

# Goat's milk allergy

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## ABSTRACT

**Background:** Goat's milk (GM) allergy not associated with allergy to cow's milk (CM) is a rare disorder. Caseins have been implicated as the major allergens eliciting symptoms.

**Methods:** We report the case of a 27 years-old female patient that experienced two episodes of urticaria related to ingestion of goat's cheese (GC). She tolerated CM, dairy products and sheep cheese. Skin prick tests were performed with GM, CM, bovine casein and  $\alpha$ -lactalbumin and fresh milk and GC. Serum specific IgE to GM, CM and its fractions, and GM and CM immunoblotting assays with inhibition were also evaluated.

**Results:** Skin tests were positive to GM and GC and negative to CM. GM immunoblot showed an IgE-binding 14 kDa band that was totally inhibited after serum pre-incubation with GM.

**Conclusions:** Allergens other than casein can be involved in allergy to GM. Even small quantities of protein can elicit symptoms.

**Key words:** allergy, cheese, cow, goat, milk

## INTRODUCTION

Goat's milk (GM) allergy not associated with allergy to cow's milk (CM) is a rare condition. It was first described in 1995 by Wuthrich and Johansson. They reported the cases of two young male whose radioallergosorbent tests (RAST) were positive to goat and sheep milk casein, but negative to cow's milk casein<sup>1</sup>. After this, several reports of anaphylaxis related to ingestion of goat and sheep milk or milk products including cheese have been made<sup>2-6</sup>.

The caseins have been implicated as the major allergens eliciting symptoms in patients allergic to goat and sheep milk<sup>2</sup> as well as in adult patients allergic to CM<sup>1</sup>. The high sequence homology between caseins from different sources explains the high frequency of cross-reactivity between milks<sup>2,7</sup>. Infants and small children allergic to cow's milk are more frequently sensitised to the species-specific and heat-unstable whey proteins  $\beta$ -lactoglobulin,  $\alpha$ -lactalbumin and serum albumin<sup>1,2</sup>.

## CASE REPORT

A 27 years-old female patient, suffering from mild persistent asthma and rhinitis since 20 years of age, experienced at age 24 two episodes of urticaria. The symptoms started two hours after intake of goat's cheese. The second episode was a result of a "challenge test" performed by the patient at home with goat's cheese to confirm the suspicion that this was the food responsible for the first episode of symptoms. She tolerated ingestion of CM and dairy products as well as sheep cheese. She had never tasted goat or sheep milk. There was no personal history of CM protein allergy during childhood.

Skin prick tests (SPT) were carried out using commercial common aeroallergens extracts (ALK-Abelló,

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Madrid, Spain) as well as cow and goat's milk (ALK-Abelló, Madrid, Spain), bovine casein and  $\alpha$ -lactalbumin (Leti, Madrid, Spain). Skin prick-prick tests with CM, GM, and two different brands of goat's cheese were also performed. Skin tests were considered positive for a wheal diameter  $\geq 3$  mm above the negative control. They showed positive results to GM extract (wheal diameter  $5 \times 5$  mm), GM ( $6 \times 5$  mm) and goat's cheese ( $4 \times 6$  mm and  $5 \times 5$  mm respectively; histamine  $5 \times 5$  mm; saline control negative). Total serum IgE was 90 IU/ml. Serum specific IgE to cow's milk and its fractions (casein,  $\alpha$ -lactalbumin,  $\beta$ -lactoglobulin) as well as to goat's milk was  $< 0.35$  KU/l (ImmunoCAP®, Phadia, Uppsala, Sweden). Cow and goat's milk immunoblot assays (AlaBLOT®, DPC, Los Angeles, CA, USA) showed an IgE-binding 14 kDa band in goat's milk immunoblot.

Immunoblotting inhibition assays (AlaBLOT® inhibition assay procedure) with cow and goat's milk commercial extracts (ALK-Abelló) showed a total inhibition of goat's milk immunoblot after serum pre-incubation with GM extract and no change after serum pre incubation with CM extract (fig. 1).

## DISCUSSION

Cow's milk allergy is the most frequent allergy to milk in infants and adults<sup>3,8</sup>. Most people who are sensitised to CM cannot tolerate goat's or sheep's milk either<sup>2,8</sup>. Goat's and sheep milk allergy are infrequent and do not usually involve cross-reactivity to CM<sup>2,8,9</sup>. Despite still being a rare disorder, the increasing consumption of goat's cheese is probably responsible for the increment in the number of cases of goat's milk allergy<sup>2</sup>. Milk allergens include casein and whey proteins, a mixture of globular proteins (mainly  $\beta$ -lactoglobulin and smaller amounts of  $\alpha$ -lactalbumin and serum albumin). The casein fraction comprises four proteins ( $\alpha$ S1-,  $\alpha$ S2-,  $\beta$ - and  $\kappa$ -casein) coded by different genes carried on the same chromosome<sup>2,7,9-11</sup>.

Cross-reactivity between milks can be explained by structural similarities and high amino acid sequence homology between milk proteins of different mammal species<sup>2,7</sup>.

Adults allergic to CM are more frequently sensitised to casein. Contrarily, infants and small children are more frequently sensitised to whey proteins. This different sensitisation pattern is probably due to a decreased consumption of whole milk but a comparable high intake of casein-enriched cheese products in adulthood<sup>1</sup>. Caseins represent 80 % of mass in milk, and are the allergens most frequently responsible for reactions to GM at all ages<sup>2,11</sup>. Whey

proteins are naturally separated from the casein fraction during traditional cheese making<sup>1</sup>.

GM allergy has been most frequently described in children. The diagnosis of GM allergy is based on a thorough history supported by positive SPT and high levels of specific serum IgE to GM allergens, especially casein. Symptoms of GM allergy may vary in severity from mild urticaria or localized oral pruritus to severe anaphylactic reactions. Our patient started symptoms later, at 24 years of age, and reported two episodes of urticaria after ingestion of goat's cheese.

SPT and skin prick-prick tests showed positive to GM extract, GM, and GM cheese and negative to CM, CM extract and CM derived casein and  $\alpha$ -lactalbumin extracts. However, seric specific IgE to GM was  $< 0.35$  KU/l. This could be explained by false negative assay. Another hypothesis is that comparing with other proteins,  $\alpha$ -lactalbumin is present in small amounts in milk and this could be responsible for a negative ImmunoCAP. In fact, we were able to evidence sensitisation to a GM 14 kDa protein in this patient by immunoblotting.

The immunoblotting inhibition assays with cow and goat's milk showed a total inhibition of GM immunoblot after serum pre-incubation with GM extract and no change after serum pre-incubation with CM extract. This proves the existence of specific IgE to GM in the serum of this patient and the absence of cross-reactivity with CM. The 14 kDa protein evidenced in the GM immunoblot has a similar molecular weight to  $\alpha$ -lactalbumin from GM<sup>7</sup>.

In opposite to the most frequently reported, this patient did not evidenced sensitisation to casein<sup>2-6,8</sup> but to a protein that might be  $\alpha$ -lactalbumin. This protein could remain in small quantities during the cheese making procedure<sup>1</sup> which could explain the symptoms of this patient after ingestion of goat's cheese.

Oral challenge procedures can be performed when anaphylactic reactions are not expected, when the diagnosis is in doubt, or to determine if tolerance is present or has developed. In this case the oral food challenge was not performed since the offending food was well identified and there was enough clinical evidence. Our patient was instructed to avoid GM, GM derived dairy products and all processed foods containing GM or milk derived products.

In conclusion, GM allergy is increasing, even among adults. Other allergens than casein can be involved in IgE mediated reactions. In fact, we identified a 14 kDa protein from GM that might correspond to  $\alpha$ -lactalbumin, as the allergen responsible for sensitisation in this patient. Goat's milk products are increasingly present in diet as ingredients and as hidden allergens in processed foods. Allergic patients

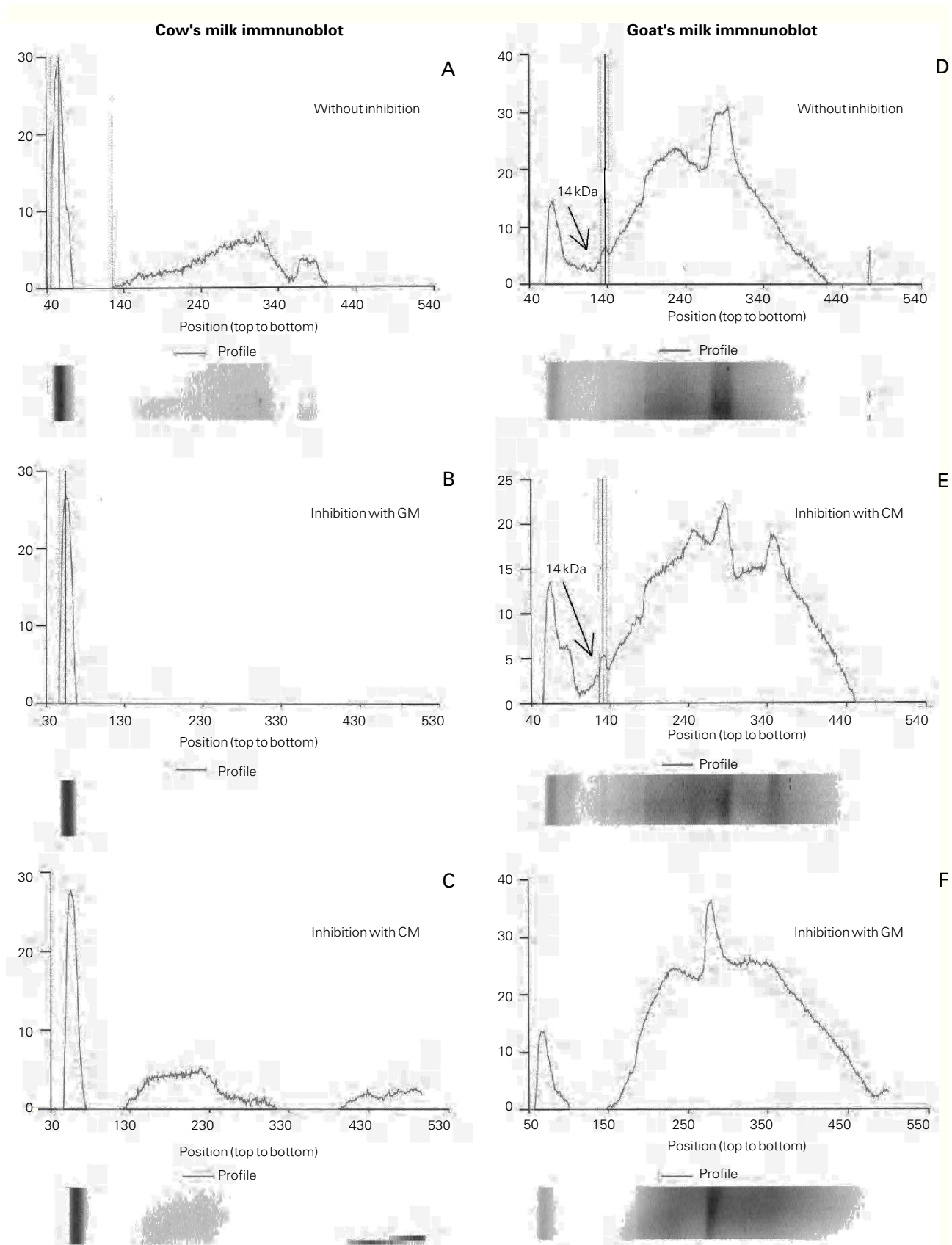


Figure 1.—Cow and goat's milk immunoblotting assays (lanes A and D). Immunoblotting inhibition assays: CM immunoblot inhibited with GM (Lane B) and CM (Lane C) extracts respectively. GM immunoblot inhibited with CM (Lane E) and GM (Lane F) extracts respectively.

should be aware of this and strictly avoid any products that contain GM, since even small amounts can elicit an anaphylaxis episode.

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## REFERENCES

1. Wuthrich B, Johansson SGO. Allergy to cheese produced from sheep's and goat's milk but not to cheese produced from cow's milk. *J Allergy Clin Immunol*. 1995;96:270-73.
2. Ah-Leung S, Bernard H, Bidat E, Paty E, Rance F, Scheinmann P, Wal JM. Allergy to goat and sheep milk without allergy to cow's milk. *Allergy*. 2006;61:1358-65.
3. Umpierrez A, Quirce S, Maranon F, Cuesta J, Garcia-Villamuza Y, Lahoz C et al. Allergy to goat and sheep cheese with good tolerance to cow cheese. *Clin Exp Allergy*. 1999;29:1064-66.
4. Alvarez MJ, Lombardero M. IgE-mediated anaphylaxis to sheep's and goat's milk. *Allergy*. 2002;57:1091-92.
5. Martins P, Borrego LM, Pires G, Pinto PF, Afonso AR, Rosado-Pinto J. Sheep and goat's milk allergy – a case study. *Allergy*. 2005;60:129-30.
6. Munoz Martin T, de la Hoz Caballer B, Maranon Lizana F, Gonzalez Mendiola R, Prieto Montano P, Sanchez Cano M. Selective allergy to sheep's and goat milk proteins. *Allergol Immunopathol*. 2004;32:39-42.
7. Wal JM. Structure and function of milk allergens. *Allergy*. 2001;56 Suppl 67:35-38.
8. Bellioni-Businco B, Paganelli R, Lucenti P, Giampietro PG, Perborn H, Businco L. Allergenicity of goat's milk in children with cow's milk allergy. *J Allergy Clin Immunol*. 1999;103:1191-4.
9. Restani P, Gaiaschi A, Plebani A, Beretta B, Cavagni G, Fiocchi A, et al. Cross-reactivity between milk proteins from different animal species. *Clin Exp Allergy*. 1999;29:997-1004.
10. Allergome – a platform for allergen knowledge 2007; <http://www.allergome.org>
11. Tomotake H, Okuyama R, Katagiri M, Fuzita M, Yamato M, Ota F. Comparison between Holstein cow's milk and Japanese-Saanen goat's milk in fatty acid composition, lipid digestibility and protein profile. *Biosci Biotechnol Biochem*. 2006;70:2771-4.