

## **Anaphylaxis Induced By Beer**

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The prevalence of cereal allergy is highly influenced by the geographical area and consumption habits. In Spain, according to Alergologica 2015 data [1], cereals allergy represents 2.1% of food allergy.

Beer is a barley-based alcoholic beverage which also contains hops, yeast and other cereals (wheat, oats, corn and even rye.) Barley is also the basis of malt vinegar, whiskey and gin. Several allergens of barley have been described such as LTP, alpha and beta-amylase, gliadin, glutenin, peroxiredoxin, thionin and trypsin inhibitor[2].

We present a case of beer allergy induced anaphylaxis: a 48 year-old man, with no personal history of allergy, presented an episode of sudden loss of consciousness in the context of beer intake.

The patient presented 5-6 years ago pharyngeal pruritus and mild dyspnea without other systemic symptoms after drinking beer. He avoided beer for years but then he tried it again and presented immediately after the beer intake loss of consciousness with mandibular fracture. The physical examination at the time of the consultation was normal.

All ingredients but barley were tolerated afterwards.

Skin-prick test (SPT) with the common panel of pneumoallergen extracts, were positive to mugwort exclusively. SPT with food extracts were negative. SPT with cereals LETI® commercial extracts (corn, wheat, rice, oat, barley, rye, gluten and gliadin) were

negative with a mild response (< histamine 2x2) to barley. Prick by prick with beer (San Miguel® beer) was positive (5x7 mm). Total IgE and basal tryptase values (ImmunoCAP®, Thermo Fisher Scientific, Sweden) were 160 kU/L and 3.84 µg/L respectively and specific IgE antibodies to wheat (*Triticum aestivum*): 0.03 kU<sub>A</sub>/L; barley (*Avena sativa*) < 0.1 kU<sub>A</sub>/L; hop (*Humulus lupulus*) < 0.1 kU<sub>A</sub>/L; rPru p 3:<0.1 kU<sub>A</sub>/L; and omega-5 gliadin: 0kU<sub>A</sub>/L. ImmCAP ISAC® microarray (Thermo Fisher Scientific, Sweden) revealed only a positive result for n Art v 1 (0.6 ISU).

Protein extract from hop, rice, barley, rye, corn, wheat and beer yeast were homogenized in phosphate-buffered-saline, and then dialyzed, concentrated and stabilized by lyophilization. Sodium dodecyl sulphate polyacrylamide gel electrophoresis (SDS-PAGE) under reducing conditions was carried out as described by Laemmli[3] with 7 different beer brands, hop, rice, barley, rye, corn, wheat and beer yeast extracts in patient sera. Western blot revealed an IgE binding band of 10-12 kDa in the extract of all beers (independently of the gluten content) and barley. (Figure 1) which it was extracted from the gel, digested with trypsin and analyzed by mass spectrometry: LC-MSMS (HR, ORBITRAP, short gradient) as previously described[4]. 3 peptides with the 15% of coverage from LTP1 (Hor v 7k-LTP) were identified.

LTP1 comes from a modification of the posttranslational lipid transporter protein by a different link between aspic acid and ester linkage.

We can find low amounts of LTP1 in barley kernel. LTP1 is highly stable during malting and brewing processes and it is particularly inalterable to boiling and proteolysis so it can be found intact in the beer, where it represents one of the major protein components[5].

Reactivity of IgE to Hor v 7k-LTP is often associated with severe systemic symptoms but unlike Hor v 14 (classical LTP of barley also LTP1 type) has no cross-reactivity with other LTP[5].

Several studies identified a 10 kDa allergenic protein by Western blot in allergic beer patients suggesting that the culprit allergen could be the classical LTP of barley (Hor v14)[6,7,8,9,10]. In most of these case reports, patients did not tolerate other fruits and nuts suggesting cross-reactivity with other LTPs[6,7,8].

Tolerance of other foods, negatives skin prick test to foods and negatives results with serum specific IgE against other LTPs suggest Hor v 7k-LTP as the responsible allergen in this case.

In conclusion, our study of a case of anaphylaxis caused by beer ingestion revealed the possible culprit allergen to be the Hor v 7k-LTP. To date, this is the first time that one of the LTP1 of barley is identified as the causative allergen of beer allergy so it has implications for the dietary recommendations to give to the patient. He only should avoid barley and manufactured products that contain barley.

### **Conflict of interest**

None of the authors have any conflict of interest regarding this paper. Dr. Roger reports personal fees from Diater outside the submitted work.

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## Previous presentations

Anaphylactic shock with beer. SEAIC 2018, National congress in Valencia (as a poster).

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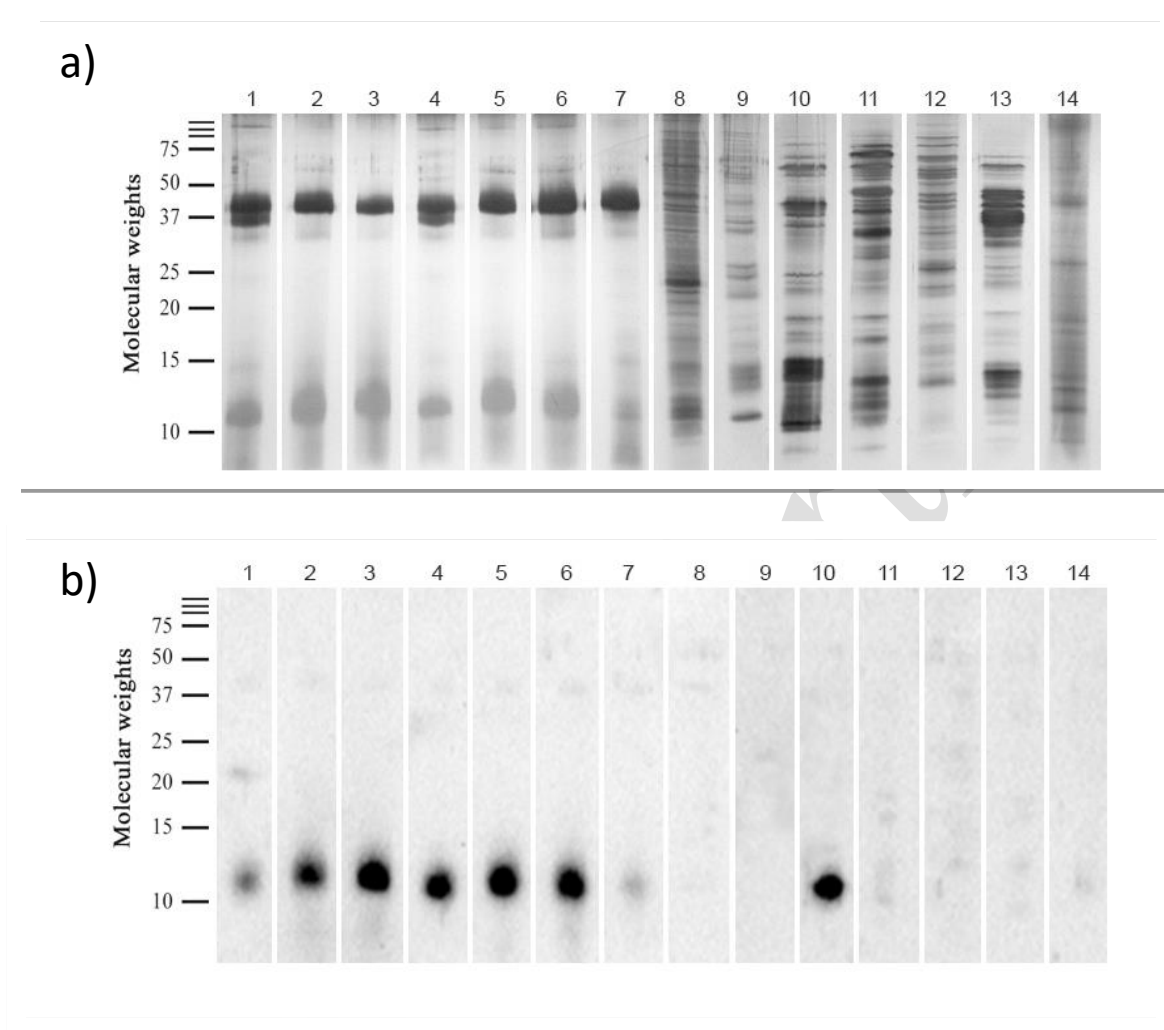
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**Figure 1.** a) SDS-PAGE. b) Western blot



Lane 1: San Miguel® beer gluten free, Lane 2: San Miguel® beer , Lane 3: San Miguel® beer without alcohol; Lane 4: Mahou® beer gluten free; Lane 5: Mahou® beer; Lane 6: Mahou® beer double hops ; Lane 7: Dutch® beer carrefour; Lane 8: Hop; Lane 9: rice; Lane 10: Barley; Lane 11: rye; Lane 12: corn; Lane 13:Wheat; Lane 14: beer yeast.