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The protein crops: A source of protein in the diet of broiler chickens in Algeria-case of faba bean and pea

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ABSTRACT

This study was performed on 330 broiler chicks over three lots. Three different diets containing soybean (lot 1 "control»), crushed peas (lot 2) and faba bean (lot 3) were distributed over the three groups. On crude protein "PB" we recorded three values for each batch corresponding to the three classical phases of farming. For the control group (PB = 20.45% at starter, 19.75% to 17.66% growth and finishing). For lot 2 we got (PB = 17.45% at starter, 16.95% to 15.46% growth and finishing). While animals of group 3 were subjected to 17.75% at starter, 17.23% to 15.68% growth and finishing. The best weight gain is obtained with rations lot 3 " fababean " and lot 1 "control" respectively 2744.72 g and 2430.50 g, weight gain differed significantly (p< 0.05). Ration based on crushed peas gave a relatively low body weight with an average of 2070.22 g. Any time the difference between the indices of consumption of various batches have not significant. For the best performance is obtained with carcass lots 1 and 3 with an average of 70.32 % for the ration containing faba bean against 70.10 % for the control diet , while Lot 2 has a return of 68.09 % .

Key words: protein crops, soybean meal, pea, faba bean.

INTRODUCTION

The choice of this work is justified by the fact that protein consumption is an important parameter in poultry feed, not only by its economic implications, but also because of its important role in the physiology of nutrition [1]. In Algeria, few studies have been conducted on the replacement of soybean meal and data are almost not existent. [2] Beyond the need to achieve food self-sufficiency, Algeria is confronted with a lack of protein Cornish. One goal should be to find substitutions for protein especially soybean meal sources using available foods in Algeria such as faba bean and crushed pea to improve the profitability of poultry farms. We must remember that the protein crops are produced by Fabaceae (legumes): faba bean, pea, lupine, vetch and beans. Their use is due to their richness in well supplied with lysine and deficient in sulfur amino acids protein. These seeds also contain fat in different proportions, starch and cell wall carbohydrates well digested. Energy value is good [12]. On this basis, it seemed to undertake this study with 3 diets of different protein sources (soybean meal, faba bean and crushed peas), with a view to give us guidance on growth performance

MATERIALS AND METHODS

330 broiler chicks a day strain ISA 15 were weighed and divided into 3 lots. The first group, control (Lot 1) is fed with a standard diet tailored to each rearing phase: startup food distributed day 1 to day 15, day 16 a growth food to day 45 and day 46 to finish food day 56. In (lot 2) and (lot 3) soybean meal was partially replaced with crushed pea and faba bean (Table 1, 2 and 3).

Table 01: Composition of starter diet

Starter feed composition	Ration 1 (control)	Ration 2 (Pea)	Ration 3 (faba bean)
Maize	62%	62%	62%
Soya meals	30%	15%	15%
Faba bean	/	/	15%
Pea	/	15%	/
Bran	5%	5%	5%
Phosphate bi-calcique	2%	2%	2%
Mineral complex vitamins	1%	1%	1%
Metabolizable energy	2912	2961	2942
% crude protein	20,45	17, 45	17, 75

Table 02 : Composition of grower diet

Grower feed composition	Ration 1 (control)	Ration 2 (Pea)	Ration 3 (faba bean)
Maize	64%	64%	64%
Soya meals	28%	14%	14%
Faba bean	/	/	14%
Pea	/	14%	/
Bran	5%	5%	5%
Phosphate bi-calcique	2%	2%	2%
Mineral complex vitamins	1%	1%	1%
Metabolizable energy	2933	2978	2961
Crude protein %	19,75	16, 95	17, 23

Table 03 : Composition of finisher diet

Finisher feed composition	Ration 1 (control)	Ration 2 (Pea)	Ration 3 (faba bean)
Maize	70%	70%	70%
Soya meals	22%	11%	11%
Faba bean	/	/	11%
Pea	/	11%	/
Bran	5%	5%	5%
Phosphate bi-calcique	2%	2%	2%
Mineral complex vitamins	1%	1%	1%
metabolizable energy (Kcal/kg)	2995	3031	3017
Crude protein (%)	17,66	15, 46	15, 68

Energy levels of our three rations are between 2,912 and 2,995 kcal / kg for the lot "witness" between 2961 and 3031 Kcal / kg for lot " crushed pea " and between 2942 and 3017 Kcal / kg for the lot " faba bean "are much lower than those recommended by Dragoul and al (2004) [11]. Regarding stock raising, an anti - stress was administered in water for the first three days. This treatment is continued during vaccinations. The chicks were vaccinated against infectious bursal disease and Newcastle. Twenty subjects are taken for each batch were weighed every five days to determine average daily gain and also to find the difference in weight change between the three lots. The daily feed intake was measured to calculate the index of consumption. At the end of the experiment, the chickens are taken from each batch and individually weighed and sacrificed by bleeding, for the determination of carcass yield. Subjects were plucked hot eviscerated the heads and feet are removed. Carcasses, livers, gizzards and abdominal fat were weighed, which allowed us to calculate the average. They were treated in the analysis of variance (ANOVA) at significance level (0.05). All analyzes were performed using MINITAB 15 software. [7]

RESULTS AND DISCUSSION

Slaughter weight and carcass yield

Table 4: Influence of the incorporation of peas and faba bean on live weight and carcass yield

	lot (control)	lot (Pea)	lot (faba bean)	ANOVA (P)		
				*	**	***
Live weight at slaughter (g)	2430,50 ±593,8	2070,4 ±462,1	2744,72 ±217	NS	S	S
Eviscerated carcass (g)	1703,56 ±454,72	1409,66 ±339 ,58	1930 ±156,84	NS	S	S
Carcass yield (%)	69,66% ±2,2	67,97 % ±4,4	70,34% ±2,4	NS	NS	S

**: Comparison between lot "control" and lot "crushed pea"*
***: Comparison between lot "control" and lot " faba bean"*
****: Comparison between lot "crushed pea" and lot " faba bean"*
S: significant difference (P <0.05), NS: not significant difference (P> 0.05)

The means to the end of the test weight, are 2744.7 g for chickens of Lot 3 " faba bean "against 2070.33 g for 2 " crushed peas" While the average in chickens in the control group was 2430.50 g. Based on our findings , we observed that the partial incorporation of faba bean in the diet (15 %, 14 % and 11 %) shows that the difference is highly significant (P <0.05) between the lot " faba bean" and lot " witness" and it is the same between the lot " faba bean " and lot " crushed pea ." values batch "control" and " crushed pea " are not significantly different from each other (P > 0.05). Carasse the best performance is obtained in birds subjected to diets containing faba bean with a yield of 70.34 % against 69.66 % and 67.97 % for batch "control" and "crushed peas" respectively. It should be noted that the differences between the carcass yields lots "control" and "crushed pea" are not as significant and even between batches "control" and «faba bean". While the difference is significant between carcasses yields lots "crushed peas" and lot "faba bean ". Results obtained with respect to a consistent faba those Perella (2009). According to the latter faba bean could be a valuable source of protein in the diet of organic chickens when used after the initial period due to 16 % in scheme [8]. According to supie and al, the incorporation of peas with a percentage of 25 % in the diet of broiler has a positive effect on growth. Thus, in the laying hen the introduction of 30% of the peas in the ration remains tolerable to prevent the decrease in egg weight [9]. One of the major problems for pea was the fact that plants sagged before harvest, which made it very difficult for mechanical harvesting. The emergence of varieties "AFILA" consisting essentially of twists and allowing an erect plant port, has solved this problem. Production has really developed in the mid 80s. The feed producers were also asked about the qualities of the protein and the incorporation rate to apply, taking into account their nutritional value and the possible presence antinutrients, the amino acid balance, taste, etc. [10]. In laying hens several studies report that faba bean beans reduces the production of laying in particular the weight of the egg. This negative effect is ascribed to the presence of anti -nutritional glucosides: vicin and convicine. According to Lessire et al (2005), an incorporation rate of 20 % of the mixture or only faba in foods, show that the intensity of spawning is not modified by the various foods, but that the average weight of the egg is closely related to the content and vicin convicine of food [3]

Feed intake and feed efficiency

Table 5: Effects of protein crops on feed intake, weight gain and feed efficiency

	feed intake (g)		
	lot (control)	lot (Pea)	lot (faba bean)
starter (day 1 to day 15)	369,70	281,70	330,24
Growing (day 16 to day 45)	3593,70	2901,49	3150,73
Finisher (day 46 to day 56)	1936,01	1685,65	2029,82
Accrued (day 1 to day 56)	5899,41	4868,84	5510,79
	weight gain (g)		
	lot (control)	lot (Pea)	lot (faba bean)
Day 15	230,80	200,28	252,48
Day 45	1838,80	1483,55	1719,57
Day 56	2430,22	2070,2	2744,72
	feed efficiency (g)		
	lot (control)	lot (Peas)	lot (faba bean)
Starter (day 1 to day 15)	1,60	1,41	1,31
Growing (day 16 to day 45)	2,23	2,26	2,15
Finisher (day 46 to day 56)	3,27	2.87	1,98
Accrued (day 1 to day 56)	2.42	2.35	2.01

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On food ingested we find that the addition of faba bean and crushed pea tends to reduce food about 388.62 g and 1030 consumption, 57 g for both lots, respectively, compared to control chickens. Thus the index of aggregate consumption indicates an improvement in the lot " faba bean" against it by lot " crushed pea " finds no positive effect due to the low weight at slaughter. According to Metayer et al. [4], the use of 20 to 25% of white or colored beans as their main source of protein in chicken feed allows comparable to those obtained with soybean performance. Lessire et al. [3] described that faba bean is rarely used given the small quantities produced and anti-nutrients it contains: tannins, antitrypsin factors, and vicin convicine. Its nutritional characteristics are, however, a possible alternative to soybean meal as its energy value (> 2500kcal/kg) and protein content (> 26%) are relatively high, even if they are deficient in sulfur amino acids and tryptophan [13]. Thus, in the experiment Brévault et al. [5], the growth performance obtained with the faba bean -based foods are significantly degraded in terms of feed efficiency up to 28 days and growth until slaughter. This seems to be due to under consumption and the overall startup time. The presence of tannin could be a hypothesis to explain this under-consumption. Replacement in equivalent proportions of protein from soybean meal with protein from 19.8 % faba bean causes a drop compared to the control diet performance during growth phase. Thus the substitution of soybean meal at a level of 60% of faba bean caused a decrease. This very pronounced during the growth effect does not appear during the finishing phase. As reported by Blair and al, (1970) the introduction of beans in starchy foods in infancy may therefore seriously affect animal performance. However, its incorporation as a substitute for soybean meal at rates not

exceeding 13.8% did not induce significant performance degradation compared to 10% rate commonly recommended by most authors (Blair and al. 1970 Kardirvel' and Clandinin 1974, Marquardt andal, (1974). Leuillet, 1974; Huyghebaert and al, (1978) [6]. Faba bean proteins are rich in lysine, but pretty poor in sulfur amino acids and tryptophan.Starch, very abundant , is not perfectly digestible by birds in the raw state ; digestibility is then 85 p. 100 . The thermal treatment of the seed (or very fine grinding) always lead to significant improvements in the energy content (AMEn) andstarch digestibility which is in the order of 10 p . 100. The heat treatments have a very limited effect on protein digestibility (3 p. 100 on average). Faba bean contains several compounds with a more or less pronounced antinutritional character. There first was the presence of tannins, localized mainly in the seed coat and whose structure and functions are discussed below. In birds, they cause a decrease in digestibility of protein and to a lesser extent, starch [16]. Very poor in tannins white varieties are the most interesting point of view in poultry feed. Faba bean also contains several trypsin inhibitors, but the total activity remains low (approximately 4 IU / mg) and easily disappears after a simple granulation steam (80 ° C) heat treatment. It does not appear that these trypsin inhibitors serious problems in vivo because the heat treatment improves only slightly protein digestibility. The presence of two molecules is more troublesome, especially in laying hens ; it is vicin and convicine . These two esters of glucose and two pyrimidine ring compounds. Vicin is 2,6- dihydro - droxypyrimidine -5-(β -D-glucopyranose) and convicine 2,4,5 -trihydroxy -6- aminopyrimidine -5- (β -D- glucopyranose) . Concentrations and vicin convicine are on average by 0.5 and 0.2 percent. 100 dry product. Little is known about their mode of action at the metabolic level in birds [14]. Other antinutrients minors were reported. Antiniacine is a thermolabile can be easily inactivated by a vitamin mixture providing enough niacin. The α -galactosides (raffinose, stachyose and verbascose) hardly pose a problem if the rate of incorporation of faba bean are moderate. The oligosaccharides are constituted by a saccharose molecule to which a fixed link 1, 2 or 3 galactoses. Little is known about their use by birds.

Pea proteins are made, like all proteins legumes three classes of proteins: globulins, albumin and say "insoluble" proteins (Gueguen and Cerletti, 1994). Pea represents 10% of poultry feed. However, the massive incorporation into the food sometimes leads to digestibility values lower than those of diets based on soybean, as well as large variations in protein digestibility. Thus, the apparent fecal digestibility varies between 67 and 83% in chicken [16]. Trypsin inhibitors are "anti-nutrients " the most widely studied. The first such proteins isolated from soybean (Kunitz 1945) , ais are found widely distributed in the plant kingdom. Pea is one of, legumes containing trypsin inhibitors least about 8 times lessthat raw soybeans. However, there are significant differences between cultivars, some varieties of peas type "winter" containing 2-3 times more trypsin inhibitors that spring varieties (Leterme and al 1992) [14] . The trypsin inhibitors are also pea albumin and are generally less than 2% of total seed protein. They are monomeric proteins of low molecular weight capable of binding irreversibly to the active sites of trypsin and chymotrypsin (two independent sites) (Birk and Smirnoff 1992). Each polypeptide contains seven disulfide bridges (Huisman and Jansman 1991) [15] . The pea is rich in protein (18-30 %) and lysine (15 g / kg), and is a good supplement to cereals. Further, these levels of methionine + cysteine , threonine and tryptophan are relatively high (respectively 6.0, 5.5, 1 g / kg) [12] and [14]. According to benabedldjalil (1990), the use of raw peas and untreated in starchy diets at a rate of 30% does not impair growth performance of broilers. The results remain consistent with those observed by Leuillet and al. 1975 Huyghebaert and al. 1979. Elevated protein levels appear to improve 1'EA plans. Indeed, Huyghebaert and al. (1979) who studied the effects of diets protein content of 20 % found that 1'EA was significantly improved ($p < 0.05$) compared to diets lower protein content (l8 %), particularly in phase finishing . The studied systems are supplemented with methionine, the rate increases with the level of incorporation of peas. Based diets peas, formulated a protein content of 21% and 19.5% supplemented with methionine yielded identical performance indicator " Soya meals " [6]

Liver and abdominal fat

Table 6: Influence of the incorporation of pea and faba bean on the liver and abdominal fat

	lot (control)	lot (Pea)	lot (faba bean)	ANOVA (P)		
				*	**	***
Liver weight (g)	47,56 ±10,76	46,56 ±10,24	63,48 ±11,43	NS	S	S
Abdominal fat (g)	24,89 ±12,73	31,66 ±13,13	53,94 ±19,50	NS	S	S

**: Comparison between lot "control" and lot "crushed pea"*
***: Comparison between lot "control" and lot "faba bean"*
****: Comparison between lot "crushed pea" and lot " faba bean "*
S: significant difference (P <0.05), NS: not significant difference (P> 0.05)

Under our experimental conditions, the introduction of faba bean in the diet significantly increased liver weight and the abdominal fat compared to batch "control" and "pea". However, no improvement in liver weight and abdominal fat of chickens is observed following the incorporation of peas in the food. Our results do not match those of yellow dock and al, (2009) [8] and Dal Bosco and al, (2013) [17] where the inclusion of faba bean does not significantly

influence the weight of abdominal fat. Nevertheless, it is interesting to note that Parviz and Siavash, (2006) [18] showed that the adition of enzymes in diets containing pea heat treated due to 20%, positively affect the liver weight.

CONCLUSION

The use of faba beans, peas and beans in the raw state and levels of incorporation up to 30% in diets low energy level, presented in mealy form and containing other protein sources give rise to relatively acceptable performance. In addition, the lack of technological treatments pulses, prior to their incorporation into adequately supplemented with sulfur amino acids foods, are excellent sources of protein locally available alternative that can alleviate the suffering caused by soybean meal. In conclusion, based on the results of this trial, the use of protein in poultry seems technically possible. Faba beans can replace a portion of meal imported, especially when soybean was selected to not submit antinutrients.

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