Berger et al. Critical Care (2017) 21:39
DOI 10.1186/s13054-017-1612-6

Critical Care

LETTER Open Access

Optimal energy delivery and measured energy expenditure—impact of length of stay

Mette M. Berger[1,4*], Claude Pichard[2] and Eric Fontaine[3]

See related research by Zusman et al. https://ccforum.biomedcentral.com/articles/10.1186/s13054-016-1538-4

The issue of optimal energy delivery in critical care patients is a matter of debate, and guidelines recommend to base energy prescriptions on measured energy expenditure (EE). Recently, the largest study ever ($n = 1171$ patients) of the relation between energy and protein delivery, measured EE, and outcome was published [1]. The authors should be commended for this contribution, particularly for confirming the importance of proteins to outcome. Nevertheless, although they tried "to reduce any possible bias caused by short stay" by including in the analysis only patients staying >96 h, the interpretation of their results was probably contaminated by short stayers, as the median reported length of stay was 5 days.

The authors calculated the percentage of administered calories by resting EE (%ADCal/REE): each patient was assigned one value representing the mean of the stay's delivered kcal. They report a U-shaped curve of mortality by %AdCal/REE, the lowest mortality being observed for 70% of the measured EE value. Despite considering only patients staying >96 h, and a very efficient feeding protocol (progression to target within 4 days), this mathematically induces a bias as shown in Fig. 1. This would occur despite their rapid progression to target (much faster than in most studies); the daily mean (DM) would be close to 88% by day 11. With a median stay of 5 days, the daily mean intake would be about 74% of target: these less severe patients are discharged because they do not require ICU treatment and not because they receive 85% of target. This is typically what was observed in trials based on equations showing that "less is more": Krishnan et al. [2] showed that a moderate caloric intake (i.e., 33 to 65% of the American College of Chest Physicians (ACCP) targets; ≅9 to 18 kcal/kg/day) was associated with better outcome. Based on similar equation targets, Heyland et al. [3] showed an optimal mortality around 85% of target. These data do not fit though with the Swiss supplemental parenteral nutrition study [4], which showed that feeding to measured target after day 3 versus feeding about 80% of target in control was associated with a significant reduction of infectious complications (both groups starting with a −4000 kcal cumulated deficit).

Our suggestion would be to redo the outcome analysis while including only in their regression the "mean kcal value of stay" of the stable feeding days, and not feed progression days. Possibly the results would show the lowest mortality somewhere between 95 and 105% of measured EE.

* Correspondence: Mette.Berger@chuv.ch
[1]Service of Adult Intensive Care, Lausanne University Hospital, Lausanne, Switzerland
[4]Service of intensive care medicine, Lausanne University Hospital (CHUV), Rue du Bugnon 46, 1011 Lausanne, Switzerland
Full list of author information is available at the end of the article

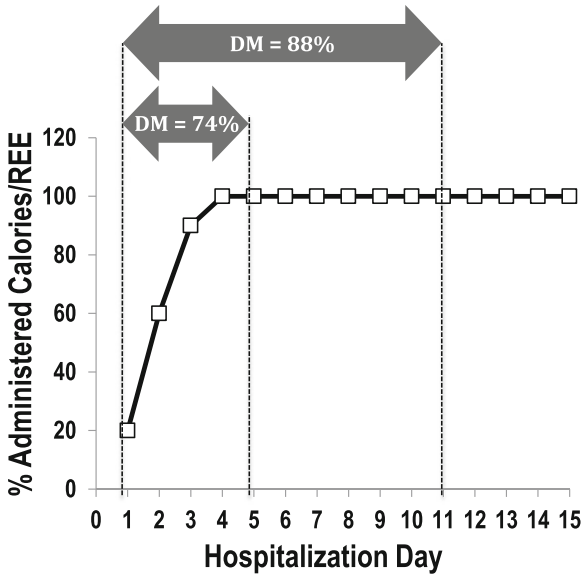

Fig. 1 Example of calories administered to a patient. The daily mean (*DM*) of calories is 74% if the patient leaves the ICU at day 5 but 88% if the patient leaves at day 11. The only way to make the mean unaffected by the length of stay is to calculate the mean only once the delivered calories have reached a plateau

Abbreviations
%AdCal/REE: Administered calories divided by resting energy expenditure; DM: Daily mean; EE: Energy expenditure

Acknowledgements
None.

Funding
No funding.

Availability of data and materials
Not applicable.

Authors' contributions
MMB, EF, and CP equally contributed to prepare the manuscript and have approved the submitted version. EF prepared the figure that was approved by MMB and CP. All authors read and approved the final manuscript.

Authors' information
Not applicable.

Competing interests
The authors declare that they have no competing interest.

Consent for publication
Not applicable.

Ethical approval and consent to participate
Not applicable.

Author details
[1]Service of Adult Intensive Care, Lausanne University Hospital, Lausanne, Switzerland. [2]Nutrition Unit; Geneva University Hospital, Geneva, Switzerland. [3]Unité de Nutrition Artificielle, Grenoble University Hospital, and INSERM 1055 Univ. Grenoble Alpes, Grenoble, France. [4]Service of intensive care medicine, Lausanne University Hospital (CHUV), Rue du Bugnon 46, 1011 Lausanne, Switzerland.

Published online: 22 February 2017

References
1. Zusman O, Theilla M, Cohen J, Kagan I, Bendavid I, Singer P. Resting energy expenditure, calorie and protein consumption in critically ill patients: a retrospective cohort study. Crit Care. 2016;20(1):367.
2. Krishnan JA, Parce PB, Martinez S, Diette GB, Brower RG. Caloric intake in medical ICU patients: consistency of care with guidelines and relationship to clinical outcomes. Chest. 2003;124:297–305.
3. Heyland DK, Cahill N, Day AG. Optimal amount of calories for critically ill patients: depends on how you slice the cake! Crit Care Med. 2011;39(12):2619–26.
4. Heidegger CP, Berger MM, Graf S, Zingg W, Darmon P, Costanza MC, Thibault R, Pichard C. Optimisation of energy provision with supplemental parenteral nutrition in critically ill patients: a randomised controlled clinical trial. Lancet. 2013;381(9864):385–93.