Investigation in the effect of using wheat gluten meal on broiler performance

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This experiment was conducted to investigate the nutrition value of wheat gluten meal and its effect on broiler performance. At first, the AMEn, TMEn as well as the nutrient composition of the wheat gluten meal were determined. Then, five different isocaloric and isonitrogenous rations including 1) Control diet without wheat gluten meal 2) Diet containing 2.5% wheat gluten meal 3) Diet containing 5% wheat gluten meal 4) Diet containing 7.5% wheat gluten meal 5) Diet containing 10% wheat gluten meal were used for 49d in a CRD, with 4 replicates and 20 day-old broiler chicks in each.

The results indicated that the weight gain was the highest in the chicks fed with control diet, 2.5% as well as 5% wheat gluten meal(P<0.05). The diet containing 7.5% wheat gluten meal resulted in the lowest feed consumption(P<0.05). The best feed conversion ratio was obtained with diets containing 2.5%, 5%, 10% wheat gluten meal(P<0.05). No significant difference was observed for mortality rate.

In addition to above-mentioned traits, the effect of wheat gluten meal on some other traits in broiler performance were determined as follows:

The least feed cost per kg of live body weight was caused by diets containing 2.5% and 5% wheat gluten meal(P<0.05). The percentage of breast weight to carcass weight was the highest in broilers fed with control diet and diets containing 2.5% and 5% wheat gluten meal. The carcass fat percentage turned out to be the highest in broilers fed with diet containing 7.5% wheat gluten meal(P<0.05). However, other traits such as thigh percentage, wings percentage and liver weight percentage were not statistically influenced by the different diets.

Keyword: Wheat gluten; broiler; performance

Introduction:

Recognition of new sources of feed is necessary to alleviate the dependence of the country on the foreign feed sources known as a grave limiting factor in poultry industry.

Wheat gluten meal is cream powder with the PH of 5.8-6.4. It is mainly used in food industry such as bakeries, sausage, pasta, infant food supplement as well as glue production. In addition, wheat gluten meal can be employed as binder in fish feed. It is also used as shroud for eggs and as biopolymer replacing synthetic polymer in developed countries.

Wheat gluten meal contains 75-80% CP, 8% moisture, 0% ash, the least CF% and its water absorption rate is at least 170%. It has some important proteins such as Glutenin, Gliadin. Not only does it have high CP%, but it is considered as an appropriate source for amino acids particularly sulphur-containing ones. The deficiency of such amino acids is regarded as a main problem in poultry nutrition.

Pack (1997) observed that digestibility of sulphur-containing amino acids in wheat and corn gluten is as low as 62%. In addition to the appropriate balance of amino acids in wheat
gluten, it has the least anti-nutrient factors and it can improve palatability of feed. (Webster, 1984).

Chickens are so sensitive to high viscosity of intestine content in the first week of age and it can lead to reduction of enzyme function and nutrient absorption. It also results in reducing the passage time of feed through digestive track which in turn, makes feed remain longer time in digestive system followed by reduction in feed intake. Meanwhile, there is a higher rate of flora proliferation which consume the protein and starch existing in digestive system. (Heger & Fernando, 1997)

It was demonstrated that wheat gluten meal can be efficiently employed as protein supplement in hogs feed. (Richart et. al., 1994). It was also used as an appropriate source of protein in fish feed especially trout and shrimps. A research conducted Yahyazadeh et. al. (2000) concluded that diet containing 3% wheat gluten meal resulted in the highest weight gain and the best FCR in broilers.

The objective of this study was the determination of nutrition value of wheat gluten and investigation in its effects on broiler performance.

Materials & Methods:

At first, a sample of wheat gluten meal was chemically analyzed to determine the nutrient compositions in accordance with procedures of A.O.A.C.. Then, AMEn and TMEn of the sample were determined using the force feeding procedure applied by Sibbald. In addition, the amino acids profile was determined.

The experiment was carried out using five different levels of wheat gluten meal including 0, 2.5, 5, 7.5 and 10% in the rations for 49 days. To compare different treatments, a CRD test was used, with 4 replicates and 20 broiler chicks in each and the data analysis was done using SAS software.

All rations were the same in containing energy and CP%. They were prepared for three stages of the rearing period including starter, grower and finisher based on the broiler nutrient requirement. (NRC, 1994)

Some performance traits such as weight gain, feed intake, FCR, mortality rate, feed cost for one Kg of body weight on hen-day basis were determined and calculated. At the end of the experiment, two chicks, whose weight were approximately the same as the weight mean of each replicate, were selected and eviscerated. Then, abdominal fat, breast, thigh, liver, spleen and wings were weighed. These weights were expressed as percentage of the live body weight.

Results and Discussion:

The nutrient composition and the amino acids profile are shown in table 1 and 2 respectively.

Table 1: Energy and nutrient composition of the wheat gluten(as-fed basis)

<table>
<thead>
<tr>
<th>DM(%)</th>
<th>AMEn (kcal/kg)</th>
<th>TMEn (kcal/kg)</th>
<th>CP(%)</th>
<th>Fat(%)</th>
<th>CF(%)</th>
<th>Ca(%)</th>
<th>P (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>93.9</td>
<td>3798</td>
<td>4048</td>
<td>75.4</td>
<td>0.3</td>
<td>1.4</td>
<td>0.09</td>
<td>0.18</td>
</tr>
</tbody>
</table>
The results obtained in this research are available in table 3 and 4. The data of table 3 indicate that some traits including weight gain, feed intake, FCR, feed cost for one Kg of live weight were influenced by different levels of wheat gluten meal(P<0.05), but no significant difference was observed in mortality rate.

The feed intake turned out to be the least and the most by the rations containing 7.5% and 2.5% wheat gluten meal respectively. Since the amount of energy and CP% of rations were the same, the hypothesis according to which chicks consume feed as much as their energy requirement is met can not be true of this experiment. Therefore, another factor related to wheat gluten consumption must be the main cause of the difference. As it was mentioned above, wheat gluten has high capacity for water absorption and it can lead to a paste-like and elastic mass which make intestinal content jelly-like when it is consumed in high amount. Hence, the feed intake is considerably reduced. In addition, the increase in adhesion of intestine due to high viscosity of the content might be the main reason for the reduction of feed intake.

Moreover, the imbalance of amino acids due to wheat gluten consumption can transmit some signals to appetite center in brain which brings about lower feed intake.(harper,1964). Pang et. al.(1972) demonstrated that amino acid imbalance can reduce the consumption of lysine as the first limiting amino acid in broiler which in turn, through making some signals in brain, it causes a reduction in feed intake.

The rations containing 7.5% and 2.5% wheat gluten meal resulted in the lowest and highest weight gain respectively. Rations containing 0, 2.5 and 5% wheat gluten showed no significant difference. With regard to the fact that chicks fed with ration containing 7.5% had the lowest feed intake, the low weight gain can be explained.

The worst FCR turned out to be in chicks fed with ration containing 7.5% wheat gluten and it can be easily justified by the lowest feed intake and weight gain in this treatment. The best FCR was by ration containing 5% wheat gluten which had no significant difference with the rations containing 2.5 and 10%. The results of the experiment is in correspondence with Yahyazadeh et. al.(2000) who reported 3 and 6% wheat gluten meal as the best levels for FCR.

The feed cost for one Kg of live weight as an economic index was the least in the rations containing 2.5 and 5% wheat gluten and there was no significant difference among the other rations.(P<0.05).

### Table 2: Amino acids profile of the wheat gluten(as-fed basis)

<table>
<thead>
<tr>
<th>Amino acid</th>
<th>%</th>
<th>Amino acid</th>
<th>%</th>
</tr>
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<tbody>
<tr>
<td>Arg</td>
<td>2.20</td>
<td>Met</td>
<td>1.57</td>
</tr>
<tr>
<td>Gly</td>
<td>2.23</td>
<td>Phe</td>
<td>3.07</td>
</tr>
<tr>
<td>Ser</td>
<td>4.34</td>
<td>Tre</td>
<td>1.67</td>
</tr>
<tr>
<td>His</td>
<td>1.32</td>
<td>Trp</td>
<td>2.85</td>
</tr>
<tr>
<td>Lue</td>
<td>2.91</td>
<td>Val</td>
<td>2.57</td>
</tr>
<tr>
<td>Lys</td>
<td>2.79</td>
<td>Glu</td>
<td>16.28</td>
</tr>
<tr>
<td>Pro</td>
<td>6.03</td>
<td></td>
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</tr>
</tbody>
</table>

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The feed cost for one Kg of live weight as an economic index was the least in the rations containing 2.5 and 5% wheat gluten and there was no significant difference among the other rations.(P<0.05).
Table 4 represents the data related to carcass quality. The breast percentage was the lowest in chicks fed with 7.5 and 10% and the highest in chicks fed with 0, 2.5 and 5% wheat gluten. (P<0.05). It seems that due to elasticity and adhesion quality of intestinal content caused by high gluten and subsequent lack of appetite, the feed intake decreases, so birds can not obtain sufficient protein particularly lysine required for perfect growth of breast muscles.

Table 4: Effect of different levels of wheat gluten on carcass composition

<table>
<thead>
<tr>
<th></th>
<th>0%</th>
<th>2.5%</th>
<th>5%</th>
<th>7.5%</th>
<th>10%</th>
</tr>
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<tbody>
<tr>
<td>Abdominal fat (%)</td>
<td>3.49&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>3.04&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>2.99&lt;sup&gt;b&lt;/sup&gt;</td>
<td>4.36&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.82&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Breast percentage (%)</td>
<td>22.43&lt;sup&gt;a&lt;/sup&gt;</td>
<td>22.92&lt;sup&gt;a&lt;/sup&gt;</td>
<td>21.75&lt;sup&gt;a&lt;/sup&gt;</td>
<td>17.45&lt;sup&gt;b&lt;/sup&gt;</td>
<td>19.15&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Liver percentage (%)</td>
<td>2.65&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.91&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.81&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.98&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.82&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Thigh percentage (%)</td>
<td>25.89&lt;sup&gt;a&lt;/sup&gt;</td>
<td>25.68&lt;sup&gt;a&lt;/sup&gt;</td>
<td>25.65&lt;sup&gt;a&lt;/sup&gt;</td>
<td>25.29&lt;sup&gt;a&lt;/sup&gt;</td>
<td>26.60&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Spleen percentage (%)</td>
<td>0.189&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.214&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>0.217&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>0.237&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.248&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Wings percentage (%)</td>
<td>9.26&lt;sup&gt;a&lt;/sup&gt;</td>
<td>9.23&lt;sup&gt;a&lt;/sup&gt;</td>
<td>9.34&lt;sup&gt;a&lt;/sup&gt;</td>
<td>9.08&lt;sup&gt;a&lt;/sup&gt;</td>
<td>9.84&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

The influence of various levels of wheat gluten on liver percentage was not significant. However, 7.5% wheat gluten meal resulted in the highest one. Abdominal fat percentage in the chicks fed with 7.5% wheat gluten was significantly higher than other treatments. (P<0.05). It can be due to amino acids imbalance, reduction of lysine consumption, reduction of protein consumption and unbalanced ratio of energy to amino acids which are followed by considerable fat deposit in abdomen. This is in correspondence with Kidd and Kerr (1998). Thighs and wings percentages as well as mortality rate were not affected by different levels of wheat gluten.

It is concluded that wheat gluten meal can be regarded as an appropriate protein supplement in broiler nutrition and the best performance is obtained using 5% wheat gluten in ration.

Reference: