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Zinātnisko rakstu krājumā *Daugavpils Universitātes 63. starptautiskās zinātniskās konferences rakstu krājums = Proceedings of the 63rd International Scientific Conference of Daugavpils University* apkopoti 2021. gada 15.–16. aprīlī konferencē prezentētie materiāli.

Daugavpils Universitātes 63. starptautiskās zinātniskās konferences rakstu krājums tiek publicēts 3 daļās: A. daļa. *Dabaszinātnes*; B. daļa. *Sociālās zinātnes*; C. daļa. *Humanitārās zinātnes*.

The annual scientific conferences at Daugavpils University have been organized since 1958. The themes of research presented at the conferences cover all spheres of life. Due to the facts that the conference was of interdisciplinary character and that its participants were students and outstanding scientists from different countries, the subjects of scientific investigations were very varied – in the domains of natural sciences, health care sciences, humanities and art, and social sciences.

The results of scientific investigations presented during the conference are collected in the collection of scientific articles *Proceedings of the 63rd International Scientific Conference of Daugavpils University*.

Proceedings of the 63rd International Scientific Conference of Daugavpils University are published in three parts: part A. *Natural sciences*; part B. *Social Sciences*; part C. *Humanities*.

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PHYSICAL PREVENTION AND REHABILITATION ALGORITHMS IN OVERWEIGHT, OBESITY AND CELLULITIS

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Abstract

Key Words: *obesity, cellulitis; physical prevention, rehabilitation algorithm*

Overweight, obesity and cellulitis are considered as a serious health and cosmetic problem, with serious consequences on the quality of life.

Physical medicine and rehabilitation can be useful in the process of prevention and rehabilitation of these patients, applying different physical modalities.

In the complex prevention and rehabilitation algorithm, we include: physical activities and sports; exercises (analytic exercises for abdominal belt, for gluteal and femoral muscles); ultrasound-cavitation and phonophoresis with anticellulite gels; **endermology (LPG technology)**; functional electrical stimulations; radio-frequency, VelaShape; diet and patient education.

We applied complex prevention and rehabilitation algorithms using a synergic combination of different physical factors: augmentation of the regular physical activity, exercises, one soft-tissue technique (lymphopressotherapy or post-isometric relaxation); two preformed modalities; one cryo or thermo-agent.

We present series of clinical cases suffering from overweight and cellulite; after application of a rehabilitation complex. Our results included: amelioration of the skin elasticity and of the “orange peel”; decrease of the body-mass index, reduction of the waist circumference).

We propose a hypothesis of the mechanisms of action of physical modalities on overweight, obesity and cellulitis.

Introduction

Overweight, obesity and cellulitis are considered as a serious health and cosmetic problem, with serious consequences on the quality of life (Burges, 2005).

Metabolic syndrome and visceral obesity are considered as the „edipemic of the last century”.

According official statistics, over 50% of the European population is overweight or obese.

Obesity has reached epidemic proportions globally, with at least 2.8 million people dying each year as a result of being overweight or obese. Once associated with high-income countries, obesity is now also prevalent in low- and middle-income countries. Governments, international partners, civil society, non-governmental organizations and the private sector all have vital roles to play in contributing to obesity prevention (WHO, 2020).

Overweight and obesity are epidemic diseases affecting over 600 million adults worldwide and have been declared by the World Health Organization (WHO) as the leading global chronic health issues. (ISPRM / ESPRM Guidelines, 2020).

Physical prevention of these conditions can be useful.

Aim of the article

The general goal of our work in this field is to demonstrate the impact of physical modalities in the prevention and rehabilitation of overweight, obesity and cellulitis.

The concrete aim of current article was to compose a complex algorithm for physical prevention and rehabilitation, based on a detailed bibliographical analysis, literature review and our modest clinical experience.

Metabolic syndrome

The key sign of metabolic syndrome is central obesity, also known as visceral, male-pattern or apple-shaped adiposity. It is characterized by adipose tissue accumulation predominantly around the waist and trunk (Antipatis, 2001).

Other signs of metabolic syndrome include high blood pressure, decreased fasting serum HDL cholesterol, elevated fasting serum triglyceride level, impaired fasting glucose, insulin resistance, or prediabetes (Oxford Handbook of Endocrinology and Diabetes, 2014). Associated conditions include hyperurikemia; fatty liver (especially in concurrent obesity) progressing to nonalcoholic fatty liver disease; polycystic ovarian syndrome in women and erectile dysfunction in men; and acanthosis nigricans.

Obesity

Obesity is defined as an excess of body fat, sufficient to adversely affect health (Antipatis, 2001).

Body mass index (BMI) and waist circumference, as a measure of fat distribution, are the most commonly used measures, but a clinical staging system is increasingly used to determine risk and management (Lavin, 2019). BMI is an imprecise measure of adiposity and does not account for fat distribution, which may better determine metabolic and cardiovascular risk at lower BMI.

In clinical practice we apply many scores for evaluation of obesity: Edmonton Obesity Staging System (fig. 1) and Body-Mass Index (ISPRM/ESPRM Guidelines, 2020), Waist circumference (Oxford Handbook, 2014) and Associated disease risk (fig. 2).

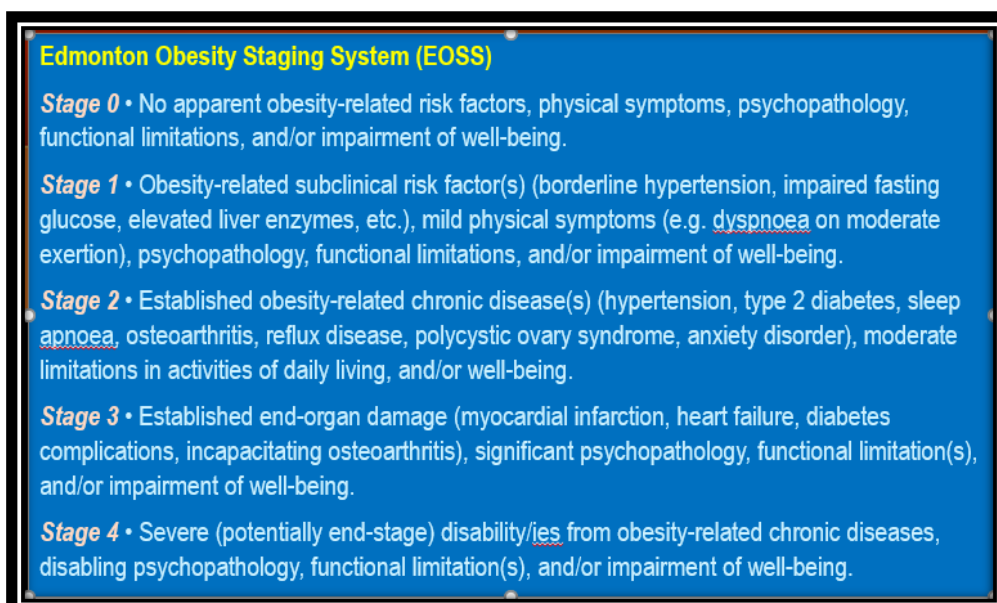


Figure 1. Edmonton Obesity Staging System (EOSS)

			Disease risk relative to normal weight and waist circumference	
			Normal category	Above normal cut-point
Weight category	BMI (kg/m ²)	Obesity class	Men <102 cm (<40 in) Women <88 cm (<35 in)	>102 cm (>40 in) >88 cm (>35 in)
Underweight	<18.5		—	—
Normal	18.5–24.9		Increased	Increased
Overweight	25.0–29.9		Increased	High
Obesity	30.0–34.9	I	High	Very high
	35.0–39.9	II	Very high	Very high
Extreme obesity	≥40	III	Extremely high	Extremely high

BMI, body mass index.

Figure 2. **Body-Mass Index, Waist circumference and Associated disease risk (according Oxford Handbook, 2014; WHO, 2020)**

Obesity consequences

Many consequences of overweight and obesity are described (Williams textbook of Endocrinology, 2016):

- ✓ **mortality rates** rise steadily at BMI >5kg/m². Obesity and physical inactivity have both independent and dependent effects on all-cause mortality.
- ✓ **loss of life expectancy**: BMI >35kg/m² —5–7 years at age 45.
- ✓ **type 2 diabetes**: elevation in BMI, the dominant risk factor for development of diabetes. Relative risk (RR) in overweight men 2.4, women 12.4; at BMI 30kg/m² >10; increased to 50–90-fold at BMI >35.
- ✓ **hypertension**: RR for overweight men 1.8, women 2.4.
- ✓ **dyslipidaemia**: moderate relationship with total cholesterol, closer relationship with triglycerides, HDL cholesterol.
- ✓ **stroke**: RR 1.2 for overweight and 1.5 for obese men and women.
- ✓ **asthma**: obese 2 ×, overweight 1.4 × more likely to develop asthma.

Some authors classified obesity consequences in the system of four M: Mental, Mechanical, Metabolic and Monetary (figure 3).

Obesity associations and consequences			
'Mental'	'Mechanical'	'Metabolic'	'Monetary'
Depression	Sleep apnoea	Type 2 diabetes	Lower educational achievement
Low self-esteem	Hypoventilation	Dyslipidaemia	Employment discrimination
Attention deficit disorder	Osteoarthritis	Hypertension	Lower income
Eating disorder	Chronic pain	IHD	Chronic disability
Cognitive impairment	Gastro-oesophageal reflux	Gout	Increased healthcare costs
	Incontinence	NAFLD and NASH	
	Thrombosis	Cancer	
	Intertrigo		

Figure 3. The four M obesity consequences

Cellulitis

Cellulite is a very common, harmless skin condition; prevalent in women. Inspection demonstrates dimpled or bumpy skin on the thighs, hips, buttocks and abdomen. It's sometimes described as having a cottage cheese or orange peel texture.

Authors described four clinical and histological phases (Goldman, 2010):

- ❖ **Pre-clinical phase 1** of lymphatic and venous stasis, and initial oedema;
- ❖ **Phase 2** of vasodilatation, with *oedema of the connective tissues* (with liquids rich in electrolytes and mucopolysaccharides) and increase of lipids;
- ❖ **Phase 3** of hyper-polymerization of mucopolysaccharides and hypertrophy of adipocytes, formation of *micronodules*;
- ❖ **Phase 4** of fibrosis, proliferation and sclerosis and formation of *macro-nodules*.

Physical activity for obesity

Regular exercise induces cardiorespiratory fitness and leads to a beneficial effect on other risk factors, with a reduction in blood pressure and improvement in lipid profile.

Recommendations include 225–300 min / week of moderate intensity exercise (equivalent to 7.5–10.5MJ, 1,800–2,500kcal) is recommended for weight loss maintenance (Pearson et al, 2002).

Physical modalities for treatment of obesity and cellulitis

Physical medicine and rehabilitation can be useful in the process of prevention and rehabilitation of these patients, applying different physical modalities (ISPRM / ESPRM Guidelines, 2020; Koleva, 2006, 2007):

- **from the group of natural physical factors:** *temperature; water and peloids; active exercises and massage (including vacuum massage, manual lymphatic drainage and lymphopressotherapy; sports and physical activities); and the corresponding parts of PRM (cryo- / thermotherapy; balneo- and peloido-therapy; physiotherapy and ergotherapy);*
- **from the pre-formed physical factors:** *electrical currents of low, medium and high frequency; electrostatic field (Deep Oscillation); phototherapy, including laser; ultrasound; and the correspondent parts of PRM (electrotherapy, lasertherapy, ultrasound-therapy).*

In the complex prevention and rehabilitation algorithm, we include: physical activities and sports; exercises (analytic exercises for abdominal belt, for gluteal and femoral muscles); ultrasound-cavitation and phonophoresis with anticellulite gels; endermology (LPG); functional electrical stimulations; radio-frequency, VelaShape; diet and patient education.

Physical methods

We use different physical methods (Koleva, 2006), as follows:

- ❖ *Analytic exercises, training of paravertebral muscles (“muscle belt” exercises, spine flexion /Williams/ and extension exercises /Superman exercises/), squats, specific exercises for abdominal press and for gluteal muscles, for femoral and brachial muscles; post-isometric relaxation, stretch techniques, manual massage; regular physical activity (10 000 steps daily, tourism, swimming and other sports or elements of sport); mechanotherapy;*
- ❖ *Hydro and balneotherapy, underwater exercises; thalassotherapy (sea water therapies);*
- ❖ *Peloidotherapy (fango, parafango, sea lye);*
- ❖ *Functional electrical stimulations; high frequency electric currents (diathermy, ultrahigh frequency, radar or radiofrequency).*

For some of the mentioned techniques, we need specific devices.

Specific devices

We apply specific devices for lymphatic drainage (Kutlubat et al, 2013; Mesencevova et al, 2017; Koleva, 2007):

- ✚ *the French system LPG-endermologie (fig. 4),*
- ✚ *the Velashape system (a combination of bipolar radio-frequency, infra-red light and mechanical vacuum - fig. 5),*
- ✚ *D-finitive Evo & endothermia (combination of multi-polar radio-frequency, progressive vacuum rotation, red and blue LED-light diodes - fig. 6),*
- ✚ *Shock-wave therapy or Adipo-wave (fig. 7),*
- ✚ *Miha-electrical stimulations (with exercises),*
- ✚ *Eximia (with radiofrequency) and*
- ✚ *the French system Cryologie or Cryolipolysis (fig. 8).*



Figure 4. The French system LPG endermologie



Figure 5. The Velashape system



Figure 6. D-finitive Evo

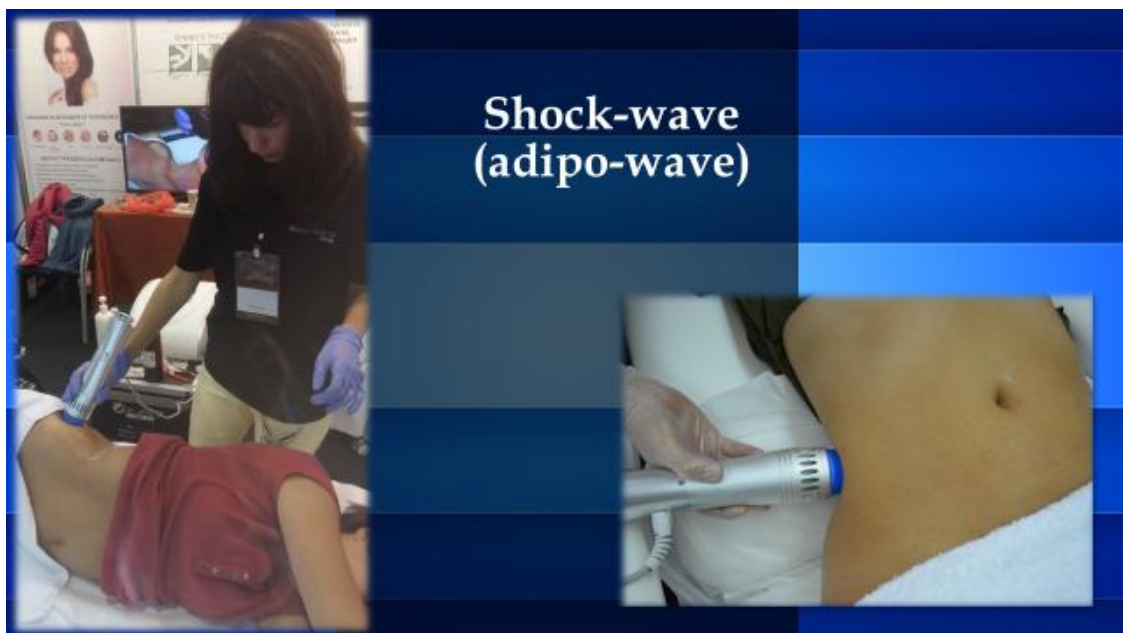


Figure 7. Adipo-wave

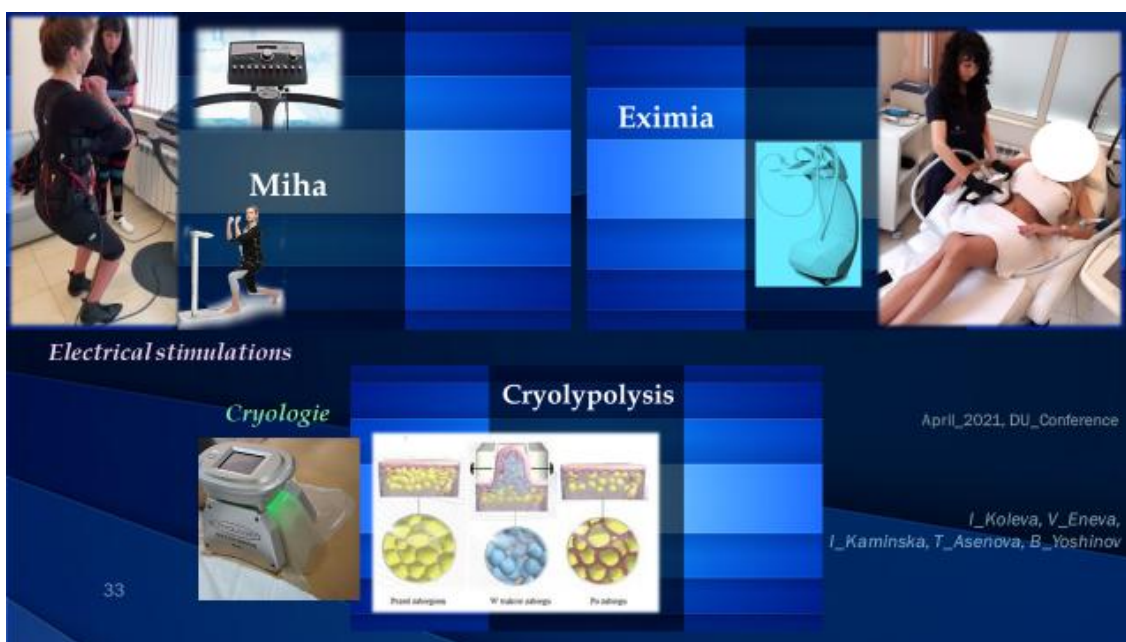


Figure 8. Miha-electrical stimulations, Eximia and Cryolipolysis

Our own experience

We applied these physical modalities and rehabilitation complex in patients with metabolic syndrome, obesity, cellulitis, after mesotherapy and after liposuction.

Usually, we apply complex prevention and rehabilitation algorithms using a synergic combination of different physical factors: augmentation of the regular physical activity, exercises, one soft-tissue technique (lympho-pessotherapy or post-isometric relaxation); two preformed modalities; one cryo or thermo-agent.

Material and methods

After the clinical exam and lab-analysis, for assessment we apply qualitative and quantitative methods, including BMI, centimetry and calipermetry (fig. 9).



Figure 9. **Calipermetry**

In the complex prevention and rehabilitation algorithm, we include: physical activities and sports; massage; exercises (including underwater exercises); laser-therapy, ultrasound - cavitation, ultraphonophoresis with anticellulite gels, high frequency ultrasound (HIFU); vacuum massage, lymphatic drainage and endermology using LPG techniques; electro-static field of Deep oscillation (DO) therapy and functional electrical stimulations (FES) with low frequency and middle frequency currents; high-frequency electric currents, including radio-frequency; diet, patient education.

Concretely, the complex programs comprised:

- ✓ ***physical activities and sports;***
- ✓ ***massage;*** vacuum massage, lymphatic drainage and endermology using LPG techniques;
- ✓ ***exercises*** (including underwater exercises);
- ✓ ***performed factors:*** Laser-therapy, Ultrasound - cavitation, ultraphonophoresis with anticellulite gels, HIFU; electro-static field of Deep oscillation (DO) therapy; functional electrical stimulations (FES) with low frequency and middle frequency currents; high-frequency electric currents, including radio-frequency;
- ✓ ***diet,***
- ✓ ***patient education.***

Results

Our comparative observations and evaluations demonstrate:

- ❖ **Stimulation of the trophic of the skin;**
- ❖ **Improvement of some anthropometric parameters:**
 - *decrease of the body-mass index,*
 - *reduction of the waist centimetry and*
 - *reduction of the calipermetric values of the skin folds;*

❖ Modification of the blood serum lipids

- ✓ decrease of the levels of the total cholesterol, LDL-cholesterol and triglycerides,
- ✓ increase of the HDL-cholesterol).

We present series of clinical cases suffering from overweight and cellulite; after application of a rehabilitation complex. Our results include: amelioration of the skin elasticity and of the “orange peel”; decrease of the body-mass index, reduction of the waist circumference). Next figures 10 and 11 present the reduction of the abdominal fat (fig. 10), of femoral and brachial cellulitis (fig. 11).

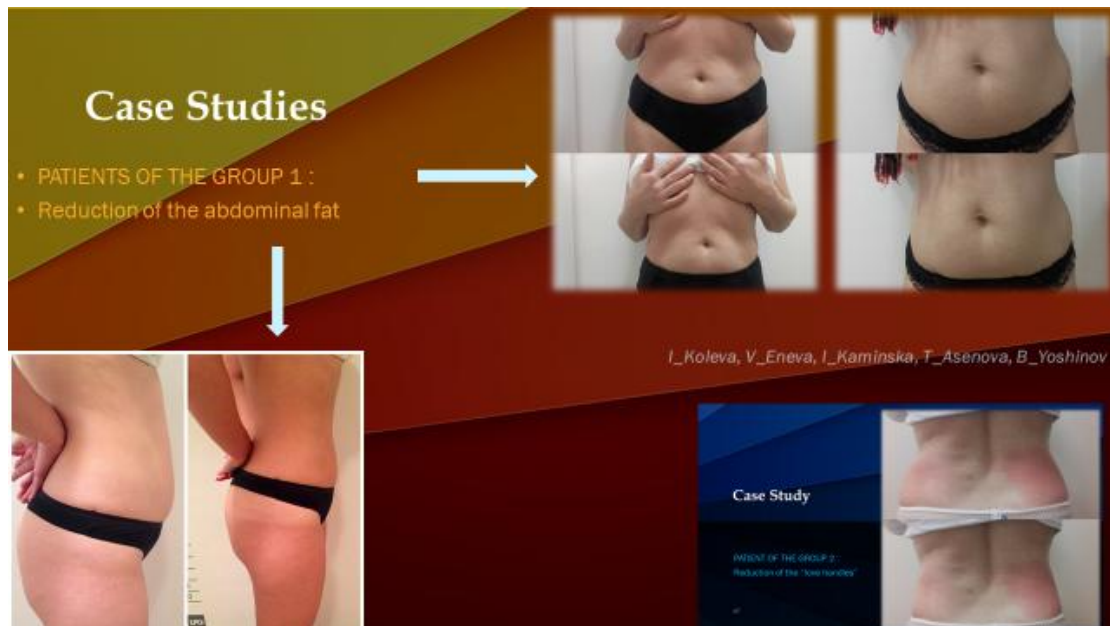


Figure 10. Results – reduction of the abdominal fat and the “love handles”



Figure 11. Results – reduction of the femoral and brachial cellulitis

Discussion: Algorithms and Mechanisms

We consider useful the synergic combination of *Diet, Basic physical activity & specific physical factors*. Our results demonstrated that in the **complex rehabilitation algorithm** we must include several physical modalities, as follows:

- ✓ **Physiotherapy & Ergotherapy** - 2-3 procedures: *augmentation of the regular physical activity, exercises, Other activities: dances, tourism, etc.*;
- ✓ **Soft tissue techniques** - One procedure: *Massage; Lymphatic drainage; Post-isometric relaxation, etc.*;
- ✓ **Cryo-/ Thermo-therapy** - *One cryo-/thermo-agent*;
- ✓ **Preformed modalities** - two preformed agents: *electrotherapy, ultrasound, LASER*.

We suggest an explanation of some **mechanisms of action of physical modalities** on obesity, cellulitis and consequences of liposuction. *Preformed physical factors* stimulate the metabolism, ameliorate the skin trophy (of epidermis, derma, hypodermis), provoke oedema reduction, stimulate the neurotransmission. *Natural physical factors* increase the energy output, stimulate the catabolic chains, regulate the balance between sympathetic and parasympathetic, provoke vasodilatation and oedema reduction. Our own hypothesis of the mechanisms of action of physical modalities on overweight, obesity and cellulitis is presented in figure 12.

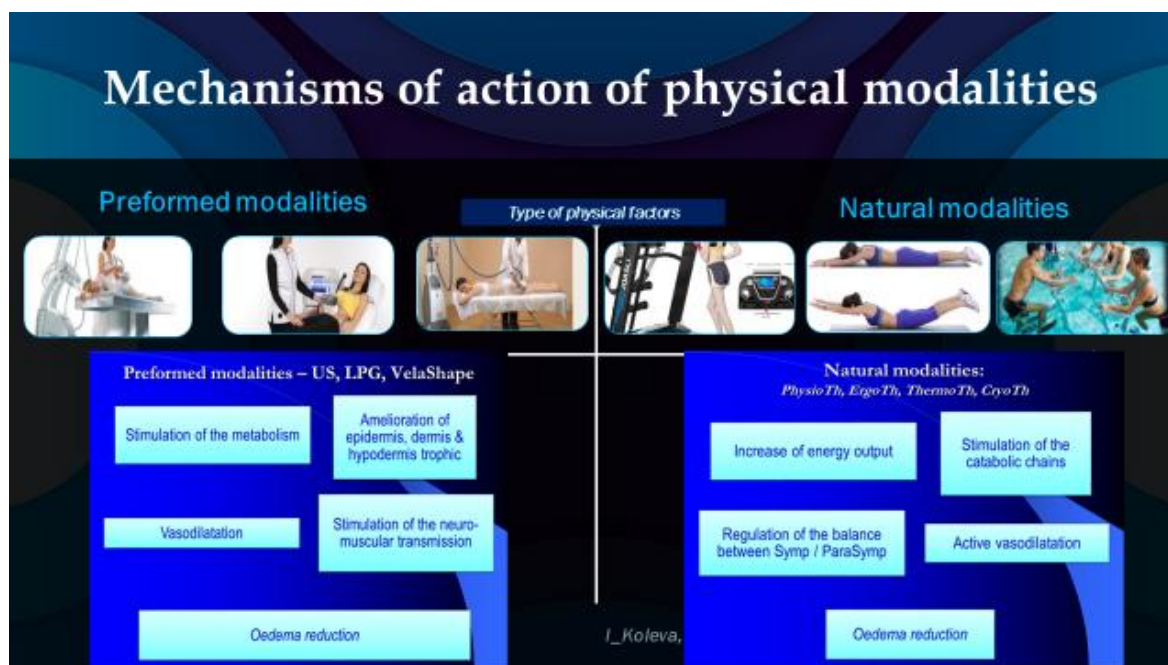


Figure 12. Mechanisms of action of physical modalities on obesity and cellulitis

Conclusions

In conclusion, we must accentuate on the interests of application of rehabilitation. Physical modalities are: *easy to apply; atraumatic; well tolerated by patients / clients; cheap; they have*

important potential of combination with specific dermatologic and cosmetologic treatments, with diet & regular physical activity. A multi-disciplinary team will be included in the rehabilitation process.

Physical modalities can be very useful in the complex programs for prevention, treatment and rehabilitation – for patients with overweight, obesity and cellulitis. The systematic approach improve significantly the quality of life of these types of patients.

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