for 30 min, 3 sessions per week for three months **Results**: showed a statistically significant decrease in waist circumferences, skin fold and ultrasonography measurements in the three groups, with a higher rate of reduction in Group (1) and Group (2) .Also there was a non-significant difference between Group (1) and Group (2). **Conclusion**: these results suggested that bothlow level laser therapy and ultrasonic cavitation had a significant effect on abdominal adiposity after gastric bypass in female.
**Keywords:** Gastric Bypass, Low level laser therapy, Ultrasonic cavitation, obesity.

## Introduction

Obesity is the most common metabolic disorder in human: there are many etiological causes for obesity. Excess fat accumulation caused by imbalance between energy intake and expenditure[1].

Obesity is an increasingly significant health problem. Over 4 decades, the prevalence of obesity (BMI >30 Kg/m2) has increased from 13 % to 31% in adults, concurrent increases occurred in adolescents and children. Obesity is especially common in developed country[2].

Abdominal obesity is known as belly fat or clinically as central obesity, is the accumulation of abdominal fat resulting in an increase in waist size. There is a strong correlation between central obesity and cardiovascular disease[3].

Gastric bypass procedures (GBP) are any of a group of similar operations that first divides the stomach into a small upper pouch and a much larger lower "remnant" pouch and then re-arranges the small intestine to connect

to both. Surgeons have developed several different ways to reconnect the intestine, thus leading to several different GBP names. Any GBP leads to a marked reduction in the functional volume of the stomach, accompanied by an altered physiological and physical response to food[4].

Low-level laser therapy has been applied in many medical fields, and low-level laser irradiation has been adopted in acupuncture .Laser acupuncture was found to be effective in the treatment of visceral postmenopausal obesity when combined with low- calorie diet .A recent clinical observation showed that laser acupuncture alone could reduce body weight (BW) and body mass index (BMI) in obese persons, but the study lacked a placebo control. Moreover, the influence of laser acupuncture on body composition was unclear, and further scientific evidence for the efficacy of laser acupuncture for obesity should be presented[5].

Ultrasonic cavitation has recovered its leading role due to effects achieved through its application at emission frequencies significantly higher than the frequencies currently used in the field of aesthetic medicine. The cavitation phenomenon takes place when a fluid medium, in this case, a biological one, is reached by the ultrasonic wave. Such wave consists in compression-expansion cycles produced at high speed that is directly related to the workflow of the equipment ultrasonic generator. Compression phases exert positive pressure on the fluid whereas expansion phases exert negative pressure. During compression phases, the fluid molecules tend to move closer; but, they tend to move away during expansion phases. Furthermore, phases repeat, micro-bubbles show a progressive enlargement that causes their collapse and implosion producing shockwaves emission. The high pressure exerted by compression phases on expanded cavities causes micro-bubbles' collapse. This process is named as cavitation phenomenon[6].

Therefore this current study is an attempt to investigate the efficacy of low level laser therapy versus ultrasound cavitation in treatment of abdominal obesity post gastric bypass.

**Subjects:-**

Sixty female suffering from localized fat deposits at the abdomen area after gastric bypass.Their weights ranged from 70 to 85 kilograms. Their ages will be ranged from 30-40years.They were divided randomly and equally into three equal groups Group (1): Twenty female suffering from localized fat deposits at the abdomen area after gastric bypass, they were received low level laser therapy plus bicycle exercises and abdominal exercises for 3 months, Group (2):Twenty female suffering from localized fat deposits at the abdomen area after gastric bypass, they were received ultrasonic cavitation therapy plus bicycle exercises and abdominal exercises for 3 months, and Group (3):Twenty female suffering from localized fat deposits at the abdomen area after gastric bypass, they were received bicycle exercises and abdominal exercises for 3 months. The treatment started 6 weeks after gastric bypass operation in all patients.

**Measurement procedures:**

**Equipment:**

**a) Measuring equipment:**

1. Plastic tape measurement to measure abdominal circumferences.
2. Electronic skin caliper to measure skin fold.
3. Ultrasonography

Weight scale: to measure the weight and height for detection of BMI.

**b) Therapeutic equipment:-**

**1 - Low level laser therapy device:**

The Lapex 2000 BCS (LipoLaser) is a 100% Non-invasive, laser-based, spot fat reduction and body contouring system. Offering the relaxation of a 40-minute massage with the benefits of inch loss without a painful incision, the Lapex 2000 BCS (LipoLaser) uses laser energy to safely (and painlessly) penetrate the skin and target specific adipose (or fat cells) , time of application 30min for 3months.

**2- Ultrasonic cavitation device:.**

Ultrasound cavitation device (MB-09 made in Italy) .Technical parameters: Voltage: AC 110 V, AC 220 V, Power: ≤ 350 W, Frequency: 1 MHz /0.8 MHz/0.4MHz and Vacuum pressure: 0.1 MPa

**Bicycle ergometer:** Electronic bicycle ergometer (Universal, made in New York, USA) equipped with pedals, electronic break, adjustable seat, handle bar, display screen and foot straps also provided with programmable control unit.

**Procedures of the study:**

The procedures of the study were classified into the following:

**A) Measuring procedures:**

**Plastic tape measurement to measure abdominal circumferences:**

Abdominal circumferences was measured in centimeter with the patient in standing position by applying a plastic tape at the level of umbilicus, above umbilicus by 5 centimeter and below the umbilicus by 5 centimeter[7]

**Electronic skin caliper:**

Abdominal skin folds were measured in centimetre with the patient in supine position by skin fold calliper, the most prominent point in the abdomen is marked; skin and subcutaneous tissues at that point will be pinched between the thumb and the forefinger and gently pulled away from the underlying muscles. Then, while the grasp is maintained, the calliper will be placed over the skin fold and left in its place for 3 seconds, and then the value will be recorded[8].

**Ultrasonography:**

Ultrasound imaging is based on the different acoustic properties of different tissues. During measurement; the patient will usually in a supine position. It was necessary to remove any air bubble prior to examination by immersing the tip of the probe in saline and massaging the tip very gently with a bent swab. When imaging, the transducer will positioned perpendicular to the skin to avoid obliquity and to prevent errors during determination of skin thickness. A thick layer of ultrasound gel is applied to improve near field visibility and avoid tissue compression, which will alter measurements of tissue thickness[9].

**B) Therapeutic procedures:**

**Ultrasonic cavitation:**

**The session protocol was performed under the following methods:**

1. The patents should drink some water before the treatment.
2. Clean the skin with alcohol cotton.
3. Application of neutral gel on the area to be treated.
4. Application treatment of ultrasound cavitation for approximately 15 minutes on each area of
5. Cavitation frequency will be 40 KHz.
6. Duration 1 time per week for 3 months[10].

**Low level laser therapy:**

- Each patient was placed into a comfortable supine lying position.
- The therapist position strides standing beside patient for observation any problems.
- Both the patient and the therapist wore protective eye glasses.

1. Two smaller probes lasers were placed over the appropriate lymphatic glands and hold in place.
2. The Lapex BCS lipolaser was switched on for 10 minutes, then was re-located and was turned on for other 10 minutes; this was repeated until all the spot fatty areas were treated, usually in 40 minutes.

3- In order to increase the body's ability to remove the triglycerides (the broken down fat cells) it will be

necessary to assist this natural process by increasing the metabolic rate. This can be achieved in a number of ways but they all involve some form of exercise. The use of a whole body vibration plate machine for about 10 minutes is effective right after the treatment. The treatment was applied 2 day per week for 3 months[11].

**Bicycle Ergometer treatment protocol:**

**The procedure of this protocol was achieved under the following steps**: -when the patient attended the treatment, they received full explanation to the purpose of the treatment, the therapeutic and physiological benefits of this method of treatment.

The patient sat on stationary bicycle ergometer with her back in relaxed position, before exercise the limit of subject tolerance was assessed by exercise test which is comprised a 3 minute control period of un loaded pedaling, followed by an incremental ramp on a cycle ergometer at a rate of 10 W per minute to the limit of subject tolerance.

Then the subject cycle at 30 W for warming up, and then the intensity will increased every 60 seconds by 15 W until exhaustion, then the subject cycle at 30 W for cooling down. Duration will be 30 minutes /sessions, each patient received 3 sessions per weeks for 2 months[12].

**Low caloric diet protocol:**

Patients began adding thicker liquids that are high in protein and low in fat and sugar. (For examples, see the list below.) They might use high-protein, low-calorie liquid supplement drinks or powders to meet your protein requirements during this period. Daily caloric intake did not exceed 400 calories. They drank 1 to 1.5 liters of water or other non-caloric liquids per day.

**Recommended thicker liquids:**

- Nonfat or 1% milk, if you can tolerate milk.
- Lactose-free or soy-based low-calorie drinks.
- Sugar-free pudding.
- Sugar-free, nonfat yogurt.
- Low-fat cottage cheese.
- Blended broth-based soup or other low-fat soups[13].

**Statistical procedures:**

**Data collection:**

Data were collected three times as follow: before starting (pretreatment) & after three months post - treatment…

N.B physical therapy treatment was beginning after six weeks of operation.

**Data analysis:**

- In this study, the mean, standard deviation and standard error were calculated for all variables in both groups.
- Paired "t" test was used also to compare results before and after treatment in the same groups of the study.
- Comparison was applied by ANOVA test to compare among three groups of the study.

## Results:

**1- General characteristics (age, weight and height) among three groups of the study.(Table 1)**

| Items | Group(1) | | Group (2) | | Group (3) | | ANOVA | S |
|---|---|---|---|---|---|---|---|---|
| | Mean | ±SD | Mean | ±SD | Mean | ±SD | F | |
| **Age (years)** | 34.50 | ±2.94 | 34.95 | ±3.05 | 34.70 | ±2.94 | 0.114 | NS |
| **Weight (Kg)** | 81.10 | ±2.38 | 80.95 | ±2.39 | 81.00 | ±2.498 | 0.020 | NS |
| **Height (cm)** | 159.00 | ±3.41 | 158.40 | ±4.12 | 158.65 | ±3.54 | 0.132 | NS |

***SD: standard deviation, P: probability, S: significant. NS: non-significant**

**2-Body weight results among three groups:**

Table (2) revealed the ANOVA results for the Body weight pre and post treatment among three groups of the study. There was no significant difference in pre treatment values. But there was a significant difference in the posttreatment values (P<0.05) **.**

**Table (2): Comparison between body weights among three groups of the study.**

| Items | Body weight | | | | | |
|---|---|---|---|---|---|---|
| | Pre- treatment | | | Post- treatment | | |
| | Group (1) | Group (2) | Group (3) | Group (1) | Group (2) | Group (3) |
| Mean | 81.10 | 80.95 | 81.00 | 67.60 | 67.55 | 73.90 |
| ±SD | ±2.38 | ±2.39 | ±2.38 | ±5.30 | ±5.59 | ±2.46 |
| F | .020 | | | 12.20 | | |
| S | NS | | | S | | |

***SD: standard deviation, S: significant. NS: non-significant**

**3-Comparison of the results of BMI among three groups:**

Table (3) revealed the ANOVA results for the BMI pre and post treatment among three groups of the study. There was no significant difference in pre treatment values. But there was a significant difference in the posttreatment values (P<0.05) **.**

**Table (3): Comparison between BMI among three groups of the study.**

| Items | BMI | | | | | |
|---|---|---|---|---|---|---|
| | Pre- treatment | | | Post- treatment | | |
| | Group (1) | Group (2) | Group (3) | Group (1) | Group (2) | Group (3) |
| **Mean** | **32.10** | **32.06** | **32.16** | **26.68** | **26.87** | **29.23** |
| **±SD** | **±1.00** | **±1.12** | **±1.54** | **±2.47** | **±2.69** | **±1.05** |
| **F** | **0.034** | | | **8.348** | | |
| **S** | **NS** | | | **S** | | |

***SD: standard deviation, S: significant. NS: non-significant**

**4-Comparison of the results of waist circumference among three groups:**

Table (4) revealed the ANOVA results for the waist circumference pre and post treatment among three groups of the study. There was no significant difference in pre treatment values. But there was a significant difference in the posttreatment values (P<0.05)**.**

**Table (4): Comparison between waist circumferences among three groups of the study.**

| Items | Waist circumference | | | | | |
|---|---|---|---|---|---|---|
| | Pre- treatment | | | Post- treatment | | |
| | Group (1) | Group (2) | Group (3) | Group (1) | Group (2) | Group (3) |
| Mean | 100.45 | 100.60 | 100.70 | 79.30 | 80.05 | 92.55 |
| ±SD | ±2.23 | ±2.47 | ±2.53 | ±15.15 | ±15.55 | ±6.80 |
| F | 0.054 | | | 6.415 | | |
| S | NS | | | S | | |

***SD: standard deviation, S: significant. NS: non-significant**

**4-Comparison of the results of skin fold among three groups:**

Table (5) revealed the ANOVA results for the skin fold pre and post treatment among three groups of the study. There was no significant difference in pre treatment values. But there was a significant difference in the posttreatment values (P<0.05) **.**

**Table (5): Comparison between skin fold among three groups of the study.**

| Items | Skin fold | | | | | |
|---|---|---|---|---|---|---|
| | Pre- treatment | | | Post- treatment | | |
| | Group (1) | Group (2) | Group (3) | Group (1) | Group (2) | Group (3) |
| Mean | 6.92 | 6.78 | 6.87 | 3.85 | 3.98 | 5.90 |
| ±SD | ±1.44 | ±1.35 | ±1.37 | ±.796 | ±.780 | ±1.605 |
| F | 0.051 | | | 20.712 | | |
| S | NS | | | S | | |

***SD: standard deviation, S: significant. NS: non-significant**

**5-Comparison of the results of ultrasonography among three groups:**

Table (6) revealed the ANOVA results for the ultrasonography pre and post treatment among three groups of the study. There was no significant difference in pre treatment values. But there was a significant difference in the posttreatment values (P<0.05) **.**

**Table (6): Comparison between ultrasonography among three groups of the study.**

| Items | Ultrasonography | | | | | |
|---|---|---|---|---|---|---|
| | Pre- treatment | | | Post- treatment | | |
| | Group (1) | Group (2) | Group (3) | Group (1) | Group (2) | Group (3) |
| Mean | 4.49 | 4.55 | 4.57 | 2.47 | 2.65 | 0.30 |
| ±SD | ±0.55 | ±0.46 | ±0.22 | ±.0.50 | ±0.68 | ±1.605 |
| F | 0.179 | | | 11.373 | | |
| S | NS | | | S | | |

***SD: standard deviation, S: significant. NS: non-significant**

**6-Comparison of the results between LASER and Cavitation groups:**

Table (7) revealed the t-test results for the waist circumference, skin fold and ultrasonographypre and post treatment between LASER and cavitation groups. There was no significant difference in the pretreatment and posttreatment values (P>0.05) **.**

**Table (7): Comparison between body weights between LASER and cavitation groups**

| Items | Waist circumference | | | | Skin fold | | | | Ultrasonography | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pre- treatment | | Post- treatment | | Pre- treatment | | Post- treatment | | Pre-treatment | Post-treatment | Pre- treatment | Post-treatment |
| | LASER group | Cavitation group | LASER group | Cavitation group | LASER group | Cavitation group | LASER group | Cavitation group | LASER group | Cavitation group | LASER group | Cavitation group |
| **Mean** | 100.45 | 100.60 | 79.30 | 80.05 | 6.92 | 6.78 | 3.85 | 3.98 | 4.49 | 4.55 | 2.47 | 2.65 |
| **±SD** | ±2.23 | ±2.47 | ±15.15 | ±15.55 | ±1.44 | ±1.35 | ±.796 | ±.780 | ±0.55 | ±0.46 | ±.0.50 | ±0.68 |
| **t-value** | 0.054 | | 0.041 | | 0.051 | | 0.012 | | 0.179 | | 0.073 | |
| **S** | NS | | NS | | NS | | NS | | NS | | NS | |

***SD: standard deviation, NS: non-significant**

## Discussion

Abdominal obesity, also known as beer belly, beer gut, pot belly or clinically as central obesity, is when excessive abdominal fat around the stomach and abdomen has built up to the extent that it is likely to have a negative impact on health. There is a strong correlation between central obesity and cardiovascular disease[14].

The current study was an attempt to investigate the efficacy of low level laser therapy versus ultrasound cavitation in treatment of abdominal obesity post gastric bypass.

The results obtained in the present study indicated that both low level laser therapy and ultrasonic cavitation had a significant effect on abdominal adiposity after gastric bypass in female.

These findings of the present study were agreed with[15,16,17,18,19,20,21,22,23,24,25,26].

Studies on low level laser therapy ( LLLT) indicate "Liquefaction" or release of stored fat in adiposities by opening of the cell membrane after a short treatment. Fat cells that were not exposed to the laser treatment looked like round grapes. Eighty percent of the fat was released from the fat cells after 4 min of laser light exposure and 99 % was released after 6 min of exposure. After exposure to the laser light, pores in fat cells were visible by scanning electron microscope. It was presumed, but not demonstrated, that the fat was released from these pores, taken up in the lymphatic and reesterified in other tissues or metabolized for energy[15]. [16]showed a decrease in body mass index and abdominal fat by training on a cycle ergometer for 3 days/week for 6 weeks because there was decrease in total amount of stored calories. This decrease in energy stores is obviously the results of a negative energy balance so that exercise produces decrease in energy intake leading to a reduction in weight.

The biochemical mechanism of action of LLLT appears to increase adenosine monophosphate (cAMP) production via cytochrome C oxidase activation, which causes the breakdown of cell lipids in adipocytes and formation of transitory pores in their cell membrane with subsequent cell collapse. Therefore, LLLT appears to provide a safe and effective alternative for the reduction of subcutaneous tissue volume[17].

LAPEX 2000 Lipolaser gives a significant waist girth loss that is sustained over repeated treatments and is cumulative over 4 weeks of eight treatments. This waist girth loss was almost 1 inch (2.54 cm) in magnitude. Therefore, the LAPEX 2000 Lipolaser gave a clinically meaningful, a cosmetically datable, and a statistically significant improvement in appearance. The fat loss was probably a consequence of laser creating temporary pores in fat cells through which triglycerideLAPEX 2000 Lipolaseres were leaked, a process that requires serum, but is not complement-mediated[18].

Low level Laser Therapy (LLLT) was FAD cleared in 2010 for fat reduction. Initial enthusiasm regarding LLLT for the treatment of fat stemmed from the in vivo observation that a 635-nm laser caused a transitory pore within the adipocyte, resulting in release of lipids into the interstitial space, and subsequent deflation of adipocyte. The pore itself does not damage the cell, but allows for the efflux of lipid contents from the cell into the interstitial space, which is then theorized to pass through the body. The mechanism of action is hypothesized to result from photoexciation of cytochrome-c oxidase, aterminal enzyme of the respiratoy chain within the mitochondria. Numerous reports highlight the role of laser- induced adipocyte modification as an adjunct to liposuction[19].

Also Brown and colleagues studied the physics of focused external ultrasound using the and attempted to validate its efficacy in a porcine model. Gross and histologic evaluations of porcine adipose tissue after treatment with the device con- firmed cavitation induced zones of injury in the adipose tissue with sparing of nervous and vascular structures as well as skin[20].

The study of [21]was designed to determine the effectiveness of cavitation ultrasoundtherapy and low caloric diet in reducing the body weight and visceral adiposity among perimenopausal obese women. It was concluded that the cavitation ultrasound therapy and low calorie diet enhance the visceral adiposity in obese perimenopausal women.

Ultrasound Fat Cavitation (USFC) is the method in handling obesity, especially in destroying fat and shaping a particular part of the body. As one of the non-surgical correction method, USFC is preferred at decreasing the risk of complications due to obesity[22,23].

Low level Laser Therapy (LLLT) started being investigated as an adjuvant to liposuction, for noninvasive body contouring, reduction of cellulite, and improvement of blood lipid profile.LLLT may also aid autologous fat transfer procedures by enhancing the viability of adipocytes. However the underlying mechanism of actions for such effects still seems to be unclear. It is important, therefore to understand the potential efficacy and proposed mechanism of actions of this new procedure for fat reduction[24].

The study of [25]revealed that aerobic training program has an effect on weight reduction after gastroplasty in obese females with no side effects reported by any patient in the study.

It has demonstrated that LLLT can reduce overall body circumference measurements of specifically treated regions. It has been proven that it is effective for the reduction of circumference of hips, waist, thighs, and, most recently, upper arms. Recent studies indicate that the results of LLLT are long-lasting if not permanent. With no adverse events reported to date, LLLT appears to be both safe and effective for fat reduction and body slimming[26].

## Acknowledgement

Prof. Dr. Ashraf Ahmed Mohammed Enab, Professor of General and plastic Surgery, Faculty of Medicine, BeniSuef University, for his great help, support and valuable advice throughout this work.

## References:

1. Sweeting HN .Measurement and definitions of obesity in childhood and adolescence: A field guide for the uninitiated". Nutr J; 2007, 6 (23): 1-8
2. Bray GA. Medical consequences of obesity. J. Clin. Endocrinol.Metab; 2004 89 (6): 2583–9
3. McTigue KM, Harris R and Hemphill B.Screening and interventions for obesity in adults: summary of the evidence for the US Preventive Services Task Force. Ann Intern Med 2003; 139: 933–49
4. Sternfeld B, Wang H and Quesenberry Jr. C. Physical activity and changes in weight and waist circumference in midlife women: findings from the Study of Women's Health Across the Nation. Am J Epidemiol2004;160:912-922.
5. Wozniak P, Stachowiak G, Piêta-Doliñska A and Oszukowski P. Laser acupuncture and low-calorie diet during visceral obesity therapy after menopause. ActaObstetriciaetGynecologica Scandinavica2003; vol. 82, no. 1, pp. 69–73.
6. Rapheal BA. and Wasserman DI.:Getting to the bare bones: A comprehensive update of non- invasive treatments for body sculpting, CurrDerm Rep,2013;(2): 144-149.
7. Janssen I, Katzmarzyk PT and Ross R. Body mass index, waist circumference, and health risk: evidence in support of current National Institutes of Health guidelines. Arch Intern Med.2004; Oct 14;162(18):2074-2079.
8. Stern L, Iqbal N and Seshadri P. The Effects of Low-Carbohydrate versus Conventional Weight Loss Diets in Severely Obese Adults: One-Year Follow-up of a Randomized Trial. Ann Intern Med. May 18, 2004;140(10):778-785.
9. RallanDand Harland CC. Ultrasound in dermatology--basic principles and applications.ClinExpDermatol. 2003 Nov;28(6):632-8.
10. Moreno-Moraga, J., Valero-Altés, T., Riquelme, A.M., Isarria-Marcosy, M.I. and de la Torre, J.R.: "Body contouring by non- invasive transdermal focused ultrasound." Lasers Surg Med., 2007;39: 315-323,
11. NeiraR,Arroyave J and Ramirez H. Fat liquefaction : The effect of low-level laser energy on adipose tissue. PlastReconstr. Surg 2002; 110:912-22.
12. Joni S. Yates, Stephanie Studenski, Steven Gollub, Robert Whitman, SubashanPerera, Sue Min Lai, and Pamela W. Duncan. Bicycle Ergometry in Subacute-Stroke Survivors: Feasibility, Safety, and Exercise Performance Journal of Aging and Physical Activity, 2004, 11, 64-74.

13. Rurik, I., Nagy, K. and Antal, M. Correlation of anthropometric parameters and blood pressure in elderly people.Orv Hetil.2004; 6:145(23): 1237-1241.
14. Yusuf S, Hawken S, Ounpuu S, Dans T, Avezum A, Lanas F, McQueen M, Budaj A, Pais P, Varigos J, Lisheng L, INTERHEART Study Investigators. "Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): case-control study". Lancet.2004; 364 (9438): 937–52.
15. NeiraR,Arroyave J and Ramirez H. Fat liquefaction : The effect of low-level laser energy on adipose tissue. PlastReconstr. Surg 2002; 110:912-22.
16. Wilmore, J.H., Gren, J.S. and Stanfosth, P.R.: Relationship of changes in maximal and submaximal aerobic fitness to changes in cardiovascular disease and non insulin dependent diabetes mellitus risk factors with endurance training. Metabolism, 2002;50(11): 1255-1263.
17. Jackson FR, Roche G, Kimberly JB and Douglas DD, T KS. Lowlevel laser-assisted liposuction: A 2004 clinical study of its effectiveness for enhancing ease of liposuction procedures and facilitating the recovery process for patients undergoing thigh, hip and stomach countouring. Am J CosmetSurg 2004;21(4):191–194.
18. Caruso MK,Pekarovic S and RaumWJ.Topical fat reduction from the waist. Diabetes ObesMetab.2007 ; 9:300-3
19. Pal G, Dutta A Mitra K, Grace MS, RomanczykTB , Wu X, Chakrabarti K, Anders J, Gorman E, Waynant RW and Tata DB.Effect of low intensity laser interaction with human skin fibroblast cells using fiber-opticnano-probes. J PhotochemPhotobiol .2007; B 86:252-61.
20. Brown, A.B., Greenbaum, L., Shtukmaster, S., Zadok, Y., Ben-Ezra, S. and Kushkuley, L.: "Characterization of nonthermal focused ultrasound for noninvasive selective fat cell disruption (lysis): Technical and preclinical assessment". Plastic and Reconstructive Surgery.2009; 124: 92–101.
21. Sabbour A., Omar H and El-Banna A.S .The Efficiency of Cavitation Ultrasound Therapy on Visceral Adiposity in PerimenpausalWomenBull. Fac. Ph. Th. Cairo Univ. 2009 Vol. 14, No. (1) Jan:93-102.
22. Ascher, B. Safety and efficacy of ultra shape contour I treatments to improve the appearance of body contours: multiple treatments in shorter intervals. Aesthet.Surg J.,2010 30(2): 217-224.
23. Palumbo, P., B. Cinque, G. Miconi, C. La Torre, G. Zoccali and M. Giuliani.Biological effects of low frequency high intensity ultrasound application on ex vivo human adipose tissue.Int J Immunopathol. Pharmacol.,2011; 24(2): 411-422.
24. Grassi FR, Ciccolella F, D'Apolito G, etal.Effect of low-level laser irradiation on osteoblast proliferation and bone formation. J BiolRegulHomeost Agents.2011;25:603-614.
25. NagibSH,.Waked SI and Borhan WH Efficacy of Aerobic Training Program on Weight Reduction after Gastric Banding (A Randomized, Controlled Trial).Bull. Fac. Ph. Th. Cairo Univ., 2012;Vol. 17, No. (2) Jul.
26. Mark SN, Jessica N, Matthew BZ"Body Contouring Using 635-nm Low Level Laser Therapy" SeminCutan Med Surg2013;32:35-40.

*****

# International Journal of ChemTech Research

[www.sphinxsai.com]

## Publish your paper in Elsevier Ranked, SCOPUS Indexed Journal.

**[1] RANKING:**

**has been ranked NO. 1. Journal from India (subject: Chemical Engineering) from India at International platform, by SCOPUS- scimagojr.**

**It has topped in total number of CITES AND CITABLE DOCUMENTS.**

**Find more by clicking on Elsevier- SCOPUS SITE....AS BELOW.....**

**http://www.scimagojr.com/journalrank.php?area=1500&category=1501&country=IN&year=2011&order=cd&min=0&min_type=cd**

**Please log on to - www.sphinxsai.com**

**[2] Indexing and Abstracting.**

**International Journal of ChemTech Research is selected by -**

**CABI, CAS(USA), SCOPUS, MAPA (India), ISA(India),DOAJ(USA),Index Copernicus, Embase database, EVISA, DATA BASE(Europe), Birmingham Public Library, Birmingham, Alabama, RGATE Databases/organizations for Indexing and Abstracting.**

**It is also in process for inclusion in various other databases/libraries.**

**[3] Editorial across the world. [4] Authors across the world:**

**For paper search, use of References, Cites, use of contents etc in-**

**International Journal of ChemTech Research,**

**Please log on to - www.sphinxsai.com**

*****