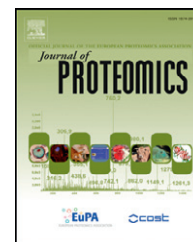


Available online at www.sciencedirect.com

SciVerse ScienceDirect

www.elsevier.com/locate/jjprot

Review

Acute phase proteins in ruminants[☆]F. Ceciliani^a, J.J. Ceron^b, P.D. Eckersall^{c,*}, H. Sauerwein^d^aDepartment of Animal Pathology, Hygiene and Veterinary Public Health – University of Milano, Milano, Italy^bDepartment of Animal Medicine and Surgery, University of Murcia, Espinardo, Murcia, Spain^cInstitute of Infection Immunity and Inflammation, School of Veterinary Medicine, University of Glasgow, Bearsden Rd, G61 1QH, Glasgow, United Kingdom^dInstitute of Animal Science, University of Bonn, Bonn, Germany

ARTICLE INFO

Article history:

Received 27 January 2012

Accepted 2 April 2012

Available online 11 April 2012

Keywords:

Acute phase protein

Ruminants

Protein function and expression

Disease diagnosis

Mammary gland

Adipose tissue

ABSTRACT

The physiological response to infections and injuries involves local inflammation and the initiation of events leading to a systemic response, also called acute phase reaction (APR). This multiplicity of changes is distant from the site of injury, and includes fever, leukocytosis and quantitative and qualitative modification of a group of non-structurally related proteins present in blood and other biological fluids, collectively named Acute Phase Proteins (APP). Proteomic investigations of serum or plasma following natural or experimental infection frequently reveal substantial alterations in the APP, several of which are high abundance proteins in these fluids. The present review will focus on the results of recent research on ruminant APP. Highlight points will include:

- The structure and the functions of the main APPs in ruminants, as well as the regulatory mechanisms that trigger their systemic and local expression in both physiological and pathological conditions.
- The clinical aspects of APPs in ruminants, including the current and future application to veterinary diagnosis and animal production.
- The APP in small and wildlife ruminants.
- Alteration in APP detected by proteomic investigations.

This article is part of a Special Issue entitled: “Farm animal proteomics”.

© 2012 Elsevier B.V. All rights reserved.

Contents

1.	The systemic reaction during inflammation	4208
1.1.	The triggering and regulation of the systemic reaction to inflammation	4208
2.	The functions of acute phase proteins	4209
2.1.	Serum amyloid A: the pathological protein	4210
2.1.1.	SAA binds cholesterol	4210
2.1.2.	SAA modulates innate immune reactions	4210
2.1.3.	SAA is an innate immunity opsonin	4210

[☆] This article is part of a Special Issue entitled: “Farm animal proteomics”.

* Corresponding author.

E-mail address: David.Eckersall@glasgow.ac.uk (P.D. Eckersall).

2.2.	Haptoglobin: binding iron, and other functions	4211
2.2.1.	Haptoglobin binds hemoglobin and prevents oxidative damages	4211
2.2.2.	The anti-inflammatory role of haptoglobin	4211
2.2.3.	Bacteriostatic effect	4211
2.2.4.	Angiogenesis and chaperone activity	4212
2.3.	Lipopolysaccharide binding protein: sentinel against bacteria	4212
2.3.1.	Lipopolysaccharide signaling in immune cells	4212
2.3.2.	LBP is an opsonin	4212
2.4.	α_1 Acid glycoprotein: the multipurpose protein	4212
2.4.1.	AGP binds and transports molecules in plasma	4213
2.4.2.	The immunomodulatory activity of AGP	4213
2.4.3.	AGP fulfills a direct antibacterial activity	4214
2.4.4.	Is AGP a chaperone?	4214
3.	Extrahepatic expression of acute phase proteins in ruminants	4214
3.1.	Acute phase protein expression in the mammary gland	4214
3.1.1.	Serum amyloid A	4214
3.1.2.	Haptoglobin	4214
3.1.3.	α_1 Acid glycoprotein	4214
3.1.4.	Lipopolysaccharide binding protein	4215
3.2.	Acute phase protein expression in the reproductive system	4215
3.2.1.	Serum amyloid A	4215
3.2.2.	Haptoglobin	4215
3.2.3.	α_1 Acid glycoprotein and lipopolysaccharide binding protein	4215
3.3.	Acute phase protein expression in the respiratory tract	4215
3.4.	Acute phase protein expression in the digestive tract	4215
3.5.	Acute phase protein expression in the adipose tissue	4216
4.	Acute phase proteins as biomarkers of disease in cattle	4217
4.1.	Acute phase proteins in mastitis	4217
4.2.	Acute phase proteins in ruminant reproduction	4218
4.3.	Acute phase proteins in the gastrointestinal tract and the effects of diet	4219
4.4.	Acute phase proteins and other aspects of bovine health and disease	4220
5.	The acute phase proteins in small and wildlife ruminants	4221
6.	Proteomic investigation and acute phase proteins in ruminants	4222
7.	Conclusion and future directions	4223
	Acknowledgments	4224
	References	4224

1. The systemic reaction during inflammation

Local inflammation is the first response of the immune system to noxious stimuli. When infections and tissue injuries overwhelm local defenses, the organism responds by activating a wide ranging systemic response [1]. These events are collectively referred to as “the acute phase reaction”. More properly, the right definition should be “systemic reaction to inflammation”, because they may accompany both acute and chronic inflammation. These changes, distant from the site of inflammation, involve many organs and include a large number of behavioral, physiologic, biochemical and nutritional changes. The most evident phenomena include fever, leukocytosis, and the over- or under-expression of a large family of structurally un-related proteins (Table 1), the acute phase proteins (APP) [2,3]. It is a highly coordinated process where several cell types and a network of proteins initiate, amplify, sustain, control and eventually resolve the inflammatory reaction.

1.1. The triggering and regulation of the systemic reaction to inflammation

The systemic reaction to inflammation is triggered by external (pathogen associated molecular patterns—PAMP) and internal (damaged associated molecular pattern—DAMP) stimuli. Pathogen associated molecular patterns are microbial structures recognized by blood and cell associated proteins. These molecules, that include exo- and endo-toxins, polysaccharides and mannans, are shared by pathogens such as Gram⁺ and Gram⁻ bacteria, as well as some fungi and viruses [4]. Damaged associated molecular patterns are derived from mitochondria, nucleus, endoplasmic reticulum and other intracellular compartments [5]. DAMP are released after cell death or injury, and are recognized by the innate immune system by pattern recognition receptors that, in many cases, are the same that recognize PAMP.

A family of membrane-bound molecules, the Toll Like Receptors (TLR), plays a central role in distinguishing different

Download English Version:

<https://daneshyari.com/en/article/10556296>

Download Persian Version:

<https://daneshyari.com/article/10556296>

[Daneshyari.com](https://daneshyari.com)