COMPLIANCE OF STANDARDIZED PARENTERAL NUTRITION WITH INDIVIDUALIZED PRESCRIPTIONS IN A NEONATAL INTENSIVE CARE UNIT

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BACKGROUND AND IMPORTANCE

Individualized parenteral nutrition (PN) should be limited to specific clinical situations where nutritional needs cannot be adequately addressed by standardized formulations.[1]

AIM AND OBJECTIVES

To evaluate the compliance of standardized PN bags with individualized prescriptions for newborns admitted to a neonatal intensive care unit (NICU).

MATERIAL AND METHODS

Four standardized aqueous formulations (Bags 1–4) and one lipid emulsion were developed according to international recommendations [2,3] and institutional expertise.[4] Individualized PN prescriptions issued between January 2024 and August 2025 were analyzed. Based on each newborn's weight and prescribed infusion rates, prescriptions were compared with the composition of the standardized bags at different infusion rates (±5% and ±10%). Prescriptions with any parameter deviating more than 5% from the recommended range were excluded. Parameters assessed included protein (g/kg/day), glucose (mg/kg/min), calcium, phosphorus, magnesium (mg/kg/day), sodium, potassium (mEq/kg/day), zinc (µg/kg/day), lipids (g/kg/day), and fat- and water-soluble vitamins (ml/kg/day). Compliance was defined as a maximum deviation of 5% from recommendations. [2,3]

RESULTS

A total of 381 prescriptions from 44 newborns were screened, with a median gestational age (GA) of 30 weeks (IQR 29–31). Of these, 252 (66.1%) were excluded due to desviations to the recommendations. The 129 included prescriptions were prescribed to 27 newborns with a median GA of 29 weeks (IQR 28–30), postnatal age of 9 days (IQR 6–14), and weight of 1.180 kg (IQR 1.000–1.350).

Compliance rates for glucose, sodium, and calcium were 93.8%, 98.4%, and 95.3%, respectively, across 20 simulations (4 aqueous bags, 5 infusion rates) and 86.8% for lipids across 5 simulations (1 lipid emulsion, 5 infusion rates).

Median compliance for the remaining componentes (in 20 simulations for the aqueous bags) was 15 for phosphorus and magnesium, 10 for amino acids and potassium; for the 5 simulations for the lipid emulsion was 5 for lipids, 3 for fat-soluble vitamins, and 1 for water-soluble vitamins. Zinc compliance was not achieved in any simulation.

COMPOSITION OF STANDARDIZED AQUEOUS BAGS AND CORRESPONDING NUTRITIONAL CONTRIBUTION (100 mL)**

BAG 1 (Day 1 of life)

Component	Volume (ml)	Nutritional Contribution	
Amino acids 10%	40,00	Amino acids (g)	4,00
Glucose 30%	33,30	Glucose (g)	9,99
Water	22,05	Water(ml)	22,05
NaCl 20%		Sodium (mEq)	
KCl 7,5%		Potassium (mEq)	
Calcium gluconate 10%	4,48	Calcium (mg)	39,97
Sodium glycerophosphate		Phosphorus (mg)	
Magnesium sulfate 20%		Magnesium (mg)	
Zinc gluconate 0,1%	0,20	Zinc (mcg)	196,14

BAG 3 (≥ day 3 of life; glucose 11,5g/100ml)

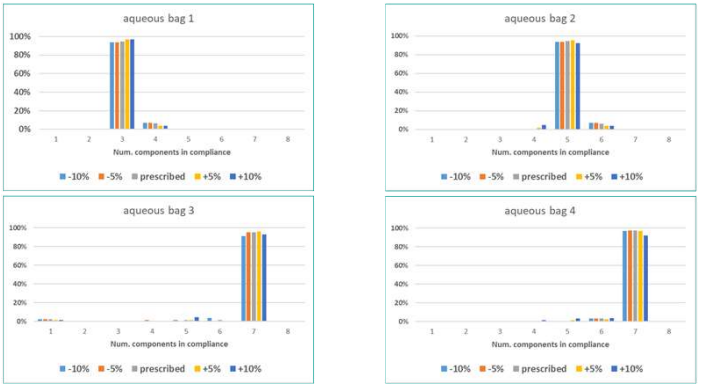
Component	Volume (ml)	Nutritional Contribution	
Amino acids 10%	23,00	Amino acids (g)	2,30
Glucose 30%	38,30	Glucose (g)	11,49
Water	28,00	Water (ml)	28,00
NaCl 20%	0,03	Sodium (mEq)	3,10
KCl 7,5%	2,00	Potassium (mEq)	2,00
Calcium gluconate 10%	6,72	Calcium (mg)	59,96
Sodium glycerophosphate	1,50	Phosphorus (mg)	46,50
Magnesium sulfate 20%	0,25	Magnesium (mg)	4,86
Zinc gluconate 0,1%	0,20	Zinc (mcg)	196,14

BAG 2 (Day 1and 2 of life)

Component	Volume (ml)	Nutritional Contribution	
Amino acids 10%	40,00	Amino acids (g)	4,00
Glucose 30%	33,30	Glucose (g)	9,99
Water	20,60	Water (ml)	20,60
NaCl 20%		Sodium (mEq)	2,40
KCl 7,5%		Potassium (mEq)	
Calcium gluconate 10%	4,48	Calcium (mg)	39,97
Sodium glycerophosphate	1,20	Phosphorus (mg)	37,20
Magnesium sulfate 20%	0,25	Magnesium (mg)	4,86
Zinc gluconate 0,1%	0,20	Zinc (mcg)	196,14

BAG 4 (≥ day 3 of life; glucose 7g/100ml)

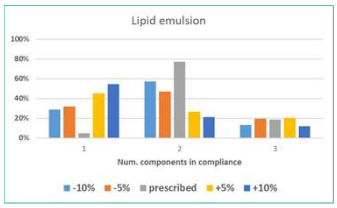
Component	Volume (ml)	Nutritional Contribution	
Amino acids 10%	23,00	Amino acids (g)	2,30
Glucose 30%	23,33	Glucose (g)	7,00
Water	42,97	Water (ml)	42,97
NaCl 20%	0,03	Sodium (mEq)	3,10
KCl 7,5%	2,00	Potassium (mEq)	2,00
Calcium gluconate 10%	6,72	Calcium (mg)	59,96
Sodium glycerophosphate	1,50	Phosphorus (mg)	46,50
Magnesium sulfate 20%	0,25	Magnesium (mg)	4,86
Zinc gluconate 0,1%	0,20	Zinc (mcg)	196,14



Assessment of the compliance of the different standardized aqueous PN bags, in terms of the number of nutritional components, relative to the individualized prescription (at the prescribed infusion rate, as well as at ±5% and ±10% of that rate).

COMPOSITION OF STANDARDIZED LIPID EMULSION AND CORRESPONDING NUTRITIONAL CONTRIBUTION (20 mL)

Component	Volume (ml)	Nutritional Contribution	
Lipids 20%	15,00	Lipids(g)	1,50
Fat-Soluble Vitamins	4,00	vit A (mcg)	276
		Vit D (UI)	160
		vit E (UI)	2,8
		Vit K (mcg)	80
Water-Soluble Vitamins	1,00	Vitamina C (mg)	10
		Vitamina B1 (mg)	0,25
		Vitamina B2 (mg)	0,36
		Vitamina B6 (mg)	0,4
		Vitamina B12 mcg	0,5
		Vitamina B5 (mg)	1,5
		Biotine (mcg)	6
		Folic acid (mcg)	40
		Nicotinamide (mg)	4



Assessment of the compliance of the standardized lipid emulsion, in terms of the number of nutritional components, relative to the individualized prescription (at the prescribed infusion rate, as well as at ±5% and ±10% of that rate).

For all 129 prescriptions included (100%), an aqueous bag containing 7 of the 8 components was compliant (except for zinc). In 83 prescriptions (64.3%), one lipid emulsion infusion rate ensured compliance for all 3 components. Among the aqueous solutions, bags 3 and 4 were identified as the most appropriate, given that the median postnatal age of the evaluated sample was 9 days.

CONCLUSION AND RELEVANCE

Standardization proved feasible. Adjusting zinc content in aqueous bags would allow full compliance with 100% of prescriptions. For lipid emulsions, compliance was achieved in approximately 64% of cases, with further optimization of vitamin content required for complete standardization.

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