

1 **Cow's milk allergy in children: adherence to a therapeutic elimination diet and**
2 **reintroduction of milk into the diet**

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50 **Abstract**

51 **Background/Objectives:** The basic treatment of cow's milk allergy (CMA) is the
52 elimination of all cow's milk proteins (CMP) from the diet. The present study aimed at
53 characterising the diet of children with a diagnosis of CMA, to assess the degree of adherence
54 to the elimination diet and to evaluate factors associated with the adherence and age of
55 recovery.

56 **Subjects/Methods:** From a birth cohort study, food records of 267 children with diagnosed
57 CMA were studied to define how strictly the elimination diet was adhered to. Subsequent
58 food records were studied to assess the age at reintroduction of milk products in the child's
59 diet.

60 **Results:** The families adhered to the elimination diet of the child with extreme accuracy in
61 85% of the cases. Older and monosensitised children had more often small amounts of CMP
62 in their diet, possibly due the absence of nutritional information by a dietitian/nutritionist.
63 Adherence to the diet was not related to any other sociodemographic factor studied nor to the
64 age at reintroduction of milk products into the diet.

65 **Conclusions:** The therapeutic elimination diet of children with a diagnosed CMA was well
66 adhered to. Low intakes of vitamin D, calcium and riboflavin are of concern in children who
67 follow or have followed a cow's milk-free diet.

68 **Key words**

69 adherence; child, preschool; cow's milk allergy; elimination diet; infant

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71 **INTRODUCTION**

72 Special infant formulas are used instead of cow's milk -based formulas in the diet of milk-
73 allergic infants if the infant is not fully breastfed. If cow's milk allergy (CMA) is diagnosed
74 by a physician, children up to the age of 2 years receive reimbursement for their costs from
75 the Finnish Social Insurance Institution, offering a great opportunity to study CMA. The costs
76 of the special infant formulas are substantial to the society, but **management will not be fully**
77 **effective if the cow's milk free** diet is not followed properly.

78 The risks of a cow's milk-free diet are well documented (Hidvegi *et al.* 2003, Jensen *et al.*
79 2004, Rockell *et al.* 2005). The diet should be balanced, providing adequate amounts of
80 calcium and vitamin D, **either by using the correct substitute foods or by supplementation**
81 (Grimshaw 2006, Vandenplas *et al.* 2007).

82 By asking parents about the level of the elimination, adherence to a therapeutic elimination
83 diet in children has been assessed in three previous studies (Vlieg-Boerstra *et al.* 2006,
84 Eggesbo *et al.* 2001, Allen *et al.* 2009). These studies suggest problems in adhering to an
85 elimination diet, whether warranted or not.

86 So far no study has **objectively assessed** the adherence to a therapeutic elimination diet in
87 children with food allergy, such as in the form of food records. The aims of the present study
88 were to **analyse the diet of children following a cow's milk protein (CMP) -free diet, to study**
89 **the reintroduction of milk products into children's diets, and to evaluate factors associated**
90 **with the adherence and age of development of tolerance.**

91

92 SUBJECTS AND METHODS

93 The Finnish Type 1 Diabetes Prediction and Prevention (DIPP) Study is a multidisciplinary
94 prospective population-based cohort study (Kupila *et al.* 2001). All newborns from the
95 catchment areas of three university hospitals in Finland (Turku, Oulu, and Tampere) are
96 screened for HLA-conferred susceptibility to type 1 diabetes from cord blood samples after
97 parental informed consent. Infants with high and moderate risk for type 1 diabetes (15% of
98 those screened) are invited to participate in the study, excluding children with severe
99 congenital abnormalities or diseases, or whose parents are of non-Caucasian origin or do not
100 understand Finnish, Swedish or English. The DIPP Nutrition study is performed in the Oulu
101 and Tampere University hospitals among children born since October 1996. The local Ethical
102 Committees have approved the study. All families have given their written informed consent
103 to participate in the DIPP study.

104 The presence of special infant formula reimbursement was checked from the Finnish Social
105 Insurance Institution for children in the DIPP Nutrition Study for whom a personal
106 identification code was known to the study (n = 6412). According to clinical practice
107 guidelines, the diagnosis is based on **improvement of symptoms on an elimination diet,**
108 **followed by a positive food challenge outcome** or, in rare cases, on a high IgE level and
109 improvement of symptoms on an elimination diet (Finnish Paediatric Association 2004). For
110 those 398 (6.2%) children who received the reimbursement, information on the month and
111 year of the beginning of the reimbursement (in other words a diagnosed CMA) was obtained.
112 Three-day food records, completed blindly to the purpose of the present study, were collected
113 at the ages of 3 and 6 months, and 1, 2 and 3 years (Kyttälä *et al.* 2010). Parents were given
114 written and oral instructions on how to record everything the child ate and drank during the
115 recording period. Separate food record forms, which also comprised questions e.g. about the

116 origin of the food, were provided for the day care. Three consecutive food record dates were
117 assigned to the family in advance and contained two week and one week end day. Examples
118 were given on how to report food consumption with household or weighed measures.

119 Vitamin and mineral supplement usage was also recorded. Food picture booklets were used to
120 help the estimation of portion sizes (Paturi *et al.* 2006, Ovaskainen *et al.* 2008).

121 Trained research nurses checked the food records with the families, and nutrition researchers
122 entered all the food consumption data using an in-house software into the Finnish national
123 food composition databank Fineli (National Institute for Health and Welfare, Nutrition Unit
124 2009). Food consumption and nutrient intakes, as well as the amount of CMP were calculated
125 as average daily intake using the database. When calculating the amount of CMP, its quantity
126 in all foods was taken into account, except for sausages, fat spreads and commercial biscuits.
127 However, these were taken into account when classifying adherence. The recording of food
128 records was checked for food consumption and nutrient intakes, and for sources of CMP, to
129 ensure valid recording and the validity of the databank used.

130 Information on special diets was collected at the ages of 3 and 6 months, and at 1 and 2 years
131 by open questions and at the age of 3 years by a structured, validated questionnaire (Tuokkola
132 *et al.* 2008). Parental reports of food allergies were double-entered to ensure valid recording.

133 To study the adherence to the cow's milk elimination diet, the next food record within 6
134 months from receiving the special reimbursement was analysed for the level of the
135 elimination. Food records were classified as containing milk products, containing hidden or
136 small amounts of CMP, containing no CMP, and containing no obvious sources of CMP but
137 having recipes for which there is some uncertainty on whether they contain CMP or not. The
138 latter consists of food items from small local bakeries and meat product manufacturers for
139 which the detailed composition could not be traced, and if a commercial product name was
140 not identified in the food record. To study the reintroduction of milk products into the diet,

141 subsequent food records either up to a food record containing milk products, up to the latest
142 food record or up to 3 years of age were further analysed.

143 Background information (parental age and education, the number of siblings) was collected at
144 the time of recruitment. Information on parental smoking, former childbirths of the mother,
145 and place of residence were obtained from the Finnish Medical Birth Registry.

146 SPSS software package 15.0 (SPSS Inc, Chicago, IL, 2006) and R 2.7.0 (R Development
147 Core Team, 2008) were used for statistical analyses. Multinomial logistic regression was
148 applied to study the associations of adherence to the therapeutic elimination diet with
149 background factors. Cox proportional hazards model with an accommodation to interval
150 censored data was used to identify the factors associated with the age of recovery.

151 **RESULTS**

152 The adherence to the cow's milk elimination diet was studied in 267 children (67% of those
153 with the reimbursement), from whom a food record within 6 months from receiving the
154 reimbursement was available. Of these 267 families, 226 had followed the therapeutic
155 elimination diet extremely accurately (Table 1). Small amounts of CMP were seen in the diet
156 of 14 children, but only eight had used actual milk products. In addition, in 19 children there
157 were no obvious sources of CMP, but food records included some recipes or foodstuffs for
158 which there is uncertainty of them containing CMP. **The parents of three children reported
159 being in a process of an oral challenge test with milk and these children were classified
160 adherent.**

161 Those eight children whose parents reported consumption of milk products had a mean intake
162 of 350 g (range 76 g – 1136 g) of milk products during the 3 days. The amount of CMP
163 ranged from 2.0 g to 36.5 g, with a mean intake of 8.5 g and median intake of 4.0 g of CMP.
164 Those 14 children whose parents reported consumption of foodstuffs classified as containing
165 small amounts of CMP had a mean intake of 6.8 g (range 0.0 g – 42.7 g) of milk products
166 during the 3 days. The amount of CMP from these foods ranged from 0.0 g to 9.1 g, with a
167 mean intake of 1.0 g and median intake of 0.02 g.

168 Four of the eight children who had used milk products had also used special infant formulas
169 (Table 2). Mean intakes of calcium were below recommendations, but due to
170 supplementation, mean intakes of vitamin D were sufficient (Table 3). In addition, the intakes
171 of riboflavin and calcium were especially low in food records containing neither milk
172 products nor a special infant formula (n = 89, data not shown).

173 **Of the children with CMA, 59% were boys. The median duration of overall breastfeeding
174 was 6 months and that of exclusive breastfeeding 2 months, and the reimbursement for the**

175 special infant formula was received at a median age of 5 months. Parental age and education,
176 the number of siblings, gender, the duration of breastfeeding, urbanity of the place of living,
177 and the study centre were not associated with the adherence to the therapeutic elimination
178 diet. An older age of the child, as well as lack of other food allergies besides CMA, increased
179 the risk of having small amounts of CMP in the diet ($p < 0.001$ for both; adjusted for
180 maternal age and education, number of siblings, sex, duration of breastfeeding, and study
181 centre).

182 The presence of CMP in the diet within 6 months from receiving the reimbursement did not
183 predict the age at reintroduction of CMP in the diet, nor did place of residence, sex, or
184 parental age or education level. The children of smoking mothers were reintroduced milk
185 products at a younger age than the children of non-smoking mothers, when adjusted for the
186 age and sex of the child, adherence to the elimination diet, maternal education and age, the
187 duration of breastfeeding, and study centre ($p < 0.05$).

188 To study the reintroduction of milk products into the child's diet, subsequent food records
189 were studied in children who initially had adhered to a CMP-free diet. Of the 259 children
190 who had followed the CMP-free diet, subsequent food records were available from 215
191 children, who were observed further. Altogether 120 children had begun to use milk products
192 during follow-up (Fig 1). At the age of 3 years, 55 children were still avoiding milk; 40
193 children had left the study before the age of 3 years and had not begun to use milk products
194 up to the last available study point.

195 The main milk products used after the period of milk elimination were milk (87% of
196 children), cheese (67% of children), and yoghurt (45% of children). However, amounts of
197 milk products used were small, and only 17% of children consumed three glasses of milk,
198 23% used at least two slices of cheese and 15% used at least 1 dl of yoghurt daily.

199 **DISCUSSION**

200 The therapeutic elimination diet in children with a diagnosed CMA was very well adhered to.
201 As many as 85% of the families followed the diet extremely accurately, and an additional 7%
202 had no obvious sources of CMP, but food records contained some foodstuffs with an
203 unknown recipe. Small amounts of CMP were observed in the diet of 5% of the children, and
204 only 3% had used milk products. Those who had consumed small amounts of CMP were
205 older and more often monosensitised, but otherwise sociodemographic factors were not
206 associated with the adherence. By the age of 3 years about a half of the children had begun to
207 use milk products and a quarter of the children were still avoiding CMP. Initial adherence to
208 the elimination diet was not associated with the age of ending the CMP-free diet.

209 Major strengths of the study are the large population studied, and that food records were
210 collected for purposes other than to study the adherence to a CMP elimination diet,
211 diminishing embellishment. On the other hand, there were some inexact elements in some
212 food records: imprecise recording of food items consumed, or not having information
213 detailed enough on products such as from small bakeries and meat product manufacturers
214 dating years back. However, for 93% of the children consumption of foods containing even
215 the smallest amounts of CMP could be accurately evaluated.

216 The limitations of the study lie within possible problems in diagnostics, in not knowing the
217 children's' symptoms, in the cumbrousness of the database used for the purpose of the
218 present study, and in the rather long intervals in which the diets of the children could be
219 studied. Relying on registry data for the diagnosis of CMA may, in part, explain the rather
220 high percentage (6.2%) of children with a diagnosed CMA, despite the national guidelines for
221 the diagnosis (Finnish Paediatric Association 2004). In our previous validation study, we
222 found that not all children underwent an oral challenge test before receiving the diagnosis, so
223 overdiagnosis is possible (Tuokkola *et al.* 2008). In addition, the strong research in the field

224 of food allergies in both university hospitals where the cohort was gathered may increase
225 awareness of the disease and the tendency to seek for a diagnosis.

226 Two of the eight children with milk products in their diet had reportedly used a special infant
227 formula only for 2 weeks, and these children had likely received the reimbursement on false
228 grounds. There were four children, who consumed both a special infant formula, and some
229 milk products. The costs of the use of special infant formulas to society are considerable, and
230 unnecessary use should be avoided. Why eight children had consumed CMP-containing
231 porridges, gruels and other ready-to-use baby foods, is not known.

232 Compared with previous studies addressing the adherence to a therapeutic elimination diet in
233 children with food hypersensitivities, in which approximately one to two thirds of the
234 populations were fully adherent, our study subjects show a much higher adherence (Vlieg-
235 Boerstra *et al.* 2006, Eggesbo *et al.* 2001, Allen *et al.* 2009). The reasons for this are most
236 likely due to methodological differences (questionnaires vs. food records), as well as
237 differences in the populations studied (age groups, the basis for diagnosis, and food allergies).
238 Adherence to dietary treatment of celiac disease shows variation between 30% to 95%,
239 depending on the methods used and the age of the children; no studies report adherence in an
240 age group comparable to the present cohort of children under the age of 3 years (Hommel *et*
241 *al.* 2008). Our results are based on 3-day food records, and we have no knowledge on the
242 diets beyond those days, which is a limitation compared with the studies using questionnaires
243 in defining the level of adherence. However, food records collected blindly to the purpose of
244 the present study are presumed to give an otherwise reliable answer. The total number of days
245 examined in our study amounts to 781. One particular reason for the high level of adherence
246 in our study population could be the requirement for the food industry to mention CMP on
247 food labels, making it easier to follow the elimination diet. Being aware of an increased
248 genetic risk for type 1 diabetes may also increase the adherence to a dietary treatment.

249 In Finland those children who are allergic only to CMP do not often see a nutritionist, which
250 may explain the association between monosensitisation and consuming CMP hidden in
251 foodstuffs. The ingestion of these foods may be considered as accidents or as ignorance, and
252 could be counteracted by dietary counselling, if necessary. Unfortunately, information on
253 visits to a nutritionist was not available to us. On the other hand, monosensitised children
254 may have a milder form of the disease, and actually tolerate small amounts of CMP. As in the
255 study by Eggesbo *et al.*(2001), maternal age and education were not associated with
256 adherence to the elimination diet.

257 When studying the introduction of milk into the child's diet, our main hypothesis was that
258 consuming small amounts of CMP would lead to a quicker recovery from CMA and
259 reintroduction of milk products into the child's diet. However, in this group of children this
260 was not the case; initial adherence was not associated with the age at reintroduction of milk
261 products. Vlieg-Boerstra *et al.* (2006) reported similar findings: in their study unintentional
262 consumption of an allergenic food did not predict the outcome of an oral challenge. Likewise,
263 in the study by Allen *et al.* (2009), adherence to an egg elimination diet did not predict the
264 outcome of a challenge. In our study, the only background factor associated with an earlier
265 introduction of milk products was maternal smoking during pregnancy. We assume that this
266 association does not truly reflect a quicker recovery from CMA, but rather the motivation for
267 following the prescribed diet. The question of whether ingesting small amounts of CMP in a
268 home setting would induce tolerance should be addressed with more frequent follow-up. We
269 could not find any such associations, but this could be due to the lengthy intervals of studying
270 the inclusion of CMP into the diet. The age at recovery from CMA is earlier in the present
271 study than that previously reported by Skripak *et al.* (2007), who studied children with an
272 IgE-mediated CMA. The recovery rate in the present study follows more closely that
273 presented by Vanto *et al.* (2004), who also included both IgE-mediated and non-IgE-

274 mediated CMA in his study. The recovery rate may also be affected by the fact that the
275 diagnosis is done in clinical practice and not by the researchers in the present study.

276 Children following a CMP-free diet require attention to fulfil their needs for calcium, vitamin
277 D and riboflavin. In addition, children recovered from CMA consume less milk products than
278 children on average do (Kyttälä *et al.* 2010); the concern of receiving enough calcium and
279 vitamin D is still present after the inclusion of milk into the diet.

280 In summary, adherence to a therapeutic elimination diet of children with diagnosed CMA was
281 extremely good. Monosensitisation and older age are associated with sloppier adherence,
282 possibly due the absence of nutritional information by a dietitian/nutritionist. Intakes of
283 calcium, riboflavin and vitamin D are of concern in children who follow or have followed a
284 CMP-free diet. This study does not show evidence that small amounts of CMP would lead to
285 a quicker recovery from CMA in a real-life setting.

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298

299 Conflict of interest statement

300 The authors declare no conflict of interest.

301

302 References

- 303 Allen CW, Kemp AS, Campbell DE (2009). Dietary advice, dietary adherence and the
304 acquisition of tolerance in egg-allergic children: a 5-yr follow-up. *Pediatr Allergy Immunol*
305 **20**, 213-218.
- 306 Eggesbo M, Botten G, Stigum H (2001). Restricted diets in children with reactions to milk
307 and egg perceived by their parents. *J Pediatr* **139**, 583-587.
- 308 Finnish Paediatric Association (2004). Food allergy among children. *Duodecim* **120**, 1524-
309 1538.
- 310 Grimshaw KE (2006). Dietary management of food allergy in children. *Proc Nutr Soc* **65**,
311 412-417.
- 312 Hidvegi E, Arato A, Cserhati E, Horvath C, Szabo A, Szabo A (2003). Slight decrease in
313 bone mineralization in cow milk-sensitive children. *J Pediatr Gastroenterol Nutr* **36**, 44-49.
- 314 Hommel KA, Mackner LM, Denson LA, Crandall WV (2008). Treatment regimen adherence
315 in pediatric gastroenterology. *J Pediatr Gastroenterol Nutr* **47**, 526-543.
- 316 Jensen VB, Jorgensen IM, Rasmussen KB, Molgaard C, Prah P (2004). Bone mineral status
317 in children with cow milk allergy. *Pediatr Allergy Immunol* **15**, 562-565.
- 318 Kupila A, Muona P, Simell T, Arvilommi P, Savolainen H, Hamalainen AM *et al.* (2001).
319 Feasibility of genetic and immunological prediction of type I diabetes in a population-based
320 birth cohort. *Diabetologia* **44**, 290-297.

- 321 Kyttälä P, Erkkola M, Ovaskainen ML, Kronberg-Kippila C, Tapanainen H, Veijola R *et al.*
322 (2010). Food consumption and nutrient intake in Finnish 1-6-year-old children. *Public Health*
323 *Nutr (in press)*.
- 324 National Institute for Health and Welfare (2009). *Fineli® - Finnish Food Composition*
325 *Database*. [Http://www.Fineli.Fi](http://www.Fineli.Fi).
- 326 Paturi M, Nieminen R, Reinivuo H, Ovaskainen ML (2006). Picture book of food portion
327 sizes, Edita Prima Oy, Helsinki.
- 328 Ovaskainen ML, Paturi M, Reinivuo H, Hannila ML, Sinkko H, Lehtisalo J *et al.* (2008).
329 Accuracy in the estimation of food servings against the portions in food photographs. *Eur J*
330 *Clin Nutr* **62**, 674-681.
- 331 Rockell JE, Williams SM, Taylor RW, Grant AM, Jones IE, Goulding A (2005). Two-year
332 changes in bone and body composition in young children with a history of prolonged milk
333 avoidance. *Osteoporos Int* **16**, 1016-1023.
- 334 Skripak JM, Matsui EC, Muud K, Wood RA (2007). The natural history of IgE-mediated
335 cow's milk allergy. *J Allergy Clin Immunol* **120**, 1172-1177.
- 336 Tuokkola J, Kaila M, Pietinen P, Simell O, Knip M, Virtanen SM (2008). Agreement
337 between parental reports and patient records in food allergies among infants and young
338 children in Finland. *J Eval Clin Pract* **14**, 984-989.
- 339 Vandenas Y, Brueton M, Dupont C, Hill D, Isolauri E, Koletzko S *et al.* (2007). Guidelines
340 for the diagnosis and management of cow's milk protein allergy in infants. *Arch Dis Child* **92**,
341 902-908.

- 342 Vanto T, Helppila S, Juntunen-Backman K, Kalimo K, Klemola T, Korpela R *et al.* (2004).
343 Prediction of the development of tolerance to milk in children with cow's milk
344 hypersensitivity. *J Pediatr*, **144**, 218-222.
- 345 Vlieg-Boerstra BJ, van der Heide S, Bijleveld CM, Kukler J, Duiverman EJ, Wolt-Plompen
346 SA *et al.* (2006). Dietary assessment in children adhering to a food allergen avoidance diet
347 for allergy prevention. *Eur J Clin Nutr* **60**, 1384-1390.
- 348

349 Table 1. Adherence to cow's milk protein (CMP) elimination diet within 6 months after the
 350 diagnosis of cow's milk allergy, n = 267

Child has consumed	n	%
No CMP	226	85.0
Some uncertain food items without obvious sources of CMP ¹	19	7.1
Hidden or small amounts of CMP ²	14	4.9
Milk or milk products ³	8	3.0

351 ¹Meat and bakery products for which a recipe was not known, or if a commercial name of a
 352 meat or bakery product or a ready-to-use baby food was not specified

353 ²CMP in food items such as industrial baby-foods, bakery and meat products, or fat spreads
 354 containing CMP as an ingredient, cookies with milk chocolate, or a few cheese puffs.

355 ³Milk products used were cheese, ice cream, infant formulas, as well as milk-containing
 356 infant porridges, and gruels.

357

358

359 Table 2. Adherence to the cow's milk elimination diet: milks and special infant formulas that
 360 were used during the 3 study days¹ within 6 months from receiving a diagnosis of cow's milk
 361 allergy by age (each child may be accounted for more than once if having consumed more
 362 than one type of milk or drink; number of children = 264).

	3 months n = 48	6 months n = 106	1 year n = 106	2 years n = 4
Breast milk	26	41	17	0
Amino-acid formula	6	26	25	0
Hydrolysed formula	22	48	47	1
Soy formula	3	7	24	2
Cow's milk formula ²	1	6	1	0
Cow's milk ²	0	0	1	0
Soydrink	0	0	6	0
Oatdrink	0	0	2	1
Ricedrink	0	0	2	1

363 ¹Those who had reported an ongoing challenge test with cow's milk are not included.

364 ²The reason for the consumption of cow's milk formula and cow's milk is not known.

365 Table 3. Adherence to the cow's milk elimination diet: mean (SD) intakes of energy and
 366 certain nutrients, intake from foods and supplements together, of non-breastfed children by
 367 age¹

		3 months (n = 22)	6 months (n = 67)	1 year (n = 89)	2 years (n = 4)
Energy kJ ²		2430 (277)	2800 (554)	3910 (760)	4370 (325)
Protein	% of energy	10.2 (0.8)	10.2 (1.6)	12.2 (2.7)	12.1 (2.9)
Carbohydrates	% of energy	40.7 (5.3)	50.8 (7.4)	55.0 (6.7)	56.1 (5.5)
Fat	% of energy	49.0 (5.1)	38.7 (7.0)	32.4 (7.2)	31.2 (7.7)
Calcium ³	mg	467 (60)	430 (130)	473 (191)	780 (248)
Vitamin D ⁴	µg	14.7 (4.2)	14.1 (4.0)	13.3 (4.2)	12.3 (10.7)
Riboflavin ⁵	mg	0.84 (0.26)	0.74 (0.25)	0.81 (0.38)	1.14 (0.55)

368 ¹within 6 months from receiving a reimbursement of the special infant formulas

369 ²Estimated needs for energy at 3 months 2100 kJ for girls and 2200 kJ for boys, at 6 months
 370 for 2600 kJ for girls and 2700 kJ for boys, at 1 year 3400 kJ for girls and 3700 kJ for boys,
 371 and at the age of 2 years 4400 kJ for girls and 4700 kJ for boys.

372 ³Recommended intake 540 mg for 6 – 11 months of age, 600 mg for 1-2 years of age

373 ⁴Recommended intake 10 µg for 6 – 23 months of age, 7.5 µg for 2 years of age

374 ⁵Recommended intake 0.5 mg for 6 – 11 months of age, 0.6 mg for 12-23 months of age, and
 375 0.7 mg for 2 years of age

Figure 1. Number of children, in whom cow's milk was reintroduced into the diet for the first time after the diagnosis of cow's milk allergy. In addition, 40 children had dropped out from the study before the age of 3 years, and had not reintroduced milk products into the diet at the last available food record.

