Acta Agraria Kaposváriensis (1999) Vol 3 No 2, 361-368
Pannon Agrártudományi Egyetem, Állattenyésztési Kar, Kaposvár
Pannon University of Agriculture, Faculty of Animal Science, Kaposvár

The effect of substituting corn with different levels of Pistacia atlantica seeds on laying hens performance in first phase of egg production

A. [1]Saffarzadeh, J. [2]Csapó
[1]Ministry of Jahade Sazandgi, Animal Science Research Institute, Karaj, P.O. Box 31585-1483. Iran
[2]Pannon University of Agriculture, Faculty of Animal Science, Kaposvár, H-7400 Guba S. u. 40. Hungary

ABSTRACT

Experiment was conducted over 12 weeks period with one hundred sixty 24 weeks old white-leghorn hens. Diets containing 0, 5, 10 and 15% Pistacia atlantica seeds were given to caged laying hens, In the first phase of egg production (weeks 24-36). Egg production rate, egg number, egg weight, egg mass, feed intake, feed conversion efficiency, mortality rate and body weight were not significantly affected by the experimental diets. It could be concluded from this study for the first time that Pistacia atlantica seeds could be used up to 15% in the ration of laying hens during the first phase of egg production (weeks 24-36) with no serious adverse effects on performance.
(Keywords: Pistacia atlantica seeds, laying hens, performance, egg production, egg number)

ZUSAMMENFASSUNG

Einfluss von Pistacia atlantica als Maisersatz im Futter auf die Leistung von Legehennen in der ersten Legeperiode

A. [1]Saffarzadeh, J. [2]Csapó
[1]Jahade Sazandgi Ministrerium, Forschungsanstalt für Tierzucht, Karaj, P.O. Box 31585-1483 Iran
[2]Pannon Agrarwissenschatliche Universität, Fakultät für Tierproduktion, Kaposvár, H-7400 Guba S. u. 40. Ungarn

12 Wochen lang wurden Versuche mit 160 Legehennen der Rasse Weiße Leghorn im Alter von 24 Wochen durchgeführt. In der ersten Legeperiode (24-36. Lebenswoche) wurden 0%, 5%, 10% und 15% Pistazien (Pistacia atlantica) als Maisersatz in das Futter gemischt. Die Versuchsfütterung zeigte keinen signifikanten Einfluss auf die Produktionsparameter Legeleistung, Anzahl der Eier, Eigewicht, Futteraufnahme, Futterverwertung, Mortalität und Lebendgewicht. Die Versuche ergaben, dass bis zu 15% Pistazien anstatt Mais im Futter die Legeleistung der ersten Legeperiode nicht bedeutend beeinflusst.
(Schlüsselwörter: Pistacia atlantica, Legehennen, Leistung, Eierproduktion, Eizahl)

INTRODUCTION

Feed is the major item of cost in the production of poultry meat and eggs, and energy sources are the most ratios, in poultry diets. The most energy sources for poultry

nutrition are cereal grains, which are in competition with human food. Finding new energy sources, which are not, or less in competition with human food is very important. Pistacia atlantica is one of the Pistacia species, which grow on Zagrossian region with Quercus species (*Sabeti*, 1994). Pistacia atlantica seeds that provide from forest are a new and unconventional energy source. It is not found any literature of Pistacia atlantica seeds in animal nutrition. The authors determined metabolisable energy content of Pistacia atlantica seeds according to *Sibald* (1989) and *Vincze et al*. (1994), and chemical composition of this feed according to the AOAC (1990) and the results were reported as following: AMEn 13.51 MJ/kg, crude protein 8.1%, ether extract 26.8%, crude fiber 32.4%, calcium 0.11%, phosphorus 0.16%, lysine 0.52%, methionine 0.05%, cystine 0.1%, and linoleic acid 5% of the feedstuff as dry matter basis, this result indicated that Pistacia atlantica could be used as an energy source in poultry diet. The aim of this study is to investigate the effect of different levels of Pistacia atlantica seeds on laying hens performance.

MATERIALS AND METHODS

Birds, housing and experimental design

One hundred and sixty 24 weeks old white leghorn hens were housed in cages located in two open-sided sheds, in double deck stair step cages. The dimensions of each cage were 40 cm length, 37 cm width and 44 cm height, and two birds were placed to each cage. The experiment was conducted in the experimental henhouse of Animal Science Research Station of Dezful in Khoozestan province in the Iran.

Twelve weeks old pullets all the same breeder flock from a commercial leghorn breeder stock was provided and raised on deep litter floor until 18 week old. The length of lightening during rearing of pullet was 10 hours with 14 hours dark pauses. At 18^{th} week of age the pullets were transferred to cages and were fed with immature leghorn-type chicken's diet from 18 weeks old to first egg. The composition of pullet diet was formulated according the requirements of N.R.C 1994, and is shown in *Table 1*.

The 24 weeks old laying hen were weighed and assigned to cages according to a randomized complete block design with four treatments and four replication in four independent separate blocks. Forty birds were randomly assigned to each treatment, 10 laying hens were placed per replication or experimental, which include 5 cages and 2 hen were located in a cage. The experiment was carried out over 12 weeks period, between 24 and 36 weeks of laying hens age, during first phase of egg production. The hens had access to feed and water adlibitum, and provided 1hours lightening per day and 7 hours dark pauses. During the experimental period, the temperature of the henhouse was fluctuated between 16-20oC.

Diets

The composition of the experimental diets is shown in *Table 2* and composition of premix is shown in *Table 3*. The control diet (To) without Pistacia atlantica seeds, was based on corn, soybean meal (44% protein) and fish meal (60% protein) as the principal sources of energy and protein, respectively.

In the all-experimental diets containing Pistacia atlantica seeds was substituted with corn. The experimental diet were formulated according leghorn - type chicken requirements was noted in Nutrient Requirements of Poultry (N.R.C, 1994). and all diets were isocaloric and isonitrogenic. The experimental diets are following:

T0 = Treatment-0: as control ton corn, extracted soybean meal, fish meal and other supplements (Basal diet).
T1 = Treatment-1: The ingredients used for the(T0)+5% Pistacia atlantica seeds.
T2 = Treatment-2: The ingredient used for the(T0)+10% Pistacia atlantica seeds.
T3 = Treatment-3: The ingredient used for the(T0)+15% Pistacia atlantica seeds.

Table 1

Composition of pullet diets in different ages

Ingredients & Composition (1)	12 – 18 week (2)	18 week to first egg (3)
Corn (4)	60	70
Soybean meal (5)	14	20
Fish meal (6)	3	4
Barley (7)	20	-
Oyster shell (8)	1.50	4.60
Dicalcium phosphate	0.65	0.55
Salt (9)	0.35	0.35
Premix *	0.50	0.50
Calculated composition (10)		
MEN (MJ/kg) (11)	12.27	12.15
Crude protein (12)	15.20	17.15
Ether extact (13)	3.03	3.2
Crude fiber (14)	3.2	2.97
Calcium	0.80	2
Phosphorus	0.30	0.33
Lysine	0.74	0.90
Methionine	0.28	0.31
Met + Cys	0.54	0.59
Linoleic acid (15)	1.55	1.63

*The composition of premix is shown in *Table 3.* (*Zusammensetzung der Vitamin- und Mineralstoffmischung zeigt Tabelle 3.)*

1. Tabelle: Futterzusammensetzung bei Junghennen verschiedener Altersgruppen

Zusammensetzung(1), 12-18. Woche(2), Von der 18. Woche bis zum ersten Ei(3), Mais(4), Sojaschrot(5), Fleischmehl(6), Gerste(7), Austernschalenmehl(8), Salz(9), Errechnete Zusammensetzung(10), MEN- Energie(11), Rohprotein(12), Rohfett(13), Rohfasern(14), Linolsäure(15)

The calculated nitrogen corrected apparent metabolisable energy (AMEn) Content of the diets was11.75 MJ/kg and crude was 145 g/kg. The ratio of energy to protein was 193.33 and the other nutrients content of the diets were balanced by ratio. The experimental diets were ground and mixed weekly by a special miller and mixer in the Animal Science Research Station of Dezful. Feed intake and remaining in feeder of each

experimental unit were weighed weekly for determination feed consumption during week, every phases and finally whole period of the experiment.

Table 2

Composition of layer diets containing Pistacia atlantica seeds

Ingredients & Composition (1)	T0 Control diet	T1 P.at 5%	T2 P.at 10%	T3 P.at 15%
Corn (2)	72	67	62.30	57.44
Soybean meal (3)	12.40	12.47	12.50	12.56
Fish meal (4)	4	4	4	4
Pistacia atlantica (5)	-	5	10	15
Oyster shell (6)	6	6	6	6
Dicalcium phosphate	0.20	0.20	0.20	0.20
Limestone(7)	5	5	5	5
Methionine	0.06	0.08	0.09	0.11
Salt	0.25	0.25	0.25	0.25
Premix *	0.50	0.50	0.50	0.50
Calculated composition (8)				
MEN (MJ/kg) (9)	11.75	11.75	11.75	11.75
Crude protein (10)	14.50	14.50	14.50	14.50
Ether extract (11)	3.21	4.09	5.52	6.68
Crude fiber (12)	2.46	3.98	5.50	7.01
Calcium	3.16	3.16	3.16	3.16
Phosphorus)	0.24	0.24	0.24	0.25
Lysine	0.70	0.71	0.73	0.74
Methionine	0.32	0.33	0.34	0.35
Met + Cys	0.56	0.57	0.57	0.57
Linoleic acid (13)	1.60	1.77	1.92	2.10

*The composition of premix is shown in *Table 3.* (*Zusammensetzung der Vitamin- und Mineralstoffmischung zeigt Tabelle 3.)*

2. Tabelle: Zusammensetzung des Legehennenfutters mit Pistacia atlantica

Zusammensetzung(1), Mais(2), Sojaschrot(3), Fleischmehl(4), Gerste(5), Austernschalenmehl(6), Kalkstein(7), Errechnete Zusammensetzung(8), MEN-Energie(9), Rohprotein(10), Rohfett(11), Rohfasern(12), Linolsäure(13)

Measurement and analyses

Egg production in each replicate group was recorded daily and the feed consumption was measured at 7 day intervals. All eggs were collected from each 16 replicate groups once a week intervals were weighed, and the average egg weight, weighted for the total number of eggs laid in each replicated groups during one week and summarized in a phase. Egg number was recorded daily for each replicate groups and summarized in a phases per hen. Individual body weights were recorded at the start and end of each phase and were summarized at the end of each phase per replication and treatments.

Table 3

Composition of vitamins and minerals premix*

Vitamins, Mineral (1)	Broiler Supplement (2)		LayerSupplement (3)		Breeder Supplement (4)	
Vitamin A	11000000	IU	10000000	IU	12000000	IU
Vitamin D3	1800000	IU	2500000	IU	2200000	IU
Vitamin E	18000	IU	10000	IU	25000	IU
Vitamin K3	2500	mg	2200	mg	3000	mg
Vitamin B1	1500	mg	1000	mg	2000	mg
Vitamin B2	6000	mg	4000	mg	6000	mg
Niacin	30000	mg	20000	mg	30000	mg
Vitamin B3	12000	mg	8000	mg	14000	mg
Vitamin B6	1500	mg	2000	mg	2000	mg
Vitamin B9 Folic acid	1000	mg	560	mg	800	mg
Vitamin B12	16	mg	15	mg	14	mg
Biotin	100	mg	150	mg	100	mg
Choline chloride	550000	mg	400000	mg	500000	mg
Antioxidant	10000	mg	10000	mg	10000	mg
Iron (Fe)	5000	mg	50000	mg	40000	mg
Selenium (Se)	200	mg	100	mg	100	mg
Cobalt (Co)	100	mg	100	mg	100	mg
Copper (Cu)	5000	mg	5000	mg	5000	mg
Manganese (Mn)	100000	mg	80000	mg	100000	mg

*Each 5-kg of premix containing Vitamins and Minerals is shown in table and is used per 1 ton ration. (*Zu 1 t Futter wurden 5 kg der in der Tabelle aufgeführten Vitamin- und Mineralstoff-Mischung gegeben.)*

3. Tabelle: Zusammensetzung der Vitamin- und Mineralstoff-Mischung

Vitamine und Minerale(1), Futterergänzung für Broiler(2), Futterergänzung für Legehennen(3), Futterergänzung für Zuchttiere(4)

Feed consumption was recorded weekly for each replicate groups and summarized per hen per day. Egg production percentage or rate of laying was calculated by dividing sum of egg number to sum hen day. Egg mass per hen per day (g) was calculated by multiplying mean egg weight (g) and egg production rate. Feed efficiency was calculated by dividing feed intake per hen per day in kg or gram to egg mass per hen per day in kg or gram. Mortality rate was recorded daily of dead hen and summarized for first phase of egg production. For investigation the effects of experimental diets on egg quality charachtriestics, eggs were collected at 28-day intervals, in each replicated group, and 2 eggs which their weight were closed to the mean weight of group used for the measurement of : egg weight, shape index (maximum width/maximum length of egg), white weight, yolk weight, yolk colour, shell weight, shell thickness, shell weight per unit surface area (SWUSA), shell strength, albumen height and Haugh unit. A digital scale measured egg weight, white weight, yolk weight, width and length of eggs for determination index by a Venire caliper, shell strength, shell thickness and albumen

height by fine apparatuses in Molasani Agricultural College of Ahwaz University. Haugh unit was calculated by use of albumen height and egg weight according the mentioned formula, yolk colour by Roche fan. Shell weight per unit surface area (SWUSA) was calculated by dividing the shell weight (mg) by the egg surface area (cm^2). Egg surface area was calculated according to *Carter* (1975) using the equation: 3.9782 × egg weight (g) 0.7056, and egg shell (plus adhering membranes) weight was determined after washing and drying at 105oC overnight and weighed. SWUSA was expressed in terms of mg/cm^2. All data for different parameters were recorded daily, weekly and summarized for first phase of egg production.

Statistical analysis

The data was subjected to analysis of variance (*Steel* and *Torrie*, 1980) and treatment means were compared by Duncan,s multiple range test (*Duncan,* 1955). A statistical analysis of experimental results was made by the STATGRAPHIC (Statistical Graphics System),Version 5 and also Excel version 5 softwares.

Table 4

Effect of dietary levels of Pistacia atlantica seeds on the laying performance between 24 and 36 weeks

Treats (1)	Rations contain Pistacia atlantica(2)	Egg laying rate % (3)	Egg number 84 days ±SD (4)	Egg Weight (g) ±SD (5)	Egg mass g/h/d ±SD (6)	Feed intake g/h/d ±SD (7)	F.C.E (g)Feed (g)Egg ±SD (8)	Mortality rate% ±SD v (9)	Body weight week 36 ±SD (10)
T0	_	85.63	71.72	57.26	49.10	110.62	2.27	12.5	1.64
T1	5%	84.45	70.81	57.29	48.48	109.87	2.28	10	1.61
T2	10%	83.90	70.27	58.14	48.82	112.67	2.32	12.5	1.53
T3	15%	86	72.12	57.99	49.92	112.44	2.27	7.5	1.61
Mean(11) ±SD SL	_	84.99 ±1.02 NS	71.23 ±0.86 NS	57.67 ±0.21 NS	49.08 ±0.62 NS	111.40 ±1.35 NS	2.28 ±0.30 NS	10.63 ±2.07 NS	1.60 ±0.03 NS

FCE: Feed conversion efficiency *(Futterverwertungsvermögen)*, T: Treatment *(Behandlung)*; SD: Standard deviation *(Standardabweichung);* SL: Significant level *(Signifikanz);* NS: Not significant *(Nicht signifikant)*

4. Tabelle: Einfluss der Menge an Pistacia atlantica auf die Leistung der Legehennen in der 24.-36. Lebenswoche

Behandlungen(1), Menge an Pistacia atlantica (%) (2), Prozentuale Eierproduktion(3), Eizahl in 84 Tagen(4), Durchschnittliches Eigewicht (g)(5), Tagesleistung Eimasse (g/Huhn/Tag)(6), Futteraufnahme (g/Huhn/Tag)(7), Futterverwertung(8), Mortalität % (9), Körpergewicht in der 36. Lebenswoche(10), Mittelwerte(11)

RESULTS AND DISCUSSION

The performance data between 24 and 36 week of age (first phase of egg production) is presented in *Table 4*. Rate of egg production, number of eggs per hen in 84, mean egg weight, egg mass per hen per day (g), intake per hen per day (g), feed efficiency (feed intake g/mass g), the mortality rate and body weight were significantly (P>0.05) affected by the dietary treatments. In all parameters the data of all treatments are very closed to each other with a little standard deviation.

CONCLUSIONS

According to the results obtain in this study experimental diets containing different levels of Pistacia khinjuk seeds were not shown significant effects on performance of laying hens in first phase of egg production (weeks 24-36) up to 15% Pistacia khinjuk seeds of whole ration. It could be concluded from this study for the first time that Pistacia atlantica seeds could be used up to 15% in the ration of laying hens during the first phase of egg production (weeks 24-36) without any problem or limitation.

ACKNOWLEDGEMENTS

The author gratefully acknowledges to the Ministry of Jahade-Sazandagi of Islamic Republic of Iran that were made possible to perform this study by a grant of scholarship and as well as Pannon Agricultural University Faculty of Animal Science Kaposvár and also Natural Resources and Animal Science Research Center of Khoozestan province in the Iran that provide possibility for caring out the experiments.

REFERENCES

Carter, T.C. (1975). The hen's egg: Estimation of shell superficial area and egg volume, using measurements of fresh egg weight and shell length and breadth alone or in combination. British poultry science, 16. 541-543.

Duncan, D.B. (1955). Multiple range and multiple F test. Biometrics, 11. 1-42.

National Research Council (1994). Nutrient Requirements of Poultry. 9th rev. ed. National Academy Press, Washington, Dc.

Sabeti, H. (1994). Forest, Trees, and Shrubs of Iran. 2nd edition, printed by Iran University of science and technology Press. 514-579.

Sibbald, I.R. (1989). Metabolisable energy evaluation of poultry diets, in: Cole, D.J.A., Haresign, W.(Ed) Recent Developments in poultry Nutrition. Tiptree, Essex, Anchor press LTD. 12- 26.

Steel, R.G.D., Torrie, J.H. (1980). Principles and procedures of statistics. McGraw-Hill Book Co. New York.

Vincze L., Jakab E., Szüts G., Dublecz K., Wágner L. (1994). The metabolisable energy content of poultry and pheasant diets, 9th European Poultry Conf. Glasgow, UK. Proc. V. 1. 535-537.

Corresponding author (*Adresse*):

Ali Saffarzadeh
Natural resources & Animal husbandry Research Center of Khoozestan
P.O.Box: 613 35 - 3341 Ahwaz, Iran
Forschungszentrum für Naturgüter & Tierhaltung Khoozestan
P.O.Box: 613 35 - 3341 Ahwaz, Iran