Nutritional value of an "anti-regurgitation" formula

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Abstract

Objectives **: Anti-regurgitation formulae are recommended in the therapeutic approach of regurgitation. However, their nutritional value needs to be evaluated. It is not known whether the addition of (fibers of) bean gum might influence the intestinal absorption of nutrients and minerals.**

Patients **: Fourty healthy infants were included in an open randomised prospective trial, receiving either a regular adapted (casein/whey ratio 40/60) or an anti-regurgitation (casein/whey ratio 80/20) formula.**

Results **: At the end of the study, at the age of 13 weeks, weight and length gain, and most serum parameters (iron, iron binding capacity, calcium, phophorus, protein, prealbumin, zinc) were comparable in the 20 infants in each group. The mean intake per day was higher in the anti-regurgitation formula group (755 $\pm$ 55 versus 680 $\pm$ 89 ml/day ; $p < 0.001$), resulting in a higher protein intake (12.80 versus 9.52 g ; $p < 0.001$), which might explain the increased plasma urea level in this group (23.1 versus 15.9 mg/dl ; $p < 0.001$). The albumine level, on the contrary, was smaller in the anti-regurgitation group (4.21 versus 4.85 g/dl ; $p < 0.001$).**

Conclusion **: All nutrition parameters are within normal ranges, although there are some significant differences between both groups (for urea and albumin). However, the formula should also be evaluated in therapeutic conditions in regurgitating babies. Differences in intake might be related to the selection of the study population, which were asymptomatic babies.** (Acta gastroenterol. belg., **1998**, 61, **285-287**).

Key words : regurgitation, infant, nutrition.

Abbreviations

AR anti-regurgitation formula
WF whey-predominant formula

Introduction

Regurgitation is a common phenomenon, occurring approximately in 20% of infants, and causes in most of the cases discomfort both for the infant and his environment (1). Effort should be made by health care providers to reassure parents and convince them about the physiologic nature of regurgitation (2). If this fails, an effective and safe therapeutic intervention such as thickened feeding is advised (2). Thickening of infant formula, with rice or corn flour in the USA, and with bean gum or pitweat in Europe, has been very popular for more than four decades as the increased viscosity of thickened feeds reduces the episodes of regurgitation (24). During the last years, new "anti-regurgitation" (AR) formulae were launched on the European market. These formulae demand less manipulations and are therefore safer than a traditional formula to which milk-thickening agents is added at home. Moreover, the industrial addition of thickening agents to a formula is considered in the composition of the formula, resulting in a nutritionally more balanced formula if the thickening agents are added by industry instead of at home. On the Belgian market, an AR-formula is cheaper than a comparable unthickened formula with the thickener added individually. A recent study showed that an AR-formula was effective to decrease the severity of regurgitation (5). However, the nutritional consequences of the addition of fibres of bean gum (0.4 g/100 ml) to a formula remains a point of discussion as fibres could possibly decrease the intestinal absorption of differents ingredients of the feeding.

The objective of the current study was to investigate the nutritional value of the AR-formula developed by Nutricia compared to a whey-predominant formula.

Materials and methods

Forty infants were included in this open randomised prospective trial. All infants were healthy newborns, born after an uneventful pregnancy and delivery. Infants with a family history of atopic disease and regurgitation from the first days after birth were excluded. After parental consent was obtained, the babies were included in one of both groups. The first group was fed exclusively a whey-predominant formula (WF-group) and the second group exclusively the "anti-regurgitation" formula (AR-group), containing bean gum. The formulae were provided free in unlabeled tins. Parents were asked to fill in a diary mentioning the volume that was daily ingested. The formula tins had to be returned, enabling us to evaluate the compliance. Both formulae are commercialised by the same company (Nutrilon Premium and Nutrilon AR, Nutricia). The composition of these formulae is summarised in Table I. The protein content of AR-formula is 1.7 g/100 ml (casein/lactalbumin 80/20), whereas the adapted formula has only 1.4 g/100 ml (casein/lactalbumin 60/40). The fat content in the AR-formula is considerably lower than in the adapted formula (3.0 versus 3.6 g/100 ml), but still within the recommended ranges for standard infant formulae. Since the caloric density is equal (66 kcal/100 ml), the carbohydrate content in the AR-formula is higher (8.1 versus

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Table I. — **Composition of the formulas tested per 100 ml**

		Whey-predominant formula	Anti-regurgitation formula
kcal		66	66
Protein equivalent	(g)	1.4	1.7
Casein/whey		40/60	80/20
Fibers (been gum)	(g)	—	0.4
Lipids	(g)	3.6	3.0
Carbohydrates	(g)	7.1	8.1
Lactose	(g)	7.1	6.1
Polysacharides	(g)	0	2.0
Iron	(mg)	0.5	0.5
Zinc	(mg)	0.4	0.5
Calcium	(mg)	54	71
Phosphorus	(mg)	27	49
Vitamin A	(IU)	250	75
Vitamin E	(IU)	1.2	0.8

7.1 g/100 ml). All infants were fed exclusively either formula at libitum during 13 weeks. No vitamin supplements were administered. No supplement, such as flour (from rice and corn), (other) milk-thickening agents, fruit juices and tea was allowed. All babies were examined at least once a month.

Weight and length gain were evaluated. At the age of 3 months (during the 13th week of life), blood was collected from the infants : iron, calcium, phosphorus, iron binding capacity, zinc, total serum protein, albumin, prealbumin and urea were analysed using standard chemical procedures. To limit the volume of blood sampled from these healthy infants, the complete battery of tests proposed by the Health and Nutrition Examination Survey was not performed.

Statistical analysis was performed using a two-tailed Student's test (significance level $p < 0.05$). Approval of the local ethical committee was obtained.

Results

There was no significant difference in birth weight between both groups. Weight gain was a little higher in AR-group (2,838 g compared to 2,581 g or 181% compared to 178% ; NS). The difference in weight gain per day was 3.3 g ; length gain is identical in the two groups (Table II). The mean ingested volume (± 1 Standard Deviation) during the 3-month study was higher in AR group (755 ± 55 compared to 680 ± 89 ml/day ; $P < 0.001$). The mean volume intake was calculated for 17 (85%) infants in the WF group and 15 (75%) infants in AR group. The mean volume per kg per day in the AR-group was 153.3 ml (100.9 kcal/kg/day) and 147.0 ml (97.0 kcal/kg/day) ($p < 0.05$) in the adapted formula group. Significant regurgitation, defined as being a spontaneous complaint of the parents, did not occur.

The laboratory results collected at the age of 13 weeks are summarised in Table III. For both groups, all parameters were within the normal ranges, except for the zinc level (mean levels slightly below the lowest normal range) ; however, there was no significant difference in the zinc level between the two groups. Parameters that were significantly different at 13 weeks are albumin and urea ; urea was higher in the AR group, and albumin was significantly lower. The protein intake per day is 9.52 g in the WF group and 12.8 g in the AR group ($p < 0.001$), or 1.61 versus 2.03 g/kg/day ($p < 0.001$) (weight reached at the end of the study).

Discussion

Since the aim was to compare a "thickened" to an "unthickened" formula, it was not possible to blind the study, although the formulae were delivered in unlabeled tins. Infants with regurgitation during the first days after birth were excluded as the aim of this study was to evaluate the nutritional value of AR formula, not influenced by regurgitated volume. Infants with a family history of atopic disease were excluded because of the increased risk of developing cow's milk protein allergy with secondary malabsorption and nutritional deficiencies, possibly influencing the results of the study.

The higher, although not significant, weight gain in AR group can be explained by a significant higher daily intake of AR formula (755 ± 89 vs 680 ± 55 ml/day

Table II. — **Weight and length at birth and 13 weeks**

		Whey-predominant formula (n=20)	Anti-regurgitation formula (n=20)	p
Weight				
Birth	(g)	3,328	3,472	NS
Week 13	(g)	5,909	6,310	NS
Gain	(g)	2,581	2,838	NS
%		178	181	NS
Gain/day	(g)	27.2	30.5	NS
p		NS	NS	
Length				
Birth	(cm)	49.8	50.1	NS
Week 13	(cm)	60.2	61.1	NS
Gain	(cm)	10.4	10.9	NS
%		121.0	121.9	NS
p		NS	NS	

Table III. — **Laboratory results at the age of 13 weeks**

	Whey-predominant formula (n=20)		Anti-regurgitation formula (n=20)		P
	mean	Std Dev	mean	Std Dev	
iron (µg/d)	51.4	13.7	51.2	12.4	0.97
IBC (µg/dl)	301	47.4	282	49	0.24
urea (mg/dl)	15.9	3.4	23.1	3.9	< 0.001
calcium (mg/dl)	10.5	0.3	10.6	0.2	0.21
phosphorus (mg/dl)	6.4	0.3	6.3	0.3	0.18
protein (g/dl)	6.4	0.4	6.2	0.3	0.10
prealbumin (mg/dl)	23.4	4.6	21.1	3.5	0.09
albumin (g/dl)	4.85	0.36	4.21	0.26	< 0.001
zinc (µg/dl)	67.6	8.9	66.7	10.6	0.78

or 100.9 vs 97.0 kcal/kg/day). The difference in weight gain might also be related to the difference in protein intake (6). Based on the recommendation that infant formula should mimic human milk as much as possible, the trend in modern infant nutrition has been in favour of whey-predominant formulas. However, scientific evidence favouring whey over casein predominant formula is weak (7). Cow's milk casein, which is predominant in the AR-formula (80% casein/20% whey) results in a better curd formation than lactalbumin. The differences in nutritional value between casein and whey might explain the lower serum albumin level in the AR-group, despite the higher protein intake. The low lipid content in the AR formula (3.0 g vs 3.6 g per 100 ml) is also likely to be a confounding variable (8).

All biochemical parameters evaluated at 13 weeks of life were within the normal range for both groups, with the exception of the zinc level. While the lowest normal zinc level is considered to be 70 µg/dl, the mean was 67.6 µg/dl in WF group and 66.7 µg/dl in AR group (suggesting that the lower normal limit might be too high for this age group). As no significant difference was observed between the two groups, the addition of fibres in the AR formula does not influence the intestinal absorption of zinc.

A detailed discussion on the composition of the tested formulae is beyond the topic of this paper. However, the higher protein content in the AR formula probably results in a higher urea plasma level in the AR group. Another observed difference in albumin levels could be the consequence of a different protein composition of both formulae, with predominance of casein in the AR milk. We hypothesize that the differences found in urea and albumin levels do not have clinical significance as both parameters were within normal ranges. A higher daily intake in volume and calories possibly related to the lower lipid content of AR milk, results in (non-significant) higher weight gain in infants exclusively fed the AR-formula. The higher protein intake might as well contribute to this observed trend (6). Since delayed gastric emptying is one of the pathophysiologic mechanisms of regurgitation (9), it can be speculated that — as a consequence — regurgitating infants might ingest smaller volumes of feeding. AR formula, such as the one evaluated, has to be considered as "a therapeutic medical food". Growth and biologic nutritional parameters were within normal ranges, although there were some significant differences between both groups. Further studies are needed to evaluate this type of formula in regurgitating infants. In order to evaluate the (absence of) effect of bean gum on the absorption of nutrients, two identical formulas, except for the thickening agent, should be compared and evaluated.

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