

# The influence of clinical nutrition on selected biochemical parameters and general nutritional status of home treated geriatric patients

## Wpływ żywienia klinicznego na wybrane parametry biochemiczne i ogólny stan odżywienia pacjentów geriatrycznych leczonych w warunkach domowych

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### ABSTRACT

**Introduction:** Eating disorders constitute one of the most serious health problems in older people.

The objective of the thesis was to evaluate the impact of clinical nutrition on selected biochemical parameters and general nutritional status in geriatric patients undergoing home treatment.

**Material and methods:** The study covered 65 people aged 65+ suffering from a chronic disease undergoing home therapy. The study was conducted based on the diagnostic survey method with the use of survey questionnaires.

**Results:** The nutritional status of the studied patients was assessed against the NRS scale during the introductory assessment. The average result obtained by the subjects was 5.28 points  $\pm 0.84$  points. The main reason for nutrition therapy in the case

of 52 patients (80.0%) was dysphagia. In the remaining 20% of patients the causes for nutritional therapy stemmed from other clinical symptoms.

**Conclusions:** 1. Nutritional therapy improves nutritional status in chronically ill patients treated at home. 2. Dysphagia in the course of oncological and neurological diseases is the most frequent indication for home nutritional treatment. 3. To a substantial extent, nutritional therapy improves albumin and haemoglobin levels in chronically ill patients. Meanwhile, no statistically significant differences were reported in terms of improved total cholesterol, triglycerides or electrolytes among patients.

**Keywords:** biochemical parameters; nutrition; nutritional therapy; older adults; patient; treatment.

### ABSTRAKT

**Wstęp:** Zaburzenia odżywiania są jednym z najpoważniejszych problemów zdrowotnych występujących u osób w podeszłym wieku.

Celem pracy była ocena wpływu żywienia klinicznego na wybrane parametry biochemiczne i ogólny stan odżywienia pacjentów geriatrycznych leczonych w warunkach domowych.

**Materiały i metody:** Badaniem objęto 65 osób chorujących przewlekłe w wieku powyżej 65. r.ż. Badania przeprowadzono za pomocą sondażu diagnostycznego z wykorzystaniem kwestionariuszy ankiet – autorskiego oraz 2 kwestionariuszy standaryzowanych.

**Wyniki:** Stan odżywienia badanych pacjentów oceniono za pomocą skali NRS w badaniu wstępnym. Średni wynik uzyskany przez badanych w tej skali wyniósł 5,28  $\pm 0,84$  pkt. Główną

przyczyną terapii żywieniowej była w przypadku 52 osób (80,0%) dysfagia. U pozostałych 20% badanych przyczyny żywienia wynikały z innych objawów klinicznych.

**Wnioski:** 1. Leczenie żywieniowe poprawia stan odżywienia pacjentów przewlekłe chorych leczonych w warunkach domowych. 2. Dysfagia w przebiegu chorób onkologicznych i neurologicznych jest najczęstszym wskazaniem do leczenia żywieniowego w warunkach domowych. 3. Leczenie żywieniowe w znacznym stopniu poprawia poziom albumin i hemoglobiny u pacjentów przewlekłe chorych. Nie stwierdzono natomiast różnic istotnych statystycznie w zakresie poprawy poziomu cholesterolu całkowitego, triglicerydów i elektrolitów wśród chorych.

**Słowa kluczowe:** parametry biochemiczne; odżywianie; żywienie; osoby starsze; pacjent; leczenie.

## INTRODUCTION

Eating disorders constitute one of the most serious health problems in older people. Undernourishment which deteriorates the quality of life, increases the risk of complications and death and affects the prolongation of hospital stay and the frequency of subsequent admissions to a hospital ward is a large medical and economic problem. Undernourishment should be diagnosed and treated as early as possible. Meanwhile, nutritional status assessment in older patients is carried out extremely rarely and even more so attention is turned to the age-related conditions which substantially affect nutritional status [1].

Research shows that oncological and neurological patients very often suffer from nutrition intake disorders, but also problems with food absorption and metabolism. Symptoms of undernourishment in patients may stem from numerous factors. Most frequent ones include dysphagia, food aversion, hypermetabolism and a severe clinical condition [2]. This clinical problem was noticed by the European Society for Clinical Nutrition and Metabolism (ESPEN). It prepared guidelines to be followed in the case of patients who suffered a stroke [1].

The aim of nutritional treatment is to provide a sufficient amount of energy and nutrients which will enable to maintain or improve the patient's nutritional status and life quality. The right nutritional status improves rehabilitation abilities and decreases the risk of morbidity and mortality in older patients [3, 4].

Standard nutrition prepared solutions are intended for patients at risk of undernourishment or undernourished patients with normal energy and protein needs (1 kcal/mL). They contain: protein approx. 4 g, lipids approx. 4 g and carbohydrates approx. 13.5 g. They are dedicated to such patients as those suffering from dysphagia, anorexia, dementia. Nutrison protein plus is administered to patients with large protein and energy needs (1.25 kcal/mL). The prepared solution is given to undernourished patients or those at risk of undernourishment who need their fluid regime to be maintained. The less popular prepared solutions for enteral nutrition include: Fre-subin HP energy, Nutrison Energy, Isosource Energy. These are prepared solutions dedicated to patients with severe undernourishment and large energy needs (1.5 kcal/mL). The least often used enteral prepared solution is Peptamen (0.5 kcal/mL), which is administered in the case of critically ill patients.

Home nutritional treatment is a therapy used for over 30 years in patients who are unable to intake food in a natural way due to a chronic disease. This method significantly decreases treatment costs, mainly because of the cost reduction in terms of hospital stays. Moreover, it improves life quality thanks to maintaining permanent contact with the patient's family and staying in a familiar environment [1]. The objective of the thesis was to evaluate the impact of clinical nutrition on selected biochemical parameters and general nutritional status in geriatric patients who are undergoing home treatment.

## MATERIALS AND METHODS

The study covered 65 people suffering from a chronic disease over 65 years of age, including 40 women (61.5%) and 25 men (38.5%). The subjects' average age was 70.68. The patient selection criterion was an incessant period of nutritional treatment of twelve months. The study was conducted at the Nutrition Clinic of Antoni Jurasz University Hospital No. 1 in Bydgoszcz after obtaining a consent from the hospital's Director and the clinic's Co-ordinator. To conduct the study a permit No. KB 703/2016 of 22nd November 2016 was obtained from the Bioethics Commission of the Nicolaus Copernicus University in Toruń, Ludwik Rydygier Collegium Medicum in Bydgoszcz. The study was conducted based on the diagnostic survey method with the use of survey questionnaires: an author's questionnaire and 2 standardised questionnaires. The nutritional status of the studied patients was assessed by means of the Nutritional Risk Score (NRS 2002) scale for assessing risk related to nutritional status, and using the subjective global assessment (SGA). Medical and nursing documentation was also analysed together with lab tests results. In order to collate all the data a study card was established – it provides space to enter such data as: personal data, disease entity, nutrition therapy indication, type of nutritional treatment and the used prepared solution, scores on the NRS 2002 scale, scores on the SGA scale and lab tests results.

The statistical analysis of the collected data was performed by means of the Statistica 10.0 software. To conduct the analysis the Wilcoxon matched-pairs signed-rank test was used – a test from the group of non-parametric statistical tests. The choice of the test was conditioned by failure to meet the fundamental assumption of parametric tests, i.e. the conformity of the studied variable distributions to the normal distribution verified with the Shapiro–Wilk test. The assumed level of statistical significance was assumed at  $p < 0.05$ .

## RESULTS

The nutritional status of the studied patients was assessed with the NRS scale during an introductory assessment. The average result obtained by the subjects amounted to  $5.28 \pm 0.84$  points, which was a sign of the patients' high demand for nutritional treatment. Half of the subjects scored at least 5 points and every fourth subject scored the 6-points maximum. A 3-point result was scored by 4 subjects (6.2%), as was also the case of a 4-point result. 27 people scored 5 points (41.5%) and 30 people scored 6 points (46.2%) – Table 1.

TABLE 1. Nutritional Risk Score (NRS) result (introductory assessment)

NRS	Descriptive statistics							
	n	$\bar{x}$	Me	Min.	Max.	Q1	Q3	SD
0–6/7 points	65	5.28	5.00	3.00	6.00	5.00	6.00	0.84

n – number of observations;  $\bar{x}$  – arithmetic mean; Me – median; Min. – minimum; Max. – maximum; Q1 – lower quartile; Q3 – upper quartile; SD – standard deviation

In the studied group the average time period of nutrition amounted to  $27.43 \pm 17.02$  months, i.e. approximately 2 years. The shortest therapy lasted 12 months (1 year), whereas the longest one lasted 90 months (7.5 years). Half of the examined patients were undergoing nutritional treatment for at least 22 months.

In the majority of cases the therapy used was the enteral one (54 people – 83.1%); 11 people were fed parenterally (Table 2). In the case of patients who received enteral nutrition the most frequently administered prepared solutions were Iso-source standard, Nutrison standard and Nutrison protein plus, whereas the most commonly used solution for parenteral nutrition was Nutriflex Omega plus, Nutriflex basal less so and the least often – SmofKabiven.

The main reason for nutrition therapy in the case of 52 people (80.0%) was dysphagia. In the remaining 20% of subjects the causes of nutrition stemmed from other clinical symptoms. Most subjects were fed via a PEG feedingtube (49 patients – 75.4%); 11 people (16.9%) were fed with CVC, 4 people (6.2%) with a probe and 1 person (1.5%) by means of gastrostomy (Table 3).

Using the SGA scale a comparison was made between the subjects' initial nutritional status (before the introduction of nutritional treatment) and the control measurement (during

TABLE 2. Type of nutrition therapy

Type of nutrition therapy	n	%
Enteral	54	83.1
Parenteral	11	16.9
In total	65	100.0

TABLE 3. Feeding methods

Feeding method	n	%
Probe	4	6.2
PEG	49	75.4
Gastrostomy	1	1.5
CVC	11	16.9
In total	65	100.0

PEG – percutaneous endoscopic gastrostomy; CVC – central venous catheter

TABLE 4. A comparison of subjective global assessment (SGA) initial and control measurement results

SGA results interpretation	Initial measurement		Control measurement	
	n	%	n	%
Normal nutritional status	13	20.0	14	21.5
Suspected undernourishment / medium undernourishment	19	29.2	29	44.6
Depletion	9	13.8	4	6.2
High risk of undernourishment	24	36.9	18	27.7
In total	65	100.0	65	100.0
p	0.005	-	-	-

n – number of observations; % – percentage; p – probability for Wilcoxon matched-pairs signed-rank test

nutritional treatment). The initial measurement a high risk of undernourishment was diagnosed in the biggest number of subjects (24 people – 36.9%), whereas in another 19 people (29.2%) undernourishment was suspected. In the control measurement the number of patients with medium undernourishment increased (29 people – 44.6%), however, the number of patients at a high risk of undernourishment decreased (18 people – 27.7%). Apart from that, also the number of depleted subjects halved. The difference between the assessment of the nutritional status in studied patients in the initial and the control measurement was statistically significant ( $p = 0.005$ ) – Table 4.

In studied patients a comparison was made between the albumin level in the initial measurement (before the start of treatment) and in the subsequent three control measurements conducted during nutritional treatment. The obtained average values of the measurements showed a growing tendency for albumin level with each new control measurement (initial average of 3.25; control measurement I – 3.48; control measurement II – 3.64; control measurement III – 3.72). The difference between the results obtained from control measurements and the result of the initial measurement were statistically significant ( $p < 0.001$ ). There was also a significant difference between the value of control measurement II and control measurement I ( $p = 0.001$ ). No significant difference was found between the values of control measurement III and control measurement II ( $p = 0.060$ ) – Table 5.

Moreover, in the group of studied patients a comparison was made between the haemoglobin level of the initial measurement (before the start of treatment) and in the three subsequent control measurements conducted during nutritional treatment. The obtained average values of the measurements showed a growing tendency for haemoglobin level with each new control measurement (initial average of 11.59; control measurement I – 12.02; control measurement II – 12.6; control measurement III – 12.69). The difference between the control measurements results and the result of the initial measurement were statistically significant (control measurement I at  $p = 0.009$ , whereas control measurement II and III at  $p < 0.001$ ). There was also a significant difference between the value of control measurement II and control measurement I ( $p < 0.001$ ), and between the value of control measurement III and control measurement II ( $p = 0.032$ ) – Table 6.

Apart from that, also the results of cholesterol and triglyceride level were analysed. The percentage of people with the cholesterol/triglyceride level within the norm did not change significantly throughout four subsequent measurements; no significant changes were found with reference to the percentage of people with the levels below or above the norm.

A normal level of electrolytes in initial measurement was reported in the case of 41 subjects (63.1%), in control measurement I – in the case of 42 people (64.6%), in control measurement II – also in the case of 42 people (64.6%) and in control measurement III – in the case of 31 subjects (47.7%). The percentage of people with a normal electrolytes level did not change statistically significantly throughout the four

**TABLE 5. The result of albumin level in initial measurement and in the three subsequent control measurements**

Albumin level	Descriptive statistics							
	n	–	Me	Min.	Max.	Q1	Q3	SD
Initial	61	3.25	3.30	1.61	4.90	2.70	3.60	0.63
Control I	64	3.48	3.40	2.20	4.80	3.15	3.90	0.52
ControlII	63	3.64	3.60	2.60	5.00	3.30	4.00	0.50
ControlIII	65	3.72	3.70	2.90	5.30	3.30	4.10	0.51
	p				vs initial measurement		vs earlier measurement	
Initial					–	–	–	–
Control I					<0.001	<0.001	<0.001	<0.001
Control II					<0.001	0.001	<0.001	0.001
Control III					<0.001	0.060	<0.001	0.060

n – number of observations; – arithmetic mean; Me – median; Min. – minimum; Max. – maximum; Q1 – lower quartile; Q3 – upper quartile; SD – standard deviation; p – probability for Wilcoxon matched-pairs signed-rank test

**TABLE 6. The result of haemoglobin level in initial measurement and in the three subsequent control measurements**

Haemoglobin level	Descriptive statistics							
	n	–	Me	Min.	Max.	Q1	Q3	SD
Initial	65	11.59	12.00	8.30	15.70	10.30	12.80	1.62
Control I	65	12.02	12.10	8.20	14.70	11.10	13.20	1.45
Control II	63	12.60	12.70	6.70	15.60	11.50	13.60	1.67
Control III	65	12.69	12.70	3.80	16.20	11.70	14.00	1.89
	p				vs initial measurement		vs earlier measurement	
Initial						–	–	
Control I						0.009	0.009	
Control II						<0.001	<0.001	
Control III						<0.001	0.032	

n – number of observations; – arithmetic mean; Me – median; Min. – minimum; Max. – maximum; Q1 – lower quartile; Q3 – upper quartile; SD – standard deviation; p – probability for Wilcoxon matched-pairs signed-rank test

subsequent measurements. No statistically significant difference was observed in the percentage of people with values below or above the norm either.

## DISCUSSION

Home nutrition therapy can be administered to patients who do not require hospital treatment and whose health condition enables their safe home treatment without the need for permanent control or round-the-clock observation. For home nutritional treatment to start, one needs to decide whether the patient is able to efficiently feed himself or herself in a traditional way, that is orally. Enteral nutrition is advised for patients whose gastrointestinal tract is functioning but is not able to use traditional food, and if such food is not sufficient or contraindicated. In such case, an undernourishment status or that of organism depletion due to undernourishment is diagnosed. Parenteral nutrition is advised for patients with a disorder of gastrointestinal tract functions and with no possibility for natural feeding to supply a sufficient amount of nutrients as published by Sobotka et al. [3]. In this group of

patients gastrointestinal failure leading to gradual undernourishment and death is diagnosed (Paul et al.) [5].

Nowak et al. [6] observed that undernourishment, and consequently its treatment, develops most often in people of advanced age. Among the elderly, hospitalised patients it reaches 30–65%. Söderström et al. [7] from the University Hospital in Uppsala conducted prospective cohort study to determine whether the nutritional status assessed using the Mini Nutritional Assessment (MNA) scale could be an independent predictor of premature death in people over 65 years of age. The prospective study covered 1767 patients at the age of 65 or older, who were observed for 50 months. Based on the MNA result, normal nutritional status was reported in 628 seniors (35.5%), a risk of undernourishment – in 973 seniors (55.1%) and undernourishment – in 166 seniors (9.4%). During the above-mentioned observations 655 (37.1%) people died. The period of 50 months was survived by 75.2% of the properly nourished patients, 60% of those at risk of undernourishment and only 33.7% of those undernourished at the moment they were included in the study. Similarly, Szczygieł [1] observes that with age the risk of undernourishment increases. Regrettably, literature lacks available studies on the effect of nutritional

treatment on albumin or electrolytes level in a human organism. However, many authors report an improvement of patients' nutritional status thanks to nutritional treatment, and as the measurement of albumin level constitutes one of the methods of checking a patient's nutritional status, a conclusion may be drawn that albumin level increases after the application of an effective nutritional treatment. It is worth emphasising, though, that according to Anderson and Wochos [8] albumin is characterised by a relatively long half-life (around 20 days) and a large 60% pool size located in extravascular fluid. These characteristics mean that in the conditions of limited caloric and protein supply, serum albumin concentration remains unchanged for a relatively long period of time. Therefore, determining serum albumin concentration may be used to describe the degree of chronic undernourishment; however, it is not suitable for an on-going assessment of the implemented nutrition therapy.

In own studies the patients' nutritional status was assessed by means of the NRS scale. In all subjects a need for nutritional treatment was diagnosed. Whereas, by means of the SGA scale, a comparison was made between the nutritional status of the subjects before the start of and during the nutritional treatment. The number of people with a reported high risk of undernourishment or organism depletion decreased in the control measurement, while the number of properly nourished people and those with medium undernourishment increased. The patients' nutritional status was also tested by measuring albumin level before nutrition therapy began and three times during the treatment. A growth tendency of albumin level was indicated with every subsequent control measurement, except for a difference between the second and third control measurement. At the same time, throughout the four subsequent measurements in studied patients electrolytes level did not change. The percentage of people with normal electrolyte level did not change in a statistically significant way.

Kłęk et al. [9] published the results of home enteral nutrition (HEN). The study assessed the results of HEN via a tube in 456 patients, including 142 children and 314 adults. Among the aforementioned group of patients HEN was conducted in the years 2007–2013. Two one-year periods were compared. In the first year the patients were being tube fed with mixed home diets, in the second year the patients were receiving industrial diets of a known composition adjusted to their illness. The status of patients from the second group was monitored by the members of nutritional treatment teams. The following aspects were compared: incidence of complications, hospital readmissions, duration of hospital stay, selected biochemical and anthropometric tests and costs of hospital stay. It was proved that HEN with industrial diets via a feeding tube contributed to: weight gain in both age groups and to a decrease in the incidence of infectious complications. In their conclusions the authors emphasise that HEN with the use industrial diets exerts a positive influence on the course of illness, on the improvement of nutritional status and that it decreases the cost of treatment [9].

While preparing a patient for nutritional treatment one needs to remember that such form of therapy is an interference into metabolism and may result in incidence of severe complications (Order of the President of National Health Fund No. 88/2013/ DSOZ of 18 December 2013) [10]. Every patient should be in a condition which makes it possible to achieve measurable advantages, independent of the choice of nutrition method. When following nutritional standards and basing on the completeness and proportionality principle of nutrients administration, and adjusting the nutrition programme to the needs and situation of the patient, nutrition therapy constitutes an effective and safe treatment method.

## CONCLUSIONS

Nutritional treatment improves nutritional status in chronically ill patients treated at home.

Dysphagia in the course of oncological and neurological diseases is the most frequent indication for home nutritional treatment.

To a substantial extent, nutritional treatment improves albumin and haemoglobin levels in chronically ill patients. Meanwhile, no statistically significant differences were reported in terms of improving total cholesterol, triglycerides or electrolytes among patients.

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