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REVIEW ARTICLE

Proteomics: a tool to develop novel diagnostic methods and unravel molecular mechanisms of pediatric diseases



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Abstract Proteomics is the study of the expression of changes and post-translational modifications (PTM) of proteins along a metabolic condition either normal or pathological. In the field of health, proteomics allows obtaining valuable data for treatment, diagnosis or pathophysiological mechanisms of different illnesses. To illustrate the aforementioned, we describe two projects currently being performed at the Instituto Nacional de Pediatría: The immuno-proteomic study of cow milk allergy and the Proteomic study of childhood cataract.

Cow's milk proteins (CMP) are the first antigens to which infants are exposed and generate allergy in some of them. In Mexico, the incidence of CMP allergy has been estimated at 5–7%. Clinical manifestations include both gastrointestinal and extra-gastrointestinal symptoms, making its diagnosis extremely difficult. An inappropriate diagnosis affects the development and growth of children. The goals of the study are to identify the main immune-reactive CMP in Mexican pediatric population and to design more accurate diagnostic tools for this disease.

Childhood cataract is a major ocular disease representing one of the main causes of blindness in infants; in developing countries, this disease promotes up to 27% of cases related to visual loss. From this group, it has been estimated that close to 60% of children do not survive beyond two years after vision lost. PTM have been pointed out as the main cause of protein precipitation at the crystalline and, consequently, clouding of this tissue. The study of childhood cataract

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PALABRAS CLAVE

Espectrometría;
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 Alergia a la leche

represents an outstanding opportunity to identify the PTM associated to the cataract-genesis process.

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Proteómica: una herramienta para desarrollar nuevos métodos de diagnóstico y descifrar mecanismos moleculares de enfermedades pediátricas

Resumen La proteómica estudia los cambios de expresión y post-traduccionales (PTM) de las proteínas durante una condición metabólica normal o patológica. En el campo de la salud, la proteómica permite obtener datos útiles para el tratamiento, diagnóstico o en la fisiopatología de diferentes enfermedades. Para ilustrar lo anterior, describimos dos proyectos realizados en el Instituto Nacional de Pediatría: El estudio inmunoproteómico de la alergia a la leche y el estudio proteómico de la catarata infantil.

Las proteínas de leche bovina (PLB) son los primeros antígenos a los que se exponen los infantes y un porcentaje de ellos generará alergias. En México, se estima que la incidencia de alergias a las PLB es del 5-7%. Las manifestaciones clínicas incluyen tanto síntomas gastrointestinales como extra-gastrointestinales, dificultando su diagnóstico. Un mal diagnóstico afecta el desarrollo y crecimiento del infante. Los objetivos del estudio son identificar las principales PLB inmunoreactivas en población infantil mexicana y diseñar herramientas diagnósticas más precisas para esta patología.

La catarata infantil es una enfermedad ocular que representa una de las causas principales de ceguera infantil; en países subdesarrollados genera cerca del 27% de casos relacionados con pérdida visual. De este grupo, se estima que cerca del 60% de los infantes no sobreviven más allá de los dos años después de perder la visión. Se señala a las PTM como las responsables de la precipitación de proteínas del cristalino y, por tanto, de su opacidad. El estudio de la catarata infantil representa una oportunidad para identificar las PTM vinculadas con la cataratogénesis. © 2017 Hospital Infantil de México Federico Gómez. Publicado por Masson Doyma México S.A. Este es un artículo Open Access bajo la licencia CC BY-NC-ND (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

1. Introduction

Proteomics can be defined as the study of expression changes and post-translational modifications (PTM) of proteins along a metabolic condition either in normal or pathological tissue, cell culture or microorganisms. Proteomics allows obtaining basic information for treatment assistance, diagnosis or pathophysiological mechanisms of different illnesses. To illustrate this point, we describe two research projects that have been performed at the Instituto Nacional de Pediatría: The immuno-proteomic study of cow milk allergy and the Proteomics study of childhood cataract.

Cow milk proteins (CMP) are the first antigens to which infants are exposed; fortunately, most kids tolerate such antigens. However, a percentage of children develop allergy. In Mexico, the incidence of CMP allergy has been estimated at 5-7%. A broad diversity of clinical manifestations appears during the first months of life including both gastrointestinal and extra-gastrointestinal symptoms making diagnosis extremely difficult. An inappropriate diagnosis promotes food rejection, fail to thrive syndrome, vomiting and persistent diarrhea; all of them affect the development and growth of children. The first work has the objective to

identify the main immune-reactive CMP in Mexican pediatric population as well as the search for more accurate diagnostic tools for this disease.

On the other hand, childhood cataract is a major ocular disease and represents one of the main causes of blindness in the pediatric group; in developing countries, this disease promotes up to 27% of cases related to visual loss. From this group, 60% of children have been estimated do not survive beyond two years after vision lost. PTM have been pointed out as the main cause of protein precipitation in the crystalline and, consequently, clouding of this tissue. The study of childhood cataract represents an outstanding opportunity to identify the PTM associated to the cataract-genesis process.

2. Immunoproteomics to CMP allergy

2.1. Overview

The CMP allergy is the most common alimentary hypersensitivity in infants under three years of age. In the last decades, the world incidence of this disease has increased in developed countries due to a decreasing of breastfeeding

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