Title: Nutritional and clinical parameters are associated with the duration of length on mechanical ventilation in critically ill children with acute respiratory failure

Authors*:* Larissa T. Feiber[1], RD; Daniela B. Hauschild [2], RD, MSc; Julia C. Ventura[1], RD; Eliana Barbosa [3], RD, MSc; Nilzete L. Bresolin [4], MD, MSc; Yara M.F. Moreno [5], RD, PhD

Job/Position title; Institution

[1] Master of Science student, Graduate Program in Nutrition, Federal University of Santa Catarina, Florianópolis, Brazil

[2] Doctorate student, Graduate Program in Nutrition, Federal University of Santa Catarina, Florianópolis, Brazil

[3] Nutrition, Joana de Gusmão Children's Hospital, Florianópolis, SantaCatarina, Brazil

[4] Dietitian, Nutrition Division, Joana de Gusmão Children's Hospital, Florianópolis, Brazil

[5] MD, Pediatric Intensive Care Unit, Joana de Gusmão Children's Hospital, Florianópolis, Brazil

Background: Respiratory failure is one of the most common causes of admission in the Pediatric Intensive Care Unit (PICU). Studies suggest that nutrition status and nutrition therapy might influence clinical outcomes, such as duration of mechanical ventilation (MV), PICU length of stay and mortality of critically ill children.

The study aimed to determine the association between nutritional status, nutrition therapy and clinical parameters with the duration of MV in critically ill children admitted to a PICU due to acute respiratory failure.

Methods: A prospective cohort study, including critically ill children with respiratory failure, aged 1 month to 15 years, requiring MV. Demographics, clinical characteristics, nutrition status and nutrient delivery details were recorded. Patients were followed up until the 21st day after admission or PICU discharge Clinical characteristics were evaluated by Prognostic Index of Mortality 2 (PIM2) , PICU length of stay and presence

of Systemic Inflammatory Response Syndrome (SIRS), acute respiratory distress syndrome (ARDS), nosocomial infections and, fluid overload. Nutritional status was evaluated by anthropometry and classified based on the z-scores of anthropometrical parameters. The predicted energy expenditure (PEE) was calculated by Schofield equation. Undernutrition was considered when the body mass index-for-age or weight-for-height were ≤-1 z-score and overweight/obese ≥ 2z-score. The cumulative balance between the required and actual intake of energy (AEI) and protein were calculated for up to 7 days in the PICU. Overfeeding was defined as AEI >110% of the PEE. The outcome was duration of MV. Categorical variables were described in absolute values and frequency. Quantitative variables as median and interquartile range [IQR]. Poisson regression, crude and adjusted (for gender, age and PIM 2) were performed, considering P-value <0.05 as significant.

Results: A total of 23 patients were included, median age of 7.2 [IQR: 3.0; 26.7] months, median PIM 2 of 1.7 [IQR:1.1; 11.7]%. Pneumonia was the main reason for PICU admission and, 65.2% of patients had ARDS and 74% SIRS. Median duration of MV was 11 [IQR:6; 21] days, median PICU length of stay was 13 [IQR:7; 33] days. The mortality incidence was 17.4%. Regarding the nutritional status on admission, 43.5% of patients were undernourished and, 13% were overweight/obese. Underfeeding was observed in 21.7%, overfeeding in 43.5% and, fluid overload in 78.3% of patients. The adequate nutritional status at PICU admission was associated with reduction of the duration of mechanical ventilation (incidence rate ratio (IRR): 0.66; 95% Confidence Interval [CI]: 0.50; 0.88) (p=0.005). Overfeeding was associated with the duration of MV (IRR: 1.77; 95%CI: 1.45; 2.16) (p<0.001) in crude analysis, but not after adjusted analysis (IRR: 1.14; 95%CI: 0.88; 1.49) (p=0.315). Fluid overload (IRR 2.36; 95%CI: 1.65; 3.37) (p<0,001), SIRS (IRR: 1.34; 95%CI: 1.03; 1.75, (p=0,029) and nosocomial infection (IRR: 1.97; 95%CI: 1.56; 2.50 (p<0,001) were associated with the duration of MV (Table 1).

Conclusions: There was observed a high prevalence of malnutrition at PICU admission. The nutritional status at admission was associate with the reduction of the duration of MV. Overfeeding, as well, fluid overload, SIRS and nosocomial infection might increase the duration of MV. Thus, the clinical care of critically ill children with respiratory failure should prioritize the adequacy of nutritional status and nutrition therapy; the management of fluid balance as well, the prevention of nosocomial infection.

Table 1: Association between nutritional status, nutrition therapy and clinical parameters and the duration of mechanical ventilation in critically ill children with acute respiratory failure (N=23).

	Crude IRR (CI 95%)	***Crude p-value***	**Adjusted IRR (CI 95%)**	***Adjusted p-value*[5]**
***Nutritional Status*[1]**				
Undernourished	1		1	
Adequately nourished	0.62 (0.50; 0.77)	<0.001	0.66 (0.50; 0.88)	0.005
Overweight/obese	0.78 (0.57; 1.06)	0.119	0.93 (0.66; 1.30)	0.691
***Nutritional Therapy*[2]**				
Underfeeding/Adequate	1		1	
Overfeeding	1.77 (1.45; 2.16)	<0.001	1.14 (0.88; 1.49)	0.315
***Fluid overload*[3]**	2.85 (2.01; 4.04)	<0.001	2.36 (1.65; 3.37)	<0.001
SIRS	0.77 (0.62; 0.95)	0.017	1.34 (1.03; 1.75)	0.029
***Nosocomial infection*[4]**	1.72 (1.41; 2.10)	<0.001	1.97 (1.56; 2.50)	<0.001

[1] According to body mass index (BMI)-for-age z score, whereas: undernourished: z-BMI<-1; adequately nourished: -1 = z-BMI = 2; Overweight/Obese: z-BMI > 2; [2] Overfeeding: actual energy intake >110% of the predicted; [3] Fluid overload: = 20 mL/kg/24 hours [4] Any acquired infection (blood stream, urinary tract or ventilator associated pneumonia); [5] Poisson's regression adjusted for gender, age and Prognostic Index of Mortality 2; CI: confidence interval; SIRS: Systemic Inflammatory Response Syndrome; IRR: incidence rate ratio