

# Effects of Formula Change on Intestinal Hydrogen Production and Crying and Fussing Behavior

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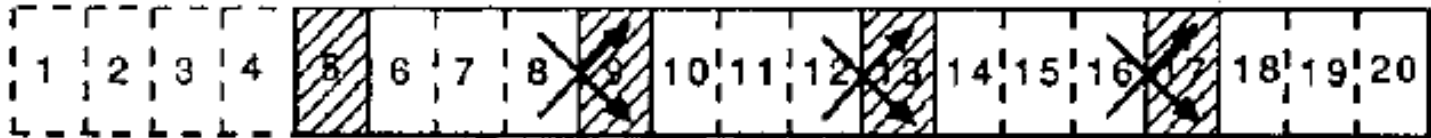
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**ABSTRACT.** To determine whether incomplete carbohydrate absorption plays a role in mediating the effects of formula change on babies' crying, breath hydrogen excretion and behavior were measured in 17 normal formula-fed infants who entered a feeding trial at 28 days of life. The trial permitted two comparisons between (1) lactose and reduced lactose soy-based formulae, and (2) the infant's usual pretrial formula and the subsequent soy-based variable-carbohydrate formulae. Reduced lactose formula was associated with a small reduction in H<sub>2</sub> excretion (from a mean of 15 to 7 ppm,  $p = .07$ ) but no difference in crying or fussing. However, compared with their usual pretrial formula, the change to soy-based variable-carbohydrate formulae was associated with a substantial and sustained reduction in H<sub>2</sub> excretion (mean 32 to 11 ppm,  $p < .03$ ) and a modest 21% decline in fussing (90.4 to 71.5 min/24 hr,  $p < .08$ ). By 8 days after the formula change, there was a 40% decline (90.4 to 53.9 min/24 hr) in fussing. These results suggest that, although behavioral changes due to differences in carbohydrate content are unlikely in normal infants, formula changes involving protein and carbohydrate can reduce colonic gas production and may have some effect on crying. Such effects may be implicated when feeding changes occur in normal infants, but their potential role in treatment of crying problems (colic) is yet to be demonstrated. *J Dev Behav Pediatr* 12:248-253, 1991. Index Terms: cry, fuss, formula, breath hydrogen, intestinal gas.

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**DAYS**



**FORMULA PERIOD**



**MEASUREMENTS**

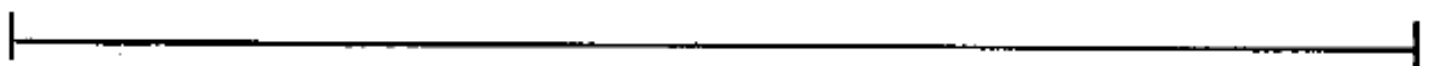
H<sub>2</sub>-producer status



Breath H<sub>2</sub> (4hr)



Diary



Food delivery



**FEEDINGS**

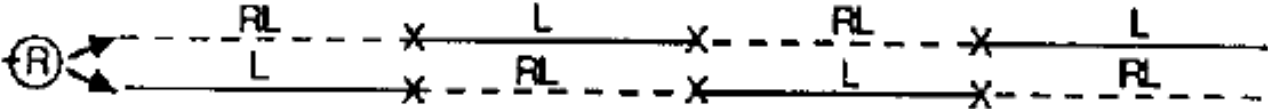
Protein

usual formula protein



Carbohydrate

usual formula carbohydrate



**FIGURE 1.** Design of crossover feeding trial. Subjects were fed their typical formula preparation during baseline and were randomized to receive lactose or reduced lactose soy-based formula starting on day 5. Cross-hatching refers to days on which diary data was discarded to remove potential carry-over effects from the previous formula period. R refers to random assignment. Crossed arrows represent crossover to the alternate formula. L and RL refer to lactose and reduced lactose formulae, respectively.

## Development and Selection of Reduced Lactose Formula

Before starting the study, testing was carried out to find a carbohydrate combination that would (1) optimize the chance of reducing incomplete carbohydrate absorption and (2) “blind” the mother (and the infant) to carbohydrate differences. To achieve the first goal, it was decided a priori to find a carbohydrate combination that would result in no or less H<sub>2</sub> excretion than that obtained on the infant’s own formula in 48-hour test trials. To achieve the second, it was made equivalent in caloric energy value, osmolality, appearance, and taste as determined by adult observers. All test formulae were made by addition of water (1:1) and carbohydrate [6.8% (g/100 mL)] to Ross Carbohydrate Free soy-based formula.

Of 48 mono-, di-, and polysaccharide combinations tested, the combination of 14.7% lactose, 35.3% glucose, and 50% glucose polymer met all the criteria. Its taste equivalence to 100% lactose formula was demonstrated in 30 parents by the “triangle” method.<sup>28</sup> To ensure reduced intestinal gas