

***Iodine status and growth in 0-2-year-old infants with
cow's milk protein allergy***

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ABSTRACT

Objectives: To investigate iodine status and growth in cow's milk protein allergic infants and to identify potential predictors of iodine status and growth.

Methods: Fifty-seven infants under two years of age were included in an observational cross-sectional study. Two spot urine samples were collected and analysed for iodine, together with a three-day food record and a food frequency questionnaire. Urine iodine concentrations were compared to the WHO cut-off values for iodine deficiency. Measurements of weight, length and head circumference at birth and study inclusion were converted to standard deviation scores. Subgroup analyses were performed on different feeding patterns, according to weaning status.

Results: Median age was nine months. Median Urinary iodine concentration was 159 ug/L. One third of the children had urine iodine concentrations indicating iodine deficiency. Infants who were mainly breastfed were at highest risk and 58 % were classified as deficient. Dietary factors positively associated with iodine excretion were intake of enriched baby cereals and meeting the dietary requirement for iodine. Stunting was present in 5 %. Underweight and wasting was frequent at 11 % and this was associated with food refusal and poor appetite, but not with iodine status. Growth failure was detected among boys.

Conclusion: This study suggests that CMPA children have high prevalence of iodine deficiency and poor growth, however the two conditions were not associated. The subgroup of mainly breastfed infants was at higher risk of iodine deficiency compared to weaned infants. Subjects with feeding problems had increased risk of malnutrition.

Abbreviations: ADHD: attention deficit hyperactivity disorder, CMP: Cow's milk protein, CMPA: Cow's milk protein allergy, GI: gastro intestinal, MUIC: Median urinary iodine content,

OUS: Oslo University hospital, RDI: recommended daily intake, SDS: standard deviation scores,
UIC: Urinary iodine content, WHO: World Health Organization

Key Words: cow's milk protein free diet, food allergy, iodine deficiency, breastfeeding, urinary iodine, weaning

What is known:

- Children on Cow's milk protein free diets are at risk of nutritional deficiencies.
- Dairy products are major sources for iodine in many westernized countries.

What is new:

- High risk of iodine deficiency in breastfeeding infants of mothers who exclude cow's milk protein.
- Boys on cow's milk protein free diets are at increased risk of growth failure
- Food refusal and poor appetite are associated with growth failure in cow's milk protein allergic children

Introduction

Allergy to dietary food components affects 2.5 - 6 % of children worldwide and treatment involves elimination the offending food from the child's diet (1, 2). Most food allergy commonly present within the first three years of life, a period characterized by rapid growth and development (2, 3). Children with cow's milk protein allergy (CMPA) must avoid all dairy products and inappropriate dietary substitutions can induce vitamin and mineral deficiencies, anemia, rickets, growth failure and kwashiorkor (3-6). Growth failure and poor nutritional status have been reported in children with CMPA and in several European countries dairy products are the main contributors of iodine (7, 8).

Iodine is an essential trace element necessary for the production of thyroid hormones, and adequate levels of thyroid hormones are needed for normal growth and neurological development of the brain and central nervous system in infancy and childhood (9). The World Health Organization (WHO) has estimated that nearly one third of children globally are at risk of iodine deficiency (10, 11). Significantly lower intelligence quotient (IQ) has been found in children with mild iodine deficiency and mild to moderate iodine deficiency has been associated with behavioral and developmental disorders like Attention Deficit Hyperactivity Disorder (ADHD) and autism (12-14). The WHO recommends using median urinary iodine concentration (MUIC) for assessing iodine status in a population and has proposed that a MUIC of more than 100 μ g/l should be considered as adequate in children under two years of age (15).

Iodine status in relation to cow's milk protein (CMP) free diet has as far as we know never been studied. Several case reports have found goiter and signs of goiter due to low iodine intake in children restricting CMP in their diet (16-19). The aim of this study was to investigate iodine intake and status along with growth in cow's milk protein allergic children and to identify

factors affecting iodine status and growth. The main hypothesis of the study is that children on a CMP free diet are at risk of iodine deficiency and compromised growth.

Methods

This study was a cross sectional study on nutrient intake, growth and nutritional status in children under two years of age following a CMP free diet. All children at the Department of Paediatric medicine, Oslo University hospital (OUS) diagnosed with CMPA under two years of age, between January 2014-May 2015, were invited to the study. Exclusion criteria were: premature birth, thyroid disease, dependence of enteral or parenteral nutrition, use of medication that affect iodine status or exposure to iodine containing contrast the past 6 months and children diagnosed with other illnesses affecting nutrient absorption or metabolism (e.g. coeliac disease). The diagnosis was made on the basis of symptom relief upon exclusion of CMP, and re-challenge was performed in cases where there was any uncertainty about the diagnosis.

Ethics: The study was carried out in accordance to the Helsinki Declaration and informed written consent was obtained from both parents. The study was approved by the Regional Committee for Medical and Health Research Ethics in Norway (REC nr. 2013/1579), and by the Head of the Department and the Research committee at OUS Division of Paediatric and Adolescent Medicine.

Patient information: A questionnaire on background data, including symptoms was completed by the parents on the first visit.

Growth assessment: The children were weighed without clothing and diaper on a digital infant scale, Data Baby scale 930 (Oriola, Espoo, Finland), to the nearest 0.005 kg. Recumbent length was measured without clothing using a length board with a fixed headpiece and a

moveable foot piece perpendicular to the surface of the board, to the nearest 0.1 cm.

Anthropometric values for birth weight, length and head circumference were taken from the child's hospital record or health visitor card, a record provided to all children born in Norway.

The anthropometric measurements were analyzed by calculating standard deviation scores (SDS) for weight for age (weight SDS), length for age (length SDS) weight for length, BMI for age (BMI SDS) and head circumference for age, based on the Norwegian reference population (20, 21). Underweight was defined as weight SDS ≤ -2 , wasting as BMI SDS ≤ -2 and stunting as length SDS ≤ -2 . Overweight or obesity was defined as BMI SDS ≥ 2 (22).

Dietary assessment: Dietary intake was recorded after the child had followed a CMP-free diet for a minimum of three weeks. Parents were given dietary advice on a CMP-free diet from a dietitian. If the child was breastfed the nursing mother was instructed to exclude CMP from their own diet.

Data on diet and nutritional supplements were collected using a 3-day food record with estimated portion sizes and entered into an online Norwegian nutrition analysis tool

(*Kostholdsplanleggeren*) (23) based on the Norwegian Food Composition Table (24).

Calculation of iodine content of foods with missing values for iodine was done manually by the investigator using values for food items published by Dahl et al (25).

If the child was breastfed, each breastfeeding was recorded along with how long the feeding lasted. Breastmilk was not entered into the food analysis tool, as we had no measure on how much breastmilk the children consumed. A semi-quantitative food frequency questionnaire was used to gather information about past and present breastfeeding, the use of hypoallergenic formula, time of introduction to solids, feeding development and difficulties, iodine rich food sources and nutritional supplements.

Iodine status assessment: Two spot samples of urine, each minimum 5 ml, were collected during the study period, preferably on a day when the child's diet was recorded. The parents were instructed to take the samples on two separate days, avoid the first morning urine, and record the date and time of the sample. Two methods for urine collections were used: Urine collection pad (Euron Newcastle Uricol collector, United Kingdom) and Urine sample collection bag (U-bag single specimen style, sterile, newborn, Briggs Healthcare, Waukegan, USA). The specimen was then frozen to -18 degrees before it was sent to the lab for quantification of iodine. The urine samples were analyzed by the Hormone Laboratory (Hormonlaboratoriet) at Aker, OUS, using a colorimetric method based on Spectrometry with the Sandell-Kolthoff reaction after oxidation of interfering substances with ammonium-sulfate. Iodine content was expressed as umol/L, the lowest iodine value quantified by the laboratory was 0.2 umol/L (25.4 ug/L).

Statistics: Statistical analysis was performed using IBM SPSS Statistics for Windows, version 22 (Armonk, New York). Normality was tested using Shapiro-Wilk test and normal Q-Q plots. Continuous variables were presented as means with standard deviation (SD) if normally distributed or medians and range if not normally distributed, except for nutritional data, which were presented as medians with interquartile range (25th - 75th percentile). Categorical data were presented as frequencies. Groups were compared using the Kruskal Wallis test if more than two groups. For normally distributed variables the Independent Sample T-test was used for groups. The Spearman rho correlations coefficient was used to assess the relationship between continuous variables. A chi-square test was used for categorical values. The paired sample t-test was used to look at changes in continuous variables over time. The level of significance for all statistical tests was 2-sided and significance level was set to 0.05.

We divided our study population into three groups according to feeding pattern at the time of the study. The breastfed children were separated into “mainly breastfed” i.e. those receiving less than 50 % of their estimated energy requirement from food and “partially breastfed” i.e. those more reliant on food for energy and nutrients (26). Those not receiving breastmilk were termed “weaned”.

The main endpoint for calculating sample size of this study was urinary iodine concentration and with 80 % power and a significance level 5 % a sample size of 46 children was needed to detect a difference of 20 ug/L from the cut-off level of 100 ug/L.

Results

Subject characteristics: Between January 2014 and May 2015, 82 children aged 0-24 months eligible for the study were identified at the Children’s clinic, OUS, Norway. 23 % did not want to participate and 7 % dropped out, leaving 57 (70 %) children included in the study. Baseline characteristics of the study population are presented in Table 1. Median age was 9 months and 54 % were boys. Four types of co-morbidities were registered for 8 patients. The median time on CMP-free diet before enrollment was 17 weeks, and median number of symptoms of CMPA were four. Almost all of the children (98 %) had gastrointestinal symptoms, 46 % had eczema or skin symptoms, more than one third had failure to thrive and one third had food refusal. Feeding difficulties were reported in 70 % of the children and one third had poor appetite. More than half of the children (57 %) were breastfed at the time of enrollment; 24 % mainly and 33 % partially. A hypoallergenic formula was used by 69 %.

Iodine status in the group: A total of 92 urine spots were collected and mean value of the two spots for each individual subject were used when possible. Median urinary iodine content (UIC) of the study group was 159 ug/L (<25 – 457 ug/L) and the prevalence of UIC < 100 ug/L was 31 % (Table 1). None had values of above 500 ug/L, i.e. iodine excess.

The mainly breastfed children had significantly higher prevalence of iodine deficiency; 58 % had a UIC under 100 ug/L compared to 12 % and 32 % in the partially breastfed and the weaned children respectively ($p=0.03$). The median UIC in the breastfed group was 86 ug/L, compared to 172 ug/L and 175 ug/L in the partially breastfed and weaned children respectively (Figure 1). The difference was, however, not statistically significant between the groups ($p=0.07$).

Iodine and diet: Hypoallergenic formula was the main source of iodine in the diet of the partially breastfed and weaned children, and there was a significant difference between the three feeding groups in provision of iodine from a hypoallergenic formula (Table 2). The correlation between intake of hypoallergenic formula and UIC was not significant, however. Enriched baby cereal was the second most important iodine source in the group and there was a significant correlation ($r=0.3$, $p=0.02$) between intake of these cereals in grams and UIC (ug/L) of the study group. The same was found for percentage of recommended daily intake (RDI) for iodine and UIC (ug/L) ($r=0.3$, $p=0.03$). As expected, total iodine intake and percentage of RDI for iodine (excluding breastmilk) was significantly higher in the partially breastfed and weaned children compared to the mainly breastfed. No significant correlation was found between iodine from other food sources or total energy intake from diet (excluding breastmilk) and UIC. Conditional correlation

revealed a significant association between intake of enriched baby cereal and UIC for the partially breastfed group, but not for the two other feeding groups.

Growth: Anthropometric measurements are shown in Table 3. The prevalence of underweight and wasting (weight SDS and BMI SDS ≤ -2) at inclusion was high (10.5 %) and stunted growth (length SDS ≤ -2) was found in 5.3 %. Boys fell significantly in SDS for length from birth to inclusion ($p=0.02$) when looking at the genders separately.

We found a significant negative correlation between BMI SDS and total number of feeding problems in the study group. Children with food refusal had significantly lower weight SDS ($p=0.009$) and BMI SDS ($p=0.01$). The same was seen in children with poor appetite, with lower weight SDS ($p=0.03$) and BMI SDS ($p=0.03$) in affected subjects. We found no significant difference in weight SDS, length SDS or BMI SDS in subjects with and without selective eating, weaning problems, choking/swallowing problems and feeding difficulties in general. A significant positive association was found between number of weeks on the cow's milk protein free diet and weight SDS ($r = 0.3$, $p = 0.04$) and BMI SDS ($r=0.3$, $p= 0.03$). There was no significant correlation between growth parameters and UIC.

Discussion

Iodine status in CMPA children and iodine status

This study is the first to present iodine status in infants and children on cow's milk protein free diets.

The median UIC in the present study was indicative of sufficient iodine status according to WHO (15). Some authors have however, suggested that the cut off for iodine sufficiency

infants and children under three years of age should be raised as urinary excretion in this age group is much lower than in adults (27). Even if the median UIC of the study group was adequate, one third of the children (31 %) had UIC values of under 100 ug/L (Table 1) and are consequently at risk of the detrimental effects of mild to moderate iodine deficiency. Health professionals need to target dietary advice in order to prevent such deficiency, hence identifying the potential predictors of insufficient iodine status in this population is crucial (12, 28).

We found significant differences in iodine status according to feeding pattern. The group median UIC of the mainly breastfed infants was lower than the cut off for iodine deficiency (Figure 1) and there was significantly higher prevalence of values under 100 ug/L among these children compared to the other feeding groups. Data on iodine status of healthy infants in Norway is currently lacking. However, the iodine status in the CMPA infants in the current study was not inferior compared to healthy infants in other iodine sufficient countries. Median UIC in Swiss infants was 91 ug/L at 6 months and 103 ug/L at 12 months (29). Half of the infants had values below 100 and median UIC in breastfed infants were significantly lower than in non-breastfed infants: 82 and 105 ug/L, respectively. Healthy infants in New Zealand were found to be iodine deficient and breastfed infants had the lowest values (MUIC 67 ug/L, breastfed infants 44 ug/L) (30).

Breastfed infants are highly dependent on the content of iodine in breastmilk, which in turn is dependent on the breastfeeding mothers' iodine status (31). Mulrine and co-workers found that breastmilk iodine concentration decreased substantially in the first six months postpartum (32). In line with WHO, health authorities in many countries recommend exclusive breastfeeding until six months of age. Breastfeeding women in Norway, New Zealand and Switzerland have been found to be iodine deficient and UIC to be associated with the intake of dairy products (29,

30, 33). In the present study, the mainly breastfed infants with CMPA had higher prevalence of iodine deficiency compared to weaned infants, as it is in healthy infants. However, since we do not have values from the normal population in Norway we cannot conclude that CMPA as such does put these children at higher risk compared to general population. Even so it seems warrant to recommend nursing mothers of CMPA children to use iodine supplementation when they follow a cow's milk elimination diet.

Dietary iodine sources and iodine status

The main iodine source in this study was hypoallergenic formula followed by enriched baby cereals (Table 2). We found no significant correlation with the intake of infant formula and UIC, however intake of enriched baby cereal was significantly positively associated with UIC in the group as a total and in particular among the partially breastfed. Other studies have found the use of formula milk to be positively associated with UIC (29, 30). The lack of significant association found in our study could be a result of differences in weaning traditions; i.e. the high rate of breastfeeding and low use of formula milk in Norway. However, the bioavailability of iodine could also have affected the results. Half of the iodine in infant formula milk is bound to organic molecules resulting in low bioavailability and poor absorption of iodine from the formula (34).

There was a positive and significant correlation between percentage of recommended intake of iodine from the diet and UIC. Hence, the quality of the weaning diet significantly affects the iodine status of the weaning CMPA child and dietary advice given to this group should include advice on iodine sources. Sea fish, eggs and poultry are good source of iodine if eaten regularly. Iodized salt however, traditionally used as a means to avoid iodine deficiency is

not a good iodine source for the weaning infant as adding salt to an infant's diet is not recommended.

Growth

We found mean weight SDS and length SDS for the study population to be slightly lower than the reference population at inclusion (Table 3) (20). Boys had a significant reduction in length SDS from birth to inclusion. The relatively high prevalence of underweight and wasting found indicates that a large proportion of the study population were malnourished. Other studies have found reduced z-scores for growth in food allergic children compared to controls (35-37). A retrospective study found lower weight at one year of age in children with CMPA compared with controls, and lower height and weight at age two. The effect was still evident at 6 -10 years of age (38). The high rates of malnutrition seen in the present study have been found in other studies of food allergic children (36, 37). Infants and young children are particularly vulnerable to growth failure as the first few years of life is a period of rapid growth and weight is affected by insufficient nutrition earlier than length.

Neither total number of symptoms, eczema, gastro intestinal or the respiratory symptoms, nor number of foods avoided correlated significantly with growth. This is different from what has been found in other studies of food allergies where growth failure significantly increases with the number of foods avoided or in the presence of atopic dermatitis (2, 36, 37). Number of weeks on the CMP-free diet was significantly positively correlated with nutritional status. Thus one could question if poor growth and nutritional status in CMPA children is a sign of persistent intestinal inflammation or antigen remnants in the hypo allergenic formula rather than nutritional deficiencies of the exclusion diet (37, 39, 40). Intestinal inflammation as part of the disease

process could negatively affect growth through reduction of nutrient absorption and/or increased requirements of the inflammation process (36). All the children in the study, except for one, had gastro intestinal symptoms (GI) before commencing CMP-free diet. Although this could explain the results on growth, we found no association between the number nor type of GI symptom and growth parameters.

Feeding difficulties could lead to inadequate nutrient intake, poor weight gain and growth failure. We found significant negative associations between food refusal and underweight and wasting in our study. The same was seen in children reported to have poor appetite. For other feeding parameters there were no associations with nutritional status or growth. A British group found feeding difficulties in 30-40 % of children with food allergy, and faltering growth was more frequent in the group with feeding problems (41). Another study found more feeding difficulties in food allergic children but no effect on growth (42). Although there seems to be an association between feeding problems and reduced growth in our study, we know little about the causation.

Growth and iodine deficiency

We found no correlation between growth and iodine deficiency. Severe iodine deficiency in pregnancy is known to cause growth failure in the offspring. The relationship between postnatal iodine status and growth is less clear, however (27).

Strength and limitations:

There are some methodological limitations to the study. Iodine excretion in the urine is subject to variations in both diet and hydration. We did not correct for hydration and cannot exclude that the differences found between the groups are partly due to such differences.

Collecting two urine samples from each child however, reduces the influence of day to day variation. Intake and iodine content of breastmilk were not measured and this makes it difficult to draw firm conclusions about the effect of diet on iodine status in this study. The growth data are collected by standardized methods and the retrospective data is of good quality, however the time of measurement at inclusion was not standardized and could affect the result. The study group was homogenous in age and symptoms, and the response rate was high which means there is less chance of selection bias.

Conclusion

The present study is the first to look at iodine status in CMPA children. It demonstrates that children with CMPA have high prevalence of iodine deficiency and poor growth, however the two conditions are not linked. Infants reliant on breastmilk as their main iodine source have high risk of iodine deficiency and our recommendation would be to ensure that breastfeeding mothers on CMP free diet are given dietary advice on iodine sources and supplements. Enriched baby cereals along with a hypo allergenic formula are important iodine sources to CMPA infants and recommended in the weaning diet. Allergic children are at risk of growth failure and malnutrition and feeding problems increases the risk of poor nutritional status. Conclusions on causations cannot be drawn. Further studies on iodine content in breastmilk during CMP exclusion, growth and iodine status of older children with CMPA, as well as investigation into the iodine status in healthy breastfed infants are needed.

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ACCEPTED

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Figure legends

Figure 1 Urinary iodine content (ug/L) according to feeding pattern in the study group.

The horizontal line indicates the median, the box indicates the interquartile range (25th percentile to 75th percentile), the whiskers represent observations within 1.5-times the inter quartile range and the stars indicate outliers. The red dotted line indicates the cut off value for insufficient status of 100 ug/L. BF = Breastfed ug/L. BF = Breastfed. There was significantly higher prevalence of iodine deficiency in the mainly breastfed compared to the partially breastfed and the weaned children, $p=0.03$. The difference in median UIC was not statistically significant between the groups ($p= 0,07$).

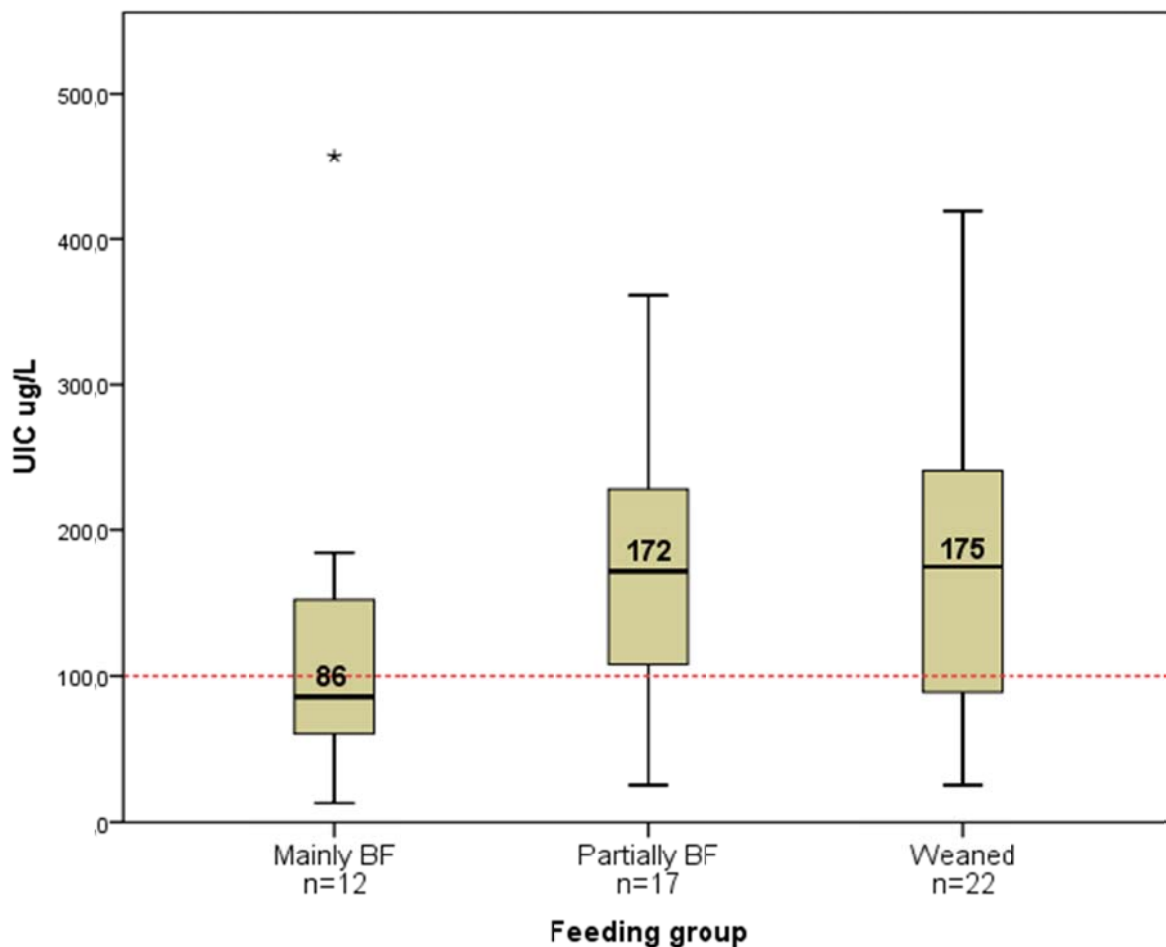


Table 1 Subject characteristics, symptoms, feeding method and urinary iodine content

	Frequency %	Median (range)
<i>Age, months (n=57)</i>		9 (2-23)
0-5 months	12	
6-11 months	61	
12-23 months	26	
<i>Gender (n=57)</i>		
Boys	54	
Girls	46	
<i>Mother's age, years (n=55)</i>		33 (23-42)
<i>Mother's ethnicity (n=55)</i>		
Scandinavian	84	
European	7	
Non-European	9	
<i>Number of weeks on milk elimination diet(n= 48)</i>		17 (4-84)
<i>Symptoms (n=55)</i>		
Number of symptoms		4 (1-8)
Number of organ systems involved		2 (1-4)
GI symptoms	98	
Skin symptoms	46	
Respiratory symptoms	4	
Failure to thrive as a symptom	38	
<i>Feeding difficulties (n=55)</i>	70	
Food refusal	35	
Poor appetite	33	
Number of foods avoided		3 (1-8)
<i>Feeding method (n=55)</i>		
Mainly breastfed	24	
Partially breastfed	33	
Weaned	43	
Using hypo allergenic formula	69	
<i>Urinary iodine Content (UIC), ug/L (n=51)</i>		159 (<25-457)
<100	31	
100-199	37	
200-300	20	
>300	12	

GI = Gastro intestinal

Table 2 Median Iodine intake in ug (interquartile range), and correlations between UIC and intake according to feeding pattern.

	Mainly BF (n=13)	Partially BF (n=18)	Weaned (n=23)	All (n=54)	p	Marginal correlation with UIC (r)		Conditional correlation with UIC (r)					
						All	p	Mainly BF	p	Partially BF	p	Weaned	p
Hypoallergenic formula	0 (0-4.5)	16 (0-32)	43 (15-73)	16 (0-44)	<0.001*	0.212	ns	0.047	ns	0.071	ns	0.068	ns
Enriched baby cereals	6 (0-15)	7.9 (0-13)	1.3 (0-16)	6.5 (0-15)	ns*	0.340	0.02	0.504	ns	0.612	0.009	0.076	ns
Fish	0 (0-0)	1.7 (0-9.6)	0.7 (0-2.6)	0.2 (0-2.6)	0.005*	-0.041	ns	-0.231	ns	-0.410	ns	-0.010	ns
Eggs/poultry	0 (0-0)	0.3 (0-1)	0 (0-1.7)	0 (0-1)	ns*	-0.640	ns	-0.147	ns	-0.255	ns	-0.209	ns
Other foods	1.8 (0.5-2.7)	5.2 (3.6-6.7)	3.8 (1.7-8.8)	3.7 (1.8-5.9)	0.001*	-0.940	ns	0.168	ns	-0.289	ns	.0.225	ns
Iodine from diet	13(8-26)	43 (27-69)	71 (48-98)	45 (24-85)	<0.001*	0.267	ns	0.209	ns	-0.022	ns	0.235	ns
% RDI for iodine	26 (14-47)	77 (55-113)	116 (69-183)	84 (46-144)	<0.001*	0.313	0.03	0.315	ns	0.055	ns	.0218	ns
Energy intake (kcal/kg**)	31 (24-35)	67 (52-90)	92 (80-107)	76 (39-94)	<0.001*	0.230	ns	0.497	ns	-0.222	ns	-0.084	ns

*between feeding patterns **excluding breastmilk

BF = breastfeeding, UIC = urinary iodine content, RDI = recommended daily intake

Table 3 Anthropometric measurements at birth and inclusion and prevalence of malnutrition at inclusion

	N	Anthropometry mean (SD)		Prevalence %	p
		At birth	At inclusion		
Boys	31				
Weight (g)		3466 (547)	9033 (1758)		
Length (cm)		51 (1.8)	73 (6.3)		
Head circumference (cm)		35 (0.9)	46 (2.2)		
Weight SDS		-0.39 (1.1)	-0.46 (1.1)		ns
Length SDS		0.25 (0.8)	-0.35 (1.1)		0.02
SDS head circumference		0.02 (0.7)	0.22 (1.0)		ns
BMI SDS		-0.63	-0.38 (1.2)		ns
Weight/length SDS			-0.31 (1.1)		
Girls	26				
Weight (g)		3283 (340)	8300 (1614)		
Length (cm)		50 (2.3)	72 (7.1)		
Head circumference (cm)		34 (1.5)	44 (2.1)		
Weight SDS		-0.74 (0.7)	-0.61 (0.8)		ns
Length SDS		-0.15 (1.1)	-0.20 (0.7)		ns
SDS head circumference		-0.91 (1.2)	-0.08 (0.9)		ns
BMI SDS		-0.55	-0.72 (1.1)		ns
Weight/length SDS			-0.69 (1.1)		
All	57				
Weight SDS		-0.54 (0.9)	-0.41 (1.0)		
Length SDS		0.07 (1.0)	-0.39 (0.9)		
BMI SDS		-0.59	-0.53 (1.2)		ns
Proportion of children below -2SDS and above +2SDS					
Weight SDS	57				
≤ -2				10.5	
≥ 2				0	
Length SDS	57				
≤ -2				5.3	
≥ 2				0	
BMI SDS	57				
≤ -2				10.5	
≥ 2				1.8	

SDS = standard deviation score