The effects of dietary biological fish silage on performance and egg quality of laying Japanese quails (Coturnix coturnix japonica)

H. COLLAZOS[1*] and C. GUIO[1]

[1]Universidad Nacional Abierta y a Distancia, UNAD. Escuela de Ciencias Agrícolas, Pecuarias y del Medio Ambiente. Departamento de Zootecnia. Bogotá D. C. Colombia
***Corresponding autor: hcollazosgar@yahoo.com**

An 8 week experiment was conducted to evaluate the effects of biological fish silage supplementation in laying Japanese quails diets on performance and egg quality.
A total of 120, 60 d-old laying japanese quails were allotted in a randomized experimental design with four treatments (Controls, 2, 4 and 6% of biological fish silage), with five replicates and 6 birds per replicate .Diets were formulated to meet or exceed NRC recommendations Feed and water were supplied ad libitum and light was scheduled for 16 hours of light and 8 hours of dark each day. Feed consumption was measured weekly and feed conversion was calculated. Laying percentage, egg weight, and egg mass were recorded daily during 8 to 16 wk of age. Random samples of 8 eggs from each treatment were collected weekly to measure egg quality: such as, eggshell thickness, Haugh units, egg specific gravity, and yolk percentage. productive parameters such as feed intake, , egg weight, , feed efficiency, body weight variation, and egg mass were not affected (P>0.05),only laying percentage was affected (P<0.01) by treatments. Egg quality parameters were no affected (P>0.05) by dietary treatments. Results obtained indicate that biological fish silage can be included in laying diets of Japanese quails up to 6% without adverse effects.

Key words: biological fish silage; laying quail; Coturnix coturnix japonica; haugh units.

Introduction

A particular problem in animal nutrition is the lack of quality protein sources with a good amino acid profile, due to availability and relative high cost. In the case of fish meal, spite of being a complete and popular protein supplement for many decades, its manufacturing is a costly process. One of these sources is fish silage. This is a product of easy manufacturing and low cost, which utilizes wastes of the fish industry such as: heads, tails, viscera, scales, and whole fish unsuitable for human consumption.

Commercial processing of fish from traditional catches and fish farming for human consumption yield large amounts of by-products, but are a potential source of pollution if dumped at rivers, sea, or discarded off shore. I t is well established that fish by-products are a valuable protein source in animal feed if converted into fish silage (Tatterson and Windsor, 1974; Raa and Gildberg, 1982; Lindgren and Pleje, 1983; Kjos et. al 1999; Kjos et.al 2000)

Through a controlled fermentation process with lactic bacteria and carbohydrates (Windsor and Barlow, 1982), an acidified stable product is obtained, with good nutritive and antimicrobial qualities against putrefaction and pathogens bacteria, which allows storage for a long time.(Green et al 1983)

In recent years manufacturing of fish silage for use in animal nutrition has been reported in

pigs(Smith, 1977; Tibbets et al.,1981; Wiseman et al.,1982),in broilers (Johnson et al.,1985 Berenz, 1994; ; Kjos et al., 2000),and few studies in layers (Herstad et al., 2000; Balios, 2003). Little research reports exist on use of fish silage in laying quails.

The objectives of the present study were to determine the effects of biological fish silage in diets of laying Japanese quails on performance and egg quality.

Materials and Methods

The processing method for biological fish silage follows the FAO procedures (1989)Concentrated fish silage, produced from slaughter by-products(heads, guts, remains after deboning) of tilapia (oreochromis spp) was obtained from the city main fish market .Wastes were washed, ,cooked for 15 minutes to reach 91^{o} C, in order to avoid contamination problem, drained and fine grounded (2mm), and added 15% molasses. The fish silage was preserved by mean of lactic acid bacteria (Lactobacillus bulgaricus and Streptococcus thermophilus), the microbial culture was previously prepared, to be added to the substract and molass (5% W:W).The culture microorganisms concentration was of 10 x 10^{8} cfu. The mixture was placed in a incubator at 40^{O} C for 96 hours, in anaerobic conditions. Silage was sampled for microbiologic and proximate analysis, acidity index and pH. Composition oft tilapia silage is shown in table 1.

Table1. Composition of tilapia silage Component **(%)**

Crude Protein	29.10
Ether Extract	12.88
Ash	12.60
Crude fiber	0.45
Dry matter	48.90
Calcium	2.96
Phosphorus	2.22
pH	4.68

A total of 120, 60 d-old laying japanese quails were allotted in a randomized experimental design with four treatments (Controls, 2, 4 and 6% of biological fish silage), with five replicates and 6 birds per replicate Birds were lodge in metallic cages .Diets were formulated to meet or exceed NRC recommendations Feed and water were supplied ad libitum and light was scheduled for 16 hours of light and 8 hours of dark each day. Prior to formulation, proximate analysis and other analysis were performed on samples of the fish silage in accordance to AOAC, 1999). Experimental diets formulated to meet or exceed NRC recommendations (1994) based on corn and soybean meal contained 20.% of Crude protein, 2605 Kcal/kg of ME, 2.50% Ca, 0.35% Available P, 1.17% Lysine, 0.48 Methionine, and 0.80 Met + Cys. **.** The mean egg production, feed consumption, and egg weight were calculated from the arithmetic mean of the respective measurement periods. All eggs laid on three consecutive days at 8, 12, and 16 wk of age were used for egg quality measurements.

Data from bird's performance were analyzed with the general linear models procedure of SAS software (SAS Institute INC, 1997) according to a completely randomized experimental design. Data were subjected to an analysis of variance, and significant differences among treatments were determined by Duncan's multiple-range test. Significant differences were declared at $P<0.05$

Results and Discussion

The fish silage used in this experiment, had a pH of 4.68 , and an acidity index of 5.43 at 96 hours. In the microbiologic analysis, the fish silage had a count <10 cfu per gram for total

coliforms, fecal coli forms, yeasts and molds, Bacillus cereus, and for spores of Clostridium. Also, in the count there were no presence of Salmonella and E. coli.
The results obtained from the feeding trial are summarized on TABLE 2.

TABLE 2 Effect of supplemental biological fish silage on performance and egg quality of laying japanese quails age[1]

Variables	Treatments				
	1	2	3	4	SEM[2]
Feed Consumption, (g/b/d)	29.13	29.80	29.75	29.38	0.415
Egg production, % bird/d	77.03[a]	67.84[c]	73.75[b]	71.23[b]	1.439
Egg weight, g	10.93	10.95	11.30	11.13	0.162
Egg Mass, g	8.42	7.45	8.32	7.93	0.607
Feed Conversion (g:g)	3.28	3.67	3.35	3.54	0.194
Weight gain, g	6.13	7.15	9.50	11.06	2.788
Specific gravity	1.074	1.074	1.073	1.076	0.00062
Haugh Units	83.63	83.33	86.20	83.31	0.796
Eggshell Thickness, mm	0.197	0.199	0.206	0.208	0.063
Yolk percentage	32.04	32.06	31.14	32.51	1.386

a-c Means in a row with no common superscript differ significantly ($P<0.05$)

[1]Data are means of five replicates of 6 laying quails 8 to 16 w of age.

[2] Standard error mean

Supplementation of fish silage in the diet had no significant ($P>0.05$) effects on feed intake, egg mass, feed conversion, weight gain, specific gravity, haugh units, eggshell thickness, and yolk percentage for the addition of Silage in feed consumption, egg weight, egg mass, feed conversion and weight gain. The level of fish silage affected egg production ($P<0.01$).Egg production was higher (77.03%) in controls, and lower in T2 (67.84%). Feed consumption egg weight were higher in the diets with fish silage, this agree with findings of Balios, 2003), who supplemented 2, 5 and 5, 0% fish silage in laying hens. Egg weight, Weight gain, and eggshell thickness, and yolk percentage increased linearly as level of silage increased. Better Feed conversion was observed in T2 , Balios, 2003, reported a better feed utilization with 2.5% of silage in laying hens.

The results obtained in this experiment showed that biological fish silage supplementation to the diet tended to improve egg weight, weight gain, eggshell thickness, and yolk percentage.

Skrede and Kjos (1996) reported that fish silage is a source of highly available aminoacids. The results of this study suggest that laying fed diets containing up to 6% biological fish silage had an acceptable production and egg quality performance .Due to popularity of fish as a human foodstuff, increasing amounts of rendered fish silage are available to the feed industry. More work needs to be done to define the nutrient value of biological fish silage and how those nutrients are best utilized. The potential exists for fish silage to be utilized economically in both developing and developed countries.

References

AOAC. (1999) Official Methods of Analysis. 16th ed. Assoc. Off. Anal. Chem., Arlington, VA.

BALIOS, J. (2003) Nutritional value of fish by-products, and their utilization as fish silage in the nutrition of poultry. *Proceedings of the 8th International Conference on Environmental Science and Technology*, Lemnos Island, Greece. 8-10 September 2003.

BERENZ, Z.(1990) utilización del ensilado de residuos de pescado en pollos. Capitulo 2. Instituto Tecnológico Pesquero del Perú, Callao, Perú, On line. http://www.fao.org/ag/AGA/FRG/APH134/cap2.htm.Accesed November 20/2006.

FAO (1992) Segunda Consulta de Expertos sobre Tecnología de productos pesqueros en América Latina. Trabajos Presentados, Montevideo, Uruguay 11-15 Diciembre 1989. FAO, Roma p368.

GREEN, S., WISEMAN, J. And COLE, D.J.A..(1983) Fish silage in pig diets. *Pig News Info*. **3**:356-358.

HERSTAD, O., OVERLAND, M., HAUGH, A., SKREDE,A., THOMASSEN,M.S ,and EGASS, E. (2000) Reproductive performance of broiler breeder hens fed n-3 fatty acid rich fish oil. *Acta Agricola Scandinavica, Sect. A, Anim. Sci*. 50:121-128.

JHONSON, J.R., BROWN, N., EASON, P. and SUMMER, J. (1985).The nutritional quality of two types of fish silage for broilers. *Journal Science of Food and Agriculture*. 36: 1051-1056.

KJOS, N.P., HERSLAD,O., OVERLAND, M.., and SKREDE, A (2000) Effects of dietary fish silage and fish fat on growth performance and meat quality. *Canadian. Journal. of Animal Science*.***80*** (4):625-632.

LINDGREN, S. and PLEJE, M. (1983) Silage fermentation of fish or fish waste product with lactic acid **bacteria.** *Journal of the Society of Food Agric.* **34**:1057-1067.

NATIONAL RESEARCH COUNCIL.(1994) Nutrients requirements of Poultry.9th rev.ed. atl. Acad. Press, Washington, D.C

RAA, J and GILDBERG, A. (1982). Fish Silage. A review. *Food Science and Nutrition*. 16(4):383-419.

SAS Institute, Inc. (1997) SAS user`s guide. SAS Institute, Cary, NC

SKREDE, A and KJOS, N.P. (1996) Digestibility of amino acids in fish silage. Page 205 i*n* A.F. Nunes, A.V. Portugal, B.P Costa and J.R. Ribiero, eds. Proceedings of the 7th International Symposium on protein metabolism and nutrition, vale de Santarem, Portugal, 24-27 May 1995. E.A.A.P.P .Publication No. 81.

SMITH, P.(1977) An evaluation of liquid fish as a protein source for fattening pigs. *Ournal of . Experimental Husbandry.* 32:34-41.

TATTERSON, I and WINDSOR, M. (1974). Torry test practical value of fish silage. *Journa*l *Science of Food and Agriculture.* 25: 25-26.

TIBBETS, G.W., SEERLY, R.W.,Mc CAMPBELLl, H.C. and VEZEY, S.A. (1981) An evaluation of an ensiled waste fish product in swine diets. *Journal of Animal Science.* 52:93-100.

WINDSOR, M. and BARLOW, S.(1982) Introduction to Fishery by-products. Fishing News Book Ltd. p.84-100.

WISEMAN, J.,GREEN, S. and COLE, D.J.A.(1982) Nutritive value of oily-fish silage when used to replace ingredients of plant origin in growing pigs diets. *Proceedings of Animal Production,* 3:358 (Abstract)