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Laporan Kes / Case Report

Addressing Failure to Thrive in a Preterm Infant with Respiratory Syncytial Virus Pneumonia and Poor Weight Gain: A Case Report

Mengatasi Kegagalan Tumbesaran pada Bayi Pramatang dengan Pneumonia Virus Pernafasan Sinsitial dan Peningkatan Berat Badan yang Lemah: Laporan Kes

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ABSTRACT

A 1-year-1-month-old premature Chinese male infant with respiratory syncytial virus (RSV) pneumonia, on a background of bronchopulmonary dysplasia (BPD) was referred to a dietitian for nutritional optimization due to failure to thrive (FTT). Since discharge from the neonatal intensive care unit (NICU), he demonstrated suboptimal weight gain, gaining only 1.58 kg (approximately 7 g/day). During admission, his weight was 7.08 kg (below the 5th percentile, indicating underweight) and length was 70.5 cm (10th–25th percentile) based on the CDC growth chart. Biochemical Data revealed high WBC (19.4×10^9/L) indicating an infection, low Sodium (135 mmol/L) suggesting electrolyte imbalance and elevated Potassium (4.8 mmol/L) suggesting hyperkalemia risk, necessitating further investigations. He experienced constipation for one week before admission due to antibiotics and was noted to be on goat milk formula based on family belief that it aids digestion and relieves constipation. The primary goal was to optimize oral intake to meet at least 75% of energy and nutrient requirements, support immune function and recovery, and achieve appropriate weight gain. Long-term goals included minimizing potassium overload to protect renal function and promoting optimal growth and development. This case highlights the importance of individualized nutrition intervention in infants with FTT, particularly those on alternative formulas such as goat milk and concurrently managing viral infections.

Keywords: Failure to Thrive (FTT), Goat Milk Formula, Respiratory Syncytial Virus (RSV), Nutritional Optimization

ABSTRAK

Seorang bayi lelaki pramatang berusia 1 tahun 1 bulan berbangsa Cina dengan pneumonia respiratory syncytial virus (RSV) dan latar belakang bronchopulmonary dysplasia (BPD) dirujuk kepada pakar dietetik akibat kegagalan tumbesaran (failure to thrive, FTT). Sejak discaj daripada NICU, beliau hanya meningkat 1.58 kg (±7 g/hari). Semasa kemasukan, berat badan 7.08 kg (< persentil ke-5) dan panjang 70.5 cm (persentil ke-10–25, CDC). Ujian biokimia menunjukkan kiraan WBC tinggi (19.4×10^9/L) menandakan jangkitan, natrium rendah (135 mmol/L) serta kalium tinggi (4.8 mmol/L) yang berisiko hiperkalemia. Pesakit mengalami sembelit seminggu akibat antibiotik dan mengambil susu formula kambing berasaskan kepercayaan keluarga bahawa ia membantu penghadaman. Matlamat pemakanan adalah memastikan pengambilan sekurang-kurangnya 75% keperluan tenaga dan nutrien, menyokong fungsi imun dan pemulihan, serta meningkatkan pertumbuhan. Jangka panjang, intervensi memberi tumpuan kepada kawalan kalium bagi melindungi fungsi buah pinggang dan menyokong

perkembangan optimum. Kes ini menekankan kepentingan intervensi pemakanan individu pada bayi dengan FTT, khususnya yang mengambil formula alternatif seperti susu kambing, di samping pengurusan jangkitan virus.

Kata Kunci: Failure to Thrive (FTT), Susu Formula Kambing, Respiratory Syncytial Virus (RSV), Pengoptimuman Pemakanan

INTRODUCTION

The term 'faltering growth' (previously called 'failure to thrive') is widely used to refer to a slower rate of weight gain in childhood than expected for age and sex. The term faltering growth is preferred as periods of slow growth may represent temporary variation from the expected pattern and the word 'failure' may be seen as pejorative (NICE 2017). It is characterized by poor physical growth, where a child's weight, height, or head circumference falls below standard growth charts, typically defined as weight below the 3rd percentile or more than 20% below ideal weight for height. Growth may also slow or stop entirely, often due to inadequate nutritional intake or underlying medical conditions (Kaneshiro 2023).

In Malaysia, Respiratory Syncytial Virus (RSV) is one of the most common respiratory infections, primarily affecting children under three years of age. It is a highly contagious virus that targets the nose, throat, and lungs, often leading to flu-like symptoms and breathing difficulties. RSV is the leading cause of hospitalisation among infants, with higher risk observed in children with congenital heart disease (CHD) and bronchopulmonary dysplasia (BPD). RSV often causes a mild, cold-like illness, it can lead to severe complications such as bronchiolitis and pneumonia. (CDC: RSV in Infants and Young Children. 2024; Suganthi. et al. 2023).

Most infant formulas are based on cow milk proteins. However, due to multiple factors, including consumer interest in alternatives, goat milk has gained popularity for manufacturing infant, follow-on, and young child formulas over the past 30 years (Gallier et al. 2020). The use of goat-milk-based formulas (GMF) is rising globally, largely due to their unique compositional benefits. Recently, goat-milk-based infant formulas (GMF) are available in several countries and have been approved by regulatory agencies such as the European Food Safety Authority (EFSA). According to the EFSA Panel (2012), goat milk protein can be considered a suitable protein source for infant and follow-on formulas, provided that careful attention is given to the protein content and nutrient composition.

CASE PRESENTATION

A 1-year-1-month-old Chinese boy, born prematurely at 27 weeks and 5 days (extreme prematurity) with corrected age of 10 months, was admitted with Respiratory Syncytial Virus (RSV) pneumonia on a background of bronchopulmonary dysplasia (BPD) and isolated gross motor delay with resolved Head-Only Control (HOC) plateau. He is the second child of the family with one older brother presented with a history of faltering growth. Main caregiver is the mother, who is a housemaker whereas the father works as a CEO in an industry setting with stable financial status. Medically, he had been unwell for the past two weeks and was previously admitted to another hospital for BPD, where he received intravenous penicillin and a 10-day course of oral amoxicillin prior to discharge. However, he was readmitted to this hospital due to worsening cough, rapid breathing, and fever. Given his suboptimal growth trajectory and persistent poor oral intake, he was referred to a dietitian for nutritional optimization to address failure to thrive (FTT).

NUTRITION ASSESSMENT

ANTHROPOMETRY MEASUREMENTS

The patient was born with a very low birth weight of 1.08 kg and weighed 7.08 kg (below the 5th percentile) upon admission. During his stay in the neonatal intensive care unit (NICU), his weight steadily increased from 1.08 kg to 5.5 kg, placing him at the 50th percentile on the CDC growth chart. At that time, he was on nasogastric tube feeding due to being ventilated for nosocomial bronchopneumonia. This allowed him to meet his energy and protein requirements, resulting in an expected growth rate. However, after discharge from the NICU and returning home, his weight gain slowed significantly, leading to a growth rate below expectations. His weight progression was as follows:

- 4.5 months: 6.1 kg (on 10th percentile)
- 7 months: 6.4 kg (below 5th percentile)
- 8.5 months: 6.85 kg (below 5th percentile)
- 10 months: 7.08 kg (below 5th percentile)

Since his last NICU discharge 7 months ago, the patient has gained only 1.58 kg (7g/day). highlighting concerns regarding his growth trajectory. His weight initially showed optimal growth at the 50th percentile during discharge (5kg). However, recently his weight gain trajectory has slowed, placing him below 5th percentile, whereas the same goes to length trajectory placing him between 10th and 25th percentile after discharge. Hence, the target weight for this patient is 8.0 kg, aligning with the 5th percentile on the growth chart)..

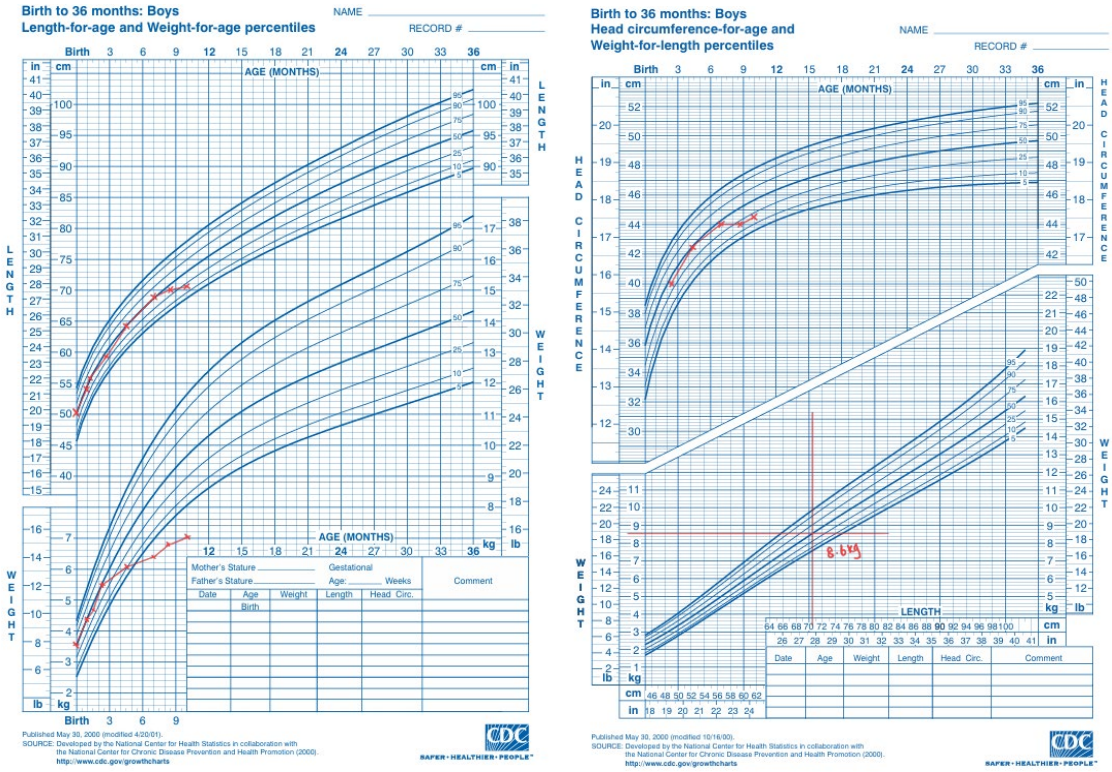

FIGURE 1 CDC Growth Chart 2001

TABLE 1 Dietary History at Home

In Ward	
Milk Formula Regime	• 1 scoop *Purenat Gold* + 50ml H2O, 2x/day (8am and 10am) • 2 scoops *Purenat Gold* + 100ml H2O, 3x/day (1pm, 4.30pm and 7.45pm) • Energy: 361.2kcal; Protein: 7.56g; Potassium: 960.8mg (exceeded recommendation of 700mg/day from RNI 2017) • No solid food intake
The total intake in ward was **361.2kcal (51 kcal/kg BW)** and **23.5g protein (3.3g/kg BW).**	
At Home	
Milk Formula Regime	• 2 scoops *Purenat Gold* + 100ml H2O, 5x/day • Energy: 425kcal; Protein: 22g • Potassium: 1201mg/day (exceeded recommendation of 700mg/day from RNI 2017)
Oral Regime	• 40-60ml porridge + minced chicken/1 whole egg yolk + 1 drop MCT oil (12pm and 7pm) • Energy: 125kcal; Protein: 1.5g • Reported the porridge was watery and the chicken/egg were not mixed well during feeding. • The mother reported limited knowledge of nutrient-dense diets and lack of varieties of food provided.
The total daily intake at home was **550kcal (77.7kcal/kg BW)** and **23.5g protein (3.3g/kg BW).**	

TABLE 2 Nutrition intervention and follow-ups

<table>
<tr><th colspan="2">Dietitian First Visit</th></tr>
<tr><td colspan="2">Although the importance of standard post-discharge formulas like Similac Neosure was emphasized and parental education provided, the family strongly preferred goat milk formula (GMF), citing improved stool patterns and constipation with Similac Neosure.

Suggested to change to a complete, balanced catch-up growth goat milk formula (Resurge Junior) due to the high potassium content of the current formula, which poses a risk of hyperkalemia if continued. Other than that, Purenat Gold Goat Milk does not support catch-up growth, which might cause inadequate nutrient consumption to improve development. MCT oil was suggested to add into the milk instead of food for better acceptance. Mother was informed to measure the volume of MCT oil precisely using a syringe before adding into the milk formula.</td></tr>
<tr><td>Suggested milk formula feeding regime</td><td>• Step 1: 2 scoops Resurge Junior + 100ml H2O, 5x/day + 1ml MCT oil in each feeding
• Step 2: 2.5 scoops Resurge Junior + 100ml H2O, 5x/day + 1ml MCT oil in each feeding
• Advance to Step 2 once tolerated Step 1 for 24 hours.
• Energy: 547.5kcal; Protein: 16.8g, Calorie density: 1.1kcal/ml
• Potassium: 500mg (within safe range 700mg/day)</td></tr>
<tr><td>Suggested oral regime</td><td>• A pureed diet was indented, including fruit puree during lunch and dinner and baby Cerelac during afternoon tea.
• Nutrition education was given to the mother focusing on nutrient-dense diet by ensuring each spoonful of food contains a balanced mix of porridge, protein, and fiber during feeding.
• Encourage orally as tolerated.
• Aiming the remaining requirements from solid foods.</td></tr>
<tr><th colspan="2">Monitoring and Evaluation:</th></tr>
<tr><td colspan="2">The patient’s intake was documented in terms of volume and nutrient adequacy, and the tolerance to the goat milk formula introduced, such as vomiting, regurgitation, stool pattern and abdominal discomfort was monitored daily to ensure well compliance and adherence. Weight status was monitored.</td></tr>
<tr><th colspan="2">First Follow Up
(3 days after initial visit)</th></tr>
<tr><td colspan="2">The patient’s current body weight was 7.17kg, increased 0.1kg (1.3%) within 3 days. Bowel movements normalized to once daily (Bristol Type 6) following Ravin enema, resolving prior constipation. The patient’s appetite improved. A detailed 24-hour dietary recall was conducted as follows:

2.50am: 2.5 scoop Resurge Junior + 100ml H2O + 1ml MCT oil
9.30am: Pureed porridge ¾ exchanges
12.40pm: Pureed porridge ¼ exchanges
2.50pm: 2.5 scoops Resurge Junior + 1ml MCT oil
4.45pm: 2.5 scoops Resurge Junior + 1ml MCT oil
9.15pm: 2.5 scoops Resurge Junior + 1ml MCT oil
11.30pm: ½ teaspoon fruit puree

Estimated total intake: 545 kcal (achieved 51% from EER) and 15.4g (2.1g/kg/d) of protein (achieved 62% from requirement).

Nutrition Diagnosis:
[Active] Inadequate protein energy intake related to physiological causes (failure to thrive and RSV pneumonia) resulting in increased protein and energy needs [Physiologic Metabolic etiology] as evidenced by weight gain 1.3% within 3 days, diet assessment in ward shows energy and protein intake only achieves 51% and 62% from requirement respectively.</td></tr>
</table>

[Resolved] Excessive mineral intake (potassium) related to food- and nutrition-related knowledge deficit concerning appropriate food and supplemental sources of minerals [Knowledge etiology] as evidenced by dietary assessment shows high amounts of potassium consumption compared to reference intake standard from RNI 2017 (700mg/day).	
Adjusted milk formula feeding regime	Continue complete, balanced catch-up growth goat milk formula: • 2.5 scoops *Resurge Junior* + 100ml H2O, 5x/day + 1ml MCT oil in each feeding once tolerated well during hospitalization. • Energy: 547.5kcal; Protein: 16.8g, Calorie density: 1.1kcal/ml
Adjusted oral regime	1. Encourage orally as tolerated. 2. Weaning diet education (10–12 months). • Introduce variety of soft foods such as cut noodles or kuey teow. • Encourage variety by introducing one new food every 3–5 days; repeat if initially refused (e.g., fish, chicken with different cooking methods). • Promote regular meal timing. • Provide home food preparation examples and a sample menu plan. 3. Nutrient-dense diet education. • Suggest *Cerelac* with mashed banana or fruit puree during teatime to increase fiber. • Emphasize balanced feeding: each spoonful should include carbohydrates, protein, and fiber. • Recommend calorie-enhancing methods: o Stir-fry meat before mincing and adding to porridge o Add starchy vegetables (e.g., pumpkin, potato). o Include MCT oil or olive oil in porridge. • Recommend protein-boosting strategies: o Mix *Cerelac* with goat milk/yogurt. o Blend chicken, fish, or egg into porridge. 4. Encourage adequate water and fiber intake. 5. Feeding environment to stimulate appetite. • Promote family mealtimes without distractions to enhance bonding and eating behaviour. 6. Feeding skills development. • Encourage self-feeding with soft finger foods to support motor skills and independence.
Second Follow-up **(3 days after first follow-up contacted via WhatsApp)**	
The mother reported watery stools (Bristol Type 7) after introducing *Resurge Junior*, prompting a request to alternate with *Similac Neosure*. This may be a post-effect of the earlier Ravin enema, though further evaluation is warranted. **Milk formula regime provided by mother:** *Similac Neosure* 2scp + 120ml water + 1ml MCT oil, 2x/day (0.84kcal/ml) *Resurge Junior* 3scp + 120ml water + 1ml MCT oil, 3x/day (1.1kcal/ml) Total intake from formula: Energy: 200.48 + 394.2 + 40 = 634.7kcal Protein: 5.2g + 12.06 = 17.3g **Current diet intake at home:** 1.5 exc porridge + 1 exc Chicken + vege + oil, 2x/day, fruit puree 1 exc and yogurt finger foods as snack.	

	Total intake from diet: 327.5kcal, 10g protein Estimated total intake: **962.2kcal (achieved 91% from requirement), 27.3g protein (achieved 100% from requirement)** The mother reported in the next two day, the patient's bowel movements, occurring 1–2 times per day, improved to Bristol Stool Chart types 4–5 after combining *Similac Neosure* and *Resurge Junior*, indicating better stool pattern and consistency. Noted well adherence to the nutrition education provided. **Nutrition Diagnosis:** [Resolved] Inadequate protein energy intake related to physiological causes (failure to thrive and RSV pneumonia) resulting in increased protein and energy needs [Physiologic Metabolic etiology] as evidenced by dietary assessment at home shows energy intake achieved 91% from EER and protein intake achieved 100% from requirement.
Adjusted milk formula feeding regime	Continue current feeding regime: • 3 scoops *Resurge Junior* + 120ml H2O + 1ml MCT oil, 3x/day and 2 scoops *Similac Neosure* + 120ml H2O + 1ml MCT oil, 2x/day • Energy: 634.7kcal; Protein: 17.3g • Calorie density: 0.84kcal/ml (*Similac Neosure*);1.1kcal/ml (*Resurge Junior*) • Potassium: 636.7mg/day (within recommendation of 700mg/day) • Suggested to increase feeding regime for *Resurge Junior* to 4x/day and reduce *Similac Neosure* to 1x/day, with close monitoring of stool pattern to rechallenge back to full *Resurge Junior*. • Keep in view to revert to the previous feeding regime if watery stools are observed.
Adjusted oral intake regime	Encourage orally as tolerated.

In addition, the patient's head circumference was 44.5cm, placed between 10th and 25th percentile, whereas the weight for length was 8.6kg (on 50th percentile).

BIOCHEMICAL ASSESSMENTS

The latest full blood count (FBC) profile revealed an elevated white blood cell (WBC) count of 19.4×10⁹/L (normal: 6-18×10⁹/L), indicating an infection associated with RSV pneumonia. For the renal profile, sodium was low at 131 mmol/L (normal: 133-145 mmol/L), suggesting electrolyte imbalance likely due to poor oral and fluid intake. Additionally, potassium was at the borderline of the upper limit at 4.8 mmol/L (normal: 3.5-5.1 mmol/L), raising concerns about excessive potassium intake as the patient had a medical history of hyperkalemia (Simon, L. V. et al. 2023), potentially linked to the current goat milk formula consumption.

NUTRITION-FOCUSED PHYSICAL FINDINGS

In the ward, the patient was observed lying in bed, ambulating freely, and crying with persistent coughing noted. His Glasgow Coma Scale (GCS) score was full, and he was on nasal prong oxygen at 2L/min. His vital signs showed elevated blood pressure (105/55 mmHg), normal heart rate (159 bpm) and respiratory rate (40 rpm), and febrile temperature (38°C). The patient had experienced constipation one week before admission with no bowel output, might be due to oral amoxicillin and was administered Ravin enema for relief. Subjective Global Nutritional Assessment (SGNA) scoring indicated moderate malnutrition. The input-output (I/O) chart showed positive balance of +223 ml.

DIETARY ASSESSMENTS

This is the patient's first-time seeing dietitian in a pediatrics ward. Upon assessment, he was on Purenat Gold Goat Milk Powder for 3 weeks as the mother believed it was better for digestion and aided in bowel opening, since the patient developed constipation after consumption of Similac Neosure for post-discharge from NICU. Low appetite was noted as the patient refused to eat. The mother reported that medium-chain triglyceride (MCT) oil had been added to the patient's meals since the last discharge from the NICU; however, she was unable to specify the exact amount used, as it was added based on estimation. It was also noted that the patient occasionally refused food, potentially due to the presence of MCT oil.

NUTRITION DIAGNOSIS

[New] Excessive mineral intake (potassium) related to food- and nutrition-related knowledge deficit concerning appropriate food and supplemental sources of minerals [Knowledge etiology] as evidenced by dietary assessment shows current milk formula contributed to high amounts of potassium consumption compared to reference intake standard from RNI 2017 (700mg/day). [New] Inadequate protein energy intake related to physiological causes (failure to thrive and RSV pneumonia) resulting in increased protein and energy needs [Physiologic Metabolic etiology] as evidenced by current weight below 5th percentile, diet assessment in ward shows energy and protein intake only achieves 34% and 30% from requirement respectively.

NUTRITION INTERVENTION

The short-term goal for this patient was to prevent excessive potassium intake to avoid potential strain on renal function, to achieve optimal nutritional status by achieving at least 75% of estimated energy and protein requirements through adequate oral intake, and to support immune function and recovery. In the long term, efforts were also directed to achieve as near to normal weight gain and growth by achieving at least 5th percentile and targeting for further development. Nutrition education and counselling was provided to the mother throughout the hospital stay.

ESTIMATED ENERGY REQUIREMENT (EER):

Based on Dorothy for Sick Children (Dorothy E. M. Francis, 1987) guidelines for children aged 6 to 12 months, an energy requirement of 150 kcal/kg body weight was applied to support higher energy intake. This was necessary as the patient was ill, experiencing persistent coughing and viral infection, leading to increased energy expenditure. Additionally, due to failure to thrive (FTT), an increased energy intake was essential to promote adequate growth and weight gain. 50kcal x 7.08kg = 1062kcal/day

ESTIMATED PROTEIN REQUIREMENT:

Based on the Dorothy for Sick Children (Dorothy . & Francis 1987) guidelines for children aged 6 to 12 months, a protein requirement of 3.5 g/kg body weight was applied to support optimal growth and strengthen the immune system to help combat the viral infection. 3.5g x 7.08kg = 24.8g/day

There was no total fluid intake determined by the pediatrician. There were two follow-ups done after the first visit and the intervention plans were summarized in the

DISCUSSION

Optimizing nutritional status in a preterm infant with failure to thrive and RSV pneumonia is challenging, influenced by factors such as prematurity, prolonged inadequate energy and protein intake post-NICU discharge, and strong family preference for a specific formula.

Infants with faltering growth often face feeding difficulties such as food refusal, crying, and vomiting (Shaw 2020). In RSV pneumonia, symptoms like poor intake, lethargy, and coughing further impair appetite and growth (Drysdale et al. 2016). Additionally, respiratory distress increases energy expenditure due to the extra effort required for breathing, further worsening nutritional deficits. Preterm infants are especially vulnerable, with higher risks of poor weight gain, longer hospital stays, and mortality. Following NICU discharge, the mother lacked appropriate knowledge on preparing a nutrient-dense diet, which contributed to the infant's poor weight gain.

Despite strong family preference for goat milk formula (GMF), current evidence is insufficient to confirm its superiority over cow milk formula (CMF), although some studies suggested potential benefits. GMF increase the rate of gastric emptying and gastrointestinal transit compared to CMF, probably due to the coagulation properties and alteration on short-chain fatty acid (SCFA) profiles (Dalziel et al. 2020). Improvements in stool consistency have been observed, with infants fed GMF showing softer stools on the Bristol Stool Scale after 3 weeks intervention and experiencing more frequent, softer bowel movements (Infante et al. 2018). However, these benefits are primarily related to digestive tolerance rather than growth outcomes. Xu et al. (2015) found no significant differences in growth outcomes between infants fed GF and CMF. On the other hand, GMF might pose risks of nutrient imbalances, particularly elevated potassium and phosphate levels which may burden the immature kidneys of infants and increase the risk of electrolyte disturbances such as hyperkalemia and hyperphosphatemia (Jankiewicz et al. 2023). Hence, parental education is essential to ensure caregivers understand the potential risks and the importance of using nutritionally appropriate formulas to prevent nutrient deficiencies and support optimal growth.

A challenge arose during this case when transitioning the infant to a new nutritionally balanced goat milk formula (Resurge Junior), resulting in watery stools (Bristol Type 7). Resurge Junior contains A2 β-casein proteins, MCTs, and prebiotic fibers, which may accelerate GI transit and cause loose stools in some infants while promoting digestion (Łoś-Rycharska et al. 2016; Meng et al. 2023; Vandenplas et al. 2014). Additionally, the loose stool could be partially attributed to the residual effects of the Ravin enema administered

earlier, as infants with sensitive gastrointestinal systems may experience transient changes in stool consistency for up to 1–2 days post-enema. To manage this, a combined feeding approach using Resurge Junior and Similac Neosure (a nutrient-enriched cow milk-based formula for preterm infants) was introduced. This strategy balanced digestive comfort with nutritional adequacy, improving stool consistency while meeting dietary needs. As the infant approaches a corrected age of 12 months, it is appropriate to gradually transition back to Resurge Junior alone as Similac Neosure is intended for use up to 12 months, while Resurge Junior is formulated to support catch-up growth in children aged one year and above.

This case underscores the importance of individualized nutritional interventions, particularly in managing feeding intolerances and promoting growth in infants with failure to thrive and concurrent viral infections. It also highlights the value of tailored formula selection—initially combining different formula types to achieve digestive comfort and nutritional adequacy, followed by a gradual transition to a single appropriate formula, with close monitoring on stool pattern and to avoid excessive intake of mineral. Despite milk formula, oral diet also played an important role in optimization nutritional status. The caregiver played an active role in ensuring proper feeding regime, food preparation and adherence to dietary recommendations. As a result, the patient's appetite increased, weight improved and successfully achieved > 75% of the protein and energy requirements.

Limitations included the inability to assess the latest renal profile for potassium levels and obtain the most recent weight during the second follow-up, as the patient had already been discharged.

CONCLUSION

Dietitians play a crucial role in supporting the recovery and developmental outcomes of vulnerable pediatric patients through patient-centered interventions, including formula adjustment, nutrient-dense diet strategies, and tailored caregiver guidance. This case reinforces the critical role of individualized nutrition intervention in managing failure to thrive in a preterm infant with RSV pneumonia and poor weight gain. It highlights the need for ongoing caregiver education and close monitoring when alternative formulas are used.

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