

PSYCHOSOMATICS IN EATING DISORDERS

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SUMMARY

Background: To study the psychosomatic options and dynamics in patients with eating disorders. To conduct a comparative study of psychosomatic characteristics of surveyed patients with eating disorders, taking into account the duration and severity of protein-energy deficiency and levels of catecholamines excretion; to reveal features of mental working capacity, basic mental processes and EEG data at different stages of eating disorders; to develop scientifically based effective methods and means for correcting pathological changes that have arisen as a result of prolonged protein-energy deficiency in eating disorders.

Methods: Catamnestic, statistical, clinico-psychopathological with somatic, psychological and laboratory examination, anthropometry, high-performance liquid chromatography, electroencephalography. Statistical analysis of collected data was processed using the program IBM SPSS Statistics 22, the confidence level p-value is ≤ 0.001 .

Results: The long-term consequences of prolonged fasting in 500 women with eating disorders (ED), who applied for help at the RUDN department and were examined in 1987-2013, were studied. The most common somatic complications of prolonged protein-energy deficiency were investigated. In addition to the clinical method and anthropometry, to measure the efficiency of weight gain after prolonged alimentary deficiencies and to treat anorexia nervosa patients the pathopsychological method of "Shabalina's complex decoding" and analysis of catecholamine excretion rates in urine of patients with anorexia at different stages of therapy were used. Improvement of mental performance and general condition of the examined after applying the developed treatment was observed. Scientifically based principles of therapy, allowing to avoid complications of long-term fasting and during weight gain were suggested.

Key words: eating disorders - catecholamine excretion - long-term consequences – treatment - mental performance

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INTRODUCTION

The existence, growth and development of the human body are inherently associated with the characteristics of nutrition. Its deficiency or excess is the main pathogenetic cause for a number of conditions linked to immunity and the reactivity of the organism. According to WHO more than 2 million people on the planet are starving. The fast-growing organism of children and adolescents is most sensitive to this ecological factor (Suleimanov 2015, Tsygankov et al. 2015). For successful growth and due development, a balanced, full-fledged diet is necessary. Its absence can hamper successful social and labor adaptation and may harm health, particularly reproductive function (Suleimanov & Artemieva 2011, Lev et al. 2016). Excessive nutrition and obesity to the point of metabolic syndrome and its various complications is even more dangerous (Tsygankov & Artemieva 2015, Zemmet et al. 2007). Eating disorders (ED) are the most accessible model for a comprehensive study of pathologic effects of prolonged exposure to hunger and overeating.

Eating disorders include anorexia nervosa (AN), nervous bulimia (BN), psychogenic overeating (BED), psychogenic loss of appetite, and psychogenic vomiting as well as atypical forms (ICD-10 1994). Anorexia nervosa is a syndrome that usually develops in ado-

lescence more often in female patients, manifested by partial or complete refusal of food for weight loss. The syndrome occurs based on an idea of existing or imaginary excess weight (Korkina et al. 1986). The main clinical manifestation of the disease, along with a decrease in body weight by 30-50%, is amenorrhea. Patients thoroughly dissimulate the exact causes of exhaustion, bringing themselves to cachexia. The prevalence of ED has been increasing in recent years up to 4-5% of population and reaches 8-10% of population under the age of 25 in some states (Artemieva & Tsygankov 2016, Tsygankov & Artemieva 2015).

In recent decades, NB has become widespread. It often develops as a complication of NA. The period of food restriction preceding bulimia results in the emergence of a non-satiated hunger, followed by bouts of overeating and massive self-induced vomiting, the use of large doses of laxatives and diuretics that are taken by patients to facilitate weight loss (Korkina et al. 1986). The described pathological eating behavior is extremely dangerous because of the development of electrolyte disturbances.

When eating disorders are observed, not only mental, but also somatic, neurological, endocrine disorders, are accompanied by cachexia with multiple organ failure and a possible threat of death. In the modern era the significant increase of this pathology is attributed to

the influence of various factors (Suleimanov 2015, Tsygankov et al. 2015), among which are the promotion of dieting, the advertising of very thin fashion models, even the production of puppets of the corresponding proportions (Suleimanov 2015, Marilov & Suleimanov 2004). All the above emphasizes the need for timely diagnosis, comprehensive long-term treatment, and rehabilitation after recovery from a severe mental and physical conditions (Artemieva et al. 2007).

According to modern ecological and physiological data, the health of children and adolescents should be one of the leading directions of research (Artemieva & Suleimanov 2006). Adaptation of the growing organism to various environmental influences, the most important of which is the quantitative and qualitative composition of food and the protein-energy value of products, is a priority in physiology and medicine. The nature of nutrition is an important component of the ecological portrait of a person, a system-forming factor of homeostasis, which largely determines the relevance of its study in medicine, human physiology, and ecology (Zemmet et al. 2007). The need for further study of the effect of deficiency and excess nutrition and the long-term effects of starvation on the body of an adult and especially on the younger generation is noted (Vainilovich et al. 2010). The acute need for research on the psychophysiological characteristics of eating disorders is due to:

- a high risk of death from protein-energy deficiency in young people;
- the advocacy of curative fasting and various diets, in which cessation of fasting is not physiologically correct and often provokes the development of secondary somatic complications.

The problem of protein-energy deficiency also arises in many somatic diseases, improper religious fasts and long-term stay on parenteral nutrition (Zemmet et al. 2007). However, despite numerous studies of domestic and foreign authors, up to the present time there are no scientifically substantiated criteria and optimal methods of withdrawal from the state of marked protein-energy undernutrition (PEU). Studies have shown that anorexia nervosa can be a model for solving an important environmental, social and medical problem – describing the consequences of prolonged fasting, developing and improving the system of human adaptation to long-term PEU, and for the study of the mental (Suleymanov et al. 2017) and somatic development of adolescents in malnutrition settings (Suleimanov & Artemieva 2007).

Unfortunately, there are no scientifically validated effective methods of correcting the insatiable feeling of hunger and withdrawal from PEU, the long-term consequences of ED have not been traced, and the features of excretion of catecholamines in ED that are indicators of nonspecific stress reactivity and mediate the effect of the main psychopharmacological agents for treatment of ED have not been studied. The present work is devoted to the study of the above issues.

To study the psychophysiological characteristics and dynamics in women with eating disorders. In connection with the purpose of the study, the following tasks were set: to study the morpho-functional and psychosomatic characteristics of women with eating disorders, taking into account the duration and severity of protein-energy undernutrition; to reveal features of the basic mental processes, impaired cognitive function and mental performance as well as EEG data at different stages of eating disorders; to develop scientifically based effective methods and techniques for correcting pathological changes resulting from exposure to the prolonged protein-energy deficiency in patients with eating disorders.

METHODS

The present work is based on a survey of 500 women with ED, conducted from 1987 to 2013 at the Department of Psychiatry and Medical Psychology of the Russian Peoples' Friendship University, Moscow.

Inclusion criteria

Subjects with prolonged nutritional deficiencies resulting from food restriction due to dissatisfaction with one's own appearance (F50.0 – 71%, F50.2 – 22%), psychogenic vomiting (F50.5 – 7%), age at the time of examination 15–45 years.

Exclusion criteria

Other causes of cachexia (various physical illnesses), including Symmonds and Sheehan diseases.

The control group

The control group consisted of healthy volunteers, comparable in gender and age. The average age at the time of the study was 30 years.

RESULTS

Eating Disorders cause disruptions in the development and functioning of both the growing and the adult organism. The severity of these changes depends on the age of onset of fasting, the reactivity of the organism, the presence of other somatic diseases and has an important prognostic value for further existence. In comparison with the control group, patients with eating disorders initially outperformed the control group in weight gain. The dynamics of the increase in body weight of the in-patients was typical: their weight decreased during the first week of treatment due to the reduction of swelling and the reluctance of the patients to gain weight. Then a gradual increase in weight began, ideas of excessive body weight were renewed in all subjects, further than the weight gain decreased or stopped. In the process of psychotherapy session and drug therapy, patients managed to overcome the fear of weight gain and resume it. Subsequently, their weight remained below the initial level and remained below the

average norms for a given age by 10-15% along with the ideas of dissatisfaction with current "excessive" weight, which were the cause of the abstinence from eating for a long time.

On admission, 10-50% deficit of initial weight was observed in 425 (82%) of surveyed patients, 72 (14.4%) patients had extreme cachexia, associated with edema or swelling in 14 patients.

The most common complications experienced among patients with PEU were the following: hypothermia and dehydration, electrolyte imbalance, increased hepatic enzymes levels and hypoglycemia, hypotension, bradycardia, arrhythmias, brain pseudoatrophy (according to MRI), peripheral neuritis, hearing loss, anemia, leukopenia, acute and chronic renal failure, decreased estrogen levels, amenorrhea, convulsions, tetany, muscle weakness, osteopenia, fractures and bone fractures, gastric mucosal hypoplasia, tooth decay, enamel erosion, severe constipation, salivary gland enlargement, bacterial infections (pneumonia, lung abscess, tuberculosis), thrombophlebitis. At the same time, cardiovascular and reproductive systems reacted first to PEU.

In accordance with the objectives of the study on the difference in the excretion rates of catecholamines in patients with eating disorders, the following groups of subjects were identified: 1) patients with the prevalence of frequent psychogenic vomiting (vomito-mania); 2) with severe exhaustion due to prolonged and persistent refusal of food with episodes of vomiting to lose weight; 3) restriction of food intake without vomiting, Body mass index (BMI) within normal limits, state of remission.

All patients of the 1st and 2nd study group were severely depleted. The feeling of hunger was reduced. There was practically no increase in body weight. Subcutaneous adipose depots were absent, dystrophic changes in the skin, nails, hair, and myocardium were detected and associated with bradycardia, hypotension, acrocyanosis, disorders of the gastrointestinal tract, amenorrhea, anemia, lowering of body temperature. Physical activity decreased in proportion to body weight loss. Mental state examination revealed patterns of asthenic syndrome, the most frequent of which were passivity, adynamia, the short temper and irritable weakness. The presence of euphoria indicated the severity of the condition with life-threatening conse-

quences. Discontent with appearance was not the motive force for eating disorders in the 1st group of patients. The subjects refused to eat because of the fear of vomiting (vomitophobia) as the slightest portion of food or liquid was accompanied by vomiting. This group had the worst prognosis of all those surveyed, since vomiting arose without patient's desire to as a typical entrenched psychological response reaction to stress factors experienced early in childhood. The severity of the condition was indicated by a significant persistent decrease in the excretion of monoamines.

In the 2nd group, dysmorphic (painful conviction in one's own fullness) experiences at the height of cachexia lost affective saturation. Formally agreeing with the fact that they excessively lost weight, the patients were satisfied with their appearance and continued to adhere to a carefully developed diet for the fear of weight gain. They could not eat properly because of the consequences of long-term starvation, which led to obsessive fear of eating (phobia) due to gastrointestinal pathology and hypochondric ideation based on coenaesthopathic sensations from the gastrointestinal tract that food is "getting stuck in the stomach", "not digested," "poisons the whole body."

The data obtained in the study of patients with psychogenic vomiting (vomitophobia) and anorexia nervosa with severe depletion were comparable with those obtained in the severe asthenic variant of the depressive syndrome, in which a marked decrease in the number of free (biologically active) mediators of the catecholamine nature was found in comparison with the matching group and the control group, as well as with other subgroups of patients with depressive disorders (Table 1).

The level of DA and NA (the main inhibitory mediator of the CNS and mediator of the autonomic nervous system) in the blood and urine was the lowest among all the groups studied, the concentration of free dopamine and adrenaline in the daily urine was extremely low, and the level of 3,4-dioxyphenylacetic acid - the main product of deamination of DA in blood plasma - displayed the tendency to decrease in comparison with the matching group. Excretion of this metabolite in the described group was also significantly reduced. These indicators displayed a manifest distress and exhaustion of all compensatory capabilities of the body.

Table 1. Excretion rates of catecholamines in the portioned urine of patients with psychogenic vomiting and cachexia

Groups	NA	A	DA
Norm (urine ng / min):	15-40	1.5-4.5	105-180
1 st (Psychogenic vomiting) N=5	0.8±0.1*	0.5±0.12	10.74±1.2*
2 nd (Anorexia Nervosa with vomiting, cachexia) N=20	5.7±2.5	1.3±0.4	40.4±23
3 rd (Anorexia Nervosa without vomiting, body mass index is normal) N=35	18.2±8.0	4.50±0.8	74.0±14.4

* p<0.001 compared with the control group

It is interesting to note that in the patients of the first group who were in a state of physical exhaustion with psychomotor deceleration and significant asthenic symptoms, a significant deficiency of all three catecholamine substances in urine was revealed (Table 1). A similar picture of depletion of central and peripheral catecholamine systems depots was marked as typical for severe asthenic depressions noted in the other researches (Agadzhanian et al. 2014, Dmitrieva et al. 1998). Characteristically, the closest to normal indicators of excretion of dopamine, norepinephrine and epinephrine were found in patients of the 3rd group (Table 1), who had episodes of serious eating disorders in the past but showed minimal restrictions on food intake during the study period.

EEG abnormalities were most often associated with the degree and duration of depletion at the stage of cachexia (80% of observations): a decrease in the alpha-index, the frequencies and amplitudes of the alpha rhythm, smoothed zonal differences, the weakening of the reaction to functional tests - in 1 / 3 of observations; outbreaks of epileptiform paroxysmal activity - in 10% of patients (disappearing after restoration of electrolyte imbalance and normalization of weight).

The effectiveness of treatment of PEU, in addition to clinical and psychological examinations, was controlled by the EEG method. Treatment led to a gradual improvement in the frequency and amplitude of alpha rhythm but did not eliminate the difference in these parameters between the group of patients and the control group. The average frequency of alpha rhythm was 8.6111 ± 0.711154 pulses per second before the treatment, and 10.185 ± 0.87035 Hz after the treatment, indicating a significant increase in the frequency of alpha rhythm, its amplitude and the prevalence factor.

EEG brain mapping performed on 30 patients with a body mass deficit (mean BMI - 17.5) showed an increase in slow-wave theta and delta activity, which were evaluated as correlates of anxiety and showed organic brain damage. In some cases (50%) there was no evidence of intracortical connections (interrelation between the brain structures), and a pronounced decrease in the EEG power in alpha-bandwidth in the anterior areas of the right hemisphere and the posterior areas of the left hemisphere were found. This data indirectly indicated endogenous depression, confirmed by later psychological studies. With EEG mapping of patients without body mass deficiency (mean BMI of 21.5-15 observations), correlates of increased anxiety were also observed, but not intracortical abnormalities.

In 34% of the examined patients (BMI from 11 to 14), MRI showed signs of compensated hydrocephaly, superficial enlargement of brain cerebrospinal fluid spaces mainly in the frontotemporal lobes and the ventricles of the brain - the so-called "pseudotrophy" which was reversible with recovery of body weight and not accompanied by the development of cognitive

disorders, according to the results of pathopsychological tests. Echoencephalography evaluated intracranial hypertension and hydrocephalic syndrome in 60% of patients in the cachexia stage. Rheoencephalography (REG) revealed changes in the hemodynamics of cerebral venous outflow, leading to insufficient venous drainage in 20% of the examined.

Psychological studies of the characteristics of patients with eating disorders using standardized instruments did not show significant differences in performance between short-term and long-term memory parameters compared to the control group, however, the disturbance of higher cognitive functions, namely attention and dynamics of mental working capacity, were found in comparison with healthy people.

Patients with ED had statistically reduced indicators of sustainability and concentration of attention measured by means of the Bourdon cancellation test in comparison with the control group: 2.19 ± 0.09 in ED patients, 2.91 ± 0.10 in the control group, respectively ($p < 0.001$). The selectivity of attention scored 7.66 ± 0.67 for the patients with ED and 9.57 ± 0.21 for the control group ($p < 0.001$).

Patients with ED had disturbances of thinking by tempo, decreased mental rate of perception, performance and productivity of mental work. They also displayed the phenomenon of "latent exhaustion", pronounced fluctuations in the quality of work and lability of productivity in comparison with the control group. The instability of cognitive activity was revealed by Shabalina's method of "Complex decipherment" (Figure 1) which usually cannot be measured by the Schulte table and other simple techniques due to stiffness, persistence, assiduity, perseverance and scrupulosity developed in patients with ED.

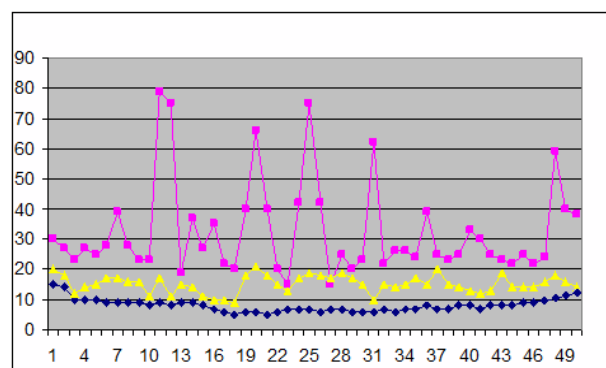


Figure 1. Dynamics of mental performance according to Shabalina's method of "Complex decipherment" during treatment of cachexia in comparison with a healthy subject

On the X-axis is the number of deciphered words, on the Y-axis is the time in seconds spent on decoding one word, the top line is for the depleted patient, the middle line is the same patient's productivity after the treatment, the bottom line is for the healthy subject.

The condition of patients required complex therapy, including strict adherence to the regimen, regular control of weight gain, 6-fold fractional nutrition, administration of cardiovascular medicines, vitamin therapy, and small doses of mild antipsychotics.

According to the duration of the necessary inpatient treatment, primacy of eating disorders is conceded over only by such chronic mental illnesses as schizophrenia and epilepsy (Sullivan 1995). When deciding on the inpatient or outpatient treatment options, it is necessary to consider the patient's propensity for dissimulation, deceit and resourcefulness regarding the causes of weight loss, as well as the desire to avoid hospitalization. It is necessary to consider the severity of secondary somatoendocrine and neurological disorders, cachexia, bulimic symptoms with frequent vomiting. Treatment should be performed only by experienced specialists with sufficient clinical background to develop good rapport with such patients. Most patients with ED required treatment in special rehabilitation wards for the isolation and treatment of malnourishment and metabolic stress under supervision of specially trained qualified personnel to control re-feeding, to regain normal food intake process for those patients who themselves are willing to be "taught to eat properly". Since the feeling of hunger and satiety is lost, the sensation of distension, feeling of fullness or retention of food appears after an intake of even small amounts of food. It is necessary to distinguish the similar clinical manifestations of miscellaneous somatic diseases such as prodromal stages of the blood cancer, oncological diseases of esophagus, etc., which are often mimicked by ED (Artemieva et al. 2014).

The medical stabilization process during the inpatient treatment period should be aimed at restoring and maintaining the patient's body weight, normalizing eating behavior to prevent dietary restraint and bulimic symptoms. It requires the establishment of an all-inclusive and multipurpose complex of medical measures regardless of the clinical picture and nosological affiliation of the syndrome and takes an average of 2-3 months. It includes the development of detailed nutritional plans, refeeding regiment, medication and psychotherapy.

The dietary system of patients is selected individually depending on the body mass index (BMI). The normal BMI is between 18.5-18.9 and 23-25 kg/m², considering age, gender and constitution.

PEU is considered as mild or low-grade malnutrition when the BMI is 18.4-17.0 kg/m², moderate when the BMI is over 15 but less than 16.9 and severe when the BMI is 15 or less. A BMI index of 26 or more indicates obesity. It is recommended to restore weight gradually. Fear of gaining excess body weight may be so intense, that it is better to adhere the patients to frequent fractional nutrition - multiple intake of small quantities of food at the first stage of the refeeding process. Then, after reaching the weight threshold to overcome the critical body weight deficit, it is necessary to take three usual meals

and at least one snack a day to reduce risk for future binge eating and bulimic pathology. Even though it is sufficient to achieve multiple intake of small quantities of food to overcome the primary fear of eating and over-eating in crisis stabilization unit specializing in the treatment of eating disorders. Refeeding and weight restoration may take weeks or months to proceed with treatment and eventually attain recovery under the supervision of specially trained medical personnel to preserve what has been achieved. Medical approaches to the refeeding process refer to providing adequate calories and nourishment for nutritional rehabilitation, therefore careful medical monitoring during the weight restoration process is required. Nutritional plans and diet options for refeeding an anorexic patient depends on the body weight deficit.

The restoration of body weight after a severe and moderate degree of malnutrition should start with intake of half a portion of a sparing diet with a daily amount of 2600-3000 calories. The calorie content of the diet should be increased gradually, on average 100 kcal a day. Parents of the patients need to be made aware of the recommendations and a list of products needed for additional meals that should be given as snacks. Transition to the consumption of a full portion of daily meal intake is possible within 2-3 weeks of treatment. Bulimic patients with normal body weight as well as all patients at the stage of stabilization of body weight are administered a high-protein diet.

Pharmacotherapy for correction of secondary somatoendocrine and neurologic disorders is considered for appropriate treatment. The first (nonspecific) stage of treatment is general restorative therapy. 5.0 ml 5% solution of ascorbic acid diluted in 15.0 ml 40% glucose solution injected IV for 15 days, as well as vitamins B1 and B6 to 2.0 ml each (10-15 injections IM, separately) contribute to the normalization of appetite, cause the sensation of a surge of energy and powerful emotional feeling of well-being. Massive infusion therapy should be avoided considering clinical severity of the somatic complications, the fluids and electrolytes imbalance, high risk of functional decompensation of internal organs, and nervous system complications. Identification of any abnormality of the cardiovascular, digestive and hemato-poietic system necessitates multiple drug use to improve bodily functions. Patients with cachexia (with a serum sodium level below 120 mmol/L) often develop peripheral edema of varying severity, which should be considered in the rehabilitation process. To improve cardiovascular endurance, trimetazine, riboxin, potassium chloride preparations and cocarboxylase were used. Most patients with gastrointestinal dyskinesia were prescribed enzyme preparations, antacid agents, and metoclopramide. After somatic stability was achieved, antidepressants, normotimics, nootropic drugs, and antipsychotics in small doses were prescribed with consideration of individual clinical differences and original nosological affiliation of the prevalent ED syndrome.

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Contribution of individual authors:

All authors contributed to writing of this paper equally.

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