

Mislabeled cow's milk allergy in infants: a prospective cohort study

Arnon Elizur,^{1,2} Michal Cohen,¹ Michael R Goldberg,² Nelly Rajuan,² Yitzhak Katz^{1,2}

ABSTRACT

Background Although cow's milk allergy (CMA) is one of the most common food allergies, mislabelling non-allergic infants as being allergic to cow's milk is more common. Despite this, characteristics of families and infants with mislabelled CMA are lacking.

Methods Using a prospective population-based study, we identified infants with any possible adverse reaction to cow's milk (n=381) from a cohort of 13 019 infants followed from birth. They had a detailed history taken, skin prick tests and an oral food challenge when indicated. Infants with symptoms for which the causative relationship to cow's milk protein was excluded were compared with infants with IgE-mediated CMA and with a control group, and followed for 2–5 years.

Results Overall, 243 infants (1.87%) with mislabelled CMA were identified. Compared with 66 infants with IgE-mediated CMA, those with mislabelled CMA presented earlier and with symptoms usually involving a single organ system. Doctor-diagnosed atopic dermatitis (AD) was associated with mislabelled CMA ($p<0.001$), manifested primarily as skin rashes, compared with control infants. Higher maternal and paternal education were also associated with mislabelled CMA ($p=0.007$ and $p=0.035$, respectively) and manifested primarily as non-specific symptoms.

Conclusions Mislabelled CMA typically presents within the first 3 months of life involving a single organ. Infant AD and higher parental academic education are associated with mislabelled reactions. Better parental and physician awareness of the importance of objectively diagnosing milk allergy is required to avoid mislabelling of infants as being allergic to cow's milk and to prevent potential nutritional deficiencies.

with or without diarrhoea,⁴ abdominal pain and bloody stools⁷) and develops several hours after ingestion of the offending food. Atopic dermatitis (AD) is occasionally associated with food-specific IgE, and many consider worsening of eczema as an expression of CMA.^{8–9} Diagnosis of IgE-CMA depends on the identification of specific IgE antibodies to the offending food, but in both IgE- and non-IgE-CMA an oral food challenge (OFC) is confirmatory.¹⁰

Multiple adverse effects are often falsely attributed by parents to the consumption of cow's milk, leading to infants being categorised as having CMA. One in every third child was previously reported to have an adverse reaction to food before 2 years of age, and milk was most commonly incriminated (7.5% at 1 year of age).¹¹ A similar rate was found in another epidemiological study, but the diagnosis was confirmed in only a third of those.¹²

Mislabeled CMA often leads to the unnecessary adoption of an elimination diet, with significant inconvenience and even potential risks.^{13–15} A few studies on infants with mislabelled CMA have found an association with a higher level of maternal education. However, no study to date has separately described these infants. In this study, infants with mislabelled CMA were identified from 13 019 infants followed prospectively from birth for 2–5 years. Symptoms related to consumption of cow's milk protein (CMP) are described, and characteristics of infants and families are compared with a group of infants with IgE-CMA and a control group with no reactions to CMP.

MATERIALS AND METHODS

Study population

The study protocol, part of a large-scale prospective research project studying the development of CMA in children, was approved by the Helsinki Review Board at Assaf Harofeh Medical Center, and informed consent was obtained from all parents.⁴ Of a cohort of 13 234 newborns, born over a 2-year period, 13 019 (98.38%) completed the study. Siblings were excluded. Parents were asked to contact the allergy clinic immediately after any adverse reaction (cutaneous, respiratory, gastrointestinal (GI) or systemic) suspected of being related to maternal or infant consumption of CMP. All parents were contacted 3 months after birth and subsequently bimonthly, and infants' feeding patterns were recorded. Any parent noting a possible adverse event related to CMP was invited for further evaluation. In addition, infants whose parents avoided exposing them to CMP despite having discontinued exclusive or almost exclusive breast feeding, because of general beliefs about the risks of this exposure,

¹Department of Pediatrics, Assaf Harofeh Medical Center, Sackler School of Medicine, Zerifin, Israel

²Institute of Allergy, Asthma and Immunology, Assaf Harofeh Medical Center, Sackler School of Medicine, Zerifin, Israel

Correspondence to

Dr Arnon Elizur, Institute of Allergy, Asthma and Immunology, Assaf Harofeh Medical Center, Sackler School of Medicine, Zerifin 70300, Israel; elizura@gmail.com

AE and MC contributed equally.

Received 24 July 2012

Revised 6 February 2013

Accepted 24 February 2013

INTRODUCTION

The prevalence of food allergy is low, yet it has been extensively studied.^{1–4} In contrast, mislabelled food allergy is more common but is relatively under-studied. In one study, 30% of women reported that they, or a member of their family, had an allergy to a food product, and 22% of the women avoided particular foods because it may contain an allergen.⁵ In another study, 28% of children had symptoms suspected by their parents or primary care physicians of being related to certain foods, but only 8% had confirmed and probable reactions reproduced.⁶

Cow's milk allergy (CMA) is categorised as IgE-mediated or non-IgE-mediated. IgE-CMA typically presents with urticaria, vomiting, cough and wheeze, and, less commonly, hypotension, and develops within minutes to 1–2 h of ingesting cow's milk. Non-IgE-CMA presents with predominantly abdominal symptoms (repetitive vomiting,

To cite: Elizur A, Cohen M, Goldberg MR, et al. *Arch Dis Child* Published Online First: [please include Day Month Year] doi:10.1136/archdischild-2012-302721

Original article

were also evaluated. Overall, 381 infants were avoiding CMP (figure 1). After the initial evaluation, 66 infants were diagnosed with IgE-mediated CMA (IgE-CMA), 36 were diagnosed with food protein-induced enterocolitis syndrome, 21 were diagnosed with CMP-associated rectal bleeding, and 15 patients had other symptoms for which a causative relationship to CMP could not be excluded. In the remaining 243 infants (1.87%), categorised as mislabelled CMA, a causal relationship between the complaint and the consumption of CMP was ruled out after a detailed history on the temporal association between the infant's symptoms and the consumption of CMP, the nature of the symptoms, and their reproducibility on repeated exposures. In most cases, the symptoms were not compatible with IgE- or non-IgE-mediated CMA. Skin prick tests (SPTs) and OFCs were performed when history alone was inconclusive.

Evaluation and follow-up

Parents of infants categorised as mislabelled CMA were encouraged to resume CMP-based feeding, and the infants were followed for reappearance of symptoms. In general, infants were followed until their cow's milk-related symptoms resolved. In infants with IgE-CMA, the follow-up extended up to 5 years. Infants with mislabelled adverse reactions to CMP were compared with the group of infants diagnosed with IgE-CMA (n=66) and with the whole group of healthy infants with no adverse effects related to CMP (n=12 638). For analyses of variables that were not available for the whole cohort, 232 infants from this group were randomly chosen, using MATLAB's randperm function, to serve as a control group. Of these, 156 families (312 parents) were successfully recruited for evaluation.

Skin prick tests

SPTs for CMP and soy were performed in the infants using the volar arm and reading the reaction after 20 min. A negative control and histamine (1 mg/ml; ALK-Abelló, Port Washington, New York, USA) were used. A wheal response ≥ 3 mm was considered positive.⁴

Oral challenge

An OFC to cow's milk formula was performed using Materna (Maabarot Products Ltd, Maabarot, Israel) infant formula unless

a history of a life-threatening reaction manifested as either anaphylaxis or severe respiratory distress on exposure to milk protein was reported. Increasing doses were given, from a 1:10 diluted formula of 1.0 ml (2.7 mg CMP) up to 120 ml (3.24 g CMP) every 30 min. The challenge was terminated if a cutaneous, respiratory, GI or systemic response was observed. In the case of a negative challenge result, the infants were observed for 3 h, and subsequent contact was made 2 weeks later to enquire about their feeding habits.

Statistical analysis

Statistical analyses were performed with SPSS software (V16). Continuous variables were analysed using the Student t test or one-way analysis of variance and are presented as mean $\pm$ SD. Fisher's exact test was used to analyse differences between groups in categorical variables. All analyses were two-tailed, and a p value <0.05 was considered significant.

RESULTS

Clinical presentation of infants with mislabelled CMA

Most infants with mislabelled CMA (n=209, 86%) were born full-term, and 16.3% were born by caesarean section. Half were male. Breast feeding was used for 192 (79%) infants, and 166 (86.5%) were exclusively breast fed initially. Soy-based formula was given exclusively or with breast feeding immediately after birth in 27 infants. For analysing age at onset of symptoms, infants who were not fed CMP but were not suspected of having CMA (n=27) were excluded. In an additional 22 infants, parents could not remember when symptoms appeared. Almost 30% of the remaining 194 infants presented within the first month of life, and nearly half presented within the first 2 months (figure 2). In contrast, only 9% of infants with IgE-CMA presented within the first month, and 20% presented within the first 2 months of life.

A single organ was affected in most infants with mislabelled CMA (73.7%), with GI (115 infants) and cutaneous (110 infants) manifestations being the most common (table 1). In contrast, infants with IgE-CMA typically (70%) presented with symptoms involving several organ systems. Infants with IgE-CMA experienced significantly more cutaneous and respiratory symptoms ($p<0.001$ for both) and fewer non-specific symptoms ($p=0.008$) than infants with mislabelled CMA (table 1).

Symptoms were attributed to CMP consumption by primary care physicians in 107 infants, by other healthcare providers in 30 infants, and by the parents in 67 infants. The parents of 39

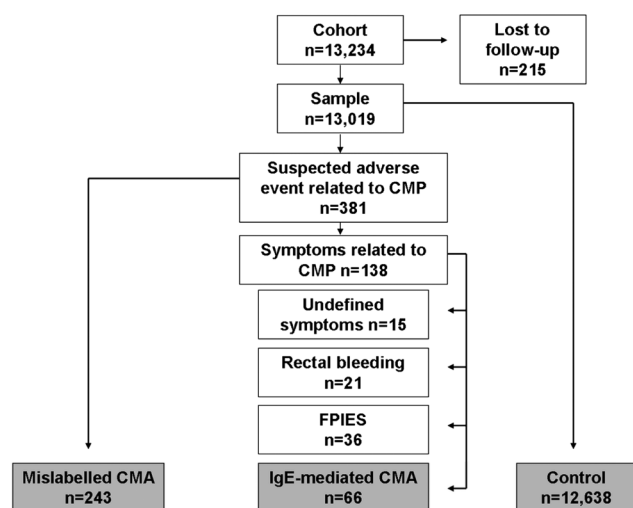


Figure 1 Cow's milk protein (CMP)-related syndromes in the study population. A flow chart showing categorisation of the study population into specific syndromes associated with CMP consumption. FPIES, food protein induced enterocolitis syndrome.

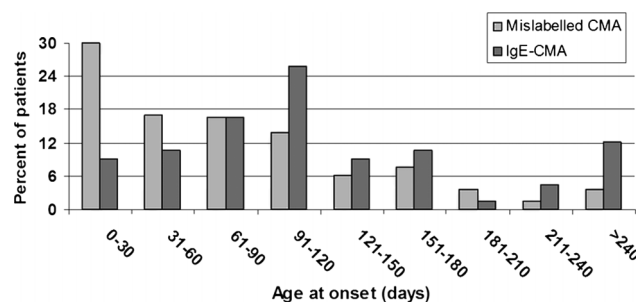


Figure 2 Age at onset of mislabelled cow's milk protein (CMP)-related symptoms. This figure shows the age, in days, at which symptoms related to mislabelled CMP intolerance or IgE-mediated cow's milk allergy (CMA) initially appeared. Infants who were not consuming CMP for non-specific reasons but who had no CMP-related symptoms were excluded.

Table 1 Clinical characteristics of infants with mislabelled and IgE-CMA

Organ system	Reaction	Mislabelled CMA (n=243)			IgE-CMA (n=66)	p Value*
		n (%)	SPT, n (–ve)	OFC (n)	n (%)	
Skin	Rash	108 (44.4)	104 (78)	49	63 (95.5)	<0.001
	Dry skin	3 (1.2)			0	
	Swelling	9 (3.7)			17 (25.8)	
	Itching	2 (0.8)			7 (10.6)	
GI	Diarrhoea	45 (18.5)	106 (96)	38	2 (3.0)	0.57
	Bloody stools	2 (0.8)			0	
	Abdominal pain	15 (6.2)			0	
	Constipation	7 (2.9)			0	
	Vomiting	53 (21.8)			34 (51.5)	
	Regurgitation	19 (7.8)			0	
	Refusal to eat	4 (1.6)			0	
	Colic	4 (1.6)			0	
Respiratory	Cough	13 (5.3)	18 (15)	5	9 (13.6)	<0.001
	Sputum	5 (2.1)			0	
	Shortness of breath	8 (3.3)			10 (15.2)	
	Rhinorrhoea	9 (3.7)			4 (6.1)	
	Crackles	1 (0.4)			0	
	Stridor	1 (0.4)			0	
Other	Restlessness	28 (11.5)	38 (37)	12	8 (12.1)	0.008
	Failure to gain weight	8 (3.3)			0	
	Previous child	15 (6.2)			0	
	Fear/belief†	8 (3.3)			0	
	Sleepiness	2 (0.8)			0	

*p values represent differences in skin, GI, respiratory and other symptoms between mislabelled and IgE-CMA.

†Fear of CMP sensitivity or belief that CMP is not healthy.

CMA, cow's milk allergy; GI, gastrointestinal; OFC, oral food challenge; SPT, skin prick tests.

infants could not remember why CMP was discontinued and by whom. After CMA was suspected, infants' diet was changed to soy-based formula in 142 cases and elemental formula in 30 cases, and exclusive breast feeding was resumed in 14 infants. Seven infants were fed with another CMP-based formula, and 50 infants had no dietary modifications.

Clinical evaluation

SPT to CMP, performed in 197 infants at a mean age of 6.5 ± 4.7 months, was negative in 166, positive in 19, and equivocal in 12 infants. Of the 19 infants with a positive SPT, 18 had a negative OFC and subsequently consumed CMP. The remaining infant was consuming CMP 5 months later with no adverse effects. Of the 12 infants with equivocal SPT results, four had a negative OFC and the rest began consuming CMP shortly after with no adverse effects. The remaining 46 infants, who were not skin prick tested, were not consuming CMP because of a sibling with CMA, the parents' belief that cow's milk is not healthy, or intermittent symptoms temporally unrelated to, and not compatible with, any of the defined entities of CMA. CMP was reintroduced into the infant's diet after evaluation in 72 infants (29.6%). A total of 82 infants (33.7%) were consuming CMP within the first 6 months of life, and an additional 85 (35%) during the second half of the first year. All 243 infants were consuming CMP by the age of 3 years.

AD and higher parental education are associated with mislabelled CMA

No significant differences in most perinatal and demographic characteristics were found between infants with mislabelled CMA, infants with IgE-CMA and control infants, but significantly more infants with IgE-CMA were breast fed ($p=0.001$). Jewish ethnicity was associated with both IgE-mediated and mislabelled CMA (table 2). AD was doctor-diagnosed in

35 (15.3%) infants with mislabelled CMA compared with only 4.7% of infants with IgE-CMA and 3.2% of control infants ($p<0.001$ and $p=0.03$, respectively). Infants with mislabelled CMA, diagnosed with AD, had more skin-related symptoms than those without AD (76.5% vs 40.8%, $p<0.001$), but these were not described as AD flare-ups.

Maternal and paternal education level was higher in parents of infants with mislabelled CMA than parents of control infants ($p=0.002$ and $p=0.01$, respectively) but comparable to parents of infants with IgE-CMA. Infants of mothers with ≤ 12 years of education had significantly more GI symptoms than those of mothers with 12–15 years or >15 years of education (61% vs 36.8% vs 44.3%, respectively, $p=0.015$). In contrast, infants of mothers with >15 years of education had significantly more non-specific symptoms than those of mothers with 12–15 years or ≤ 12 years of education (41.9% vs 20.9% vs 24.4%, $p=0.02$). We did not find such differences for paternal education. A history of maternal allergic disease (asthma, AD and allergic rhinitis) was associated with IgE-mediated ($p=0.03$), but not with mislabelled, CMA.

DISCUSSION

We describe a cohort of infants with mislabelled adverse reactions to CMP, derived from a large-scale population-based study. Mislabelled reactions to CMP developed in the first 3 months of life and typically involved a single organ. AD was often incorrectly attributed to CMP consumption, and a range of non-specific responses to CMP were more prevalent in infants of mothers with a higher level of education.

The prevalence of self-reported CMA is highly variable, ranging from 3.4% to 18% worldwide and in Israel,^{2 16–20} and our finding of 2.8% falls within this global range. Perception of CMA often appears at an earlier age than other food allergies, based on questionnaires, but the exact age of onset is often not

Original article

Table 2 Comparison of infants with mislabelled cow's milk protein intolerance, infants with IgE-mediated CMA and healthy controls

Subcategory	Control (n=12638)	Mislabelled CMA (n=243)	IgE-CMA (n=66)	p Value 1*	p Value 2†
Perinatal					
Gestational age at birth	39.2±1.9	39±2.1	39.2±1.7	0.24	0.51
C-section delivery	15.4	16.3	21.2	0.72	0.36
Birth weight	3.2±0.59	3.2±0.56	3.3±0.42	0.35	0.63
Male gender	50.7	50.6	62.1	1.0	0.13
Infant atopic dermatitis‡	3.2	15.3	4.7	<0.001	0.03
Family characteristics					
Maternal age	29.7±5.2	29.8±4.5	29.6±4.8	0.88	0.78
Breast feeding	75.5	79.4	95.5	0.18	0.001
Child order in family	2.4±1.5	2.3±1.5	1.9±1.2	0.63	0.06
Urban residence	86.2	85.6	80.3	0.79	0.34
Ethnicity					
Jewish	81.0	92.6	95.5	<0.001	0.6
Muslim	13.7	4.1	1.5		
Other	5.3	3.3	3		
Maternal education‡	13.3±3.3	14.3±2.8	13.8±2.7	0.002	0.18
Paternal education‡	13.5±3.5	14.3±2.8	13.9±3.1	0.01	0.26
Household smoking‡	38.2	36.3	40.6	0.74	0.55
Maternal allergic disease‡	17.3	16.7	29.2	0.89	0.03
Paternal allergic disease‡	8.7	14.0	15.9	0.15	0.69

Values are mean±SD or percentage.

*Mislabelled CMA versus control.

†Mislabelled CMA versus IgE-CMA.

‡These variables were compared with a subgroup of 156 control patients. CMA, cow's milk allergy.

detailed.²¹ Most infants in our cohort presented during the first 3 months of life, and many (~30%) presented during the first month. In contrast, the age of peak presentation for IgE-CMA was 3–4 months. The delayed presentation for IgE-CMA suggests that mislabelling of CMA and an elimination diet may potentially lead to subsequent development of IgE-CMA, although this did not occur in this study.

IgE-mediated reactions to food typically involve the skin, GI tract and respiratory tract.²² Most patients with IgE-CMA in our study experienced reactions involving several organs, while most mislabelled reactions to CMP affected a single organ. In addition, whereas in IgE-CMA, urticarial rash was almost a universal finding and non-specific symptoms were rare, GI symptoms were more common in infants with mislabelled CMA, and many infants had non-specific symptoms. These differences may serve as clinical clues for the primary care physician regarding the nature of the infant's symptoms, but cannot replace additional evaluation including SPTs.

Food allergy is often diagnosed in patients with atopic eczema, ranging from 33% to 65% in some series.^{23–26} However, the benefit of an elimination diet is limited,²⁷ and an OFC is recommended to confirm food allergy status.²⁸ However, elimination diets are often tried for AD, carrying risks of malnutrition and development of anaphylactic reactions on subsequent exposure, regardless of whether an offending food is found.^{13 14 29–30} Most infants diagnosed with AD in our study had mild eczema; only two had a positive SPT and most either never discontinued CMP or began consuming it shortly after our evaluation without worsening of their eczema. These findings emphasise the need to rely on an OFC for diagnosing CMA in infants with AD in the absence of anaphylaxis.

A higher level of maternal education was shown to be associated with mislabelled food intolerance in children in studies

based on questionnaires or performed when children were 2 years old and mislabelled reactions resolving before this age might have been missed.^{21 31} We found that higher maternal education was associated primarily with non-specific symptoms (restlessness, parental belief that CMP is not healthy, and having a previous child with suspected CMA). Parents with a higher level of education might be more influenced by national education campaigns, and these could help to reduce the burden of mislabelled CMA in this population. The finding that mislabelled CMA is associated with Jewish ethnicity may reflect different levels of education in different ethnic populations in Israel. Alternatively, Jewish families may be more comfortable than non-Jewish patients about going to their family doctor regarding minor problems.

Several lines of evidence suggest that we did not miss a significant number of infants with 'transient allergy'. The clinical characteristics of the infants did not match any of the well-defined CMA phenotypes, most infants had SPT and/or OFC results that were usually negative, and many GI symptoms previously considered to be due to non-IgE-mediated CMA are not currently considered to be symptoms of allergy.⁷ Furthermore, most of the infants with GI-related symptoms in our study resumed CMP consumption during the first year of life without sequelae. Still, we cannot exclude the possibility that a small minority of the infants had non-IgE-mediated, short-lived and atypical CMP-related symptoms.

Another potential bias is that the active follow-up during the study period made parents more aware of potential milk-related symptoms. However, in the majority of infants, symptoms developed and dietary modifications were made before the first contact. Also, the prevalence of mislabelled CMA in our population matches descriptions elsewhere. With such active follow-up, undetected CMA could not significantly affect our results.

In summary, infants with mislabelled CMA are characterised by early onset of non-specific symptoms and by involvement of a single organ system. Infant AD and higher maternal education are associated with a specific set of symptoms. Thorough evaluation should be performed in every patient with suspected CMA so that true CMA can be treated appropriately, and mislabelled CMA can be identified, and the use of unwarranted and potentially harmful elimination diets prevented.

What is already known on this topic

- Mislabelled cow's milk allergy (CMA) is more common than actual CMA and often leads to use of an elimination diet.
- A few studies have briefly described characteristics of infants with mislabelled CMA; most are based on questionnaires only.
- A detailed description of reactions mislabelled as related to cow's milk, and their association with the infant and family characteristics, is lacking.

What this study adds

- Most infants with mislabelled CMA present within the first 3 months of life.
- Symptoms are often non-specific and typically involve a single organ.
- Infant atopic dermatitis and higher maternal academic education are associated with a specific set of symptoms mislabelled as related to CMA.

Contributors All authors contributed to the conception and design of the study. AE, MC and YK contributed to analysis and interpretation of data and drafting the article. NR: In partial fulfillment of a PhD thesis at the Sackler School of Medicine, Tel Aviv, Israel. All authors have given final approval of the version to be published.

Funding Michael R Goldberg is funded by a Kamea grant from the Chief Scientist office, Ministry of Health, Israel. Israeli Dairy Board.

Competing interests None.

Patient consent Obtained.

Ethics approval Helsinki Review Board at Assaf Harofeh Medical Center.

Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCES

- 1 NIAID-Sponsored Expert Panel Boyce JA, Assa'ad A, Burks AW, *et al.* Guidelines for the diagnosis and management of food allergy in the United States: report of the NIAID-sponsored expert panel. *J Allergy Clin Immunol* 2010;126:S1–58.
- 2 Katz Y, Rajuan N, Goldberg MR, *et al.* Early exposure to cow's milk protein is protective against IgE-mediated cow's milk protein allergy. *J Allergy Clin Immunol* 2010;126:77–82.e1.
- 3 Elizur A, Rajuan N, Goldberg MR, *et al.* Natural course and risk factors for persistence of IgE-mediated cow's milk allergy. *J Pediatr* 2012;161:482–7.
- 4 Katz Y, Goldberg MR, Rajuan N, *et al.* The prevalence and natural course of food protein-induced enterocolitis syndrome to cow's milk: a large-scale, prospective population-based study. *J Allergy Clin Immunol* 2011;127:647–53.e1–3.
- 5 Sloan AE, Powers ME. A perspective on popular perceptions of adverse reactions to foods. *J Allergy Clin Immunol* 1986;78(1 Pt 2):127–33.
- 6 Bock SA. Prospective appraisal of complaints of adverse reactions to foods in children during the first 3 years of life. *Pediatrics* 1987;79:683–8.
- 7 Elizur A, Cohen M, Goldberg MR, *et al.* Cow's milk associated rectal bleeding: a population based prospective study. *Pediatr Allergy Immunol*. 2012;23:766–70.
- 8 Sicherer SH, Sampson HA. Food hypersensitivity and atopic dermatitis: pathophysiology, epidemiology, diagnosis, and management. *J Allergy Clin Immunol*. 1999;104:S114–22.
- 9 Wood RA, Sicherer SH, Vickery BP, *et al.* The natural history of milk allergy in an observational study. *J Allergy Clin Immunol* 2013;131:805–12.
- 10 Burks AW, Tang M, Sicherer S, *et al.* ICON: food allergy. *J Allergy Clin Immunol* 2012;129:906–20.
- 11 Eggesbø M, Halvorsen R, Tambs K, *et al.* Prevalence of parentally perceived adverse reactions to food in young children. *Pediatr Allergy Immunol* 1999;10:122–32.
- 12 Høst A, Halken S. A prospective study of cow milk allergy in Danish infants during the first 3 years of life. Clinical course in relation to clinical and immunological type of hypersensitivity reaction. *Allergy* 1990;45:587–96.
- 13 Johnston GA, Bilbao RM, Graham-Brown RA. The use of dietary manipulation by parents of children with atopic dermatitis. *Br J Dermatol* 2004;150:1186–9.
- 14 David TJ. Anaphylactic shock during elimination diets for severe atopic eczema. *Arch Dis Child* 1984;59:983–6.
- 15 Schrander JJP, van den Bogart JP, Forget PP, *et al.* Cow's milk protein intolerance in infants under 1 year of age: a prospective epidemiological study. *Eur J Pediatr* 1993;152:640–4.
- 16 García Ara MC, Boyano Martínez MT, Díaz Pena JM, *et al.* Incidence of allergy to cow's milk protein in the first year of life and its effect on consumption of hydrolyzed formula. *An Pediatr (Barc)* 2003;58:100–5.
- 17 Venter C, Pereira B, Grundy J, *et al.* Incidence of parentally reported and clinically diagnosed food hypersensitivity in the first year of life. *J Allergy Clin Immunol* 2006;117:1118–24.
- 18 Dalal I, Binson I, Reifin R, *et al.* Food allergy is a matter of geography after all: sesame as a major cause of severe IgE-mediated food allergic reactions among infants and young children in Israel. *Allergy* 2002;57:362–5.
- 19 Steinke M, Fiochi A, Kirchlechner V, *et al.*; REDALL study consortium. Perceived food allergy in children in 10 European nations. A randomised telephone survey. *Int Arch Allergy Immunol* 2007;143:290–5.
- 20 Berger-Achituv S, Shohat T, Romano-Zelekha O, *et al.* Widespread use of soy-based formula without clinical indications. *J Pediatr Gastroenterol Nutr* 2005;41:660–6.
- 21 Rona RJ, Chinn S. Parents' perception of food intolerance in primary school children. *Br Med J* 1987;294:863–6.
- 22 Rancé F, Grandmottet X, Grandjean H. Prevalence and main characteristics of schoolchildren diagnosed with food allergies in France. *Clin Exp Allergy* 2005;35:167–72.
- 23 Burks AW, Mallory SB, Williams LW, *et al.* Atopic dermatitis: clinical relevance of food hypersensitivity reactions. *J Pediatr* 1988;113:447–51.
- 24 Sampson HA, Mccaskill CC. Food hypersensitivity and atopic dermatitis: evaluation of 113 patients. *J Pediatr* 1985;107:669–75.
- 25 Sampson HA. The immunopathogenic role of food hypersensitivity in atopic dermatitis. *Acta Derm Venerol* 1992;176:34–7.
- 26 Koletzko S, Filipiak-Pittroff B, von Berg A, *et al.* German Infant Nutritional Intervention Study Group. Supplementation with cow's milk at birth is not recommended. *J Allergy Clin Immunol* 2011;127:836–8.
- 27 Bath-Hextal F, Delamere FM, Williams HC. Dietary exclusions for improving atopic eczema in adults and children: systematic review. *Allergy* 2009;64:258–64.
- 28 Fleischer DM, Bock AS, Spears GC, *et al.* Oral food challenges in children with diagnosis of food allergy. *J Pediatrics* 2011;158:578–83.
- 29 Flinterman AE, Knulst AC, Meijer Y, *et al.* Acute allergic reactions in children with AEDS after prolonged cow's milk elimination diets. *Allergy* 2006;61:370–4.
- 30 Katz Y, Rajuan N, Goldberg MR, *et al.* Supplementation with cow's milk at birth is not recommended. *J Allergy Clin Immunol* author reply 2011;127:839–40.
- 31 Eggesbø M, Botten G, Stigum H. Restricted diets in children with reactions to milk and egg perceived by their parents. *J Pediatr* 2001;139:583–7.



Mislabelled cow's milk allergy in infants: a prospective cohort study

Arnon Elizur, Michal Cohen, Michael R Goldberg, et al.

Arch Dis Child published online March 26, 2013

doi: 10.1136/archdischild-2012-302721

Updated information and services can be found at:

<http://adc.bmj.com/content/early/2013/03/25/archdischild-2012-302721.full.html>

These include:

References

This article cites 31 articles, 3 of which can be accessed free at:
<http://adc.bmj.com/content/early/2013/03/25/archdischild-2012-302721.full.html#ref-list-1>

P<P

Published online March 26, 2013 in advance of the print journal.

Email alerting service

Receive free email alerts when new articles cite this article. Sign up in the box at the top right corner of the online article.

Topic Collections

Articles on similar topics can be found in the following collections

[Immunology \(including allergy\)](#) (1168 articles)
[Epidemiologic studies](#) (927 articles)
[Dermatology](#) (211 articles)

Notes

Advance online articles have been peer reviewed, accepted for publication, edited and typeset, but have not yet appeared in the paper journal. Advance online articles are citable and establish publication priority; they are indexed by PubMed from initial publication. Citations to Advance online articles must include the digital object identifier (DOIs) and date of initial publication.

To request permissions go to:

<http://group.bmj.com/group/rights-licensing/permissions>

To order reprints go to:

<http://journals.bmj.com/cgi/reprintform>

To subscribe to BMJ go to:

<http://group.bmj.com/subscribe/>