Effect Using Wheat *Triticum aestivum* and Corn *Zea mays* in Broiler Diets and Sex on Specific Characteristics

S. I. YOUSIF 1*, W. A. AL-HAMDANI2, B. H. MOUSA1 and A. A. Y. Al-Hamdani3

1 Department of Food Science, Collage of Agriculture, University of Anbar, Iraq
2 Ministry of Trade, Anbar, Iraq
3 Department of Animal production, Collage of Agriculture, University of Anbar, Iraq

*Corresponding author: e-mail: ag.saad.ibrahim@uoanbar.edu.iq

Abstract. This study was conducted on poultry farm belong to Animal production, College of Agriculture, University of Anbar, from 5/2/2020 to 11/3/2020 (35 days). The aim of the study was to find out the effect of cereal type and sex on broiler performance. Four Hundred broiler chicks (males + females) strain (Ross 308) with the average initial body weight of 40 gm/chick used in this study. Chicks randomly assigned to two groups; each group subdivided into two replicates (100 chicks per replicate). Birds in Group 1 (100 males) + (100 females) fed with a diet based on wheat as cereal type, Birds in Group 2 (100 males) + (100 females) fed with a diet based on corn as cereal type. Chemical analysis of corn and wheat were calculated in cereal laboratory to belong to general company of cereals and feeds / Anbar Province, protein , fat , ash , fiber, nitrogen was analyzed . At the field experiment, feed and water provided. Chicks reared in a closed farm containing ground cages with an area 10m². Use a continuous lighting program 24 hours/day from the first day of the experiment to the end. The data of Body Weight Gain (BWG), Feed Intake (FI) recorded weekly, and Feed Conversion Ratio (FCR) was calculated. Birds in the group fed diets based on wheat as cereal type (males) showed highest values in body weight and body weight gain, the lowest feed intake, and better-feed conversion ratio during overall experimental periods as compared with other groups. On the other hand, bird's in-group fed diets based on corn as cereal type (males + females) recorded lowest values in body weight, body weight gain and worst feed conversion ratio. From these results, we can conclude that broiler more efficient when diets based on wheat s cereal type more than corn, especially at an advance age.

1. Introduction

Wheat and corn are most common sources of cereal used in poultry diets as energy source[1] . Corn is the most important source of preferred cereal for most specialists in broiler nutrition, but it is not always available at the economic price that supports in poultry feeds. As well as, its exposure to fungi (Aflatoxins and Mycotoins), which requires alternative sources and cheap of cereal suitable for feeding. Wheat is one of these sources, which is an ideal economic alternative due to its availability. However, wheat consider is the main source of cereals in almost strains of broiler feeds in Europe, Australia and Canada [2], while corn used widely in the USA and Brazil, due to high production in those countries [3]. Diets of broiler contain large quantities of forage materials of from plant origin (especially wheat or barley), which including high amounts of Non-Starch Polysaccharide (NSP) dissolved in water, will negatively affect the benefit of the nutrients they contain, and that led to negative impact on the performance of broiler. The negative effects of non-starch saccharides dissolved in water represented by an increase in the viscosity of the intestine, and an increase in number of pathological microorganisms within intestine of birds. Which causes a decrease in digestibility factor of nutrients and an increase in the intensity of competition between
microorganisms, for nutrition for these nutrients as well as a change in anatomical shape of the intestine [4]. The presence of many non-starchy saccharides dissolved in water, especially arabinoxylan, beta-glycan in wheat, requires addition of exogenous enzymes such as xylanase and glucanase in sufficient quantities to reduce viscosity of intestine, increase efficiency of nutrients digestion and improve performance. Due to the role, that enzymes play in breaking bonds that prevent the release of elements important food those endogenous enzymes cannot release, especially in older age poultry [5]. Found [6] that broiler females at the age of 21 days are more efficient than poultry males in taking advantage of energy diet due to the difference in the morphological anatomy (morphology) and microbiology in gut. However, [7] noticed that values of the apparent representative energy in broiler males are higher than broiler females at 6 weeks of age. The blurry and unclear vision of the effect of cereal type in broiler diets as well as sex on productive performance, led us to carry out this research. The aim of it gives the best possible combination between the gender and cereal.

2. Materials and Methods

The experiment carried out in poultry farm/ College of Agriculture - University of Anbar from the period 5/2/2020 to 11/3/2020 (35 days). Broiler chicks (Ross308) 400 chicks with an average weight 40g used at the age of one day, sexed, obtained from the Habbaniyah hatchery in Anbar province, were distributed to (200 male chicks, 200 female chicks) randomly into four replicates with initial weight 40 gm.

The chicks fed three phases’ rations, a starter from (1- 10 days), Grower (11-24) days and finisher (25-35) days; the diets formulated to meet the requirements of birds established by the (NRC, 1994) for broiler (Table 1). Table 2 shows the content of 100 g of cereal (moisture base), of the base materials. Measurements made in laboratories of General Authority for Cereal Processing / Ministry of Trade. Diets samples analyzed in triplicate protein, fat contents, moisture content, total carbohydrate [1], Energy (kcal/kg) [8], Fiber [9], Lysine, Methionine, Cysteine, Calcium and available phosphorus [10].

Table 1. wheat and corn in broiler diet with other content

| Forage     | Starter (1-10days) | Grower (11-24days) | Finisher (25-35) |
|------------|--------------------|---------------------|------------------|
|            | Wheat   | Corn   | Wheat   | Corn   | Wheat   | Corn   |
| Wheat      | 62    | 63.34  | 59     | 67.26  | -       | -      |
| Corn       | -     | 58.5   | -      | 59     | -       | 63     |
| Soybean    | 30.63 | 35.77  | 29     | 35.1   | 24.6    | 30.7   |
| Premix     | 2.6   | 2.6    | 2.6    | 2.6    | 2.6     | 2.6    |
| Fat        | 3.3   | 1.7    | 4      | 2.4    | 4.1     | 3      |
| limestone  | 0.6   | 0.75   | 0.5    | -      | 0.65    | -      |
| Di-calcium phosphate | 0.5 | 0.45 | 0.3 | 0.75 | 0.35 | 0.7 |
| DL-methionine | 0.17 | 0.13 | 0.12 | 0.15 | 0.07 | - |
| L-lysine   | 0.2   | 0.1    | 0.14   | -      | 0.07    | -      |
| Total      | 100   | 100    | 100    | 100    | 100     | 100    |

Chemical composition analysis

|                  | Cereal Composition Analysis |
|------------------|-----------------------------|
| Crude protein %  | 22.46 22.46 21.17 21.18 19.45 19.47 |
| Energy (kcal/kg) | 3021 3022 3095 3195 3165 3167 |
| Fiber%           | 3.7 2.7 3.02 2.65 2.97 2.57 |
| Fat%             | 5.24 4.4 5.89 5.12 6.54 5.73 |
| Lysine %         | 1.41 1.45 1.25 1.29 1.09 1.18 |
| Methionine%      | 0.68 0.69 0.65 0.64 0.55 0.52 |
| Cysteine%        | 0.38 0.38 0.36 0.37 0.33 0.34 |
| Methionine+cysteine% | 1.06 1.07 1.01 1.01 0.88 0.86 |
| Calcium %        | 0.67 0.99 0.90 0.92 0.89 0.88 |
| Available phosphorous% | 0.48 0.48 0.46 0.46 0.45 0.44 |

Note. Chemical analysis calculated based on feed consumption Tables of [11].
Table 2. Cereal chemical composition

|          | Wheat     | Corn     |
|----------|-----------|----------|
| Moisture (g) | 13        | 10       |
| Energy (kcal) | 1372      | 1428     |
| Curd protein (g) | 12.6      | 9.6      |
| Fat (g)     | 1.59      | 4.75     |
| Carbohydrate (g) | 72        | 74       |
| Fiber (g)  | 12.1      | 7.5      |

Statistical Analysis System -SAS [12] used in data analysis to study the effect of different parameters on the studied traits according to the complete randomization design of four experimental parameters. The coefficients were combinations between the quality of the cereal and the sex of the bird, and the difference between the averages tested using the Duncan polynomial test.

3. Results and Discussion

3.1. The effect of cereal type and sex on body weight and weight gain average

The results of statistical analysis in table (3) showed no significant differences between treatments at 1 day and 7 days in body weight. This table also showed significant differences between treatments, birds in group fed-diet with wheat as cereal type with highest weight (374, 825, 1415.6 and 2157) gm. in weeks (14, 21, 28 and 35), respectively.

The results of the statistical analysis in table (4) showed significant differences between treatments in all weeks for body weight gain average. The treatment of wheat-male gave highest body weight gains rate (95.7, 237.7, 451.3, 590 and 741.4) gm. in for ages (7, 14, 21, 28 and 35) days old respectively. The high percentage fat in wheat diet may be a reason for improving performance of broilers compared to corn as cereal type with highest weight (374, 825, 1415.6 and 2157) gm. in weeks (14, 21, 28 and 35), respectively.

The results also showed that body weight and body weight gain increases in males significantly higher than female at all ages, degree of significance increased with older age. These results may be due to Ross strain is a European strain of origin and fed mainly by diets whose main source of cereal is wheat and for very many generations. Therefore, the gene expression will change accordingly, which enables broiler to adapt through the type of feeding to provide them and thus will have ability to consume rations of wheat without a negative effect, this result in agreement with[14]. Results evident males have achieved better productive performance than females. This case occurs with effect of androgen hormone and its effects on embryos during incubation period, its role in increasing growth, differentiation of muscle fibroblasts and length sarcomeres. During embryonic stage after hatching, which leads to emergence of differentiation and difference between sexes in treatments [15].

Table 3. Effect of cereal type and sex in body weight (gm.)

| Treatments   | 7day  | 14day | 21day | 28day  | 35day  |
|--------------|-------|-------|-------|--------|--------|
| Wheat / male | 136.2 | 374.0 | 825.4 | 1415.6 | 2157.0 |
| Wheat / female | 136.2 | 348.9 | 758.7 | 1235.2 | 1842.8 |
| Corn / male  | 129.8 | 330.6 | 695.8 | 1186.2 | 1872.4 |
| Corn / female | 123.9 | 320.0 | 687.0 | 1104.5 | 1691.1 |

*letters within columns indicate the presence of significant differences between treatment (P <0.05).*
Table 4. Effect of cereal type and sex in weight gain average (gm.)

| Treatments       | 0-7   | 8-14  | 15-21 | 22-28 | 29-35 | 1-35  |
|------------------|-------|-------|-------|-------|-------|-------|
| Wheat / male     | 95.7a | 237.7b| 451.3a| 590.0a| 741.4a| 2116.5a|
| Wheat / female   | 89.2b | 219.2c| 409.8b| 476.5c| 607.6c| 1802.4b|
| Corn / male      | 88.5b | 200.7c| 365.2a| 490.4b| 686.2b| 1831.2b|
| Corn / female    | 82.6b | 267.0d| 367.0c| 417.5d| 586.5d| 1650.7c|
| Sig.             | 0.0274| 0.0006| 0.0018| 0.0008| 0.0113| <0.0001|

*letters within columns indicate the presence of significant differences between treatment (P <0.05).

The effect of cereal type and sex in feed intake (gm.)
The results of statistical analysis in table (5) showed no significant differences between treatments in period 0-7 day in feed intake. In the other periods, there were a significant differences between treatments, wheat/female outperform to other treatment and recorded (284, 646, 768.6 and 1002.7) gm at periods (8-14, 15-21, 22-28 and 29-35) respectively. For accumulative period 1-35 days, wheat/ female treatment recorded lowest feed intake 2818.4 gm. There are large wide differences between wheat types because of different varieties and regions. Local wheat is considered medium quality due to long period of storage, as it founds an increase in the content of poor quality forage materials from apparent energy represented, especially during the first six months of storage [16]. In addition to the slower pace releasing dissolved sugars in water, which have a negative impact on digestibility nutrients factor [17].

Table 5. Effect of cereal type and sex in feed intake (gm. feed/bird)

| Treatments       | 0-7   | 8-14  | 15-21 | 22-28 | 29-35 | 1-35  |
|------------------|-------|-------|-------|-------|-------|-------|
| Wheat / male     | 122.9 | 317.0a| 737.1a| 813.5c| 1157.1c| 3147.6c|
| Wheat / female   | 116.3 | 284.0b| 646.8b| 768.6a| 1002.7a| 2818.4a|
| Corn / male      | 121.0 | 324.4a| 740.2a| 1033.0a| 1381.3a| 3601.7a|
| Corn / female    | 113.2 | 315.3a| 709.4b| 880.1b| 1231.5b| 3249.6b|
| Sig.             | 0.6807| 0.051 | 0.0382| 0.0306| 0.0004| 0.0082|

*letters within columns indicate the presence of significant differences between treatment (P <0.05).

The effect of cereal type and sex in feed conversion ratio (gm. feed intake /gm. weight gain)
The results of statistical analysis in table (6) showed no significant differences between treatments in period 0-7 day in feed conversion ratio. However, in other periods, results showed an improvement in feed conversion ratio (FCR) significantly at period (8-14) days and it recorded the lowest rate. The cumulative period, periods (8-14 and 15-21) significantly improvement (FCR) to other periods by recorded the lowest rate. The results of this study agree somewhat with [18], they indicated the lowest feed conversion ratio was when using corn, while the wheat ration gave the highest nutritional FCR for broilers (Ross308).

Table 6. Effect of cereal type and sex in feed conversion ratio (gm. feed intake /gm. weight gain)

| Treatments       | 0-7   | 8-14  | 15-21 | 22-28 | 29-35 | 1-35  |
|------------------|-------|-------|-------|-------|-------|-------|
| Wheat / male     | 1.28  | 1.33b | 1.63c | 1.38c | 1.56c | 1.49c |
| Wheat / female   | 1.30  | 1.29b | 1.58c | 1.61b | 1.65c | 1.56b |
| Corn / male      | 1.36  | 1.61a | 2.03a | 2.11a | 2.01b | 1.96a |
| Corn / female    | 1.37  | 1.18c | 1.93b | 2.11a | 2.10a | 1.97a |
| Sig.             | 0.1398| 0.0001| 0.0008| 0.0066| <0.0001| <0.0001|

*letters within columns indicate the presence of significant differences between treatment (P <0.05).
4. Recommendations
We recommend using poultry diets containing wheat as an energy source, due to its availability in Iraq with large amount, in addition to fact using corn as an energy source increases the risk of infection with fungi, which leads to large losses.

References
[1] Yousif, SI, Bayram, M and Kesen, S 2018, Characterization of volatile compounds of bulgur (Antep type) produced from durum wheat. Journal of Food Quality.
[2] Bird, JN 1996, Performance improvements following enzyme supplementation of wheat-and barley-based poultry diets. Enzymes in Poultry and Swine Nutrition, 73-84.
[3] Moran, Jr, Chen, EX and Blake, J 1993, Comparison of broiler strain crosses developed in the US and UK using corn and wheat based feeds: live performance and processing of males for nine piece cuts. Journal of Applied Poultry Research, 2(1), 26-32.
[4] Parsaie, S 2007, Influence of wheat-based diets supplemented with xylanase, bile acid and antibiotics on performance, digestive tract measurements and gut morphology of broilers compared with a maize-based diet. British poultry science, 48(5), 594-600.
[5] Rao, S 2004, Replacement of yellow maize with pearl millet (Pennisetum typhoides), foxtail millet (Setaria italica) or finger millet (Eleusine coracana) in broiler chicken diets containing supplemental enzymes. Asian-Australasian Journal of Animal Sciences, 17(6), 836-842.
[6] Hughes, R 2001, Variation in the digestive capacity of the broiler chicken.
[7] Freitas, D 2011, Performance and nutrient utilization of broilers fed diets supplemented with a novel mono-component protease. Journal of Applied Poultry Research, 20(3), 322-334.
[8] Ledikwe, JH 2005, Dietary energy density determined by eight calculation methods in a nationally representative United States population. The Journal of nutrition, 135(2), 273-278.
[9] Cummings, J 1976, Changes in fecal composition and colonic function due to cereal fiber. The American Journal of Clinical Nutrition, 29(12),1468-1473.
[10] Shafey, T and McDonald M 1991, The effects of dietary concentrations of minerals, source of protein, amino acids and antibiotics on the growth of and digestibility of amino acids by broiler chickens. British Poultry Science, 32(3), 535-544.
[11] NRC, U 1994, Nutrient requirements of poultry. National Academy Press Washington, DC.
[12] Petersen, RG 1994, Agricultural Field Experiments: Design and Analysis. CRC Press.
[13] Nitsan, Z, Dunnington, E and Siegel, P 1991, Organ growth and digestive enzyme levels to fifteen days of age in lines of chickens differing in body weight. Poultry Science, 70(10), 2040-2048.
[14] Rogel, A 1987, Improvement of raw potato starch digestion in chickens by feeding oat hulls and other fibrous feedstuffs. Australian Journal of Agricultural Research, 38(3), 629-637.
[15] Laseinde, E and Olayemi, J 1994, Effect of sex separation at the finisher phase on the comparative growth performance, carcass characteristics and breast muscle development between male and female broiler chickens. Nigerian Journal of Animal Production, 21,11-18.
[16] Belaid, A 1994, Nutritive and Economic Value of Triticale as a Feed Grain for Poultry. CIMMyT.
[17] Annison, G 1993, The role of wheat non-starch polysaccharides in broiler nutrition. Australian Journal of Agricultural Research, 44(3),405-422.
[18] Ivanova, I., Georgieva, V and M. Lallev M 2013, Effect of wheat dry distiller’s grain in compound feeds for broiler chickens on productive and slaughter traits. Bulgarian J. Agric. Sci, 19(1),102-108.