

RESEARCH ARTICLE

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Immunological adjuvant effect of the peptide fraction from the larvae of *Musca domestica*

Liqing Chen, Juan Zhang and Hongxiang Sun*

Abstract

Background: The larvae of *Musca domestica* (Diptera: Muscidae) have been used traditionally for malnutritional stagnation, decubital necrosis, osteomyelitis, ecthyma and lip scald and also to treat coma and gastric cancer in the traditional Chinese medicine. Its immunomodulatory effects in naïve mice in relation to the traditional uses were also reported. However, the immunological adjuvant potentials of this insect have not yet been studied.

Methods: The peptide fraction from the larvae of *Musca domestica* L. (MDPF) was evaluated for its adjuvant potentials on the immune responses to ovalbumin (OVA) and avian influenza vaccine (rL-H5) by determining antigen-specific antibody titers, splenocyte proliferation, activity of natural killer (NK) cell, the secretion of cytokines from splenocytes in the immunized mice.

Results: MDPF significantly enhanced not only the concanavalin A (Con A)-, lipopolysaccharide (LPS)- and antigen-stimulated splenocyte proliferation, but serum antigen-specific IgG, IgG1, IgG2a, and IgG2b antibody titers in the mice immunized with OVA and rL-H5. MDPF also remarkably promoted the killing activities of NK cells in splenocytes from the mice immunized with rL-H5. Furthermore, MDPF significantly promoted the production of Th1 (IL-2 and IFN- γ) and Th2 (IL-10) cytokines from splenocytes in the immunized mice.

Conclusions: The results indicated that MDPF had a potential to increase both cellular and humoral immune responses and elicit a balanced Th1/Th2 response, and that MDPF may be a safe and efficacious vaccine adjuvant candidate.

Keywords: *Musca domestica* larvae, Peptide, Adjuvant, Avian influenza vaccine, Cellular and humoral, Th1/Th2 immune responses

Background

The larvae of *Musca domestica* (Diptera: Muscidae) have been used traditionally for malnutritional stagnation, decubital necrosis, osteomyelitis, ecthyma and lip scald and also to treat coma and gastric cancer in the traditional Chinese medicine. Its immunomodulatory effects in naïve mice in relation to the traditional uses were also reported. However, the immunological adjuvant potentials of this insect have not yet been studied. The peptide fraction from the larvae of *Musca domestica* L. (MDPF) was evaluated for its adjuvant potentials on the immune responses to ovalbumin (OVA) and avian influenza vaccine (rL-H5) by determining antigen-specific antibody titers, splenocyte proliferation, activity of natural killer (NK) cell, the secretion of cytokines from splenocytes in the immunized mice. MDPF significantly enhanced not only the concanavalin A (Con A)-, lipopolysaccharide (LPS)- and antigen-stimulated splenocyte proliferation, but serum antigen-specific IgG, IgG1, IgG2a, and IgG2b antibody titers in the mice immunized with OVA and rL-H5. MDPF also remarkably promoted the killing activities of NK cells in splenocytes from the mice immunized with rL-H5. Furthermore, MDPF significantly promoted the production of Th1 (IL-2 and IFN- γ) and Th2 (IL-10) cytokines from splenocytes in the immunized mice. The results indicated that MDPF had a potential to increase both cellular and humoral immune responses and elicit a balanced Th1/Th2 response, and that MDPF may be a safe and efficacious vaccine adjuvant candidate.

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domestica () 16 (A 1).
 56.24 % 3.9 %
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18, 19 . **Experimental animals**
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Methods
Materials

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 (5-A)
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 (), 3-(4,5- -2-)-2,5-
 (), -1640 ,

Toxicity assays
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 (s.c.)
 0.5, 1.0, 2.5, 5.0 0.5 14 .
 A
 (100, 150, 200 μ)
 s.c.
 () A/
 () 562 , , A.
 -1640

Immunization
 A,
 (s.c.) A 25 μ
 A (10 μ) (10, 25, 50 μ) 2-
 100 μ / 2 - , 10 % 37 . A
 5 % 2- .

Preparation and characterization of MDPF
M sca domestica
 Z , 2010. 14
 A (. 20101105) A-
 , Z A
 -A A - 5
 Z .
M sca domestica . A s.c.

0.2 5×10^6 (100, 200, 300 μ) -2, -10, - γ
 A (10 μ), 1. A 2 A .

Statistical analysis

() A A . P-
 0.05

Splenocyte proliferation assay

2 A (-
 5 μ /), (10 μ /), A
 (0.125 20 μ /), 5-A (-
 1640 37 (A)/ , -
 2 48 . 5 % 0.5 10 /
 20 . ()
 : = 5.0 , s.c.

Results

Toxicity of MDPF

Assay of NK cell activity

2 200 / . ,
 A .
 562
 21 . 2 3 72
 : A 150 200 μ
 : (%) = (- (-))/
 100, , ,

Effect of MDPF on splenocyte proliferation

Measurement of serum antigen-specific IgG antibody and its isotype titers

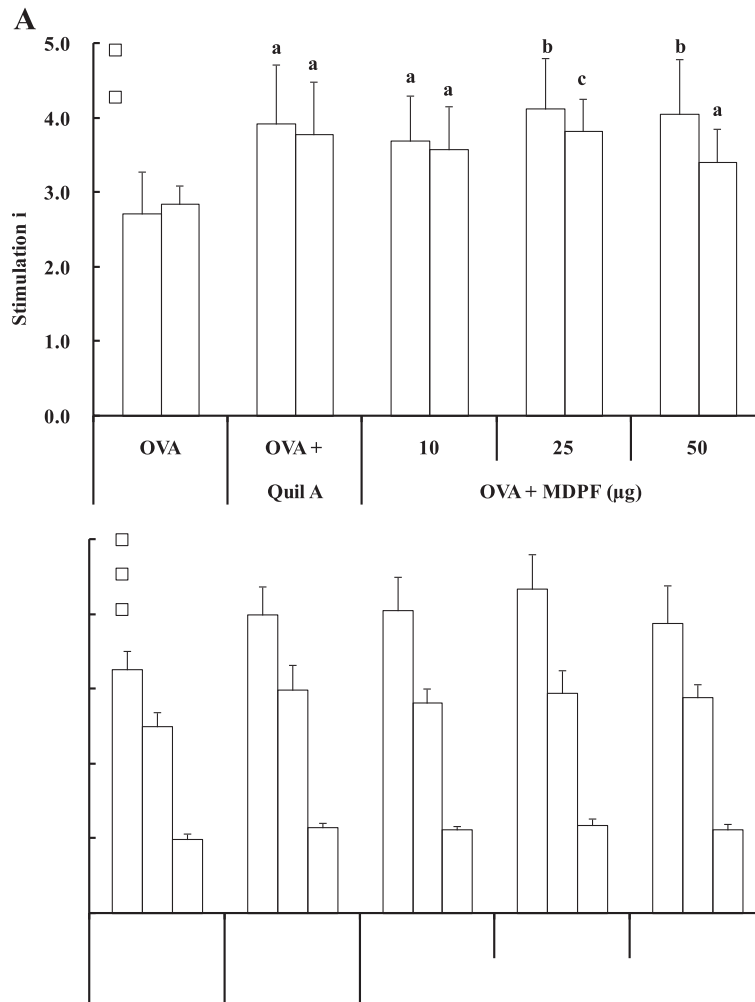
A- 5-A - , 1, 2 , 2
 A 22 . A 492 ,
 A
 A- (10, 25, 50 μ) A/ A
 (P < 0.05, P < 0.01
 P < 0.001). A . 1 , A (100,
 200, 300 μ) A-
 - 5 (P < 0.01 P < 0.001). 5-A -
 - 5/ A - 5/ (100, 200, 300 μ)
 - 5 (P < 0.01 P < 0.001).

Cytokine measurements

(5 10^6 /)
 (5 μ /) 24-
 37 5% 2. A 48 ,
 1400 g 5
 A -2, -10, - γ
 A 20 .

Effects of MDPF on NK cell activity

- 5 . 2. A
 - 5-
 562 - 5



($P < 0.05$, $P < 0.01$, $P < 0.001$),

- 5.

Effect of MDPF on the serum antigen-specific antibody response

A-

. 3 . A (10, 25, 50 µ)

A- A- 1

A- ($P < 0.05$, $P < 0.01$, $P < 0.001$).

A- 2

2

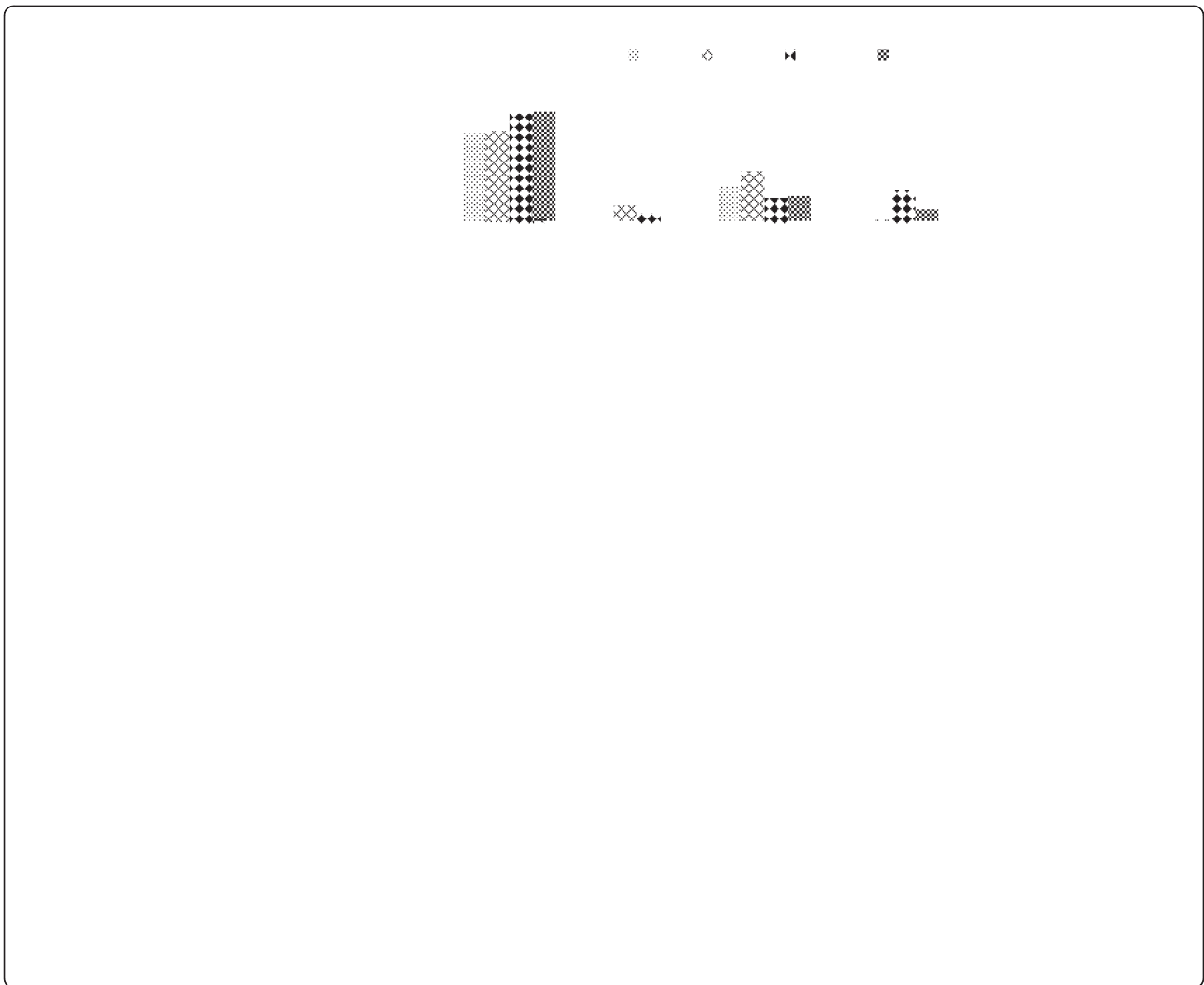
A/ A A/

A ($P < 0.01$ $P < 0.001$). ,

5-A - , 1, 2 , 2

- 5-

A ($P < 0.05$, $P < 0.01$)



$P < 0.001$ (. 3).

A- - 5-

23 .

Effect of MDPF on cytokine secretion by splenocytes

-2, - γ , -10

24 .

0.9980. A

. 4 , -2, - γ , -10

Q. illaja sapotaria,

A/ A A/

25 .

A ($P < 0.05$ $P < 0.001$). A

1

-2, - γ , -10
- 5 ($P < 0.01$ $P < 0.001$) (. 4).

26 .

Discussion

27

28 .

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 γ 180- 16. A -4 1 2
, , 41. 1 2
A - 5 .
- 42. 1
. A -2, β γ , 2 2 3 . 2
, , -4, -5
. -10, 1 -
A 43 .
, - 1
36. 44 ,
- - 37 .
A 45 . 2 , ,
46 ,
A-, -, 5-A -
(. 1). 47 . -
A- - 1/ 2 -
5- , - A - 5 A. 2
- - -10, 1
, 38 . - - -2 γ -
(. 4). 1 2-
, , , A - 5 .
39 . ()
- 5 (. 2), - 48 . A -
- 5 -37,
- - 49 ,
, 50 .
A - 5 .
A- α , β -
5-A - 1 , (. 3). 48 . M.
2 2
domestica
8, 51-54 .
1/ 2 A - 5 *M. domestica*

*M. sca domestica***Additional file**

Additional file 1: Extraction, purification and characterization of MDPF. (DOC 243 kb)

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

HXS designed the research plan. LQC, JZ, and HXS conducted all experiments. HXS drafted and edited the manuscript. All authors read and approved the final manuscript.

Acknowledgments

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