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# EFFECT OF PARTIAL REPLACEMENT OF WATER-SOAKED FABA *BEANS* POWDER INSTEAD OF SOYBEAN MEAL IN THE DIET ON SOME PRODUCTIVE TRAITS OF LAYING HEN

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## Abstract

A total of 84 ISA Brown hen layer were used, supplied one of the private fields in Diyala Governorate at the age of 16 weeks, located in rearing house, at the fields of poultry of the Animal Production Department as one group, when reached 17 weeks of age, transferred to the experiment house, Includes wire pens with dimension (3 × 3 m), divided into three equal sections for each, each section contains 7 laying hens (21 laying hen / treatment), during the period 17-21 weeks, the birds fed the diet of control, before starting the experiment, to adapt to the new environment, the treatments were as follows; T1(control treatment): The diet contained 100% soybean meal. T2: water-soaked faba *beans* powder instead of soybean meal in the diet by 25%. T3: water-soaked faba *beans* powder instead of soybean meal in the diet by 50%. T4: water-soaked faba *beans* powder instead of soybean meal in the diet by 75%. The results show that no significant differences appeared in the studied productive traits (egg production percent, egg weight and feed conversion factor) for laying hens, when water-soaked faba *beans* powder instead of soybean meal in the diet by 0, 25, 50 and 75%.

***Key words:*** water-soaked, faba *beans*, soybean meal, productive traits, laying hen.

## Introduction

The main goal of setting up poultry projects, especially laying hens, is to provide eggs, as eggs are an integral food for humans because they are rich in protein, vitamins, mineral elements and essential fatty acids that are necessary for human health, therefore, countries around the world are seeking to expand poultry projects to meet the increasing requirements of their people (Al-Fayyad and Naji, 2012). Led to an increase in the demand for feed materials used in the composition of poultry feed, including imported feed materials, especially those that prepare protein in the diet, such as soybean meal, which costs a lot of money as well as it increases the nutrition costs, therefore, the researchers turned their attention to searching for alternative or inexpensive diet available in the local market, to be included in the composition of poultry diets, including faba bean, to be a substitute for soybean meal in diets of flesh or laying hens (Karman and Al-Sardary, 2009). Faba beans contain 28% protein but contain some inhibitors that limit their use in poultry diets such as Antitrypsin, Vicine, Covicine and phytic acid (Iji and Tirey, 1998), faba beans contain other factors that determine or correlate with nutrients, lead to lower utilization of nutrients and minerals (Samtiya *et al*., 2020), such as protein inhibitors (Kamarudheen and Rao, 2018), lectin inhibitors (Hamid and Masood, 2009). Several attempts were made to improve the nutritional value of beans, using various methods, including cooking, fermentation, germination, marinating, or support them with essential amino acids or add some enzymes, for partial or total use, replace soybean meal in diets, characterized by high digestibility coefficient which is not less than 83%, rich in lysine and a good source of phosphorous (Blair *et al*., 2008).

The lack of studies related to the use of faba beans soaked in water in laying hens diet, used in 25, 50, 75% substitutions of soybean meal in laying hens, study the effect on some productive characteristics of laying hens.

## Materials and Methods

### Design the experiment

A total of 84 ISA Brown hen layer were used, supplied one of the private fields in Diyala Governorate at the age of 16 weeks, located in rearing house, at the fields of poultry of the Animal Production Department as one group, when reached 17 weeks of age, transferred to the

**Table 1.** Percentage and calculated chemical composition of diet components used in the experiment (22-32) weeks.

| Item | Treatment | | | |
|---|---|---|---|---|
| | T1 | T2 | T3 | T4 |
| Maize | 38.5 | 38.5 | 38.5 | 38.5 |
| Wheat | 10 | 10 | 10 | 10 |
| Barley | 6.5 | 6.5 | 6.5 | 6.5 |
| Faba beans | 0 | 5.75 | 11.5 | 17.25 |
| Soybean meal | 23 | 17.25 | 11.5 | 5.75 |
| Wheat bran | 8 | 8 | 8 | 8 |
| Premix | 2.5 | 2.5 | 2.5 | 2.5 |
| Plant oil | 2 | 2 | 2 | 2 |
| Limestone | 8 | 8 | 8 | 8 |
| Salt | 0.5 | 0.5 | 0.5 | 0.5 |
| Multi- vitamins | 1 | 1 | 1 | 1 |
| **Chemical analysis** | | | | |
| Crude protein (%) | 17.09 | 16.22 | 15.13 | 14.15 |
| Metabolizable *energy* (kilo calorie/ kg diet) | 2784.72 | 2786.85 | 2789.70 | 2792.55 |
| Lysine (%) | 0.82 | 0.76 | 0.69 | 0.62 |
| Methionine (%) | 0.39 | 0.37 | 0.35 | 0.33 |
| Available phosphorus (%) | 0.48 | 0.46 | 0.44 | 0.42 |
| Calcium (%) | 3.59 | 3.66 | 3.73 | 3.80 |

*The chemical composition values for feed materials included in the feed composition were calculated according to (NRC, 1994).

experiment house, Includes wire pens with dimension (3 × 3 m), divided into three equal sections for each, each section contains 7 laying hens (21 laying hen / treatment), during the period 17-21 weeks, the birds fed the diet of control, before starting the experiment, to adapt to the new environment, the treatments were as follows (Table 1). T1 (control treatment): The diet contained 100% soybean meal. T2: water-soaked faba *beans* powder instead of soybean meal in the diet by 25%. T3: water-soaked faba *beans* powder instead of soybean meal in the diet by 50%. T4: water-soaked faba *beans* powder instead of soybean meal in the diet by 75%. Faba beans used in the experiment were soaked in water for 12 hours at room temperature, analyzed before and after fermentation in the laboratories of the Faculty of Agriculture, Al-Muthanna University (Table 2).

**Table 2.** Chemical analysis of forage beans before and after the soaking process.

| Content (%) | Before soaking | After soaking |
|---|---|---|
| Moisture | 12.75 | 14.32 |
| Dry matter | 87.25 | 85.68 |
| Protein | 27.93 | 27.89 |
| Fat | 1.50 | 1.47 |
| Fiber | 21.22 | 21.19 |
| Calcium | 1.15 | 1.17 |
| Phosphorus | 3.73 | 3.76 |
| Carbohydrates | 44.47 | 44.52 |

### Studied traits

• Egg Production Percent: Eggs were collected at two o'clock throughout the experiment, the egg production ratio for each hen was calculated on the basis of the number of chickens present at the end of each period for each treatment (Hen Day Production), for three times, the following formula (North, 1984):

$$Egg\ production\ percent = \frac{\text{Egg production}}{\text{Hen number}} \times 100$$

• Egg Weight: Eggs were weighed weekly and collectively for each of the treatments repeat, by a balance Type Muttler 2000 was sensitive to the nearest gram, the average egg weight was extracted during each trial period.

• Feed Conversion Coefficient: The feed conversion factor was calculated by the following formula (North, 1984):

$$\text{Feed Conversion Coefficient} = \frac{\text{Feed consumption}}{\text{Egg mass}}$$

$$Egg\ mass = \frac{\text{Egg production percent}}{100} \times Egg\ weight\ mean$$

### Statistical analysis

Completely Randomized Design (CRD) was used to study the effect of different treatments on the studied traits, comparison of the mean differences between the means of the Duncan, (1955) multiples test under a significant level of 0.05 and 0.01, SAS, (2001) was used in statistical analysis.

## Results and discussions

### Egg Production Percent

Table 3, shows that no significant effect in reducing

**Table 3.** The effect of partial replacement of water-soaked faba *beans* powder instead of soybean meal in the diet on weekly egg production H.D% (mean ± standard error).

| Treat-ments | Age (weeks) | | | Total |
|---|---|---|---|---|
| | 22 | 28 | 32 | |
| T1 | 0.44±82.35 | 0.51±90.01 | 0.66±92.74 | 0.08±88.86 |
| T2 | 0.18±82.16 | 0.10±90.19 | 0.28±92.18 | 0.24±88.63 |
| T3 | 0.40±81.43 | 0.40±89.90 | 0.55±92.94 | 0.18±88.72 |
| T4 | 0.73±81.91 | 0.56±90.86 | 0.18±92.60 | 0.20±88.82 |
| Sig. | N.S | N.S | N.S | N.S |

T1 (control treatment): The diet contained 100% soybean meal. T2: water-soaked faba *beans* powder instead of soybean meal in the diet by 25%. T3: water-soaked faba *beans* powder instead of soybean meal in the diet by 50%. T4: water-soaked faba *beans* powder instead of soybean meal in the diet by 75%. N.S no significant differences.

the percentage of egg production in partial substitution treatments of soaked faba beans instead for soybean meal, may be due to the soaking process for beans, as the process of maceration led to the reduction or scaling up of the effect of inhibitors present in the leguminous, worked to activate internal enzymes, which led to an improvement in the digestion of soaked beans and then accelerated the absorption process.

Yasar and Forbes, (2000) indicated that the soaking process removes the anti-nutritional compounds in the beans that are soluble, because soaking reduces the anti-nutritional compounds in the beans of the beans by 45%. The soaking process also helps smooth the seed layer, does not affect the protein content of beans, help increase protein digestibility factor, because of the reduced level of trypsin inhibitor and other antagonists such as tannins and multiple phenols, which interact with protein to form complex compounds to make these compounds soluble during soaking (Abdel-Aleem *et al*., 2019).

**Egg Weight**

Table 4, show that effect of replacing soaked faba beans instead soybean meal in the diets at rates of 0, 25, 50 and 75%, there were no significant differences between the treatments in the egg weight and there were no significant differences in the cumulative weight of the egg weight, as the various treatments were close to the cumulative weights rate, which ranged between 55.65, 55.56, 55.38 and 55.35 g / egg during the production period.

This convergence in the weights rates between substitution treatments between soaked faba beans and soybean gain in diets is explained, may be due to the process of maceration, which led to reducing or limiting the effect of inhibitors in the legumes, while improving the nutritional value of the existing elements of proteins

**Table 4.** The effect of partial replacement of water-soaked faba *beans* powder instead of soybean meal in the diet on weekly egg weight (g) (mean ± standard error).

| Treat-ments | Age (weeks) | | | Total |
|---|---|---|---|---|
| | 22 | 28 | 32 | |
| **T1** | 0.63±54.16 | 0.58±55.43 | 0.33±58.48 | 0.27±55.65 |
| **T2** | 0.43±54.42 | 0.39±55.41 | 0.26±57.82 | 0.07±55.56 |
| **T3** | 0.55±55.18 | 0.55±54.60 | 0.19±58.17 | 0.03±55.38 |
| **T4** | 0.71±55.33 | 0.38±53.63 | 0.49±58.13 | 0.19±55.35 |
| **Sig.** | N.S | N.S | N.S | N.S |

T1 (control treatment): The diet contained 100% soybean meal. T2: water-soaked faba *beans* powder instead of soybean meal in the diet by 25%. T3: water-soaked faba *beans* powder instead of soybean meal in the diet by 50%. T4: water-soaked faba *beans* powder instead of soybean meal in the diet by 75%. N.S no significant differences.

**Table 5.** The effect of partial replacement of water-soaked faba *beans* powder instead of soybean meal in the diet on weekly feed conversion (g diet/ g egg mass) (mean ± standard error).

| Treat-ments | Age (weeks) | | | Total |
|---|---|---|---|---|
| | 22 | 28 | 32 | |
| **T1** | 0.015±2.57 | 0.019±2.31 | 0.026±2.17 | 0.006±2.32 |
| **T2** | 0.017±2.57 | 0.015±2.30 | 0.022±2.15 | 0.016±2.32 |
| **T3** | 0.013±2.55 | 0.024±2.34 | 0.025±2.18 | 0.008±2.34 |
| **T4** | 0.012±2.54 | 0.033±2.33 | 0.011±2.19 | 0.008±2.34 |
| **Sig.** | N.S | N.S | N.S | N.S |

T1 (control treatment): The diet contained 100% soybean meal. T2: water-soaked faba *beans* powder instead of soybean meal in the diet by 25%. T3: water-soaked faba *beans* powder instead of soybean meal in the diet by 50%. T4: water-soaked faba *beans* powder instead of soybean meal in the diet by 75%. N.S no significant differences.

and minerals, their utilization is increased by laying hens, by speeding up the process of digestion and absorption of these nutrients, then the effect of these inhibiting factors on reducing eggs produced from chickens fed on diets containing replaceable peas instead of soybeans (Mateos and Puchal, 1982).

**Feed Conversion Coefficient**

Table 5, show that the effect of partial substitution of soaked faba beans instead soybean meal in diets in feed conversion factor, no significant differences appeared between substitution treatments, at rates 25, 50 and 75% and between control treatment, the average feed conversion factor was 2.32, 2.32, 2.34 and 2.34 g feed/g egg mass, for the T1, T2, T3 and T4 are cumulative respectively over the trial period.

The researchers interpreted these results as being due to the treatment of beans used in the diet in one of the ways to improve the nutritional value of beans, then reduce the effect of nutritional inhibitors, which reflects positively on the digestion and absorption of nutrients in the beans, therefore, no effect was shown on the food conversion factor (Guillaume and Bellee, 1977; Newton and Hill, 1983).

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