South African Journal of Clinical Nutrition 2023; 36(2):i–iii
https://doi.org/10.1080/16070658.2023.2219508

SAJCN
ISSN 1607-0658 EISSN 2221-1268

EDITORIAL

Nutrition support in critical care: How does a South African unit measure up against the suggested guidelines and against the world?

Anna-Lena du Toit*

Dietetics Department, Groote Schuur Hospital, Cape Town, South Africa
Anna-Lena.duToit@westerncape.gov.za

Check for updates

It is well established that both under- and overnutrition in the intensive care unit (ICU) has detrimental effects on clinical outcomes.[1, 2] In recent years, it has become more apparent that over nutrition in the early phase of critical illness is detrimental and that the aim should be to only reach nutritional requirements by day 3 of the ICU stay.[3]

Both the European Society for Clinical Nutrition and Metabolism (ESPEN) and the American Society of Parenteral and Enteral Nutrition (ASPEN) in their published guidelines agreed that indirect calorimetry (IC) should be used to determine energy requirements in the critically ill patients, where feasible and available.[1, 3] However, ESPEN advocated a progressive implementation of energy provision.[3] In this approach, hypocaloric nutrition not exceeding 70% of energy expenditure, in the early phase of acute illness was recommended.[3] Provision of 80–100% of requirements should only be implemented after 72 hours following admission.[3] In the absence of IC, ASPEN and ESPEN suggest that simple weight-based equations be used.[1, 3] The ASPEN 2016 guidelines gave a range of 25–30 kCal/kg/day.[1] ESPEN however suggested that hypocaloric nutrition support, below 70% of estimated needs, should be continued for the first week of ICU stay when weight-based equations are being used.[3] The reasoning behind progressively increasing energy provision in the critical care setting by ESPEN is based on earlier data (Tappy et al. 1998), which showed that exogenous glucose provision does not suppress endogenous glucose production.[4] Endogenous energy production, which occurs in the early phase of critical illness, can provide 500–1 400 kCal/day.[3, 4] Currently, it is not possible to measure this endogenous production at the point-of-care, however providing full measured or calculated requirements during this stage would result in overfeeding.[3, 4]

In South Africa, IC has not been available in the clinical setting for several years. In 2020, Groote Schuur hospital became the first hospital to acquire the new IC calorimetry technology and, since then a few other units have started implementing IC in the ICU setting. In this SAJCN issue, Laher et al, affords a glimpse into nutritional practices in an ICU in Johannesburg, South Africa.[5] Data collection took place in 2018 and the authors based their requirements on the ASPEN recommendations published in 2016 which were the most up to date international guidelines at the time. The more recent recommendations by ESPEN were largely based on the findings of studies published after 2013, which were not included in the ASPEN data analysis for the 2016 guidelines.[1, 3] Most notably a meta-analysis by Marik and Hooper suggesting lower hospital mortality in permissively underfed patients.[6] In addition, Zusman et al, demonstrated a non-linear association between energy provision and mortality.[2] Increasing energy provision up to 70% of requirements resulted in a reduction in mortality, while increases above 70% suggested an increase in mortality.[2] This was also associated with an increased length of stay and increased duration of ventilation.[2] In 2022, ASPEN published updated guidelines and adjusted the suggested weight-based requirement to a much lower 12–25 kCal/kg during the first 7–10 days of ICU admission.[7]

How does the Laher study then measure up against the current guidelines?[5] Provision of calories during the acute phase were reported as a median of 15.7 kCal/kg, which is in line with current recommendations from ESPEN and ASPEN.[1, 7] However, with further analysis, the authors reported providing more than 80% of the recommended targets on 38.6% of chart days. Furthermore, on 18.4% of chart days nutritional delivery reached more than 110% of the recommended energy target range. Looking at the other end of the spectrum, in the recovery phase, where meeting nutritional requirements now becomes a priority, overall provision of calories was reported as a median of 21.1kCal/kg; this was well below the recommendations. In further analysis, > 80% of recommended calories were provided on 56.1% of chart days. In the recovery phase, 59.3% of patients were managed on enteral nutrition (EN) alone, while 13.2% received parenteral nutrition (PN) support. EN and PN as a combined feeding strategy were used in 15.8% of cases. Energy dense, high protein EN formula was utilised in 32.6% of cases in the recovery phase. Feeding interruptions in the recovery phase were mostly related to feeds being stopped for surgery (27.7%) or feeding intolerance (53.2%).[5]

Feeding interruptions around theatre schedules must be kept to a minimum by adhering to correct nil by mouth protocols for surgery.[8, 9] In the case of intubated patients where the airway is not going to be manipulated intra-operatively or with post-pyloric tubes, feeds should not be interrupted.[9–12] In other instances, fasting times should be kept to a minimum.[8–10] Schedules for catch-up feeding or volume based protocols can also be employed in units to ensure patients, who can tolerate an increased volume, will still receive the daily target over the reduced time period.[12–14] Consideration should be given to calorie and protein dense formulations to ensure adequate nutrition delivery and where needed EN and PN administration should be combined to ensure nutritional targets are met.[15]

The ASPEN 2016 guidelines recommend a wide range of 1.2–2.0 g/kg protein during critical illness while ESPEN recommends of 1.3 g/kg Protein equivalents per day.[1, 3] At first glance this seems low, especially when compared to ASPEN and the previous ESPEN guidelines.[1, 16] It must be noted that the weight of free amino acids is greater than the weight of the protein they create.[17] For example, 100 g of free amino acids will only provide 83 g of protein.[17] Therefore, when ESPEN suggests a 1.3 g/kg of protein equivalents, the equivalent when providing a protein hydrolysate, for instance in PN formulations and hydrolysed enteral formulas, will be in the range of 1.6 g/kg/day. This is often overlooked in clinical practice. The Zusman trial suggested that an increase in protein provision is associated with a decrease in mortality with significantly higher survival with protein administration of >1.3 g/kg/day.[2] In the study by Lehar et al overall protein provision in the acute phase only reached 0.7 g/kg/day.[5] This did not improve markedly during the recovery phase with overall protein provision of 0.9 g/kg/day.[5] Even when the disease specific categories are considered, the protein provision remained far below the recommended targets.[5]

It is notable in most studies, and this study by Lehar et al is no exception, that energy targets are often met within reasonable range while protein provision remains far below recommendations. This can partly be attributed to the provision of non-nutritional calories in the form of Propofol and/or dextrose containing intravenous fluids. However, another significant factor is commercially available enteral and parenteral nutrition formulations. The ratio of energy to protein is fixed in these formulations and leaves little room for provision of more protein without exceeding energy requirements. Addition of protein containing modulars is one way to address this limitation, but it is often unattainable due to the increased fluid administration and additional costs. In the case of EN support, a lot has improved in recent years with the availability of higher protein containing formulations, providing 100 g protein/liter, in a range of caloric densities, from 1.2 kCal/ml up to 2 kCal/ml. In the case of parenteral nutrition formulations, this remains a big challenge.

At the international level, the recently published EuroPN trial ($n = 1172$); from 77 intensive care units from 11 countries in Europe reported a median intake of 14.4 kCal/kg/day by day 3, and by day 7 patients reached 21.9 kCal/kg/day.[18] Energy provision remained under the ESPEN recommendation of 25 kCal/kg for the remainder of the study period. Patients received a median protein provision of 0.6 g/kg by day 3. By day 7 protein provision improved to a median of 1 g/kg/day. The maximum provision achieved for the 15-day study period was a median of 1.2 g/kg/day, remaining below the ESPEN recommendation. The median delivery over the 15-day study period was 15.9kCal/kg/day and 0.7 g/kg/day protein.[18]

Ridley et al published data on nutrition practices in Australian and New Zealand (ANZ) ICUs in 2018.[19] They compared data submitted for the two countries as part of the International Nutrition Survey with international practices. The total energy delivery per day was 15 kCal/kg/day in ANZ units compared to 13kCal/kg/day internationally. Protein delivery was similar to international practices at 0.6 g/kg/day.[19] Furthermore, data from the nutritionDay initiative published in 2017 included data collected over a seven-year period.[20] Mean nutritional delivery at day 3 based on the median reported weight was 13.3 kCal/kg; this increased to 20 kCal/kg by day 7–13 and remained stable within this range for up to 180 days.[20] From this data, it is evident that nutritional goals are also poorly met in the critical care setting internationally. The study by Lehar et al, therefore, is in line with international experience and demonstrates that nutritional practices in an intensive care unit in Johannesburg is not that different from achieved practices internationally and that we often fail to meet recommended nutritional requirements for critically ill patients.

ORCID

Anna-Lena du Toit http://orcid.org/0000-0001-7677-1694

References

1. Taylor BE, McClave SA, Martindale RG, et al. Guidelines for the provision and assessment of nutrition support therapy in the adult critically ill patient: Society of Critical Care Medicine (SCCM) and American Society for Parenteral and Enteral Nutrition (ASPEN). Crit Care Med. 2016;44(2):390–438. https://doi.org/10.1097/CCM.0000000000001525
2. Zusman O, Theilla M, Cohen J, et al. Resting energy expenditure, calorie and protein consumption in critically ill patients: a retrospective cohort study. Critical Care. 2016;20(1):1–8. https://doi.org/10.1186/s13054-016-1538-4
3. Singer P, Blaser AR, Berger MM, et al. ESPEN guideline on clinical nutrition in the intensive care unit. Clin Nutr. 2019;38(1):48–79. https://doi.org/10.1016/j.clnu.2018.08.037
4. Tappy L, Schwarz JM, Schneiter P, et al. Effects of isoenergetic glucose-based or lipid-based parenteral nutrition on glucose metabolism, de novo lipogenesis, and respiratory gas exchanges in critically ill patients. Crit Care Med. 1998;26(5):860–7. https://doi.org/10.1097/00003246-199805000-00018
5. Laher AE, McDowall J, van Welie M, et al. Nutritional support practices at an intensive care unit in Johannesburg, South Africa. S Afr J Clin Nutr. 2022;2:1–6.
6. Marik PE, Hooper MH. Normocaloric versus hypocaloric feeding on the outcomes of ICU patients: a systematic review and meta-analysis. Intensive Care Med. 2016;42:316–23. https://doi.org/10.1007/s00134-015-4131-4
7. Compher C, Bingham AL, McCall M, et al. Guidelines for the provision of nutrition support therapy in the adult critically ill patient: The American Society for Parenteral and Enteral Nutrition. JPEN J Parenter Enteral Nutr. 2022;46(1):12–41. https://doi.org/10.1002/jpen.2267
8. Søreide E, Ljungqvist O. Modern preoperative fasting guidelines: a summary of the present recommendations and remaining questions. Best Pract Res Clin Anaesthesiol. 2006;20(3):483–91. https://doi.org/10.1016/j.bpa.2006.03.002
9. Douglas MJ, Ciraulo D. Variability in perioperative fasting practices negatively impacts nutritional support of critically ill intubated patients. Am Surg. 2017;83(8):895–900. https://doi.org/10.1177/000313481708300843
10. Hartl T, Anderson D, Levi J. Safety of a no-fast protocol for tracheotomy in critical care. Can J Surg. 2015;58(1):69–70. https://doi.org/10.1503/cjs.027213
11. Alkhawaja S, Martin C, Butler RJ, et al. Post-pyloric versus gastric tube feeding for preventing pneumonia and improving nutritional outcomes in critically ill adults. Cochrane Database Syst Rev. 2015;8:CD008875. https://doi.org/10.1002/14651858.CD008875.pub2
12. McCartt J, Loszko A, Backes K, et al. Improving enteral nutrition delivery in the critically ill trauma and surgical population. JPEN J Parenter Enteral Nutr. 2022;46(5):1191–7. https://doi.org/10.1002/jpen.2353
13. Pham CH, Collier ZJ, Webb AB, et al. How long are burn patients really NPO in the perioperative period and can we effectively correct the caloric deficit using an enteral feeding "Catch-up" protocol? Burns. 2018;44(8):2006–10. https://doi.org/10.1016/j.burns.2018.07.005
14. Krebs ED, O'Donnell K, Berry A, et al. Volume-based feeding improves nutritional adequacy in surgical patients. Am J Surg. 2018;216(6):1155–9. https://doi.org/10.1016/j.amjsurg.2018.05.016
15. Oshima T, Heidegger CP, Pichard C. Supplemental parenteral nutrition is the key to prevent energy deficits in critically ill patients. Nutr Clin Pract. 2016;31(4):432–7. https://doi.org/10.1177/0884533616651754
16. Singer P, Berger MM, Van den Berghe G, et al. ESPEN guidelines on parenteral nutrition: intensive care. Clin Nutr. 2009;28(4):387–400. https://doi.org/10.1016/j.clnu.2009.04.024
17. Hoffer LJ. Human protein and amino acid requirements. JPEN J Parenter Enteral Nutr. 2016;40(4):460–74. https://doi.org/10.1177/0148607115624084
18. Matejovic M, Huet O, Dams K, et al. Medical nutrition therapy and clinical outcomes in critically ill adults: a European multinational,

prospective observational cohort study (EuroPN). Crit Care. 2022;26 (1):1–4. https://doi.org/10.1186/s13054-022-03997-z
19. Ridley EJ, Peake SL, Jarvis M, et al. Nutrition therapy in Australia and New Zealand intensive care units: an international comparison study. JPEN J Parenter Enteral Nutr. 2018;42(8):1349–57. https://doi.org/10.1002/jpen.1163
20. Bendavid I, Singer P, Theilla M, et al. NutritionDay ICU: a 7 year worldwide prevalence study of nutrition practice in intensive care. Clin Nutr. 2017;36(4):1122–9. https://doi.org/10.1016/j.clnu.2016.07.012

Received: 21-05-2023 Accepted: 25-05-2023