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Effect of Combinations of Protein Sources on Body Weight Growth of Broiler Hens in Morocco

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Abstract

Chickens are so-called omnivorous animals, which require a thoughtful and balanced diet to ensure a good yield. Protein intake is also very important for their muscles and their good egg laying. In order to produce quality chicken, we are interested in defining the optimal combinations of food sources of protein (legumes and cereals). It has been shown that the combination (*Phaseolus vulgaris*, *Triticum turgidum*) gave a 7.14% greater weight increase than the weight increase provided by the combination (*Pisum sativum*, *Triticum turgidum*). It has been shown that the combination (*Phaseolus vulgaris*, *Triticum turgidum*) gave a 7.14% greater weight increase than the weight increase provided by the combination (*Pisum sativum*, *Triticum turgidum*). The costs of food sources in the first and second combinations are on average higher than the costs of the control diet, by 35% and 32%, respectively. The costs of food sources in the first and second combinations are on average higher than the costs of the control diet, by 35% and 32%, respectively. Such an increase in the feed costs ingested by the hens was offset by an increase in weight.

Keywords: Legumes, cereals, proteins, chickens, growth, cost, Morocco.

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1. Introduction

Poultry farming has experienced sustained growth attributed to many factors including the improvement of the sanitary conditions of farms, control of the means of production, etc. Global poultry meat production increased by 45.8% in 2019 compared to 2009 [1]. Protein is a key component of a healthy and sustainable diet. They are not only a source of dietary amino acids and bioactive peptides, but play an important role in formation of food structure and texture. From a nutritional point of view, pea proteins are rich in lysine and branched-chain amino acids [2] do, however, contain low amounts of methionine (limiting amino acid), cysteine, and trypto-phan [3] do, however, contain low amounts of methionine (limiting amino acid), cysteine, and trypto-phan [3]. It is known that protein-rich foods form different structures during gastrointestinal transit, with significant consequences on gastric emptying and enzymatic degradation [4]. It is known that protein-rich foods form different structures during gastrointestinal transit, with significant consequences on gastric emptying and enzymatic degradation [4-5]. In addition, heat treatment can affect the protein's resistance to digestion [6].

A recent study investigated the effect of severe treatment (autoclaving, reheating) on the extent of pea protein proteolysis, and demonstrated an increase in digestibility caused by pea protein subunit unfolding [7]. A recent study [8] showed slight differences in the in vitro gastric phase of a pea protein isolate, expressed as peptide release extent and degree of hydrolysis (DH). In this case, a slight reduction in digestibility reported for samples heated to 90℃, which then recovered after reheating (120℃). It was concluded that heating (120℃) of denatured pea protein ingredients can increase their susceptibility to pepsin hydrolysis, improving their digestibility. The seeds of several bean species, particularly those of the genus Phaseolus, have long been known to be a rich source of protein, minerals, vitamins, and energy in the diets of humans and monogastric animals [9]. The nutritional protein value of most beans is limited in several ways compared to animal protein. . Attempts to increase the use of pulses have involved a wide range of processing techniques (soaking, autoclaving, granulation, dry roasting, shelling, germination, fermentation), including recently extrusion firing [10-11].

2. Materials and Methods

2.1. Spatio-temporal description

The field study lasted 3 months and carried out in a 70m² breeding space located in Laayayda, a Moroccan commune in the Salé prefecture, in the Rabat-Salé-Zemmour-Zaër region. Laayayda is a district with continuous exponential growth in terms of population. It represents 17.06% of the entire population of the city of Sale [12].

2.2. Sampling

For this survey, 30 broiler hens aged 30 to 35 days were selected.2 feed rations consisting of equal proportions of each of the types of legumes (*Phaseolus vulgaris*, *Pisum sativum*) were available in quantities capable of guaranteeing a level higher than the minimum level of the daily requirement of broilers in protein and energy [13]. Equal quantities of cereals (*Triticum turgidum*) have been added to the various diets mentioned above and ensuring a balanced daily intake of methionine and lysine (Tables 2 and 3). A control group of broilers was fed a basic diet without any administration of cereals or legumes that were chosen for this study (Table 1).

3. Results and discussion

3.1. Effect of Incorporated Diets on Feeding Cost and Body Weight Growth

At the age of slaughter, after a period of 15 days of rearing under the feeding conditions selected for this study, consumption of the diet chosen for Group 1 and Group 2 resulted in an average increase of 50% and 40% in body weight, respectively, compared to the control group. Comparing the two diets, the weight growth of group 2 hens was 7.14% greater than that of group 1. (Table 4) The costs of food sources consumed by the first and second groups are on average higher than the costs of the control diet by 35% and 32% respectively [14].

3.2. Effect of Added Plans on Economic Gain on Sale

The economic gain analysis showed that food costs more with the addition of different combinations of cereals and legumes. However, this supplementation leads to an increase in the weight of the hens. The average daily weight for the first group is equivalent to 60 g/d and is equal to 56 g/d for the second group. While the average daily weight of the control group is only 40g/day [15]. The gain obtained for the first group is 20g/d, while it is 16g/d for the second group. After 15 days of rearing on the Group 1 and Group 2 diets, the economic gain was 30% and 24%, respectively, compared to the economic gain of the control group (Table 5). Such an increase in the economic gain of the two food groups can be explained by the growth in the body weight of the group and the group, which are 50% and 40% respectively. When comparing the 2 food groups, group 1 shows an economic gain of 25% compared to group 2.

4. Analysis

The increase in production costs is mainly linked to food. The modification of the nutritional characteristics of foods carried out in this study by the introduction of different protein sources (legumes and cereals) increases avian performance, with a direct impact on yields. It has been proven that even if the price of the food increases, the effect is beneficial. Choosing to feed hens additional sources of protein consumes more energy and feed, but increases yields [16]. This study was therefore able to confirm that the increase in economic performance after the sale of chicken compensates for the increase in production costs of farms by increasing body weight. The growth in the weight of hens linked to the evolution of muscle mass is justified by the proportion of amino acids (methionine and lysine). The methionine and lysine provided by these two feed rations are essential for the physiological and metabolic synthesis of the various proteins in the hens.

The minimum daily requirement of broiler hens for lysine and methionine is 0.65% and 0.25% of the feed ration, respectively [17]. The proportions of lysine and methionine present in the 2 combinations consumed by the 2 groups of hens meet their daily nutritional needs. In the case of this study, the increase in breeding costs represents economic advantages since it promotes a relatively rapid increase in the weight of the hens compared to normal growth and balanced nutritional intake. The analysis of the results showed that the farmer makes economic gains explained by a saving in breeding time. The number of grams sold of chickens belonging to groups 1 and 2 is higher than that of the control group during the same period without the selling price increasing [18-19]. This survey will therefore accelerate the weight gain of hens and ensure that farmers have a significant economic gain.

Table 1: Proportion of diets

Composition of diets		Control group	Group 1 %	Group 2 %
Control combination	Corn, Vegetable oil, fish extract.	**100**	**66**	**66**
combination 1	*triticum turgidum*	**-**	**17**	**-**
	Phaseolus vulgaris		**17**	
combination 2	*triticum turgidum*	**-**	**-**	**17**
	Pisum sativum			**17**

Table 2: Amounts of methionine and lysine in the components of the 1st and 2nd diet

Diet	Composition	Lysine (g/hen/day)		Methionine (g/hen/day)	
D1	triticum turgidum	0,086	0,406	0,0425	0,08
	Phaseolus vulgaris	0 ,32		0,0375	
D2	triticum turgidum	0,086	0,386	0,0425	0,0965
	Pisum sativum	0,30		0,054	

Table 3: Daily intakes of lysine and methionine from the 2 diets

	Lysine (g/100g)	Méthionine (g/100g)
triticum turgidum	0,46	0 ,23
Phaseolus vulgaris	1,7	0,2
Pisum sativum	1,64	0,29

Table 4: Presentation of Diet Costs and Body Weight Gain

	Feed Cost (dh/hen/dr)	Body weight gain (g/day/hen)
CD	C1	W1
D1	C2 = C1+0,35 C1	W1+ 0,5W1
D2	C3=C1+0,32C1	W1+ 0,4W1

dh: Moroccan dirhams, RT: control diet, R1: group 1 diet, R2: group 2 diet, C1: control diet food cost, C2: diet 1 feed cost, C3: diet 1 feed cost, P1: control diet weight

Table 5: Presentation of diet yields

	Economic gain (dh/15 days/hen)
Control group	CG
Group1	CG+ 0,3 CG
Group2	CG + 0,24 CG

CG: Economic gain in the control group

5. Conclusions

The results of this study showed that the increase in body weight provided by the diet consisting of *Triticum turgidum* and *Phaseolus vulgaris* is greater than that induced by the control diet and the diet consisting of *Triticum turgidum* and *Pisum sativum*. The present study conducted under acceptable rearing conditions that met the requirements of European regulations. Variations in weight gain as well as economic gain from the results of this study may fluctuate. It is important to take into consideration that the results of this study influenced by the disruptive effect of repetitive weighing and by the presence of some noise sources near the rearing area. This allows us to expect different results but constant differences between the results obtained following the consumption of the different diets by the 3 groups of hens, in normal cases of breeding where the hens are raised in conditions free of stressful situations. Further research carried out in the context of this study on larger samples and under better conditions will be used to clarify the relationship between poultry diet and the evolution of (their different body characteristics) body weight.

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