



## POSSIBILITIES OF MODERN PHYSICAL FACTORS FOR PREVENTION OF OVERWEIGHT AS A CONSEQUENCE OF HYPODYNAMIA AS A RESULT OF THE COVID-19 PANDEMIC

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### ABSTRACT

**Introduction.** The COVID-19 pandemic and the consequent changes, such as “home office” practices, directly related to hypodynamia, have led to an increase in the incidence of overweight and obesity. Reduced physical activity is a factor with a negative impact on a person's quality of life.

**Aim.** The aim of this study is to assess the possibilities of innovative physical factors in the prevention of overweight and related complications.

**Material and methods.** We have used scientific publications related to medical devices such as LPG Endermologie, Velashape, D-finitive EVO, Eximia, Emsculp NEO, Venus Legacy, Miha Body Tec. They have been analyzed. These machines are used in the fight against obesity and related complications. They are indicated for: the reduction of stagnation and elimination of toxins from the body, improvement of microcirculation and lymph circulation, increase in temperature in the affected areas, acceleration of lipolysis, toning of muscles, and tightening.

**Results.** Modern physical factors such as Radiofrequency, Infrared light, Ultraporation, High-intensive (mechanical) focused ultrasound and electromagnetic technology, Cryotherapy, and Lipolytic Laser have draining, vascularizing, analgesic, toning, and sculpting effect on the body, improve metabolism and removal of skin imperfections.

**Conclusion.** The present analysis shows the potential of innovative physiotherapeutic technologies for overweight patients and improving their quality of life

**Key words:** overweight, obesity, modern physical modalities, quality of life, LPG Endermologie, Velashape, D-finitive EVO

### INTRODUCTION

Obesity is a serious socially significant health problem and it is widespread. Its prevalence has affected both old people and many children and adolescents. Being overweight is a multifactorial disease that adversely affects a person's physical and mental condition and impairs their quality of life (1). According to recent studies, obesity is associated with over 200 complications (2). A sedentary lifestyle is at the root of this disease. The COVID-19 pandemic and the consequent changes - such as “home office” practice and distance learning,

directly related to hypodynamia, have led to an increase in the incidence of overweight and obesity (3). The decreased physical activity is a factor with a negative impact on a person's quality of life. Modern physical modalities play an important role in the prevention of overweight and obesity. Some complications of obesity are: slowing down of lymph-venous microcirculation, tissue inflammation and stagnation, dermal-epidermal temperature reduction, lipodystrophy, and loss of tone. According to a study (2011) on the different levels of health literacy in European countries, the health literacy in Bulgaria is low: 61% of the Bulgarian population has limited health literacy and 26% is health illiterate; for comparison, this percentage is only 1,6% in the Netherlands (4). It is necessary to improve the

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role of prevention and health promotion. Obesity is a chronic recurrent disease that can lead to a fatal outcome in COVID-19 patients. According to reports of the World Health Organization, the number of deaths from COVID-19 in one year is similar to the number of patients who died from obesity-related diseases. This makes it a global epidemic (5).

The etiology of obesity includes genetic causes, overconsumption of calories (unhealthy diet), reduced water intake, decreased physical activity- Hypodynamia ("home office"), lack of night sleep, endocrine disorders, high-stress levels (emotional trauma), medications, vitamin D deficiency, etc.

The types of obesity are classified according to different criteria:

- The morphological criteria consider obesity in individuals, depending on the way of increase (number or volume) of fat cells, according to the prevalence of hyperplasia or hypertrophy of adipocytes.
- The clinical criteria define the following types of obesity: central (android, visceral and male type) peripheral (gynoid, gluteo - femoral or female type)
- According to the severity of obesity (BMI) - first second and third degree
- According to the reason- exogenous and endogenous

Diagnostics include somatoscopy, manual pressing test, and contact thermography. They determine the severity and type: edematous or fibrotic. The first and second stages have a "mottled" appearance with blurred edges, the third stage is like leopard skin and the fourth is a black hole.

Other important indicators besides BMI are skinfold thickness (calipermetry), waist-to-hip ratio (WHR), and waist-to-height ratio (WHtR). EOSS - The Edmonton Obesity Staging System is a five-stage system of obesity classification that considers the metabolic, physical, and psychological parameters in order to determine the optimal obesity treatment. It allows to determine the health status, functional status of the patient and the severity of complications associated with obesity. EOSS is a good predictor of the metabolic syndrome (6).

## MATERIAL AND METHODS

The modern physical modalities, applied for prevention of overweight and obesity, are as follows: Mechanical suction (LPG

Endermologie), Radiofrequency (Velashape +IR, Venus Legacy, Ionica), Ultrasound (Eximia, HIFU), Cryolipolysis (Cryo cool med), Lipolytic Laser (D-finitive EVO-combined), Electromuscle stimulation (Miha body tec), Adipo wave, Emsculpt NEO, etc.

1. **LPG Endermologie-** Louis-Paul Guitay is the creator of the LPG device. He is a French engineer who set out to make his life, and the lives of other people suffering like him, better after a car accident. This terrible accident was an inspiration to create this revolution technology. It represented a new type of physical therapy to maximize the effect of massage therapy. According to Prof. Pier Antonio Bacci (7), LPG technology represents a real revolution in the field of physiotherapy, both for therapy and aesthetics. LPG has shown clinical efficacy in cellulite and its associated well-proven circulatory, anti-edematous, dermatrophic, and lipolytic properties (8). It works on the principle of deep non-aggressive lymphatic drainage. A study by A. Moseley, comparing MLD (manual lymphatic drainage) with this new technology, shows that LPG achieves a faster reduction of limb swelling in lymphedema (9). A study by Gharib and Diab (2016) shows that the combination of vacuum therapy (LPG device) with physical exercises leads to better results and has a positive effect on obesity as a reduction of circumferences and skinfold thickness (10). Mezencevová and Torok examine in detail the mechanism of action of the non-invasive Endermologie method by observing physiological effects on patients. Their report is focused on the benefits of this innovative system on human health (11). To improve the effect of LPG, we may make exercises with bands during the procedure (lipo-isolation).

Indications for LPG include edema, disorders of the venous-lymphatic circulation, overweight (obesity), cellulite, and chronic fatigue. The benefits of LPG therapy include reduction of fluid retention, improvement of filtration and removal of toxins; strengthening immunity; improving metabolism; reducing of swelling and inflammation, and improving the appearance of cellulite, reducing the circumferences of the hips, abdomen, and thighs - troublesome parts of the body that are resistant to training and diet shaping, firming and improving the quality of the skin, cellulite removal, skin regeneration, and rejuvenation. Contraindications are cancer in progress, infection, blood disease, and skin irritation.

**2. Vela shape** - Velashape is a medical device from the portfolio of world leaders in device procedures Syneron Candela. Velashape is the updated version of Velasmooth. According to Pavan Nootheti (2006) and co-authors, the device leads to an improvement in the condition of cellulite (12). There are already several generations of Velashape I, II, and III on the market. Hexel and authors propose a digital scale CSS-Cellulite Severity Scale, which includes 5 morphological criteria:

1. Number of dimple depressions
2. Their depth
3. Morphological appearance of the skin surface - type:
  - "orange peel"
  - "cottage cheese"
  - "mattress"
4. Degree of laxity of the skin
5. Scale of Nuremberg

Velashape is a system that combines the elos technology (electro-optical synergy) with the mechanical action of a vacuum on the skin. The application of radio frequency energy in combination with infrared (IR) and mechanical massage is an effective way to reduce the circumference of the abdomen, buttocks, thighs and improve the appearance of the skin (13). It is indicated for both medical (muscle spasms) and aesthetic purposes (treatment of cellulite and reduction of circumferences). The mechanical impact of the vacuum improves blood circulation, enhances lymphatic drainage and accelerates the metabolic processes in adipocytes. On the other hand, the elos technology provides heating of the dermal and subdermal layers, where it is possible to get a localized burn if the procedure is not performed correctly. The innovative bipolar radiofrequency technologies have proven to be effective, non-invasive, and easy to apply for dermatological imperfections (14). A study by N. Sadick and C. Margo in 2007 in the *Journal of Cosmetic and Laser Therapy* shows positive results, safety, and efficacy from the application of the Velashape system (15). A study by Neil Sadick and Lian Sorhaindo (2005) reviewed this technology and concluded that the combined radiofrequency light sources are safe and effective treatments including skin tightening, reduction of skin folds and thickening, and skin rejuvenation (16).

**3. D-finitive EVO** - D-finitive EVO is an integrated platform for non-invasive and painless treatment of problem areas, which includes the following systems: Digital Rotary

Vacuum System (D.R.V.S) –Beco Medical patent including progressive vacuum rotation with rotation up to 90°, multipolar radio frequency, LEDs: red (vasodilators) and blue LEDs (anti-inflammatory).

Endotermia- static vacuum system with radio frequency 0.8 and 2.6 MHz + contact cryo or thermotherapy applicator. There are two selectable frequencies according to the required depth of impact -0.8 MHz (deep) and 2.6 MHz (superficial). Peltier cells (Peltier) –two metal plates allow temperature selection on the applicator up to 44°, and with heat intolerance or sensitive skin - choice for contact with the applicator to -5°. Maximum safety, without patient discomfort due to the low temperature. The difference in cryofrequency is that this method uses a surface cooling system producing thermal shock by combining deep heat and surface cold (17).

Another tip is a lipolytic diode laser that affects the adipocytes by applying low-intensity laser energy with a wavelength of 650 nm. It causes an emptying effect of adipocytes at the intracellular level and significantly improves drainage functions to remove excess fluids and toxins. The application is absolutely painless. For a better effect of the hexapolar radio frequency, the laser leads to an effective way to stimulate the permeability of the adipocyte membrane without attacking the adjacent tissues, which causes a lipolysis effect without risk to the surrounding cells. In combination, the two technologies tighten the skin very well. A study investigating the effectiveness and mechanism of low-level laser energy (LLLT) with a wavelength of 635–680 nm acting as a non-invasive method of intervention in body contouring, concluded that LLLT achieved safe and significant girth loss. Loss of waist circumference produced a clinically and statistically significant improvement (18).

The latest HIMFU handpiece is designed to treat edematous areas. It does not heat the tissues, but only mechanical and athermal effects occur, disrupting the membrane of fat cells. The applicator allows the emission of energy in 3 modes: single, double, and triple, focusing and concentrating the energy at the depth required for treatment, which allows for working with very high precision.

The indications are cellulite, lymphatic drainage, local accumulation of fat, lipo reduction in obesity, and loose body skin.

Contraindications are pregnancy, mental implants in the body, oncological diseases, inflammatory processes in the body, and varicose veins.

**4. Eximia** – This device is a combination of ultrasonic cavitation and electroporation (ultraporation) with a four-phase endodermal vacuum (aspiration - pressure - aspiration - pause). Prof. Pier Antonio Bacci from the University of Siena examines in detail in Basic and Clinical Dermatology part 10 what dermo-electroporation is (19). Unlike iontophoresis, electroporation is superior to it because it has many more potential transdermal routes and is a faster method (20). Electroporation is a typical method in which active substances can be infiltrated without any side effects (21). The Eximia has two separate body tips. In one, ultrasound and electroporation work synergistically, and the other tip is for the vacuum. The one for the vacuum has two separate heads - small and large, depending on the size of the area being worked on. There is another one, which is the Skin report for the vacuum test. It is done once before the first procedure on the area where the accumulations are, to assess how elastic the skin is. According to Margit Juhász, Dorota Korta and Natasha Atanaskova Mesinkovska, ultrasound is an effective method for lipolysis and reducing the appearance of cellulite (22). The lipolytic effect continues partially even after the procedure itself is completed. Unlike the frequency of other ultrasound devices, which acts on the surface (1-3 MHz), the low frequencies of this ultrasound reach a depth - 33 KHz. In this way, a cavitation phenomenon is created, different from classical cavitation. It is safe and effective in reducing skinfold thickness (23).

**5. Emsculp NEO** - It is a device in which simultaneous High Intensive Focus Electromagnetic technology (HIFEM) and Radio Frequency treatment work (24). For the very first time, this patented concept allows practitioners to simultaneously apply RF heating and HIFEM activation in the same treatment area, at the same time. Several clinical studies show synergistic effects on the muscle and fat tissues (25). A 2020 study by David Golberg demonstrated that the simultaneous application of both technologies is safe and leads to visible results (26).

**6. Venus Legacy**- In 2013, Venus Legacy was approved by the FDA (27). It is a device, which

includes two physical modalities: RF-multipolar radiofrequency, using a complex algorithm to apply homogeneous energy and heat at different depths in the tissues. This allows safe and quick accumulation of heat and easy maintenance of the required temperature of 44-45° and PEMF - the effect of radiofrequency is increased by the use of a pulsating electromagnetic field. It is a non-thermal technology that radiates through the electrodes of the applicators (28). A 2011 study by Ghislaine Beilin and Philippe Benech demonstrated the safety and effectiveness of an electromagnetic field (EMF) in reducing abdominal obesity (29).

**7. Electro-muscle stimulation-EMS** significantly reduces waist circumference in adults with abdominal obesity without side effects. This is why EMS is an effective and safe treatment for men and women with visceral obesity (30). The authors of a study published in the Journal of Strength and Conditioning in 2012. , state that EMS offers a promising alternative to traditional strength training for improving strength parameters and motor abilities in humans (31). The authors of a study (Jin-seop Kim and Duck-won Oh), entitled "Effects of high-frequency current therapy on abdominal obesity in young women: a randomized controlled trial", published in 2015 in the Journal of Physiotherapy, concluded that EMS did produce significant effects on reducing waist circumference, abdominal obesity, subcutaneous fat mass, and body fat percentage (32). EMS significantly improves the functional capacity toward higher resistance to fatigue. This increase also results in increased lipolytic activity and increased mitochondrial activity in abdominal adipose tissue (33).

## RESULTS AND DISCUSSION

The bibliographic review of currently available scientific publications related to modern physical factors shows their possibilities for the prevention of being overweight and its related complications. These medical devices are indicated for: the reduction of stagnation and elimination of toxins from the body, improvement of microcirculation and lymph circulation, increase in temperature in the affected areas, acceleration of lipolysis, toning of muscles, and tightening. Modern physical factors such as Radiofrequency, Infrared light, Ultraporation, High- intensive (mechanical) focus ultrasound, High- intensive focus electromagnetic technology, Cryotherapy,

Lipolytic Laser have draining, vascularizing, analgesic (reduction of tissue tenderness), toning, and sculpting effect on the body, improve metabolism and removal of skin imperfections.

The Endermologie technology is applied with the help of the latest generation apparatus that treats skin structures with a combination of suction and rubbing. This process involves special motorized roller skates, and it restructures the connector skin tissue, and stimulates blood- and lymphatic circulation. In our fat, there are two types of fat receptors: Alpha (add and store fat) and beta (burn fat). Women have more alpha receptors. The principle of the Endermologie technology is based on Mechano-Stimulation. It stimulates the beta receptors. The direction of the rollers may be forwards, backwards, inside and out depending on the depth of the work. They may rotate in a concurrent or opposite direction. The technology of the maneuvers may be different according to the area being processed: rock, swing, sanding, and bouncing.

Using this new methodology we can have active action for connective tissue, lymphatic drainage, vascular system, metabolic function, adipose tissue, the status of the skin, and collagen production. During the procedure, the patient is having put on Endermowear (personal and opaque clothing specific to lipo massage). LPG Lipo Massage sculpts and uplifts while reducing excess fat, helps reshape and slims disproportional figures, improves contours, and smooths cellulite.

Vela shape's Elos technology includes RF bipolar radio frequency- 1MHz (power 50 W), IR infrared light in the spectrum 700-2000nm, and Mechanical vacuum -360 mbar. The innovative bipolar radiofrequency technologies have proven to be effective, non-invasive, and easy to use for dermatological imperfections. These technologies are combined in one tip with two metal rollers. The applicator should fit snugly on the skin for good contact. Good contact ensures the effectiveness of the three technologies. The main goal of RF and IR is to achieve hyperemia, which leads to saturation with a greater amount of oxygen. In this way, lipolysis is increased, and the purpose of the vacuum is to enhance blood circulation. On the other hand, the massage rollers of the vacuum facilitate deeper penetration of the heat to the hypodermis, where the fat is located. The vacuum also aids in the drainage of excess

intracellular and intercellular fluids to the lymphatic system.

Eximia's exclusive patent is the synergistically acting techniques - ultrasonic cavitation and electroporation (transdermal "injection" technique or needle-free mesotherapy), the effectiveness of which has been scientifically proven. This so-called "deep transdermal injection" aims and guarantees the strengthening of metabolic functions, facilitates the elimination of adipocytes, which enhances the effect of the procedure. The effect of this irreversible electroporation IRE - irreversible electroporation on adipocytes leads to delayed harmless apoptosis.

Emsculp NEO -a new approach- simultaneous emission of synchronized radiofrequency and magnetic fields in a single applicator is for fat elimination and muscle building. The device utilizes a circular coil for magnetic field induction and radiofrequency electrodes in a single applicator which poses a technological challenge to the construction. It allows a simultaneous treatment of muscle laxity through supramaximal muscle stimulation and reduction of excessive adipose tissue through radiofrequency heating.

Venus Legacy- through the two non-invasive mechanisms - thermal (multipolar radio frequency) and non-thermal (PEMF) and the integrated VariPulse platform, enhances blood circulation and lymphatic drainage, improves the lipolytic effect, and the reduction of fat accumulations. It provides adjustable pulsed suction through positive and negative air pressure that provides deeper energy penetration. The device has RealTime Thermal Feedback which improves the physical therapist's work.

The electro-muscle stimulation achieves stronger and more intense muscle contractions than voluntary effort can achieve on one's own. Depending on the intensity and individual goals, one can build muscles, achieve a better-shaped body, and while doing so the muscles become stronger and more efficiently working. Unlike using encumbrances, here in no way joints are stressed - this method spares them. Hence, the risk from tension in the joints is missing, which makes the workout appropriate for older people or people with joint problems as well. Unlike the other exercises, here we can target specific body areas where we want to work on.

An American study published in the Lancet in 2020 (34) highlights the psychological impact of the lockdown - the duration of a lockdown itself is a stress factor: a duration of more than 10 days is predictive of symptoms of post-traumatic stress disorder. A lockdown can cause many symptoms such as anxiety, emotional (chronic) fatigue, insomnia, anger, stress, as well as loss of motivation to work, and modified immunity. These devices (with vacuum massage) have an important role for relax our body and for improving our well-being which is major for our health. A 2017 U.S. survey showed that approximately 7% of U.S. adults used massage therapy primarily for general disease prevention (35). These people reported positive results of the massage on specific health problems and general well-being.

A study by Günay Eskici from the Faculty of Health Science at the Department of Nutrition and Dietetics at Erzincan University in Turkey, in 2017 was conducted to show the effect of innovative physical modalities on fat deposit's removal (36).

Massage therapy is a beneficial tool for people's health because it can reduce their psychological stress levels. The massage also helps reduce anxiety, and improve mood, overall health, and quality of life but also has a positive effect on attention deficit, insomnia, pain, and immunity. It generally improves physical, emotional, and mental well-being through improved sleep, relaxation, stress, and muscle tension relief.

## CONCLUSION

The advantages of the modern physical modalities to bariatric surgery (radical method for morbid obesity) are easy to apply, non-invasive applications, no recovery period, safe and nearly painless, different application protocols, visible results, non-surgical alternative for liposuction, no anesthesia needed, no downtime required, flexible application of parameters according to the individual needs, different combinations of technologies in the devices for the synergistic action, reduced risk of surgical complications and infection. The performed physical factors stimulate the metabolism. The physiotherapy devices have the potential to improve filtration and elimination of toxins; Reduction of fluid retention, Strengthening immunity; Improving metabolism; Reduction of swelling and inflammation, reduction of circumferences of

thighs, hips, abdomen - problem parts of the body that are resistant to training and shaping through diet, tightening and improving the quality of the skin, removal of fibrosclerotic-edematous panniculopathy, regeneration and rejuvenation of the skin. The present analysis shows the potential of some innovative physiotherapeutic technologies which can be very useful in the complex program for overweight`s prevention and improving people`s well-being and quality of life.

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