Glucosafe 2 - A new medical device to guide healthcare professionals with glucose control and nutritional therapy

Predictive accuracy of blood glucose levels in a retrospective mixed ICU cohort

Pielmeier, Ulrike Sabine; de Watteville, Aude; Parel, Nicolas; Siegenthaler, Nils; Primmaz, Steve; Skripkina, Elena; Pugin, Jérôme; Andreassen, Steen; Heidegger, Claudia-Paula

Published in:
Clinical Nutrition ESPEN

DOI (link to publication from Publisher):
10.1016/j.clnesp.2023.09.783

Publication date:
2023

Document Version
Publisher's PDF, also known as Version of record

LB14-T

MEAL ANABOLIC CAPACITY, MEASURED BY EITHER NON- OR COMPARTMENTAL ANALYSIS AFTER PULSE TRACER ADMINISTRATION, IS NOT DIFFERENT BETWEEN HMB OR LEU ADDED TO AN ESSENTIAL AMINO ACID MIXTURE IN OLDER ADULTS

S.B. Knezek*[1], M.P. Engelen [1], C.N. Perez [1], G. A. Ten Have [1], J.J. Thaden [1], N.E. Deutz [1]. [1] *KNSM, Texas A&M University, College Station, United States*

Rationale: A decreased anabolic response to dietary protein has been observed in older adults. To improve anabolism, intake of meals containing free essential amino acids (EAA) with either □□-hydroxy □□-methylbutyric acid (HMB) or leucine (LEU) added have been suggested. However, calculation of the anabolic response is hampered by methodological challenges such as amino acid splanchnic extraction measurement and the underestimation of the true amino acid appearance. Using a novel stable isotope pulse method, we aimed to characterize the prandial metabolic response of older adults to free EAA mixtures using (non) compartmental analysis to estimate more accurately the whole body anabolic response to meals.
Methods: Eleven healthy men and women, aged 60-80 years, participated in 4 separate study days, >3 days apart, where they consumed by sip feeding every 20 min for 6 hours according to a randomized placebo controlled single-blind design an oral mixture containing: a) EAA (20g), b) EAA+HMB (20+3g), c) EAA+LEU (20+3g), d) and Placebo (water). Three hours after start of intake, a pulse of stable isotope tracers, containing L-[ring-13C6]phenylalanine and L-[ring-2H4]tyrosine was administered. Blood samples were collected before each sip. Plasma amino acid tracer enrichments were analyzed by LC-MS/MS. (Non)-compartmental (NC or C) analysis to estimate increase (delta) above placebo of WbProteinSynthesis (dWbPS), WbEndogenous Protein breakdown (dWbEndoPB) and netWbPS (net anabolism) from isotope decays calculations and statistical analysis (ANOVA) by Graphpad Prism. Significance: $P<0.05$. Results are expressed as mean [95% CI].
Results: No differences (**table**) were observed in dWbPS, dWbEndoPB, or netWbPS after EAA+HMB, measured by NC or C analysis. Using NC or C analysis, all mixtures had >80% efficiency in converting intake. Only NC analysis showed that EAA+HMB stimulated dWbPS ($p=0.021$) and dWbEndoPB ($p=0.006$) more than EAA+LEU, but not NetWbPS.

TABLE	Non-Compartmental			Compartmental		
EAA mixture	18.6 [15.6, 21.5]	-19.2 [-20.9, -17.5]	*37.8 [34.4, 41.2]*	39.7 [26.9, 52.5]	5.3 [-2.3, 13.0]	*34.4 [19.5, 49.3]*
EAA+ HMB mixture	22.1 [19.0, 25.2]	-15.6 [-17.3, -13.9]	*37.7 [34.1, 41.2]*	47.3 [33.9, 60.6]	13.0 [5.4, 20.7]	*34.2 [18.9, 49.6]*
	#=0.094	#=0.011	*#=0.965*	#=0.413	#=0.189	*#=0.988*
EAA+ LEU mixture	17.2 [14.3, 20.1]	-19.5 [-21.2, -17.8]	*36.7 [33.3, 40.1]*	36.6 [23.8, 49.4]	4.6 [-3.0, 12.3]	*32.0 [17.1, 46.0]*
	#=0.517	#=0.833	*#=0.675*	#=0.735	#=0.905	*#=0.825*=0.837*
	***=0.021**	***=0.006**	**=0.708*	*=0.248	*=0.152	

Table Legend: Values are estimated mean [95% CI], expressed in μmol/min above placebo group. #=p vs EAA, *=p vs EAA+HMB. Intake PHE = 40.4 umol/min.
Conclusion: Our results, using (non)compartmental analysis after pulse tracer administration, do not support a higher anabolic capacity (NetWbPS) in older adults when adding HMB or LEU to an EAA mixture. Furthermore, EAA mixtures do not reduce endogenous protein breakdown. The novel pulse isotope analysis provides new insights in the underlying mechanisms of the anabolic capacity of meals.
Disclosure of Interest: None declared

Critical care
LB15-T

GLUCOSAFE 2 - A NEW MEDICAL DEVICE TO GUIDE HEALTHCARE PROFESSIONALS WITH GLUCOSE CONTROL AND NUTRITIONAL THERAPY: PREDICTIVE ACCURACY OF BLOOD GLUCOSE LEVELS IN A RETROSPECTIVE MIXED ICU COHORT

U. Pielmeier [1], A. De Watteville [2], N. Parel [2], N. Siegenthaler [2,3], S. Primmaz [2,3], E. Skripkina [2,3], J. Pugin [2,3], S. Andreassen [1], C. Heidegger*[2,3]. [1] *Department of Health Science and Technology, Aalborg University, Aalborg, Denmark;* [2] *Division of Intensive Care, Department of Acute Medicine, Geneva University Hospitals;* [3] *Faculty of Medicine, Geneva University, Geneva, Switzerland*

Rationale: Glucosafe 2 (GS2) is a clinical decision support software for the ICU that predicts blood glucose (BG) levels based on a mathematical model using BG measurements, nutrition, and insulin as input (1). Based on the BG prediction, GS2 gives personalised advice on insulin and nutrition therapy for the period until the next BG measurement, with advice depending on the accuracy of the prediction. The aim was to validate the accuracy of BG predictions in the historical control group of the GS2 study before the start of the prospective phase of the study.
Methods: Data from 71 consecutive hyperglycemic (BG $\geq$ 10 mmol/l or 2 BG $\geq$ 8.5 mmol/l and expected LOS $\geq$ 72 h) mixed ICU patients were extracted into GS2. The prediction error was calculated as logarithmic difference between actual and model-predicted BG value, and the root mean sum of squares (RMS) was found for five prediction time intervals: $\leq$ 0.5 h; 0.5-1.5 h; 1.5-2.5 h; 2.5-3.5 h; 3.5-4.5 h. Based on a prior pilot trial (2), our clinical protocol stipulates that for a typical interval of 2 h between BG measurements, the prediction error should be lower than 26% to serve as a reliable basis for GS2 to provide advice.
Results: In 71 patients, 11173 BG predictions were analysed in five-time intervals. The prediction error increased with the length of the prediction time**.** For a typical 2-hour interval, the RMS error was 19%, which was below the specified threshold of 26% (2). Table 1 shows the mean prediction time and the RMS prediction error.

Table 1. Root Mean Square (RMS) prediction error in the prediction of blood glucose levels with the GS2 model for different prediction time periods

Mean prediction time (h)	RMS prediction error (%)
0.2	11
1.1	18
2.0	19
3.0	22
4.0	25

Conclusion: The GS2 model has sufficient accuracy in predicting blood glucose levels in a mixed ICU population. The start of the prospective phase of the GS2 study is therefore safe.
References: (1) de Wattevlile A et al., Usability study of a new tool for nutritional and glycemic management in adult intensive care: Glucosafe 2. J Clin Monit Comput. 2021; 35(3):525-535. (2) Pielmeier U et al., Comparison of Identication Methods of a Time-varying Insulin Sensitivity Parameter in a Simulation Model of Glucose Metabolism in the Critically Ill. Proceedings of the 7th IFAC Symposium on Biological and Medical Systems, Aalborg, Denmark 2009: 67-72.
Disclosure of Interest: None declared

LB16-T

THE ROLE OF PARENTERAL NUTRITION COMPARED WITH ENTERAL NUTRITION ALONE IN CRITICALLY ILLNESS PATIENTS: A SYSTEMATIC REVIEW AND META-ANALYSIS

A. Liu*[1], Y. Cai [1], Y. Yang [1]. [1] *Zhong-da hospital, Southeast university, Nanjing, China*

Rationale: Parenteral nutrition is an alternative feeding way for critical illness patients with gastrointestinal dysfunction and enteral feeding intolerance. However, it is still controversial about the effects for the critical illness patients.This meta-analysis aimed to compare the clinical outcomes of parenteral nutrition and EN in critically ill adults.
Methods: Randomized controlled trials (RCTs) targeting the comparison of PN added to EN or PN alone vs. EN alone in adult critically ill patients published before March, 2023 were searched. Assessed outcomes include mortality, ICU length of stay, ventilation days, infectious complications.
Results: As the results, 20 RCTs with 12824 patients were included. Compared to EN alone, PN application reduced the duration of mechanical ventilation (mean difference -1.70 days, CI -3.08 to -0.32, p = 002), increased the risk of blood stream infection (relative risk (RR) = 1.29, 95%CI 1.07 to 1.54, p = 0.006), and had a trend of decreasing the risk of pneumonia (RR=0.87, 95%CI 0.74 to 1.02, p = 0.09). But no significant differences were observed between PN administration and EN alone in the all-cause hospital mortality, 30-day mortality, length of ICU stay and total incidence of infections.
Conclusion: The administration of PN when EN fails to fulfill the nutrition requirements in critically ill patients was beneficial for shortening ventilation duration and possibility decreased the risk of pneumonia, but no effect on mortality and length of ICU stay. The increased risk of bloodstream infection with PN should be cautious. Further research is needed to determine the optimal use of PN in critically ill patients.
Disclosure of Interest: None declared

LB17-T

REFERENCE VALUES FOR ULTRASOUND MUSCLE MASS ASSESSMENT IN CRITICALLY ILL PATIENTS: A PRELIMINARY ANALYSIS FROM A PROSPECTIVE COHORT

C. Rosa Domingues*[1], S. Rodeia [1], A.R. Francisco [1], P. Fortuna [1], A. Brito-Costa [1], L. Bento [1]. [1] *Centro Hospitalar Universitário Lisboa Central, EPE., Lisbon, Portugal*

Rationale: Low skeletal muscle mass at the time of ICU admission is known to be a prognostic value for clinical outcomes and nutritional assessment in critically ill patients is stiil a challenge. Ultrasonography is a promising tool to assess muscle mass at the bedside. To date there are no reference values for muscle mass assessment (MMA) using ultrasonography in critically ill patients. The aim of this study is to obtain reference values for muscle thickness (MT) from a prospective cohort of critically ill patients submitted to a baseline MMA.
Methods: This cross sectional preliminary analysis comprises data from 40 critically ill adult patients submitted to a MMA on the first 72h of ICU admission. Ultrasound quadriceps MT was measured by two trained dietitians, whose inter-observer variability was previously demonstrated to be non-significant. The MT measurements were performed using a linear or curvilinear transducer and applying the minimal pressure on the midpoint of the length between the anterior superior iliac spine and the upper border of the patella accordingly with the ultrassonography method and image acquisition protocol developed for the study. The data was statistically analyzed through SPSS v26 (SPSS Inc., Chicago, IL, USA).
Results: The mean (standard deviation) age of the study participants was 64 (16,5), and 70% were male. 42,5% and 32,5% of the patients were admitted in ICU by a medical cause and trauma, respectively. The MT median (P25, P75) was 2,60 cm (1,95, 3,14) with a mean value of 2,73 (0,93). A BMI correction of the MT values was applied with a median result of 0,10 cm/kg/m^2 (0,07, 0,13) and a mean value of 0,10 (0,33). Differences in MT values were observed according to sex and age <40, 40-60 and >60 years. The findings of the present preliminary analysis are presented on Table 1.
Conclusion: This preliminary analysis provides sex and age specific percentiles for ultrasound quadriceps MT. The construction of a large critically ill patients cohort is needed in order to establish reference values and improve nutritional assessment and intervention in critically ill patients.
Disclosure of Interest: None declared

LB18-T

ALTERATIONS IN SERUM ALBUMIN, MAGNESIUM, AND PHOSPHORUS LEVELS DURING HEMADSORPTION WITH OXIRIS® IN CRITICALLY ILL PATIENTS WITH SEPTIC SHOCK

D. Smirnova*[1,2], V. Liguts [3], P. Zviedre [1,2], V. Baltmane-Veckalne [1,2], G. Freijs [1], O. Sabelnikovs [1,2]. [1] *Department of Anesthesiology and Intensive Care, Pauls Stradins Clinical University Hospital;* [2] *Department of Clinical Skills and Medical Technology, Riga Stradins University;* [3] *Department of Acute Renal and Liver Replacement Therapy, Pauls Stradins Clinical University Hospital, Riga, Latvia*

Rationale: Multiple research studies have provided evidence supporting the effectiveness of early implementation of oXiris® hemadsorption in mitigating hyperinflammation and enhancing hemodynamic among individuals with septic shock. However, further investigation is needed to fully understand its potential impact on the removal of albumin, magnesium (Mg) and phosphorus (P).
Methods: This observational study was conducted in the intensive care unit (ICU) of a tertiary care center in Latvia from January to March 2023. The study included seven adult patients with septic shock caused by gram-negative bacteria who were undergoing continuous veno-venous hemofiltration (CVVH) with oXiris®. The objective of the study was to investigate the reduction of serum albumin levels during hemadsorption therapy in patients who did not receive nutrient supplementation during the early phase of septic shock. Statistical analyses, including appropriate tests such as paired t-tests or Wilcoxon signed-rank tests, were conducted to evaluate the significance of the observed changes in serum albumin, Mg, and P levels before and after 48 hours of hemadsorption therapy with oXiris®.
Results: The median age of the patients included in the study was 55 years (interquartile range [IQR]: 51-56). The median pre-treatment dose of norepinephrine (NE) was 0.24μg/kg/min (IQR: 0.18 − 0.43), Endotoxin (EU/L; median 0.5, IQR 0.47-0.75), Procalcitonin (PCT; 58; IQR: 31-96). Hemadsorption therapy with oXiris® was initiated in all patients within 3 hours (IQR: 3;17) of ICU admission and after 48 h of CVVH, median NE dose, Endotoxin and PCT levels decreased by 0.18 μg/kg/min (66%), 0.33EU/ml (85%); 34ng/ml (22%) respectively. Additionally, significant reductions were observed after 48 hours of hemadsorption therapy with oXiris® in serum albumin levels (median level: 29.5 g/L [IQR: 28.3;30.8] vs 24.5 g/L [IQR: 22.5;25.8], p=0.031), Mg levels (0.8 mmol/L [IQR: 0.77;0.82] vs 0.59 mmol/L [IQR: 0.57;0.63], p=0.016), and P levels (1.32 mmol/L [IQR: 1.1;1.98] vs 0.98 mmol/L [IQR: 0.85;1.03], p=0.047).