Course and Treatment of Obesity*

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The problem of disturbances in fat metabolism is acquiring an ever greater importance in the contemporary study of the symptoms and course of internal diseases. Primarily, disturbances in the regulation of fat and carbohydrate metabolism form the pathogenetic basis for such widespread diseases as atherosclerosis, obesity, and various lipodystrophies of individual organs and systems. However, the course and especially the treatment of these disturbances of fat metabolism still need further study.

FACTORS IN THE PATHOGENESIS OF OBESITY

Most evident and pronounced are disturbances of fat metabolism in obesity. Taking into account the present considerable incidence of this ailment, as well as the lack of experience on the part of general practitioners in methods of treating it, the Clinic of Medical Nutrition of the Institute of Nutrition, Academy of Medical Sciences, USSR, has been working for the last three years on improving diet therapy in obesity and has also been studying the problems of its clinical manifestations and pathogenesis.

The observations compiled by the Clinic, which cover over 450 cases, permit an approach to a classification of obesity, a study of its pathogenesis and, on the basis of this, to the problems of treatment.

Neuroendocrine Disturbances

Multiple mechanisms of the central nervous system participate in the regulation of fat metabolism—those of the cortex and subcortical areas, and primarily the pars intermedia of the pituitary and the diencephalon. The autonomic nervous system, the spinal cord, and the peripheral nervous system are also of vast importance. Numerous pathologic processes, both of organic and functional origin, are capable of upsetting this complex regulatory system and may lead to the development of excessive deposit of fat. These disturbances in obese patients may be linked with changes in the cortical activity of the central nervous system.

Levitskii and associates,[1] in a study of conditioned motor reflexes mediated through a secondary signal system, noted disturbances in the circuit-closing function of the cerebral cortex, sluggish function of the processes of excitation, as well as pronounced inertia of the main nerve processes in the majority of patients.

Editorial note: In 1956 the National Institutes of Health of the Department of Health, Education, and Welfare established a Russian Scientific Translation Program. The objective is to acquaint the American scientist with Russian medical-biologic research.

As part of the program a number of scientific articles have been translated for republication in English-language periodicals. We take pleasure in presenting the following article (published originally in *Voprosy Pitaniya* [*Problems in Nutrition*] 16: 36, 1957), which has been altered only to conform more closely to the American idiom. It is hoped that this service will not only give American workers some idea of the current thinking of their Russian counterparts but also add a bit to international understanding.

* Original title: Klinika i lechenie ozhireniia.

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A limited number of tearsheets of this article will be available from the National Institutes of Health, Russian Scientific Translation Program, Bethesda, Md.

Prostiakov[2] has studied in obese patients the complex of nerve centers having "multilevel" cortico-subcortical distribution (the alimentary nerve center). Overexcitation of the alimentary nerve center was observed in many patients. Together with the processes of overexcitation there was also a reduction of its inhibitory function.

Disturbances of neuroendocrine function in obese patients have been quite inadequately reflected in current literature. In our observations disturbances of the autonomic nervous system have been determined by widely adopted clinical tests, the adrenal-histamine test among them. According to these data, in obese patients a hypervagotonic reaction clearly prevailed, and was also often accompanied by hyposympatheticotonus. Besides these dissociated reactions, reactions of an amphotonic type were observed more rarely. Thus, the disturbances of the nervous system that are observed in obese patients are multiform.

It is essential to note that the unique character of these disturbances is in a certain measure connected with the form of obesity. In the metabolic-alimentary forms, phenomena of heightened excitability of the alimentary nerve center and depression of the processes of its inhibition predominate; in the cerebroendocrine forms, disease of the diencephalon—of the hypothalamus and the pars intermedia of the pituitary, in particular—is more pronounced.

However, it would be erroneous to ascribe the entire problem of obesity to disturbance of the nervous system.

Endocrine-Metabolic Disturbances

The endocrine-humoral link plays a subordinate but important role, and the nature of the disturbances that arise is unique and has a rather broad range of effects. From the point of view of contemporary science it is incorrect to think of an isolated functional disturbance of any one endocrine gland. One characteristic of these polyendocrine disturbances is the presence of dissociated shifts: for example, the function of one gland may be accelerated, that of another slackened.

An important feature of the endocrine-metabolic disturbances in patients with obesity is their unique character, which is determined by the range of normal (maximal or minimal) functional potentialities remaining in one or another endocrine gland. Thus, it is correct to characterize these disturbances as alterations of the functional activity of the glands. It is not yet a pathologic endocrine function, but endocrine-metabolic shifts predicated on the altered interrelations of the central regulatory apparatus.

For characterization of these disturbances the composite data of investigations into the insular apparatus (islands of Langerhans)[3] and the thyroid gland[4] in patients with obesity may be cited. Presented in Table I are the data on changes in the functional activity of the insular apparatus and of the thyroid gland, the percentage of demonstrated deviations from the normal of biochemical studies and clinical tests having been taken into account.

These composite, antagonistically oriented disturbances of the functional activity of the insular apparatus and thyroid gland (one with plus, the other with minus activity) may result in the increased deposit of glycogen and increased fat formation, as well as in the reduction of fat mobilization. It should be noted, however, that, according to recent data, the presence of hyperinsular reaction in obesity may have a more complex origin: initially, there is increased formation and deposit of glycogen, and only secondarily does insulin secretion occur.

Defective endocrine-metabolic relationships are not exhausted with the functional disturbances of the pancreas and the thyroid gland. The pathogenetic endocrine-metabolic form of obesity has not as yet been fully studied. Other endocrine glands, such as the gonads, the adrenals, etc., certainly participate in it. The adrenal cortex can be cited as an example of similar, but even more complex, hormonal interrelations in patients with obesity.

According to the data of Kazakhov[5] with obese patients, a decrease in the formation and excretion of urinary 17-ketosteroids and a tendency toward increase in total corticosteroids and glucocorticoids are observed. Thus, even more complex disturbances of the hormonal relations are demonstrated here, according to the type of glandular dysfunction.

TABLE I

Changes in the Functional Activity of the Insular Apparatus and Thyroid Gland

Changes in functional activity	% of demonstrated deviations from normal of usual clinico-biochemical tests	% of demonstrated deviations from the normal of special tests	Demonstrated pathologic disturbances
Increased activity of beta cells in the pancreas	Increase or decrease of the blood-sugar level in 20% of the cases	Hyperinsular type of reaction of the sugar curves in 60% of all cases	Prediabetes in 8% of the cases
Decrease of functional activity of thyroid gland	Reduction of basal metabolism in 41% of the cases	Evidences of I^{131} after 24 hrs reduced in 85% of the cases	Clinically demonstrated hypothyreosis in less than 10% of the cases

Tissue Metabolic Disturbances

Finally, the local tissue factor plays an important role. We certainly cannot support the mechanistic theory of Bauer (cited by Leites[6]) on isolated "lipophilia" of the tissues of patients with obesity. However, the factors in metabolic disturbances in the fatty tissue proper are interconnected with the disturbances of the nervous and endocrine system and are capable of acquiring an important pathogenetic role in the development of obesity. In studying the permeability of capillaries according to Landis, Levitskii[7] demonstrated that the interrelations between tissue and blood metabolic processes in obesity patients are very complex. He likewise demonstrated the presence of increased permeability of the capillaries by sodium chloride, water, and, to a lesser extent, serum proteins, sugar, and cholesterol.

It was established long ago that fat tissue is not inert and possesses rather considerable metabolic activity.[8] Nonetheless, a more detailed biochemical characterization of these processes has only recently become possible. In the fatty tissue itself a number of changes actively occur—the hydrogenation and dehydrogenation of fatty acids and the conversion of glucose into glycogen and fat. It has been demonstrated experimentally that in obesity a number of these processes are clearly altered. For example, the formation of fat from carbohydrates is increased, and the enzymatic breakdown of carbohydrates is blocked. There is a further tendency to explain a number of disturbances in corpulent patients by the presence of peculiarities of local tissue metabolism. For instance, in the deposition of fat and glycogen, insufficient sugar is utilized by the tissues. This leads to hyperglycemia, but, because of the interoceptive signaling, responsive alterations of the neuroendocrine system take place: the excitability of the alimentary nerve center increases, the production and flow of insulin into the blood become greater, and so forth.

The neural-endocrine-metabolic disturbances observed to some degree in all cases of obesity exclude the possibility of purely exogenic forms of obesity. The "gluttony" and "indolence" of corpulent patients are endogenically stimulated, but the biochemical shifts in these patients are still not always discerned, because of our imperfect knowledge.

CLINICAL COURSE

In obesity a change occurs in the life activity which is due to the influence of the neural-endocrine-metabolic disturbances; the course of the primary life processes—circulation, respiration, and digestion—is altered. As mentioned, these changes are connected on the one hand with changes in the processes of central regulation, and on the other with secondary anatomic and functional modifications of tissues and organs. For example, the character of the atherosclerotic disturbances in obesity is linked with the fact that they arise and progress on a background of already pronounced dystrophic disturbances. The reactions to this superimposition proceed at a considerably slower rate. Hence, advanced coronary atherosclerosis produces phenomena of functional insufficiency, attacks of angina pectoris, etc., at a relatively later time. The somewhat benign course of atherosclerosis in obesity and the relative ease and speed of improvement in the condition of these patients dictate the need of unremitting, energetic treatment in the earlier stages of adi-

posis. A number of electrocardiograms have shown clearly pronounced coronary insufficiency that disappeared after a short period (1–2 months) of diet therapy. The same response has occurred in cardiopulmonary insufficiency and in disturbance of the peripheral circulation.

The digestive organs are also affected by obesity. Here are often found rather persistent changes in gastric secretion and motility. Hyperacidity and often hypersecretion are characteristic; they proceed, however, with few signs or symptoms. Gastritis and ulcers are rare. The pancreatic enzymes in obese patients are subject to qualitative shifts, and as the observations of Dzhelieva[3] have attested, changes occur in the quantitative ratios of the basic enzymes amylase, lipase, and trypsin.

In contrast to gastric secretion, which in obesity tends to increase, both gastric and, especially, intestinal motility decreases. Colonopathy is a quite frequent complication and, in considerable measure, develops in proportion to the degree of obesity. Hypokinesia and dyskinesia of the gallbladder and bile ducts are common. Angiocholecystitis frequently develops, proceeding slowly with few symptoms (in up to 30 per cent of all obese women patients).

Hormonal Treatment

The adrenocorticotropic hormone (ACTH) has been used in our clinic for treatment of certain complications in obesity patients. We have been convinced of the good effect of this hormonal preparation in a number of patients, not only in regard to complications (principally bone and joint) but also in regard to general muscle tonus.

Kazakhov[5] gives a basis for thinking that the organism of the obese patient reacts in a unique way at introduction of ACTH. After average therapeutic doses we have not observed any increase in weight, as is noted in subjects with normal metabolism, and only a certain reduction in rates of weight loss in our patients. Apparently the latter was connected with the retention of water by the tissues, since later an increase of diuresis and a faster rate of further weight loss occurred. We noted especially effective action of ACTH in women in the climacteric or preclimacteric period.

Hormonal therapy, entirely a prospect of the future, has not yet developed a preparation for practical use. The fat hormone, adiposin, obtained in 1955 by Leites,[9] still has not gone beyond the experimental laboratory.

Nutritional Measures

At the level of our present knowledge, nutritional therapy is the principal method of treatment in all cases of obesity. On the basis of earlier observations and of our own recent works, the temporary reduction in caloric intake to the level of the patient's basic metabolism, and sometimes even lower, still remains the rule. This decrease, in the main, should result from sharp reduction of carbohydrates and, to a lesser degree, of fats. The amount of proteins should remain at the level of the physiologic norm. To facilitate carrying out this diet, feeding should be fractional (five to six times a day). On the basis of much clinical experimentation, the diet[10] worked out in the Clinic has been fully approved. The composition of the diet is cited in Table II.

This diet provides for the gradual reduction in caloric value of the therapeutic feeding (for diets No. 1 and No. 2 and their variants). The amount of table salt is also reduced, and extracts that boost appetite are banned.

Construction of such a diet facilitates normalization of the overactive insular apparatus, lowers the excitability of the alimentary center, and heightens the specific dynamic action of the food. However, even this diet is effective for only a comparatively short period of time. For further weight reduction it is necessary to use the impact effect of unilateral zigzag diets or slimming diets. Unilateral diets, comprising mainly one of the basic foods (proteins, fats, carbohydrates), lead to a quicker reorganization of the metabolism and act favorably on the central nervous system, the cardiovascular system, and the liver.

As a result of the course of treatment carried out, the patients lost, depending on the degree of obesity, 6–29 kg in weight, i.e. from 10 to 15 per cent of their weight. [In this course of weight reduction, the slimming foods used

TABLE II

Diets for Obesity (Chemical Composition and Caloric Value) and Their Variants[a]

	Proteins (%)	Fats (%)	Carbohydrates (%)	Caloric value variants A	B	C
Diet No. 1 (test)				2000	2400	2700
Caloric value	18	28	54			
Diet No. 2 (slimming)				1250	1500	1660
Caloric value	28	44	28			

[a] Part of table has been omitted.

were: meat, pot cheese, sour cream, other milk products, and apple. Over a two-month period, weight reduction was achieved by starting the patient on "one-food slimming days"—only meat for the first ten days, only pot cheese for the next seven days, then either meat, curdled milk, or apple for one day each—then giving two of these foods per day thereafter. For the course of treatment the average weight loss of the men was approximately 14 kg, that of the women approximately 10 kg. In obesity, considerable weight losses not only are harmless, but lead to considerable functional improvement of the nervous system, the cardiovascular apparatus, the gastrointestinal tract, and other systems and organs.

Types of Diets

Of the various diets used recently for treatment of obesity, that of Pennington[6] may be mentioned. This asymmetrical diet with drastic restriction (almost complete exclusion) of carbohydrates is a far departure from the physiologic norms of nutrition, and tolerance of it by patients for more or less prolonged periods is poor. Hence, it may be regarded as only for exceptional cases or short periods of treatment.

The impact effect of weight reduction in obesity can be attained in three ways: (1) by slimming days, which are extensively used in the first variant of our diet, (2) by contrast periods in dietetic management (this method is used for some food allowances in foreign countries and is being studied in a new diet variant at our clinic), or (3) by fasting diets or a course of therapeutic fasting. We are testing its use in our clinic.

We shall not dwell in detail on slimming days, since they have been discussed repeatedly and are extensively put into practice. For slimming purposes we used mainly the so-called protein days (pot cheese, meat), more rarely carbohydrate (apples and vegetables), and very rarely fat (sour cream, cream). The number of slimming days in the course of therapy occupied only about one-third of the whole period of the patient's stay in the hospital.

The use of frequent slimming days against a background of dieting, although it led to good therapeutic results, was not always tolerated equally well by the patients. Our diet, moreover, underwent special processing to eliminate purines, a matter that did not contribute to improving its savory properties. Because of this, prolonged use of such a diet ran into difficulties now and then. A follow-up of long-term results revealed that only 35 to 40 per cent of our patients were able to maintain this diet for a prolonged period. This was especially difficult for the younger groups of patients. Therefore, the question was raised of creating a more easily tolerated diet without restriction of purines and, consequently, with more acceptable savory properties.

The creation of special contrast periods in dietetic management permits, if not avoidance of slimming days completely, at least their curtailment considerably. The most distinctly expressed multiform, zigzag periods in dietetic management proposed for treatment of obesity patients is Kannengieser's French diet schedule.[11] This diet has been used with success in England. The intent of the diet is to include different "unvaried" days in the weekly menu according to the following scheme.

Monday—vegetable day. About 2 kg of different vegetables, 100 g of black bread, 5–10 ml of vegetable oil.

Tuesday—meat day. 300–400 g of meat for the day as a whole with addition of vege-

tables and fruits (broiled beef, no sauces, and no gravy).

Wednesday—egg day. 5 eggs with addition of vegetables and 50 g of black bread.

Thursday—milk day. 1500 ml of milk with addition of 150 g of black bread and 200 g of potato.

Friday—fish day. 400 g of boiled fish with vegetables, fruits, tea or coffee, 100 g of bread for the day as a whole, and vegetable salad.

Saturday—fruit day. Fruits (except nuts, bananas, and grapes), mainly apples and pears, up to 1.5 kg.

Sunday—free selection of food, but limiting fats and avoiding large portions of meat and fish.

During the 2-to-3-month course of treatment the patients lost about 15–20 kg of weight [the author does not cite total statistics]. No doubt, such a course of diet, varied for the week and unvaried for the day, is rather difficult to carry out.

Proceeding from the principle of obtaining more varied regimens, recently in the Clinic of Medical Nutrition of the Institute of Nutrition, USSR, Prostiakov set up a new modification of the diet for obesity, in which an increase is specified of protein and purine food components with ordinary culinary preparation. Thanks to this, the taste properties of the diet have been improved and the diet is made less monotonous. It has also succeeded in reducing the number of slimming days. This diet is in the stage of experimental clinical testing.

Finally, the observations made in the Clinic on the use of therapeutic fasting should be mentioned. We do not make reference to the use of fasting as a therapeutic method, since this is an antiphysiologic method and, in addition, is not always without harm to patients. However, in some cases we did proceed to include fasting days in the diet, or even short periods of fasting (up to 5 days, especially in the younger subjects).

At the suggestion of the Academy of Medical Sciences, USSR, we also made observations on the use of longer periods of therapeutic fasting. Five of the patients with obesity who had expressed a desire to subject themselves to this method of treatment went on a 15-day course of fasting. Results were calculated in weight lost by these patients and by five patients of an analogous type who were treated by our diet with slimming days. The therapy with fasting yielded no advantages in weight loss, since at their emergence from the period of fasting considerable weight increase is noted in the patients.

The dietetic method worked out in the Clinic of Medical Nutrition and stated above, in the vast majority of cases, rather effectively reduces the weight of patients and considerably improves their general state. On the basis of observations of patients hospitalized repeatedly and of those ambulatory who are patients for a much longer time, we are able to note good tolerance of even greater losses of weight (up to 40–50 kg over a $1^1/_2$-year period). In the majority of cases of obesity the prognosis for cure or considerable improvement is entirely favorable.

The chief duties of the physician during treatment of obesity are recommendations and checking of the precise weight ratios in the diet, observation of the patient's weight (daily is desirable), as well as active psychotherapy. The physician should aid the patient in his psychologic re-education, which is requisite for proper continuing therapy and maintenance of the designated feeding and living regimen. The processes of normal inhibition of the alimentary center are developed only with the active participation of patient and physician.

A system of prophylactic measures is made the basis for rational combating of obesity, as well as of many other metabolic diseases—proper assembling of food products, a normal systematic course of diet, proper exercise, hygiene suitable to the age of the patient, early clinical care of patients with obesity, and extensive culturally enlightening work. All this aids proper functioning of the organs and normal metabolism and helps prevent overeating and physical inertia.

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