# Effect of calorie-enriched formula on postoperative catch-up growth in infants with cyanotic congenital heart disease: a prospective randomized controlled study

*Zhou HM, Qiu Q, Yan MH, Peng LJ, Fang JJ, Zhou BJ, Yang SS, Zhang GC. Chin J* Contemp Pediatr 2021; 23(1): 78-83.

Congenital heart disease (CHD) is one of the most common congenital diseases in children, with an incidence of 4% to 10%. Cyanotic CHD has a significant impact on infants and children due to its complex condition and long surgical time, however despite nutritional status being critical for their growth, development, immunity and postoperative clinical outcomes infants with CHD often present with varying degrees of malnutrition.

There are a few studies/reports on the recovery of cardiac function and nutritional status, growth and development in children with CHD after surgery, but nutritional (intervention) studies in special populations such as cyanotic CHD are sparce. As such this study investigated the effect of an Energy Nutrient Dense Feed (ENDF, Infatrini) on postoperative catch-up growth in infants with cyanotic congenital heart disease.

## METHODS

Subjects were included in this study if they were <6 months of age, receiving artificial feeding, diagnosed with cyanotic CHD and underwent surgery. The exclusion criteria were 1) severe gastrointestinal malformations; 2) inherited metabolic diseases; 3) postoperative chylothorax; 4) cow's milk protein allergy; 5) transfusion of blood products, albumin or other nutritional support therapy in the month before admission; 6) life expectancy of <6 months. Infants were randomised to receive either an ENDF (Infatrini) or standard infant formula post operatively for a period of 6 months.

All infants were followed up until 6 months post-surgery. Measurements included body weight, length, prealbumin, and N-terminal pro-B-type natriuretic peptide (NT-proBNP) before surgery, at the time of postoperative ventilator weaning and extubation, and at 1, 3, and 6 months after surgery. Length-for-age Z-score (LAZ), weight-for-age Z-score (WAZ), and weight-for-length Z-score (WLZ) were assessed alongside adverse reactions and GI tolerance parameters. Malnutrition was defined as having at least one of the three z-scores (WAZ, LAZ, WLZ) <-2.

## RESULTS

100 infants with CHD were included, with 50 cases in each group with similar baseline characteristics.

### Growth & Nutritional status

50% (n=25) and 42% (n=21) of subjects in the ENDF and control groups were malnourished prior to surgery (P >0.05), with both groups significantly improving their nutritional status during the course of the study (P <0.05).

There we no differences in LAZ, WAZ and WLZ between groups prior to surgery, however the ENDF group had a significantly lower incidence of malnutrition at the end of the intervention (18% vs 36%; P < 0.05). At 3- and 6-months post-surgery, LAZ and WAZ were significantly higher in malnourished infants receiving ENDF compared to malnourished infants receiving standard formula (P < 0.05) with WLZ also being significantly higher in the malnourished ENDF group at 6 months post-surgery (P < 0.05).

At 6 months post-surgery, the proportion of infants with WAZ < -2 was significantly lower in the ENDF group compared to controls (P=0.005).

No GI intolerance occurred in either group.

### Cardiac function

In both groups NT-proBNP levels decreased after surgery with significant differences within groups at 1-, 3- and 6-months post-surgery (all P < 0.05). There were no significant differences in NT-proBNP between groups.

| Group | | LAZ | | | | | | WAZ | | | | | | WLZ | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | No. of subjects | Pre-op | Postoperative extubation | Post-op 1 month | Post-op 3 months | Post-op 6 months | No. of subjects | Pre-op | Postoperative extubation | Post-op 1 month | Post-op 3 months | Post-op 6 months | No. of subjects | Pre-op | Postoperative extubation | Post-op 1 month | Post-op 3 months | Post-op 6 months |
| Control (x ± s) | malnourished | 9 | -2.6 ± 0.5 | -2.7 ± 0.5 | -2.7 ± 0.6 | -2.7 ± 0.6 | -2.6 ± 0.6 | 20 | -3.7 ± 1.2 | -3.7 ± 1.2 | -3.8 ± 1.3 | -3.4 ± 1.1 | -2.8 ± 0.9 | 19 | 3.1 ± 1.4 | -3.2 ± 1.3 | -3.2 ± 1.4 | -3.1 ± 1.1 | -2.8 ± 1.1 |
| | not malnourished | 41 | -1.2 ± 0.7 | -1.2 ± 0.8 | -1.3 ± 0.6 | -1.2 ± 0.7 | -1.1 ± 0.8 | 30 | -1.3 ± 0.7 | -1.3 ± 0.7 | -1.4 ± 0.6 | -1.1 ± 0.8 | -0.9 ± 0.9 | 31 | -1.2 ± 0.7 | -1.3 ± 0.6 | -1.3 ± 0.7 | -1.1 ± 0.8 | -1.0 ± 0.9 |
| ENDF (x ± s) | malnourished | 10 | -2.4 ± 0.3 | -2.5 ± 0.4 | -2.5 ± 0.6 | -2.4 ± 0.5a | -2.2 ± 0.4a | 21 | -3.9 ± 1.1 | -3.9 ± 0.9 | -4.1 ± 1.1 | -3.1 ± 1.2a | -1.8 ± 1.1a | 20 | -3.9 ± 1.3 | -3.9 ± 0.7 | -4.0 ± 0.6 | -3.5 ± 0.6 | -2.2 ± 0.8a |
| | not malnourished | 40 | -1.0 ± 0.8 | -1.1 ± 0.7 | -1.1 ± 0.9 | -1.1 ± 0.9 | -1.0 ± 1.0 | 29 | -1.2 ± 0.7 | -1.3 ± 0.7 | -1.3 ± 0.6 | -1.0 ± 0.9 | -0.6 ± 1.0 | 30 | -1.2 ± 0.8 | -1.2 ± 0.7 | -1.1 ± 0.9 | -1.1 ± 0.9 | -0.7 ± 0.9 |
| Proportion with < -2 change [n (%)] | Control | 50 | 9 (18) | | 9 (18) | 8 (16) | 8 (16) | | 20 (40) | | 19 (38) | 18 (36) | 10 (20)b | | 19 (38) | | 19 (38) | 13 (26) | 15 (30) |
| | ENDF | 50 | 10 (20) | | 10 (20) | 9 (18) | 7 (14) | | 21 (42) | | 20 (40) | 12 (24) | 4 (8) a, b | | 20 (40) | | 19 (38) | 12 (24) | 8 (16) b |

[LAZ] length-for-age Z-score; [WAZ] weight-for-age Z-score; [WLZ] weight-for-length Z-score. (a) Comparison with the control group, P < 0.05; (b) comparison with the preoperative status in the same group, P < 0.05.

## CONCLUSIONS

Infants with cyanotic CHD requiring surgery have a high incidence of malnutrition. Postoperative use of ENDF in these infants is a safe and well tolerated intervention that can improve nutritional status and promote effective catch-up growth.