Evaluation of Some Immunostimulants on the Immune-response of Broiler Chickens Against Avian Influenza and Newcastle Diseases Vaccination

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Abstract

Immunostimulants get an increasing importance to enhance the immune system and allowing maximum performance in poultry production. The effects of using different immunostimulants on the immune response of broiler chickens to Newcastle disease (ND) and Avian influenza (AI) vaccination were investigated in this study. 100 day-old Ross broiler chicks were randomly divided into 4 groups, 25 birds for each group. Group A was not treated with any immunostimulants and used as a control, while groups B, C and D were supplemented with Imutrix® (oregano oils plus β-glucan), Evit liquid® (Vitamin E plus selenium) and immunair® 17.5 (Propionibacterium acnes and E. coli lipopolysaccharides), respectively. Statistical analysis results demonstrated significant divergence (P < 0.05) in body weight (BW) and feed conversion ratio among the applicable treatments. Birds of group B had the heaviest body weight (2.03 kg), followed by group C (1.87 Kg) and D (1.82 Kg) in comparison to the birds of group A (control, 1.79 Kg). Bursa of Fabricius weight showed non-significant differences among groups except in group B that showed an increase in the Bursa of Fabricius weight more than other groups especially the control group (1.15 g more). Comparable immune response was recorded for both AI and ND vaccination. The highest mean antibody titers were recorded for birds in group B at 14, 28 and 35 days old, while those in group D had the lowest antibody titre values. Thus, supplementing immunostimulants especially Imutrix® and Evit liquid® had a significant positive effect on performance characteristics and immune response against AI and ND vaccination in broiler chickens in contrast to non-treated group, which had low levels of immune response, rapid decreasing and no persistence for keeping high HI titer for long time.

Keywords: Immunostimulants, Immune response, Broiler chickens, Avian influenza, Newcastle, Vaccination.

Introduction

Infectious diseases are the chief challenge in the commercial poultry industry. Newcastle disease (ND) and avian influenza (AI) are considered the most somber worldwide diseases affecting poultry flocks which causing stark economic losses to the poultry industry [1]. Both of them can be controlled by bird vaccination using both live and inactivated virus vaccines [2,3]. Despite the use of the available vaccines, disease outbreaks are still common due to variety of stresses of intensive production systems, high density, nutritional and antibiotic administration as well as immunosuppression that adversely affect the immune status of the birds [4,5]. Thus, there is a need to improve the immune response of ND and AI vaccines to produce respectable antibody titers that can reduce viral replication. This enhancement can be achieved by using of adjuvants and/or immunostimulant supplements. Therefore, immunostimulants have been used as adjuvants to give long lasting humoral and cellular immune responses and improving the response of vaccines [6,7].

Immunostimulants consist of a cluster of biological and synthetic compounds that boost the non–specific cellular immunity by activating macrophages which consequently stimulate the immune response such as antigen engulf, cell killing, cytokine release and creation of antibody as well as humoral defense mechanisms in animals [8] which increases the sustainability of immune

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response to the infectious agent and resistance to disease infections [9,10]. Antioxidants, vitamin E and selenium (Se), play an important role in caring cells from reactive oxygen (RO) by free radical reduction and stopping the lipid peroxidation [11]. Vitamin E is the main lipid soluble antioxidant present in the cell membrane [12] and provides the first defense line against oxidative damage. Selenium (Se) is an essential component of the enzymes, Se-dependent glutathione peroxidases, which reduce hydrogen peroxide and lipid hydroperoxides [13]. Selenium addition to chickens infested with coccidia created changes in the numbers of blood leucocytes, revealing that Se possibly improves resistance to infection [14]. Therefore, it is not astonishing that deficiency of Se or vitamin E seriously affects immunological functions [15,16]. A combination of selenium and vitamin E play a major role in the development and maintenance of defense systems.

Immunair 17.5® (Propionibacterium acnes, and E. coli lipopolysaccharides) is one of the commercial products available in the Egyptian market as nonspecific immunostimulant for the chicken farms. Propionibacterium acnes is a Gram positive, non-spore forming opportunistic bacteria [17]. P. acnes is an effective activator of macrophage, lymphocyte, natural killer cells and cytokine release in the examined lab animals [18]. Lipopolysaccharides are the main components of the outer membrane of Gram-negative bacteria, induce strong immune responses. Lipopolysaccharides of Escherichia coli (LPS) had a role in releasing IL-1, IL-6, or tumor necrosis factor (TNF) by macrophages [19].

Oregano essential oils (OEO) are extracted from Origanum vulgare plants (leaves and flowers). They consist of more than 30 ingredients, most of which are carvacrol and thymol that constitute 78-82% of oregano essential oil [20]. Oregano essential oils have potent antioxidant effects, which inhibit the oxidative reactions that exert on phospholipid membranes [21]. They support increasing the proportion of differentiation (CD) molecules of lymphocytes CD4+ and CD8+ (T lymphocyte), in pigs fed oregano in contrast to control ones [22]. β-Glucans are glucose molecules that considered the base components of cell wall of several bacteria, fungi, algae and yeast [23]. β-glucans activated the immune cells, macrophages, dendritic cells neutrophils, B cells, T cells, and natural killer cells [24]. The intensification of specific immunity (humoral and cell-mediated) will increase the animal’s ability to resist diseases. Therefore, the present study was undertaken to investigate the immunomodulatory effects of the different immunostimulants on antibody response and performance against routine vaccination of ND and AI in broiler chickens.

Material and Methods

Chickens and experimental design

A total of 100 one-day-old broiler chicks (male and female Ross), were weighed and randomly divided into four groups on arrival. All groups received AI and ND vaccines; group A is control (vaccinated non treated birds); group B was treated with (imutrix®) in a dose of 1.5ml/L to drinking water for 24 hours at the first three days of every week along the period of experiment. Group C was treated by Vit E and selenium with the same regimen of administration and group D was similarly supplemented with immunair 17.5. Chicks were raised on floor for 5 weeks and had free access to feed (Elwadi feed Co., Egypt) and water throughout the entire experimental period. The lighting program was 23 h light and 1 h of darkness. The temperature was gradually decreased from 33 to 25°C on day 21 and then was kept constant.

Vaccination schedule

The birds of all groups were vaccinated against ND via eye drop at 7th day of age (HB1, Pfizer), 15th day of age (LaSota, Pfizer) and at 21 days of age (clone30, Izovac). AI (Nobilis, H5N2) vaccination was given one S/C shot at the 5th day of age using killed (H5N2). Gumboro (Pfizer) disease vaccination was applied at 11th day of age with intermediate strain vaccine via eye drop route.

Immunostimulants

Purified β- glucan 11 g and oregano oils essential oils 120 g (carvacrol 60 g + thymol 3.6 g) in demineralized water up to 1 liter emulsifiers produced commercially under the trade name “Imutrix®” (ELT Co., South
Korea) were used. Vitamin E and selenium produced commercially under the trade name “EVIT LIQUID®” (Tecnozoo Co., ITALIA) were used. The Immunair 17.5® (LABORATORIOS CALIER SA) which consists of (inactivated cells of propionibacterium acnes 0.17 mg, lipopolysaccharide from E. coli 0.05 mg, Thiomersal, 0.10 mg and Excipient q.s 1 ml).

**Immunological measurements**

**Sera for determining the HI titre**

Blood samples were collected from the wing and brachial veins of 5 birds randomly selected from each treatment at the 7, 14, 21, 28, 35 days into tubes without anticoagulant to determine the antibody titre following vaccination against ND and AI. Blood samples were dated and labeled according to number of chickens and groups. Samples were centrifuged for 10 min at 3000 rpm to obtain serum then were divided into aliquots and stored in Eppendorf tubes at -20ºC until analysis.

**HI test**

Two fold serial dilutions of the collected sera (50 μL) were prepared, then 4 HA units of NDV and AIV were prepared and added to each dilution. Subsequently, 30 minutes of incubation, 50 μL of 0.5% washed chicken red blood cells (RBC) was added on each well, the blend was incubated for 30 min at room temperature. Hemagglutination inhibition endpoint (the highest dilution of serum cause complete inhibition) were scored and recorded as reciprocal log2 values of the highest dilution of HI.

**Bursa index**

Birds were weighed and then slaughtered. The bursa of Fabricius was directly removed and weighed from 5 birds per group. The immune organ index was calculated: organosomatic index = organ weight (g)/body weight (kg) [25].

**Performance**

The experimental period duration was 35 days. On day 7, 14, 21, 28 and 35 birds were weighed by group. For weight measurement, individual birds were weighed and the mean weight of each group was calculated. Feed conversion ratio (FCR) was estimated as the amount of feed it takes to grow a kilogram. (https://en.wikipedia.org/wiki/Feed_conversion_ratio#Poultry).

**Statistical analysis**

Data were analyzed by one-way ANOVA using SPSS14 and Duncan's multiple range test was used to compare the means (P<0.05).

**Results**

Impacts of different immunostimulants on weight gain of broilers at different ages were presented in Table (1). The average of total BW of treated groups was higher than that observed in the control group along the experimental period but the difference was non-significant except group B; the body weights tended to significantly increase (P>0.05) at days 28 and 35 in comparison to group A (table 1). As presented in Table (2), the FCR of control group (1.503) was higher than treated groups (1.33, 1.406 and 1.42 for group B, C and D, respectively), which was significantly lower in group B at day 35 in comparison to control group. According to the results shown in Table (3). There was an increase in the bursa weight of birds that were treated with inmunitrix (group B) at day 35 of age (2.78 g) which was 1.15 g increased from the weight of control group.

**Table 1: Average body weights of broiler chickens (g) during the experimental period**

<table>
<thead>
<tr>
<th>Group</th>
<th>7 days</th>
<th>14 days</th>
<th>21 days</th>
<th>28 days</th>
<th>35 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A(^1)</td>
<td>160±0.12</td>
<td>420±0.17</td>
<td>825±0.43</td>
<td>1278±0.32(^a)</td>
<td>1795±0.37(^a)</td>
</tr>
<tr>
<td>Group B(^2)</td>
<td>179±0.37</td>
<td>454±0.42</td>
<td>855±0.22</td>
<td>1426±0.38(^b)</td>
<td>2030±0.18(^b)</td>
</tr>
<tr>
<td>Group C(^3)</td>
<td>180±0.25</td>
<td>445±0.19</td>
<td>850±0.12</td>
<td>1340±0.26(^a)</td>
<td>1877±0.63(^a)</td>
</tr>
<tr>
<td>Group D(^4)</td>
<td>172±0.14</td>
<td>462±0.23</td>
<td>825±0.54</td>
<td>1300±0.13(^a)</td>
<td>1825±0.46(^a)</td>
</tr>
</tbody>
</table>

1: group A was not treated with any immunostimulants and used as a control. 2: groups B was supplemented with Imutrix® (oregano oils plus β-glucan). 3: group C was supplemented with Evit liquid® (Vitamin E plus selenium). 4: group D was supplemented with Immunair® 17.5 (Propionibacterium acnes and E. coli lipopolysaccharides). The means within the same column with common letter, do not have a significant difference (P>0.05).
Effects of different immunostimulants treatments on humoral immune response against ND and AI vaccination were presented in Table (4). The evaluated antibody response at all intervals of the experiment starting from the day 14 revealed the AI and ND titer in control group had low levels of immune response and rapid decrease which reflected as no persistence for keeping high HI titer for long time (Figure 1A and 1B). Improved immunological response of AI was observed in group B at day 21, 28 and 35 by HI. At day 14, group C was found in the second category in the response to immunostimulant, while for response to ND vaccination, as shown in Table (4) and Figure (1B). There was a significant improvement ($P<0.05$) of antibody titer against ND, especially in group B at day 21, 28 and 35 followed by group C which significantly increased especially at day 35 of age in birds. Group D had the lowest positive effect by increase the antibody response to ND but not statistically significant ($P>0.05$) in comparison to control group.

**Table 2: Average Feed conversion ratio (FCR) of broiler chickens during the experimental period**

<table>
<thead>
<tr>
<th>Group</th>
<th>7 days</th>
<th>14 days</th>
<th>21 days</th>
<th>28 days</th>
<th>35 days</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>A$^1$</td>
<td>1.13±0.33</td>
<td>1.49±0.32</td>
<td>1.50±0.19</td>
<td>1.60±0.14</td>
<td>1.80±0.12$^a$</td>
<td>1.50±0.32$^a$</td>
</tr>
<tr>
<td>B$^2$</td>
<td>1.00±0.02</td>
<td>1.27±0.19</td>
<td>1.33±0.25</td>
<td>1.45±0.22</td>
<td>1.60±0.53$^b$</td>
<td>1.33±0.34$^b$</td>
</tr>
<tr>
<td>C$^3$</td>
<td>1.00±0.10</td>
<td>1.35±0.27</td>
<td>1.40±0.37</td>
<td>1.55±0.36</td>
<td>1.73±0.14$^d$</td>
<td>1.40±0.56$^d$</td>
</tr>
<tr>
<td>D$^4$</td>
<td>1.00±0.02</td>
<td>1.30±0.45</td>
<td>1.44±0.51</td>
<td>1.60±0.21</td>
<td>1.76±0.27$^a$</td>
<td>1.42±0.11$^a$</td>
</tr>
</tbody>
</table>

1: group A was not treated with any immunostimulants and used as a control. 2: groups B was supplemented with Imutrix® (oregano oils plus β-glucan). 3: group C was supplemented with Evit liquid® (Vitamin E plus selenium). 4: group D was supplemented with immunair®17.5 (Propionibacterium acnes and E. coli lipopolysaccharides). The means within the same column with common letter, do not have a significant difference ($P>0.05$).

**Discussion**

It is a significant to get a good immune response to prevent viral diseases in poultry. So, the use of immune stimulants is a resolution to enhance bird’s resistance to infectious diseases. Our results revealed that, the average of total BW and FCR of treated groups were higher and lower, respectively in comparison with that observed in control non treated birds along the experimental period. Group B which was supplemented with imutrix® as a source of β-glucan and oregano oil, is the only group that differed statistically in BW gain ($P < 0.05$) at day 28 and 35 in comparison to the control group. These results are in agreement with a broad idea of Iren [26] who found the submission of immune stimulating substances lead to increase the immune response that could result in enhanced growth rate and performance may be due to the decrease in the load of infectious causes and give chance to maximum performance. Also, increased the body weight of broiler chickens treated with immunostimulants may be due to an increase in the digestive enzymes as trypsin and amylase [27-29].

**Table 3: Mean bursal weight (g) and relative weight to body weight of the experimental groups at day 35**

<table>
<thead>
<tr>
<th></th>
<th>A$^1$</th>
<th>B$^2$</th>
<th>C$^3$</th>
<th>D$^4$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body weight (kg)</td>
<td>1.79±0.37$^a$</td>
<td>2.03±0.15$^b$</td>
<td>1.87±0.63$^d$</td>
<td>1.82±0.46$^a$</td>
</tr>
<tr>
<td>Bursa weight (gm)</td>
<td>1.63±0.12$^a$</td>
<td>2.78±0.23$^b$</td>
<td>1.47±0.34$^d$</td>
<td>1.58±0.39$^a$</td>
</tr>
<tr>
<td>At 35 days*</td>
<td>0.91</td>
<td>1.31</td>
<td>0.78</td>
<td>0.86</td>
</tr>
</tbody>
</table>

1: group A was not treated with any immunostimulants and used as a control. 2: groups B was supplemented with Imutrix® (oregano oils plus β-glucan). 3: group C was supplemented with Evit liquid® (Vitamin E plus selenium). 4: group D was supplemented with immunair®17.5 (Propionibacterium acnes and E. coli lipopolysaccharides). The means within the same row with common letter, do not have a significant difference ($P>0.05$). $^*$ Relative weight of bursa to body weight of the experimental groups at day 35.
In particular, with Imunitrix® treated group (a combination between β-glucan and oregano oil), our results were in concordance with Mocar et al. [30] who observed that oregano essential oils help in improving the BW gain of broilers through improvements of feed consumption and encouragement of proteins deposition in muscle. There was a positive effect of oregano oils on body weight gain through an increase in the feed conversion efficiency [29,31,32].

In group D which supplemented with Inmunair17.5® (Propionibacterium acnes +lipopolysaccharides of E. coli), the increase in BW was low that was in agreement with Gaines et al., [33] and Yang et al., [34] who found that the LPS administration is a potent inflammatory inducer which elicit the pro-inflammatory cytokines that have an effect on BW gain as a consequence of inflammatory response. Also, Korver and Klasing [35] noted the decrease in growth rate that resulted from LPS due to the rationing of nutrient supply from growth and directed toward inflammatory immune response.

In this study, the bursal weights (as a percentage to the BW) were not significantly different for experimental supplemented immunostimulants when measured at 5th weeks of age except in group B in which there was an increase in the weight of bursa in comparison to the control group. Broilers supplemented with feed containing thyme had no considerable diversity in the spleen and bursa relative weights in comparison to control groups which was disagreed with our results [36]. In this study, the highest AI and ND HI-antibody responses were emerged in birds of group B followed by group C and the least response was of group D in comparison to control group.

Table 4: Average HI log₂ titers of immune response against Avian Influenza and Newcastle Diseases vaccination

<table>
<thead>
<tr>
<th>Groups</th>
<th>AI day 7</th>
<th>AI day 14</th>
<th>AI day 21</th>
<th>AI day 28</th>
<th>AI day 35</th>
<th>ND day 7</th>
<th>ND day 14</th>
<th>ND day 21</th>
<th>ND day 28</th>
<th>ND day 35</th>
</tr>
</thead>
<tbody>
<tr>
<td>A¹</td>
<td>5.0±0.21</td>
<td>4.0±0.42</td>
<td>3.5±0.45</td>
<td>2.0±0.19</td>
<td>6.0±0.52</td>
<td>4.7±0.36</td>
<td>2.6±0.44</td>
<td>4.6±0.71</td>
<td>4.0±0.48</td>
<td></td>
</tr>
<tr>
<td>B²</td>
<td>4.8±0.34</td>
<td>4.3±0.36</td>
<td>5.4±0.56</td>
<td>3.5±0.34</td>
<td>6.7±0.19</td>
<td>5.4±0.55</td>
<td>6.3±0.10</td>
<td>6.7±0.57</td>
<td>6.2±0.21</td>
<td></td>
</tr>
<tr>
<td>C³</td>
<td>5.2±0.47</td>
<td>4.4±0.53</td>
<td>5.1±0.76</td>
<td>3.2±0.54</td>
<td>6.3±0.61</td>
<td>5.0±0.61</td>
<td>5.6±0.27</td>
<td>6.2±0.74</td>
<td>5.1±0.37</td>
<td></td>
</tr>
<tr>
<td>D⁴</td>
<td>4.8±0.65</td>
<td>4.5±0.12</td>
<td>4.9±0.32</td>
<td>3.0±0.56</td>
<td>6.0±0.43</td>
<td>4.6±0.38</td>
<td>5.1±0.54</td>
<td>6.0±0.66</td>
<td>4.75±0.22</td>
<td></td>
</tr>
</tbody>
</table>

¹: group A was not treated with any immunostimulants and used as a control. ²: groups B was supplemented with Imunitrix® (oregano oils plus β-glucan). ³: group C was supplemented with Evit liquid® (Vitamin E plus selenium). ⁴: group D was supplemented with immunair®17.5 (Propionibacterium acnes and E. coli lipopolysaccharides). The means within the same column with common letter, do not have a significant difference (P>0.05).

Figure 1: The immune profile of AI vaccination with immunostimulant supplementation in broiler chickens. A: The HI log₂ titers after AI vaccination. B: The HI log₂ titers after ND vaccination. The birds in group A were not treated, while, groups B, C and D were supplemented with Imunitrix® (oregano oils plus β-glucan), Evit liquid® (Vitamin E plus selenium) and immunair®17.5 (Propionibacterium acnes and E. coli lipopolysaccharides), respectively.
Similar to our results immune stimulants have antioxidant property such as thyme and Vit. E plus selenium could improve immune responses [37-39]. Acamovic and Brooker [37] investigated the mechanism of how thyme could raise the immune response and stated the immune-stimulating activity of thymol and oregano essential oil hence to the phagocyte system, cellular and humoral immunity. Also, continuous dietary application of thymol + carvacrol has a potential humoral immunostimulant activity in broilers [29,40]. Moreover, another study was carried to see the effect of thymol and carvarcol combination on NDV-HI specific antibody of broiler chickens and they found that those oils induced NDV-HI specific antibody titers in superior manner than that mentioned with levamisole [41].

In accordance with our results of group C, the humoral immune response was improved in broilers supplemented with 132mg/kg of vitamin E than the control group [42,43]. Explaining the mechanism of Vitamin E in intensification of the immune response in birds, Moriguchi et al. [44] and Tampieri et al. [45] noticed an enhancement in macrophage phagocytic function, declining in prostaglandin E₂ production, increasing IL-1 secretion by macrophages, and enhancing IL-2 production and T-cell in broilers fed diets with high levels of Vitamin E. In particular to group D, there was a little effect on the immune response in comparison to other treated groups, this may be in accordance with the previous researchers who found a poor humoral immune response in goats treated with P. acnes and attributed this to the method of administration (oral route) [46]. Also, Flaminio et al. [47] did not detect any improvement on IgG and IgM levels on foals treated with P. acnes.

Conclusion

In conclusion, there was a noteworthy effect of oregano essential oils with β-glucan (Imutrix®) on BW gain at the end of the experiment. However, birds supplemented the vitamin E plus selenium (Evit®) had a lower feed intake and a better FCR than birds in the control group. Regarding the serological data, immunomodulators (Oregano oil plus β-glucan and Vitamin E plus selenium) used in present study were revealed a slight positive effect on antibody production against AI and ND vaccines. However, Propionibacterium acnes plus LPS of E. coli did not significantly change the serum IgG levels of broilers.

Conflict of interest

None of the authors have any conflict of interest to declare.

References


الملخص العربي

تقييم مقارن لبعض المحفزات المناعية على رد الفعل المناعي في بداري التسمين ضد تحسينات افلونزا الطيور والنيوكاسل

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إن استخدام المحفزات المناعية جنب مزيد من الإهتمام لتقنية الجهاز المناعي وتحسين الإداء في إنتاج الدواجن. تناولت هذه الدراسة تأثير استخدام المحفزات المناعية المختلفة على الاستجابة المناعية للقاحات ضد مرضي الأنفلونزا والنيوكاسيل. استُخدمت هذه التجربة باستخدام عدّ 100 كمبيست من سلالات روس عمر يوم حيث تم تربيتهم حتى عمر 35 يوم مع تقسيمهم منذ اليوم الأول إلى أربعة مجموعات (أ، ب، ج، د). كل مجموعة عبارة عن 25 كمبيست. المجموعة الأولى (أ) المضافة بدون إضافة أي محفزات مناعية. بينما المجموعات ب، ج، د تم إضافة محفزات متعددة (عقار عن زويت الوريجانو وبتيجلوكان) و فيتامينات هـ، سيتامين و مضادات المبالحة. هو عبارة عن نموذج لكل كمبيست لزيادة مناعة المحمض. الأكولواتي بالإضافة إلى كبريتيا أكب. وقد أظهر التحليل الإحصائي لبيانات وجود فروق معنوية بين مداء المحمض بالنسبة لوزن الجسم وكذلك معامل التحويل الغذائي حيث سجلت المجموعة (ب) أعلى وراثي للجسم (3.2 كجم) بينما طور المجموعة (ج) 2.87 كجم، بينما المجموعة (د) 2.80 كجم. وقد جاءت النتائج كلاً على من المحمض المضافة (9.79 كجم). أوضح وزن البريسا عدم وجود أي فرق معنوي بين المحمضات معاد المحمض (ب) والتي زاد وزن البريسا بها عن باقي المحمضات والذي وصل بتراول 1.15 جرام عن المحمض المضافة. وقد كانت الاستجابة المناعية متباين لجهازاً مع هذه النتائج وكانت_creator أجتازت تستًس المجتمع المصعوبات. استهدفت المحمض المحمض من لد تحسين افلونزا الطيور والنيوكاسيل أعلى درجة أجتаз في المحمض (ب) وخاصة في أيام 21 والي 35 بينما سجلت أقل مستوى أجياني بدون فرق معنوي عند درجة 3.5 في المحمض (د). من كل ما سبقنا يوضح أن استخدام مضادات المناعة خاصة بمحيط كنزيك أو تيامين + في قطعان التسمين له تأثير أجياني واضح على إعاقة وازن الطور المعالجة كما أن استخدام هذه المحفزات المناعية يعمر من قدرة واستجابة الجهاز المناعي لداري التسمين ضد تحسينات افلونزا والنيوكاسيل مما يزيد من الحفاظ على مستوى الحماية للإجسام المنضدة المتكونة ومنع انسحابه بصورة سريعة كما شوهد في مجموعات التحفيز المضافة.