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Nutritional Status of Patients Suffering from Eating and Nutrition Disorders Valued with Biochemical, Anthropometric Parameters and Body Composition in a Cohort of 95 Patients in Intensive Rehabilitation at Villa Miralago

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Abstract

The nutritional status is the result of supply and need for nutrients. Malnutrition is a state of nutrition by defect or excess resulting from the discrepancy between needs and supplies. In some forms of food disorders, important weight fluctuations can expose patients alternately to both forms of energy imbalance. Protein-energy malnutrition (MPE) characterizes the disorders of nutrition and defines a state of depletion of body reserves of energy and/or nitrogen with a preferentially chronic course. In anorexia nervosa, malnutrition (also associated with deficiencies of various micronutrients, vitamins and minerals) can influence the evolution and prognosis of the disorder (National guidelines for nutritional rehabilitation in eating disorders. Notebooks of the Ministry of Health no. 29, September 2017).

Keywords: *Nutritional Status; Eating; Nutrition Disorders; Anthropometric Parameters; Body Composition; Intensive Rehabilitation*

Introduction

The nutritional classification of the patient in these pathologies cannot be based on a single nutritional index or exclusively on a series of anthropometric measurements, other more accurate evaluation indices are required such as the analysis of body composition, biochemical and immunological parameters. Taking into account that the body component that most determines energy consumption is the lean one (Nielsen., *et al.* 2000), it is understandable that, in people with eating and nutrition disorders with significant losses or weight gains, it becomes fundamental to measure the body composition to evaluate with specific methods, of which the most used is the analysis of bioelectrical impedance (BIA), the percentage distribution of the two main body components, lean mass and fat mass. These considerations are at the origin of this observation, conducted with the aim of examining how the nutritional status of 95 patients affected by Eating and Nutrition Disorders in intensive nutritional rehabilitation is changed, through the evaluation of biochemical, anthropometric parameters and through analysis of body composition, to establish which of these are clinically useful for defining the state of malnutrition [1-4].

Methods

Villa Miralago is a long-term care center that welcomes people suffering from AN, BN, DAI and obesity. It consists of three communities for adults and one for minors. The care model implemented at Villa Miralago is an integrated, multidisciplinary and analytically oriented method.

Integrated because it correlates the medical-nutritional care with the psychic aspects by creating a therapeutic path where the nutritional aspects are always and constantly connected to the emotional, cognitive and relational aspects. Diet plans, types of menus are elements that are assessed and addressed on the patient's care needs; the desirable weight increase in cases of AN, the elimination of compensation behaviors as well as binge eating in cases of BN or AN, are never the result of mechanical protocols, but always the result of a detailed analysis of the psychophysical balance of the guest.

Multidisciplinary because the figures involved in the care have different profiles. the team includes child psychiatrists and neuropsychiatrists, nutritionists, psychologists and psychotherapists, professional educators, art therapists, kinesiologists, nurses, ASA/OSS.

Multidisciplinarity is a requirement that guarantees quality and correctness in care and is a requirement present in all international guidelines, also sanctioned in Italy by the Consensus Conference held last 2013 at the Istituto Superiore di Sanità.

An analytically oriented method of treatment has in its most radical aspect the idea that a psychophysical symptom is the result of a series of deep and unconscious passages which then manifest themselves through the most evident suffering. An analytically oriented treatment works first on depth allow everyone to be free from any unconscious conditioning, from every symptom that cages their life, solving the root causes and not the superficial aspects.

In this regard, the care of the DAN at Villa Miralago doesn't go through the mere correction of pathological eating behaviors, nor exclusively through the modification of the weight, at most the work is centered on the profound aspects of suffering that produce as an effect an improvement of the symptomatic food aspects. Clinical improvement is always a result of a profound change that is a guarantee for future stability and stable results achieved.

In the months of the study it was observed how intensive nutritional rehabilitation affects the nutritional status of patients in the various types of DAN that Villa Miralago treats and which of the parameters that are detected are clinically useful for defining malnutrition. The analysis (lasting about 5 months, from May 2019 to October 2019) was of a retrospective observational type and was conducted on a group of patients hospitalized from January 2016 to May 2019, which I divided into three subgroups based on the pathology:

1. Anorexia group (AN);
2. Bulimia group (BN);
3. Uncontrolled Feeding Disorder (DAI) group.

All the subjects examined underwent anthropometrically and body composition checks at the time of hospitalization (T0), after 1 month (T1), after 3 months (T2) and after 6 months of intensive nutritional rehabilitation (T3), for observe how their nutritional status varies. Biochemical data were collected at T0 and T3, then upon admission and after 6 months.

The anthropometric data observed were:

- Sex
- Weight
- Age
- Size
- BMI.

Body composition data collected through BIA Akern 101 were:

- Phase angle (PA)
- Total and extracellular water (TBW and ECW)

- Body cell mass (BCM)
- Body Cell Mass Index (BCMI)
- lean body mass (Fat-free body mass) (FFM)
- Fat mass (FM).

The biochemical parameters observed were:

- Albumin
- Lymphocytes
- Transferrin.

Results

The total sample that was significant and that was analyzed consists of 95 subjects, of both sexes divided into the three pathologies as follows:

- AN: N=50, 48 women and 2 men of 25,7 ±10,3 years old;
- BN: N=27, 25 women and 2 men of 23,7 ± 8,7 years old;
- DAI: N=18; 15 women and 3 men of 21,05 ± 5,5 years old.

The subjects underwent intensive nutritional rehabilitation at the facility for six months and underwent both dietetic and anthropometric checks for the duration of the observation.

Below are the correlations in the different groups and at different times.

AN group

AN - 50 PZ	BMI	Pearson correlation	PA°	Pearson correlation	TBW %	Pearson correlation	ECW %	Pearson correlation	BCM	Pearson correlation	FM	Pearson correlation
Kg	T 0	,836**	T 0	,448**	T 0	−,592**	T 0	−,500**	T 0	,621**	T 0	,601**
	T 1	,839**	T 1	,401**	T 1	−,613**	T 1	−,415**	T 1	,641**	T 1	,616**
	T 2	,825**	T 2	,384**	T 2	−,619**	T 2	−,406**	T 2	,554**	T 2	,683**
	T 3	,860**	T 3	/	T 3	−,665**	T 3	/	T 3	,481**	T 3	,723**
BMI			T 0	,631**	T 0	−,588**	T 0	−,628**	T 0	,807**	T 0	,600**
			T 1	,565**	T 1	−,639**	T 1	−,520**	T 1	,764**	T 1	,646**
			T 2	,538**	T 2	−,629**	T 2	−,503**	T 2	,729**	T 2	,672**
			T 3	,374**	T 3	−,682**	T 3	/	T 3	,598**	T 3	,707**
PA°					T 0	−,641**	T 0	−,922**	T 0	,804**	T 0	,650**
					T 1	−,590**	T 1	−,947**	T 1	,696**	T 1	,603**
					T 2	−,562**	T 2	−,964**	T 2	,809**	T 2	,559**
					T 3	−,418**	T 3	−,582**	T 3	,663**	T 3	,395**
TBW%							T 0	,663**	T 0	−,345*	T 0	−,972**
							T 1	,589**	T 1	−,321*	T 1	−,971**
							T 2	,570**	T 2	/	T 2	−,977**
							T 3	/	T 3	/	T 3	−,977**
ECW %									T 0	−,788**	T 0	−,699**
									T 1	−,680**	T 1	−,628**
									T 2	−,787**	T 2	−,586**
									T 3	−,389**	T 3	−/
BCM											T 0	,357*
											T 1	,335*
											T 2	,326*
											T 3	/

As can be seen from the table, observing the anthropometric and body composition parameters in the AN group, it is noted that, following intensive nutritional rehabilitation, all improved from T0 to T3, tending to approach the reference parameters of normal weight. All other correlations are also statistically valid from moderate to strong (p-value < 0.05).

BN group

BN - 27 PZ	BMI	Pearson correlation	PA°	Pearson correlation	TBW %	Pearson correlation	ECW %	Pearson correlation	BCM	Pearson correlation	FM	Pearson correlation
Kg	T 0	,907**	T 0	,395*	T 0	−,751**	T 0	−,414*	T 0	/	T 0	,844**
	T 1	,888**	T 1	,396*	T 1	−,662**	T 1	−,411*	T 1	,420*	T 1	,780**
	T 2	,856**	T 2	,496**	T 2	−,525**	T 2	−,392*	T 2	,412*	T 2	,701**
	T 3	,802**	T 3	/	T 3	−,609**	T 3	/	T 3	/	T 3	,734**
BMI			T 0	,496**	T 0	−,832**	T 0	−,485*	T 0	,391*	T 0	,898**
			T 1	,527**	T 1	−,846**	T 1	−,528**	T 1	/	T 1	,905**
			T 2	,543**	T 2	−,732**	T 2	−,412*	T 2	/	T 2	,857**
			T 3	,404*	T 3	−,850**	T 3	/	T 3	/	T 3	,899**
PA°					T 0	−,398*	T 0	−,962**	T 0	,781**	T 0	/
					T 1	−,424*	T 1	−,984**	T 1	,755**	T 1	/
					T 2	/	T 2	−,819**	T 2	,699**	T 2	/
					T 3	/	T 3	−,901**	T 3	,717**	T 3	/
TBW%							T 0	,424*	T 0	/	T 0	−,956**
							T 1	,438*	T 1	/	T 1	−,965**
							T 2	/	T 2	/	T 2	−,916**
							T 3	/	T 3	,421*	T 3	−,976**
ECW %									T 0	−,739**	T 0	/
									T 1	−,740**	T 1	−,389**
									T 2	−,598**	T 2	/
									T 3	−,702**	T 3	/

In BN group the weight-dependent parameters tend not to vary significantly since already in T0 the average of the sample is in normal weight. The other parameters show improvements over time. The correlations are statistically valid from moderate to strong (p-value < 0.05), excluding weight/IMC- BCM/BCMI, BCM/BCMI-TBW, BCM/BCMI-FFM and BCM/BCMI-FM.

DAI group

DAI - 18 PZ	BMI	Pearson correlation	TBW %	Pearson correlation	BCM	Pearson correlation	FM	Pearson correlation
Kg	T 0	,909**	T 0	−,549*	T 0	/	T 0	,899**
	T 1	,903**	T 1	−,474*	T 1	/	T 1	,847**
	T 2	,897**	T 2	−,565*	T 2	/	T 2	,858**
	T 3	,901**	T 3	−,583*	T 3	/	T 3	,860**
BMI			T 0	−,595**	T 0	/	T 0	,867**
			T 1	−,546**	T 1	/	T 1	,835**
			T 2	−,565**	T 2	/	T 2	,808**
			T 3	−,618**	T 3	/	T 3	,830**
PA°			T 0	/	T 0	,682**	T 0	/
			T 1	,511*	T 1	,778**	T 1	/
			T 2	,551*	T 2	,785**	T 2	/
			T 3	,670**	T 3	,751**	T 3	−,535*
TBW%					T 0	/	T 0	−,848**
					T 1	,534*	T 1	−,862**
					T 2	,603**	T 2	−,905**
					T 3	,518*	T 3	−,912**

In DAI group, no statistically significant correlations were found between weight/BMI and BCM, BCMI, PA and ECW and between BCM/BCMI and FM.

All other correlations were statistically valid from moderate to strong (p-value < 0.05).

The blood chemistry parameters are not correlated with any anthropometric and body composition values.

Discussion

The statistical analysis of all the data collected was processed by applying the Pearson correlation test.

Adiposity was measured with a precision balance approximated at 100 g in the morning with the patient on an empty stomach and after urination.

The stature evaluates the distance between the floor (the soles of the feet, barefoot) and the highest point of the head. The instrument used is the stadiometer or anthropometer, consisting of a vertical bar incorporating a meter and a horizontal one to be put in contact with the highest point of the head. The height was measured with an approximation of 0.1 - 0.5 cm.

BMI is a derived measure, calculated by dividing the real body weight, expressed in kg, by the height of the subject in square meters.

Impedancemetry (BIA)

On the right side of the body two electrodes are applied at the height of the foot, one on the dorsal surface at the base of the II-III phalanx and the other on the front of the ankle, and two electrodes at the level of the hand, one at the base of the II- III phalanx and the other on the wrist, between radio and ulna.

The subject is lying supine on a non-conductive surface, in a room at constant room temperature, legs slightly apart and upper limbs moved away from the body by about 30°. The skin must be clean, creams must not have been applied before the examination. This method does not require a high degree of skill from technicians and it isn't invasive.

BIA is based on the measurement of the impedance (Z) offered by the human body to the passage of alternating electric current at a fixed frequency, by the organism's conduction capacity is directly proportional to the quantity of water and electrolytes contents (TBW).

Impedance-Z:

- Increases with increasing FM and decreases with increasing FFM
- Decreases with decreasing FM (which logically has a greater resistance - R).

Bia Vector also measures component which consists of the two components that make up the vector of impedance-Z (resistance [R] and reactance [Xc]).

It uses alternating current (at constant intensity and frequency), injected on the skin by electrodes- patch, which passes through the electrolytic solutions of the extra-cellular liquid (LEC) and the intracellular liquid (LIC) of all tissues (excluding fat and bone) generating an impedance vector Z.

Cell membranes and tissues phase out current conduction (Phase Angle between voltage and current of the vector) generating the capacitive component of impedance Z, the reactance Xc. Bia vector provides specific values on the conductive tissues, compartment expressed as resistance value R from the intra and extracellular electrolytic solutions, and as reactance value Xc from the whole of the cell membranes of the compartment itself.

By combining non-invasive BIA measures and specific formulas by instrument and population, mass or volume data are obtained for: TBW, FFM and FM.

The BIA Akern directly measures the fundamental compartments for assessing the nutritional status: the BCM and the ECW%.

The BCM in kilograms and the percentage of ECW clearly reflect the hydration and nutrition of the subject.

In addition to BCM and ECW%, BIA Akern also provides the values of: Basal Metabolism (MB) in Kcal, Reactance (Xc), Resistance (R) and Phase Angle in degrees (PA°).

As for ECW%, the normal threshold is about 40%; values > 45% indicate water retention and < 38% reflect extracellular dehydration. The phase angle decreases when the BCM decreases and is very useful for the interpretation of the state of nutrition. The phase angle of a well-fed and well-hydrated young person ranges from 6 to 8 degrees.

Conclusion

At the end of the analysis of the data found in the observed sample, it can be concluded that in patients with AN results show that the increase in BMI corresponds to an improvement of any other anthropometric and body composition parameter, and therefore of the whole nutritional status of the subjects.

In patients with DAI, the parameters assessed are independent of the improvement in body weight, while in patients with BN, the weight-dependent parameters were not indicators of assessing the nutritional status.

These data suggest that in this sample and for all three pathologies the biochemical parameters observed for the evaluation of the nutritional status are not suitable for the diagnosis of the malnutrition status. In fact, although the affected patients are seriously malnourished, the albumin, lymphocyte and transferrin values remain almost unchanged, very close to the limits of normalcy in all 4 time intervals. This highlights a strong adaptive mechanism of the body, which precisely "adapts" to the altered eating habits of subjects affected by DAN. The same situation, in fact, is not found in malnourished patients due to other pathologies, where, on the contrary, the blood chemistry values also reflect the altered nutritional status. Further studies are therefore needed to consolidate the clinical reliability of the body composition parameters observed and to define if there are and which are the blood chemistry parameters to be used for a better assessment of the nutritional status in the DAN.

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