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TECHNICAL NOTE

PHARMACEUTICAL AND IMMUNOMODULATION EFFECT OF YEAST AND MYCOTIC EXTRACTS AS FEED ADDITIVES FOR LIVESTOCK AND POULTRY

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The present article highlights the pharmaceutical and physiological effect of purified *β*-glucan from an edible mushroom (*Pleuratus florida*) as an immunomodulator on the innate immune responses in broiler. Also, mushroom glucan as a feed supplement significantly provides protection against disease. This article portrays the potentiality of *β*-glucan (mushroom origin) as an immunostimulant in poultry.

Key words: Fungus, Chicken, Immunomodulator, Yeast.

INTRODUCTION

Immunomodulator stimulates leucocytes, particularly cells of the macrophage system and modulates and potentiates the immune system of the body (Wadstrom, 1990). It has been recommended earlier that the constant addition of immunomodulators to feed is beneficial for prevention of diseases (Onarheim, 1992). One of such immunostimulant compound is *β*-Glucan, polymers of glucose which consists of a linear backbone of *β*-1, 3 linked D-glucopyranosyl residues having varying degree of branching from the C_6 position (Bohn and BeMiller, 1995). *β*-Glucans are major structural components of yeast, mushrooms and fungal mycelia.

Supplementation of *β*-glucan in diets increase the macrophage phagocytic activity, PHA-P-mediated lymphoproliferative response and also humoral response (Guo *et al* 2003). *β*-Glucan provides significant protection against pathogen as a feed additive by upregulating phagocytosis, bacterial killing, and oxidative burst in chicken (Lowry *et al* 2005).

In the mammalian system, action of *β*-glucan is mediated through toll-like receptors (TLR) and dectin-1 (Lowry *et al* 2005). In the present work, evaluation was carried out for short term dietary influence of a purified *β*-glucan, prepared from an edible mushroom, on innate immunity and disease resistance of broiler birds (**Figure 1**).

Fig. 1. Image of *Pleuratus florida*

Immunomodulator is a substance that stimulates leucocytes-particularly cells of the monocyte/

macrophage system and thereby modulates, and most often potentiates, the immune system of the body (Wadstrom, 1990). The term immunomodulator was used interchangeable with immunostimulants, adjuvants and biological response modifiers. Glucan and mannan are the main components of yeast cell wall (YCW) that are gained from pure culture of yeast, *Saccharomyces cevisiae*. *β*-D-glucan is major component of yeast cell wall and has been shown to stimulate non-specific immune response. Glucans with *β* 1-3, *β* 1-4 and *β* 1-6 glucosidic linkages are major structural components of YCW (Brown and Gordon, 2003), mice (Selvaraj *et al* 2005), rats (Williams and di Luzio, 1979), rabbits (Reynolds *et al* 1980), sheep and pigs (Xiao *et al* 2004).

Importance as dietary supplement

Yeast *β*-glucan has been reported to enhance the immune responses in fish (Ganguly, 2013; Ganguly *et al* 2009; 2010; 2013), cattle (Persson Waller *et al* 2003) and humans (Engstad *et al* 2002). However, information regarding the effect of dietary administration of yeast cell wall preparation on immune responses in birds is limited. In the present study we evaluate the augmentation of the non-specific immune responses *viz.* production of oxygen and nitrogen species, lymphoproliferation and IL-2 (cytokine) production in broiler birds following YCW treatment. Previous studies showed that infections caused by *Staphylococcus aureus* and *Eimeria vermiformis* in mice can be prevented by *β*-glucan administration (Yun *et al* 2003). Experimental respiratory challenge with *Escherichia coli* in broiler chicks can also be prevented by *β*-1,3 / 1,6 glucan derived from *Saccharomyces cerevisiae* (Huff *et al* 2006). Rice *et al* 2005 showed that dietary administration of glucan to rat enhanced survivability against *Staphylococcus aureus* infections. Orally administered yeast *β*-glucan to mice could reduce the mortality in anthrax infections (Vetvicka *et al* 2002).

Immunomodulatory implications

In vertebrates, the immunomodulating abilities of *β*-glucans are thought to stem from their ability to activate leukocytes, but there is some confusion about their precise biological effects (Brown and Gordon, 2003). Paul *et al* 2012 assessed the immunostimulatory role of glucan extracted from yeast (*Saccharomyces cerevisiae)* cell wall was assessed in two different doses in terms of cellular immune effector activity. The production of oxygen radicals by YCW (both dose group) fed broiler birds was higher up to 20th day post treatment than control values. The O.D. value was in peak level at 10th day post treatment and significantly higher than control group (P<0.05) and then the O.D. values on 20th day decreased. The oxygen radical production in 0.8 g/kg treatment group was higher than 0.4 g treatment group on 10th day post treatment. Nitrite production was increased in both YCW fed groups than control group at 0 day. From 10th day onward, the nitrite production level was decreased in 0.8 gm treatment group but in 0.4 g treatment group nitrite production was peak level at 10th day post treatment. In 0.4 g treatment group *in vitro* non-specific lymphocyte proliferation and IL-2 production was first increased and then decreased abruptly. But in 0.8 g treatment group *in vitro* non-specific lymphocyte proliferation and IL-2 production was increased and then decreased gradually and IL-2 production was in peak level at 10th day post treatment (Paul *et al* 2013). The previous workers showed that the use of yeast glucan was enhanced oxidative respiratory burst in human and chicken (Wakshull *et al* 1999), monocyte activity and nitrite production also enhanced in sheep and chicken (Waller and Colditz, 1999).

Guo *et al* 2003 observed glucan enhanced the lymphocyte proliferation in cattle. Oral administration of yeast glucan enhanced the cytokine production in mice (Tsukada *et al* 2003). The enhancement of oxygen radicals, nitrite, cytokine (IL-2) production and lympho-proliferation of broiler birds might be related to the oral administration of yeast cell wall preparation (Nutriferm™) from *Saccharomyces cerevisiae*.

CONCLUSION

It can be concluded that dietary *β*-glucan may provide immunostimulatory properties necessary to reduce the incidence of any infection in poultry.

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