

# NURSING STAFF KNOWLEDGE OF PARENTERAL NUTRITION – PRELIMINARY REPORT

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A. Study design/planning • B. Data collection/entry • C. Data analysis/statistics • D. Data interpretation • E. Preparation of manuscript • F. Literature analysis/search • G. Funds collection

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## ABSTRACT

**Introduction:** Parenteral nutrition provides all necessary nutrients, bypassing the gastrointestinal tract in patients in whom oral or enteral nutrition is not possible. Parenteral nutrition can be effective and safe, but unfortunately it also carries the risk of complications. Most of these can be avoided if the procedures are closely supervised and monitored by those performing them. The main aim of the study was to assess nursing staff's knowledge of parenteral nutrition.

**Material and methods:** The study used a diagnostic survey method – the questionnaire technique. The research tool was a self-designed questionnaire and a knowledge test. One point was awarded for answering each single-choice question correctly, while 0.5 points were given for selecting each of the correct answer options for the multiple-choice questions.

**Results:** A total of 118 respondents from intensive care, surgical, and general medicine wards took part in the survey. The level of knowledge of nursing staff about parenteral nutrition was assessed as inadequate in 72% of the cases, while a good level of knowledge was possessed by 28%. None of the respondents had a very good level of knowledge. In the majority of wards where the respondents worked, the preparation of parenteral nutrition was handled by the hospital pharmacy (54.2%). In the majority of wards where the nursing staff prepared parenteral nutrition, there was a procedure for preparing parenteral nutrition under aseptic conditions (54.4%).

**Conclusions:** The knowledge of medical staff about parenteral nutrition was incomplete. The place of work, completion of a qualification course in anaesthesia and intensive care, having a specialisation, and having experience of the procedure for preparing parenteral nutrition under aseptic conditions all had a significant impact on the level of knowledge of the respondents.

**Key words:** knowledge, nursing care, nutritional treatment, parenteral nutrition.

## INTRODUCTION

Clinical nutrition is an important component in the treatment of critically ill patients. According to the European Society for Clinical Nutrition and Metabolism (ESPEN) guidelines, in patients with normal gastrointestinal function, enteral nutrition is the preferred route of nutrition to prevent atrophy and gastrointestinal dysfunction. However, if enteral supply is contraindicated, impossible, or insufficient and the full nutritional requirements cannot be covered within 3 days, the ESPEN guidelines recommend implementing parenteral nutrition [1]. The Polish Society of Parenteral and Enteral Nutrition and Metabolism defines total parenteral nutrition (TPN) as “a supply of protein, energy (carbohydrates, fats), electrolytes, vitamins, trace elements, and water via the intravenous route in amounts adjusted to the needs and

metabolic status of the patient” [2-5]. An additional definition of parenteral nutrition is as nutrition “in which the parenteral supply of energy and nitrogen (amino acids), including the addition of electrolytes, calcium salts, covers more than 50% of the prevalent (for the stage of the illness and condition of the patient) daily requirement” [5]. From these definitions, it is clear that parenteral nutrition is one component of the nutritional treatment of patients when, due to an underlying disease, the nutrients necessary to cover the patient's daily requirements cannot be administered by oral or enteral means [5]. Were it not for the possibility of intravenous feeding, gastrointestinal failure caused by various diseases would lead to nutritional deficits and a progressive collapse of the bodily systems, which in turn would result in death from starvation [5-7]. Parenteral nutrition can be ef-

fective and safe, but unfortunately it also carries the risk of complications. Most of these can be avoided if the procedures are closely supervised and monitored by those performing them [8].

The aim of the study was to assess the level of knowledge of nursing staff working in various hospital wards on the subject of parenteral nutrition.

## MATERIAL AND METHODS

The study was conducted using a diagnostic survey method with a self-designed survey questionnaire. The first part of the questionnaire consisted of a metric to identify variables relating to gender, age, education, length of service, additional qualifications including a course on the basics of enteral and parenteral nutrition, the existence of a nutritional support team, and place of work. The survey also contained 18 questions to test knowledge of the topic under study. The questions concerned, among others, the definition of complete and incomplete parenteral nutrition, routes of parenteral nutrition delivery, indications and contraindications for parenteral nutrition, the order in which contents of the ready-to-use (RTU) bag should be activated, and possible complications. The survey used single-choice questions and one multiple-choice question. One point was awarded for answering each single-choice question correctly, while 0.5 points were given for selecting each of the correct answer options for the multiple-choice questions. A maximum of 20 points could be scored by the respondents. Those scoring 16.5-20 points were assumed to have a very good level of knowledge, 10-16 points a good level of knowledge, and a score below 10 points was considered insufficient knowledge.

The study was conducted between 1 May and 31 July 2022 among the nursing staff of 3 hospitals in the Podbeskidzie region. In each of the institutions, permission was obtained from the management to conduct the study. Respondents were informed about the purpose of the study and their voluntary participation. There were 180 survey questionnaires prepared for the study, and 126 completed questionnaires were returned, of which 118 were qualified for the study (65.5% return rate).

The significance of relationships between nominal variables was tested using the chi-square test of independence. For quantitative variables, the difference between 2 mean scores independent of each other was tested using Student's *t*-test for independent samples. The significance of differences between more than 2 unrelated quantitative variables was tested using one-way analysis of variance with Bonferroni's post hoc test. Statistical analyses assumed a significance level of  $p = 0.05$ . Analyses were performed using SPSS Statistics and Office software.

## RESULTS

Most respondents were women (93.2%), and the most common age group was 21-30 years (31.4%). Almost half of the respondents had a master's degree in nursing (47.5%). The highest percentage of staff surveyed had worked in the profession for 1-5 years (23.7%), while the length of service of the remaining respondents fell within the following ranges: less than one year – 7.6%, 6-10 years – 16.1%, 11-20 years – 16.9%, 21-30 years – 18.6%, over 30 years – 16.9%. Almost 30% of the respondents had a qualification in anaesthesia and intensive care nursing (27.1%). Half of the respondents declared that they had completed a specialisation course (48.3%). The vast majority of respondents had participated in some further training (96.6%). Only one in ten had completed a refresher course on the basics of enteral and parenteral nutrition (9.3%). Most respondents worked in a place that had a nutrition support team (62.7%). The highest percentage of respondents worked in intensive care units (ICU) (43.2%) and surgical wards (31.4%) (Table 1).

In most wards where the respondents worked, the preparation of parenteral nutrition was handled by the hospital pharmacy (54.2%), while in more than 45% of cases the nursing staff were responsible for the preparation of parenteral nutrition (45.8%). In most wards where the nursing staff prepared parenteral nutrition, there was a procedure for preparing parenteral nutrition under aseptic conditions (54.4%). In wards where parenteral nutrition was prepared by the hospital pharmacy, 66% of respondents had no knowledge of the existence or use of the procedure in question. A significant association was found between the way parenteral nutrition was prepared and the existence of a procedure for preparing parenteral nutrition under aseptic conditions ( $p < 0.05$ ).

Only 16.1% of respondents were able to list all available routes of parenteral nutrition delivery. Only 14.4% of respondents knew how to initiate parenteral nutrition in a malnourished patient. More than half of the respondents related the initiation of the nutrition to the patient's nutritional requirements while also taking into account any test results. Incomplete parenteral nutrition is when, without clinical justification, the nutrition does not contain micronutrients. Only 16.1% of respondents knew the correct answer. Most respondents knew that when a patient is identified as having an indication for parenteral nutrition, it should be started immediately, i.e. within 24 hours, but after the metabolic state has stabilised (71.2%). The RTU bag should be connected to the patient immediately after preparation – 36.4% of respondents were aware of this. Only a third of respondents knew in which order the contents of the RTU bag should be activated (31.4%). Most respondents had no knowledge of the maintenance timing of intravenous accesses

**Table 1.** Detailed characteristics of the group studied

Parameter	Number	Percentage
Gender		
Women	110	93.2
Men	8	6.8
Age (years)		
21-30	37	31.4
31-40	31	26.3
41-50	27	22.9
Over 50	23	19.5
Level of education		
Nursing degree	38	32.2
Master's degree in nursing	56	47.5
Medical school	16	13.6
Medical training college	8	6.8
Length of service in the profession (years)		
Less than one year	9	7.6
1-5	28	23.7
6-10	19	16.1
11-20	20	16.9
21-30	22	18.6
Over 30	20	16.9
Successfully completed an anaesthesia and intensive care nursing course		
Yes	32	27.1
No	86	72.9
Specialist		
Yes	57	48.3
No	61	51.7
Participated in further training		
Yes	114	96.6
No	4	3.4
Completion of a refresher course – the basics of enteral and parenteral nutrition		
Yes	11	9.3
No	101	85.6
I did not realise there was such a course	6	5.1
A nutrition support team exists in the workplace		
Yes	74	62.7
No	11	9.3
I don't know	33	28.0
Place of work		
Anaesthesia and ICU	51	43.2
Surgical Ward	37	31.4
Haematology Ward	7	5.9
ENT Ward	5	4.2
Oncology Ward	4	3.4
Internal Medicine Ward	4	3.4
Gastroenterology Ward	9	7.6
Operating Theatre	1	0.8

for parenteral nutrition (94.1%). A relatively low percentage (11.9%) of respondents were aware that if carbohydrates need to be restricted, they should be replaced by lipids. Most respondents knew that only micronutrients and vitamins can be added to the nutrition bag while it is not recommended that other drugs be added (89.8%). Most respondents knew that a blood transfusion device should not be used to administer parenteral nutrition (67.8%). Only 49.2% of respondents knew what the osmolality of a feeding preparation administered by peripheral vascular route should be. Vitamins A, B2, and K can be inactivated when exposed to daylight. Only 17.8% of respondents knew the correct answer. More than a quarter of respondents stated that this affected only B vitamins. If there is reverse blood flow during the delivery of the contents of the feeding bag into the vein, the infusion device should be replaced. This correct answer was chosen by most respondents (72.9%). The following percentages of respondents were able to identify the individual true statements concerning the preparation of parenteral nutrition: using RTU is a high-risk procedure (48.3%); it concerns microbiological and metabolic risks, followed by financial and legal risks (26.3%); it requires great care (54.2%); it is a pharmaceutical service (39%); it must be carried out with the rigorous use of aseptic principles (67.8%); and the administration of parenteral nutrition requires the use of infusion equipment that meets the requirements of working in a closed infusion system (55.9%).

A relatively high proportion of respondents knew that enteral feeding was indicated in the case of a severely ill patient where gastrointestinal function was preserved (41.5%). Only one in three respondents knew who might be affected by refeeding syndrome (32.2%). One third (35.6%) of the respondents did not know the correct answer, and 28% indicated an answer that only included patients on parenteral nutrition. Only a third of respondents knew that mechanical, infectious, and metabolic complications can occur during parenteral nutrition (34.7%).

With regard to knowledge of parenteral nutrition, the respondents scored an average of 7.91 points (SD = 2.98 points) out of a possible 20, in the range of 0.5-15 points.

The level of knowledge of nursing staff about parenteral nutrition was rated as in-

adequate in 72% of cases; a good level of knowledge was possessed by only 28%. None of those surveyed had a very good level of knowledge.

The study investigated if age had an impact on the respondents' level of knowledge. The highest number of points was obtained by those in the age range 31-40 years (8.44 points, SD = 2.49). Respondents over 40 years of age scored 8.04 points (SD = 3.44). Respondents aged 21-30 years scored the least, with 7.28 points (SD = 2.64). Univariate analysis of variance showed no significant difference in the results obtained in the questionnaire on parenteral nutrition, depending on age.

Next the question of whether length of service influenced the level of knowledge about parenteral nutrition was explored. The highest score was obtained by those working in the profession for 6-20 years (8.67 points, SD = 2.55). Respondents with work experience of more than 20 years scored less (7.77 points, SD = 3.55), with the lowest scores among employees with seniority of up to 5 years (7.26 points, SD = 2.58). There was no significant difference in the results obtained in the questionnaire on parenteral nutrition, when compared to the length of service in the profession.

Next, the relationship between the nurses' level of knowledge of parenteral nutrition and level of education was investigated. Those with a master's degree in nursing scored the highest (8.44 points, SD = 2.49). Respondents who graduated from a medical high school or medical training college scored an average of 8.04 points (SD = 3.44). In contrast, those with a bachelor of nursing degree scored the least on the knowledge test (7.28 points, SD = 2.64). Statisti-

cal analysis showed no significant difference in the scores obtained in the questionnaire on parenteral nutrition relating to education.

A correlation was observed between the level of knowledge and completion of a specialisation and further training courses. Analysis by Student's *t*-test for independent samples showed a significant difference in scores obtained in the questionnaire on parenteral nutrition, depending on whether the respondent had completed the anaesthesia and intensive care nursing course ( $p < 0.05$ ). Those who had completed the course scored significantly higher (8.80 points, SD = 2.79) than the others (7.58 points, SD = 3.00) (Table 2).

Statistical analysis showed a significant difference in the scores obtained in the questionnaire on parenteral nutrition, depending on whether the respondent held a specialisation ( $p < 0.05$ ). Those who held a specialisation scored higher on the knowledge test (8.61 points, SD = 2.63). Those without a specialisation scored an average of 7.25 points (SD = 3.16) (Table 3).

The study also examined whether the place of work influenced the level of knowledge about parenteral nutrition. Employees in ICU wards scored an average of 8.86 points (SD = 2.28), surgical wards 7.26 points (SD = 3.00), and other wards 7.08 points (SD = 3.59). The Bonferroni post hoc test showed that respondents who worked in an ICU scored significantly higher than respondents performing their professional duties in surgical wards ( $p < 0.05$ ) or other wards ( $p < 0.05$ ). Thus, there was a significant difference in questionnaire scores depending on the place of work (Table 4).

**Table 2.** Number of points obtained in the questionnaire on parenteral nutrition compared with the completion of the anaesthesia and intensive care nursing course

	Completion of the anaesthesia and intensive care training course				Student's <i>t</i> -test	
	Yes		No			
	M	SD	M	SD	<i>t</i>	<i>p</i>
No. of points	8.80	2.79	7.58	3.00	2.003	0.047

**Table 3.** Number of points obtained in the questionnaire on parenteral nutrition by specialisation

	Specialisation				Student's <i>t</i> -test	
	Yes		No			
	M	SD	M	SD	<i>t</i>	<i>p</i>
No. of points	8.61	2.63	7.25	3.16	2.548	0.012

**Table 4.** Number of points obtained in the questionnaire on parenteral nutrition by place of work

	Place of work						ANOVA	
	ICU		Surgical ward		Other wards			
	M	SD	M	SD	M	SD	<i>F</i>	<i>p</i>
No. of points	8.86	2.28	7.26	3.00	7.08	3.59	4.957	0.009

**Table 5.** Number of points obtained in the questionnaire on parenteral nutrition in connection with the use of the procedure for preparing parenteral nutrition under aseptic conditions

	Is there a procedure for the preparation of parenteral nutrition in aseptic conditions in your ward?					
	Yes		No/Don't know		Student's <i>t</i> -test	
	M	SD	M	SD	<i>t</i>	<i>p</i>
No. of points	8.49	3.22	7.12	2.44	2.513	0.013

**Table 6.** Number of points obtained in the questionnaire on parenteral nutrition according to who prepares the parenteral nutrition for the ward

	Who prepares parenteral nutrition for the ward where you work?					
	Hospital pharmacy		Nursing staff		Student's <i>t</i> -test	
	M	SD	M	SD	<i>t</i>	<i>p</i>
No. of points	7.05	2.66	8.93	3.05	-3.578	0.001

The research attempted to determine the relationship between the existence of a nutrition support team and the level of knowledge of the respondents. Respondents who answered positively to the question about the existence of a nutrition support team obtained an average of 7.97 points (SD = 2.83). On the other hand, the respondents working in hospitals either where, in their opinion, there was no nutrition support team or where they did not know if such a team existed obtained lower results (7.81 points, SD = 3.26). One-way analysis of variance showed no significant difference in results based on the existence of a nutrition team in the workplace. However, there was a significant difference in the results obtained in the parenteral nutrition knowledge test on the use of the parenteral nutrition preparation procedure in aseptic conditions ( $p < 0.05$ ). Respondents who worked where this procedure was applied obtained a significantly higher score (8.49 points, SD = 3.22). Respondents who either did not know of its existence or were from wards where the procedure was not used obtained an average of 7.12 points (SD = 2.44) (Table 5).

Respondents working on wards where the nursing staff prepared parenteral nutrition (45.8%) had a higher score of 8.93 points (SD = 3.05). In contrast, nurses from wards where this procedure was handled by the hospital pharmacy scored 7.05 points (SD = 2.66). Analysis by Student's *t*-test for independent samples showed a significant difference in the scores obtained in the questionnaire on parenteral nutrition depending on who prepared the parenteral nutrition in the ward (Table 6).

## DISCUSSION

The knowledge and skills of nurses administering parenteral nutrition are 2 key factors in preventing errors. This survey aimed to determine nursing staff's level of knowledge on parenteral nutrition. The results showed that up to 72% of all respondents had an insufficient level of knowledge. This may be due

to a lack of extensive coverage of parenteral nutrition during pre-qualifying training, lack of staff, and, in some cases, inadequate management and work planning. The results of a study by Kochan and Akin [9], as well as Yalcin *et al.* [10], also showed that nurses had moderate knowledge of both parenteral and enteral nutrition, in contrast to the studies by Ameri *et al.* [11] and Doganay *et al.* [12].

Our study assessed the level of knowledge of nurses working in ICUs, and surgical and non-surgical wards. Respondents who worked in ICUs had significantly higher scores. Respondents who performed their professional duties in surgical wards, however, had a similar level of knowledge to staff in other wards. These results confirm reports by Kochan and Akin [9], in which nurses from surgical and oncology-haematology wards scored lower than those working in internal medicine wards or ICUs. Khalefa *et al.* [13] confirmed the above findings in their study by indicating a significant statistical difference in the mean knowledge test scores of intensive care staff compared to staff in other wards. This situation may be due to the fact that ICU patients are more likely to receive parenteral nutrition, and hence the respondents have a higher level of knowledge.

In their study, Khalefa *et al.* [13] found no significant correlation between the number of years' work experience, age, and level of knowledge with overall standards of TPN practice. Similarly, in our study, a one-way analysis of variance showed no significant difference in questionnaire scores on parenteral nutrition relating to age or number of years of work experience. A study by Yalcin *et al.* [10] also showed no correlation between years of work experience and clinical nutrition knowledge test scores. In a study by Ameri *et al.* [11], none of the demographic information such as age, work experience, level of education, type of employment, and parenteral nutrition courses influenced the nurses' practices and knowledge scores. A statistical analysis in a study by Taherkhani *et al.* [14] showed no significant difference in the mean score of nurses with different work

experience. However, nurses with less than 5 years of work experience showed a slightly lower level of knowledge compared to nurses who had 5 to 10 years or more than 10 years of experience. These cited research results may show that education is more effective than clinical experience. They also show that there is a need for periodic training on nutrition in the workplace and that more emphasis should be placed on nutrition education in nursing school curricula and continuing education. In this study, there was no statistically significant difference in the results obtained in the questionnaire on parenteral nutrition relating to education; however, the highest number of points was obtained by respondents with a master's degree. Similarly, in the study of Taherkhani *et al.* [14], the average score obtained among nurses with a bachelor's degree and those with a master's degree was similar. The results of Yalcin *et al.* [10], where nurses who had graduated obtained the highest score, however, were different because there was a statistically significant difference in the groups, which was due to the low level of knowledge of medical secondary school graduates. The results of Kochan and Akin [9], obtained from the "Information Form on Parenteral Nutritional Practices", showed that the results of nurses with bachelor's degrees were statistically significantly lower than the results of registered nurses.

Nursing staff are obliged to continuously improve their professional qualifications and update their knowledge. In this study, the factor that significantly influenced the level of knowledge was completion of the Anaesthesia and Intensive Care Nursing course and having a specialisation. Those who had both completed the course and had a specialisation showed a higher level of knowledge on parenteral nutrition. Nevertheless, the overall level of knowledge was found to be insufficient. As many as 94% of respondents claimed to have participated in further training, but less than 50% had completed a specialisation. This may be related to seniority, as one-third of the respondents had worked in the profession for 1-5 years or less. The analysis of the survey showed that up to 90% of the respondents had not completed a supplementary training course on the basics of enteral and parenteral nutrition or did not know that such a course was available. The relationship between the completion of this course and the level of knowledge of the respondents was, therefore, not investigated. In a study by Yalcin *et al.* [10], there was no statistically significant difference between knowledge scores on parenteral nutrition and participation in a nutrition course during formal education. In contrast, Khalefa *et al.* [13] observed a statistically significant difference in the mean knowledge scores for those who attended refresher courses. A study by Ameri *et al.* [11] showed that the mean knowledge test scores before and after completing a train-

ing course were significantly different. However, the mean scores of practical knowledge before and after the course were not significantly different. The authors of the study estimated that the level of staff knowledge of parenteral nutrition was above average, both at the beginning of the study and one month after the training-instruction programme.

Getting the RTU bag ready or preparing a custom-made bag according to the individual needs of the patient is a pharmaceutical service and should therefore be performed by a pharmacist. The analysis of this study showed that nurses working in wards where the nursing staff prepare parenteral nutrition have a significantly higher level of knowledge than staff in wards where this is handled by the hospital pharmacy.

In a study by Szlagatys-Sidorkiewicz *et al.* [15], the establishment and implementation of a nutrition support team and systematic education of medical staff allowed a significant reduction in the risk of infectious complications related to parenteral nutrition in hospital. In our study, there was no correlation between the functioning of the nutrition support team in the hospital and the level of knowledge of the respondents. As many as 37.3% of the respondents did not know about the existence of a team or, in their opinion, one did not exist. This may be due to the low activity of the team, lack of training, and ineffective collaboration between the staff and the nutrition support team. Different results were observed in studies by Yalcin *et al.* [10] and Kochan and Akin [9], in which nurses working in hospitals that had a nutrition support team scored higher on average compared to nurses working in hospitals that did not have a nutrition support team. In their study, Laskowska *et al.* [16] proved that the establishment of Nutrition Support Teams, as a group of experts, without the creation of a system of continuous education and enforcement of the recommendations, as well as without the will to change the existing habits of the staff, is pointless and does not lead to the improved care and safety of treatment.

Despite the important role of nurses in the assessment and treatment of critically ill patients receiving TPN, the results of this study show that nurses have insufficient knowledge in the care of patients receiving TPN. Therefore, developing a training programme to increase nurses' knowledge, practice, and skills is the first step towards improving the TPN delivery procedure and reducing complications.

## CONCLUSIONS

Nurses' knowledge of parenteral nutrition is insufficient.

Nurses working in ICUs have a higher level of knowledge of parenteral nutrition than those working on other wards.

Variables such as age, length of service, and education do not significantly affect the level of knowledge of nursing staff regarding parenteral nutrition.

Nursing staff with a specialisation or who have completed a course in anaesthesia and intensive care nursing demonstrate a higher level of knowledge of the principles of TPN.

The existence of a nutrition support team does not affect the respondents' level of knowledge. In contrast, the use of the parenteral nutrition procedure in practice and the preparation of TPN by the nursing staff in the ward, rather than the pharmacy, significantly affect the respondents' knowledge level regarding parenteral nutrition.

It is essential to constantly update nurses' knowledge about nursing procedures in TPN through the introduction of educational programmes based on scientific evidence.

### Disclosure

The authors declare no conflict of interest.

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