FEEDING PROGRAMS FOR ITIK PINAS (*Anas platyrhynchos*) DURING THE GROWING PHASE AND THEIR INFLUENCE ON THE SUBSEQUENT EGG PRODUCTION PERFORMANCE

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ABSTRACT

A total of 300 (12-week old) *Itik Pinas* (IP) ducks were used in the study to evaluate the influence of different feeding programs during the growing period on their growth parameters and subsequently, on their productivity, egg quality and reproductive capacity during the first 12 weeks of lay. Ducks were randomly assigned to the pens using randomized complete block design (RCBD). There were 10 ducks per pen with 10 replications for each treatment. The feeding programs were: developer feeding program (developer diet at 12-18 weeks of age); pre-lay feeding program (developer diet at 12-15 weeks of age, pre-lay diet at 16-18 weeks of age) and layer feeding program (developer diet at 12-15 weeks of age, layer diet at 16-18 weeks of age). Results revealed that performance during the growing stage was not influenced ($P>0.05$) by the feeding programs. However, the bodyweight uniformity of ducks under the layer feeding program tended to be higher ($P=0.10$) than their counterparts. For the laying period, all parameters were not influenced ($P>0.05$) by the feeding programs, except for the eggshell weight of ducks under the layer feeding program which was heavier ($P<0.05$) than those in the other programs. IOFC was numerically highest from ducks fed pre-lay diet at 16 weeks of age due to the lower cost of feed and high egg production rate. The findings indicated benefits to growing IP ducks under pre-lay feeding program i.e. developer diet at 12-15 weeks, pre-lay diet at 16-18 weeks, layer diet at point of lay.

Key words: developer, feeding programs, *Itik Pinas* ducks, layer, pre-lay

INTRODUCTION

The Philippine Mallard Duck (PMD) is the predominant stock being raised for egg production and it is primarily utilized for balut. Problems of the duck industry include a decline in quality breeder stocks and an unstable supply of ready-to-lay ducks (PCAARRD, 2016), high cost of feeds, and seasonality of demand for balut and salted eggs, lack of standards in processing, poor distribution and marketing, and lack of efficient technology (Chang *et al*., 2006; Lambio, 2000). Present problems in the duck egg industry such as a

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decline in quality breeder stocks and an unstable supply of ready-to-lay ducks are among the major factors contributing to the decline in egg production (PCAARRD, 2016).

Recently, a superior breeder duck called *Itik Pinas* (IP) was developed by continuous selection and breeding of the traditional Pateros duck or Philippine Mallard duck (PMD) to address the lack of quality breeder stocks through collaborative efforts from different government institutions including the Bureau of Animal Industry (BAI), and PCAARRD and University of the Philippines Los Baños (UPLB). However, any improvement in the genetic potential of the PMD should be accompanied by a proper feeding regimen for the ducks to reach their maximum potential. An effective and efficient feeding system is essential to enable the ducks to perform at their optimum capacity.

A good feeding program for the pre-lay phase should be taken as a basis of the animal's nutritional requirements, which should be evaluated (Rodrigues *et al*., 2013) because most dietary interventions are ineffective if hens are already in lay (Fleming, 2008).

Therefore, it is necessary to determine if there is a need to offer a pre-lay diet for egg-type ducks, in preparation for their laying period and to prevent calcium depletion during the start of egg production to meet the requirement of the bird as they lay their first egg. In addition, during the pre-laying stage, the birds regulate egg production feather production and growth simultaneously. Thus, this study aims to establish a feeding program that will improve the performance of IP ducks in the growing phase and on the subsequent egg production.

MATERIALS AND METHODS

A total of three hundred 12-week old *Itik Pinas* ducks (IP-Itim and IP-Khaki) were used in the study. They were randomly distributed into three treatments with 10 replicates per treatment. Each replicate was composed of 10 ducks (9 females: 1 male). Each duck was weighed at the start of the experiment and allocated to the treatments using Experimental Animal Allotment Program following randomized complete block design with initial weight and paddock location as blocking factors.

A shed-type experimental house with litter-floor consisting of rice hulls was used. There were 30 pens (30m x 3m) with 10 ducks each pen. Tube feeders were provided in each pen and water troughs made of halved 5cm PVC pipe were fitted at the end of the pen. Feeds were provided on ad libitum basis. Drinking water was also available to the ducks at all times. Ducks were exposed to natural and artificial lights. Incandescent bulbs were provided and switched on at 5:00 in the afternoon and switched off at 6:00 in the morning.

The feeding programs during the growing period and the schedule of feeding the diets are shown in Table 1. All diets were in mash form. The composition, calculated and proximate analysis of the diets are shown in Table 2.

All diets were formulated using the feeding values of different ingredients and nutrient requirements for PMD by Adiova (2018). The proximate, calcium and phosphorous contents of the diets were analyzed in Lipa Quality Control Center in Bocaue, Bulacan. All amino acids were in digestible values, based on PHILSAN (2010).

Eggs were collected every day at 6:00 in the morning and weighed. Egg composition and egg quality were determined during the last 6 weeks of the study. Additionally, a total of 90 eggs (30 eggs per treatment) were incubated for fertility and hatchability test. Fertility was determined using a candler, 1st candling was done on the 10th day of incubation

Table 1. Diets and schedule of feeding during the growing period (12-18 weeks of age).

Treatments	Diets	Feeding Period
Developer Feeding Program	Developer diet	12-18 weeks
Pre-lay Feeding Program	Developer diet; Pre-lay diet	12-15 weeks; 16-18 weeks
Layer Feeding Program	Developer diet; Layer diet	12-15 weeks; 16-18 weeks

Table 2. Composition, proximate and calculated analysis of diets for various periods.

Ingredients	Developer (12-18 weeks)	Pre-lay (16-18 weeks)	Layer (16-18 weeks)
Yellow corn	33.71	33.30	43.84
Rice bran (fine; D1)	50.00	40.00	25.00
Soybean meal (USHP)	12.24	19.91	21.50
Limestone (fine)	1.79	2.30	3.88
Limestone (course)	-----	2.00	3.00
Monodicalcium phosphate	1.24	1.27	1.39
Salt	0.40	0.44	0.44
DL- methionine	0.10	0.16	0.22
Lysine	0.03	-----	0.11
Threonine	-----	0.02	0.02
Poultry vitamin premix[1]	0.03	0.03	0.03
Poultry mineral premix[2]	0.15	0.15	0.15
Choline Chloride	0.10	0.20	0.20
Antioxidant	0.02	0.02	0.02
Toxin binder	0.20	0.20	0.20
Total	100.00	100.00	100.00
Cost/kg diet, Php	18.71	18.99	19.02

and 2nd candling was done on the 15th day of incubation.

The data gathered were the following: Average daily gain (ADG), bodyweight uniformity, feed intake, feed conversion ratio (FCR), egg production, egg quality parameters, egg classification, fertility and hatchability rates, shank and keel length and income over feed cost (IOFC).

Data were analyzed using ANOVA for Randomized Complete Block Design (RCBD) in Statistica. Least significant difference (LSD) was used to determine the differences among treatment means at 5% level of significance.

Table 2. Continued...

Ingredients	Developer (12-18 weeks)		Pre-lay (16-18 weeks)		Layer (16-18 weeks)	
	Calculated	Analyzed	Calculated	Analyzed	Calculated	Analyzed
AME, kcal/kg	2814	2839	2750	2719	2750	-----
Crude protein, %	14.71	14.02	17.04	15.49	16.90	18.14
Crude fat, %	8.13	3.23	6.89	3.26	5.33	4.27
Crude fiber, %	3.50	4.06	3.31	4.63	2.95	4.19
Calcium, %	1.00	0.95	2.00	1.27	3.00	3.17
Available phosphorus, %	0.42	0.87	0.42	0.89	0.42	0.60
Sodium, %	0.19	----	0.20	----	0.20	----
Chlorine, %	0.29	----	0.31	----	0.31	----
Linoleic acid, %	3.15	----	2.69	----	2.09	----
Lysine, %	0.63	----	0.77	----	0.86	----
Methionine, %	0.33	----	0.41	----	0.47	----
Methionine + Cystine, %	0.55	----	0.66	----	0.72	----
Threonine, %	0.45	----	0.55	----	0.56	----
Tryptophan, %	0.14	----	0.17	----	0.17	----
Arginine, %	0.94	----	1.09	----	1.05	----
Isoleucine, %	0.49	----	0.62	----	0.63	----
Leucine, %	1.05	----	1.23	----	1.28	----
Valine, %	0.62	----	0.72	----	0.70	----

[1]Each kg contains: 65,000IU vit A; 5,000,00 IU vit. D3, 100,000 mg vit. E; 10,000 mg vit. K3,, 10,000 mg vit. B1, 27,000 mg vit. B2; 15,000 mg vit. B6; 200 mg vit. B12; 200,000 mg niacin; 5,000 mg folic acid; 60,000 mg pantothenic acid; and 1,000 mg biotin.

[2]Each kg contains: 80,000 mg iron; 10,000 mg copper; 80,000 mg zinc; 70,000 mg manganese; 200 mg selenium and 800 mg iodine.

RESULTS AND DISCUSSION

Growing Period

The feeding programs during the growing period (Table 3) did not elicit a difference (P>0.05) in any of the parameters in the growing ducks. This occurred despite the difference in CP and energy contents of the diet that the ducks received starting at 16 weeks of age. Though, benefits in terms of bodyweight uniformity (P=0.10) could be realized in feeding the ducks with a pre-lay diet or layer diet commencing at 16 weeks of age. It was plausible that the growing ducks with inferior weight had caught up growth with the provision of a diet with more than 15% CP (Table 2). Hence, the improvement in the body of the ducks.

Table 3. Comparative effects of different feeding programs on mean (±SEM) production performance of growing duck (12-18 weeks of age).

Parameters	Feeding Program			LSD (0.05)	*P*-Value
	Developer (12-18 wks)	Pre-Lay (16-18 wks)	Layer (16-18 wks)		
Bodyweight[1], g	1398 ± 16.35	1402 ± 16.02	1409 ± 19.22	50.08	0.90
Bodyweight uniformity[1], %	87.50 ± 3.59	94.44 ± 3.42	96.67 ± 1.70	8.78	0.10
Gain in weight[2], g	425 ± 15.51	429 ± 16.77	435 ± 15.81	46.54	0.91
Feed conversion ratio[2]	3.14 ± 0.18	3.03 ± 0.19	3.08 ± 0.14	0.50	0.90
Daily feed intake[3], g/day	135 ± 2.75	136 ± 2.69	138 ± 2.25	7.47	0.67
Feed consumed[2], g/bird	6593 ± 131.43	6655 ± 120.28	6684 ± 99.90	342.22	0.86
Livability[1], %	98.89 ± 1.11	98.89 ± 1.11	100.00 ± 0.00	2.63	0.61

[1]Taken at 18 weeks of age.
[2]Cumulative data gathered from 12 to 18 weeks of age.
[3]Average of data gathered from 12 to 18 weeks of age.

The effects of a higher level of calcium and a lower level of energy could not be discounted as contributory factors. In related studies, different CP levels in combination with different energy levels also had no effect on the performance of growing meat-type ducks (Siregar, *et al*., 1982) and on growing egg-type ducks (Datuin, 2003; Hussein *et al*., 1996; Dagaas, 1995; Thongwittaya *et al*., 1992; Doran *et al*., 1983).

The result (Table 4) favored the use of a developer feeding program (developer diet at 12-18 weeks of age) containing lower nutrient density at the lowest cost per kilogram. Utilization of this diet would lead to a comparable growth rate of ducks, showing the efficiency of IP ducks in converting feed intake to bodyweight.

Laying Period

The findings disclosed that the feeding programs during the growing period had no influence ($P>0.05$) on the subsequent production of the ducks (Table 5). Irrespective of the feeding programs during the growing period, the IP ducks had comparable age at the first lay of 19 weeks and bodyweight of 1.40kg, this is one week earlier than the reported age of IP ducks in their first lay by Davao (2016) which is 20-22 weeks of age. It was also interesting to note that there was no carry-over effect of the feeding programs during the growing period on the egg production, feed conversion and egg weight nor the livability of the ducks during the first 12 weeks of their lay. These findings suggest that the IP ducks can be raised on any of the feeding programs applied during the growing period with the same effects on egg production performance from 19 to 30 weeks of age. For modern strains of chickens, feeding a growing diet with the recommended specification is a must for them to perform well in their subsequent egg production period (Leeson and Summers, 2005). Calcium for medullary bone development (Bornstein, 1977), and protein and energy for

Table 4. Comparative feed cost of growing IP ducks (12-18 weeks of age) under different feeding programs.

Parameters	Feeding Program			LSD (0.05)	*P*-Value
	Developer (12-18 wks)	Pre-Lay (16-18 wks)	Layer (16-18 wks)		
Consumed developer diet, g	6,593	3915	3897		
Consumed pre-lay diet, g	-------	2740	-------		
Consumed layer diet, g	-------	-------	2787		
Total feed consumed, g	6,593	6,655	6,684	342	0.86
Total feed cost/ duck, Php	123.40 ± 2.46	125.30 ± 2.28	125.90 ± 1.90	6.46	0.70

Price per kilogram of diet: developer (Php18.71/kg); pre-lay (Php18.99/kg); layer (Php19.02/kg)

Table 5. Comparative effects of different feeding programs during growing period on mean (±SEM) production performance of IP ducks during their first 12 weeks of laying period (19-30 weeks of age).

Parameters	Feeding Program			LSD (0.05)	*P*-Value
	Developer (12-18 wks)	Pre-Lay (16-18 wks)	Layer (16-18 wks)		
Bodyweight[1], g	1414 ± 34.20	1454 ± 30.46	1404 ± 32.22	93.81	0.52
Gain in weight[2], g	470 ± 39.67	513 ± 27.46	457 ± 33.66	98.55	0.48
Age of 1st lay, week	19.00 ± 0.26	19.30 ± 0.40	19.10 ± 0.18	0.85	0.76
Egg production[3], %	58.57 ± 2.81	60.69 ± 3.25	62.55 ± 2.18	8.07	0.60
Daily feed intake[3], g/day	162 ± 5.56	163 ± 4.63	168 ± 5.93	15.67	0.70
Feed conversion ratio[3]	5.35 ± 0.31	6.14 ± 0.85	5.58 ± 0.47	1.72	0.64
Egg weight[3], g	59.00 ± 0.92	55.80 ± 1.42	58.18 ± 0.93	3.24	0.13
Livability[1], %	93.17 ± 3.56	97.78 ± 1.46	97.14 ± 1.51	6.93	0.26

[1]Taken at 31 weeks of age.
[2]Gain bodyweight from 19 to 30 weeks of age.
[3]Average of data gathered for the first 12 weeks of laying period (19 to 30 weeks age of ducks).

body mass development (Mcdonald *et al*., 2010) are important during the growing period.

The results revealed that the feeding programs during the growing period had no influence (P>0.05) on the size or classification of eggs (Table 6). This suggests that any of

the feeding regimens can be used for IP ducks during the growing period with no adverse effect on egg size. The age and bodyweight of birds at the point of lay are major factors that influence egg size or weight (Leeson, 2010). As highlighted in the preceding sections, the IP ducks had comparable bodyweight and age when they attained sexual maturity despite the differences in their ration starting at 16 weeks of age.

Results showed no significant difference ($P>0.05$) on the egg quality of the IP ducks subjected to different feeding regimen during the growing period (Table 6), except for the eggshell weight which was higher for the IP ducks fed layer diet commencing at 16 weeks of age than those fed developer diets at 12 to 18 weeks of age and those fed pre-lay diets at 16 to 18 weeks of age.

The findings indicated that feeding layer diet with 3.0% Ca and 0.42% available phosphorus starting at 16 weeks of age affected the production of eggs with heavy shells. Feeding such kind of diet could have fully developed the medullary bone of the IP ducks. Calcium needed for eggshell synthesis is drawn from the medullary bone (Leeson and Summer, 1997) especially when dietary Ca intake is low. It was probable that the sustained supply of Ca for shell formation contributed to the heavier shells from the IP ducks fed layer diet starting at 16 weeks of age.

There was no significant difference in the fertility and hatchability rates due to the growing feeding regimen as shown in Table 7. Ducks under the pre-lay feeding program had the highest fertility of 93.33%, while those under the layer feeding program had the highest hatchability rate of 45.83%. The pre-lay feeding program (93.33%) had exceeded the 80% fertility rate for PMD (PCAARRD, 2015). Meanwhile, the hatchability rate of IP ducks under the three feeding programs was low as compared to the hatchability rate from 10-40 weeks (laying period) which was 87.73% of mallard ducks (Romjali *et al*., 2006). Irrespective of the feeding program during the growing period, the hatchability rate was extremely low, this could be due to earlier and shorter laying period (first 12 weeks of laying period) covered and egg hatchery management in the present study.

Both the keel length and shank length of ducks were not affected ($P>0.05$) by the feeding programs. Ducks with the longest average keel bone of 11.014 cm were those under the layer feeding program, while ducks under the developer feeding program had the longest average shank length of 4.848 cm. Shank length is related to the production performance of the birds (Debes *et al.*, 2015). The lack of differences in shank length relates well with the insignificant differences in egg production of the IP ducks.

Table 8 shows the economic parameter of IP ducks under the three feeding programs during the growing period. The data indicated the numerical advantage of the IP ducks subjected to pre-lay feeding during the growing period. The higher IOFC from this group was largely accounted for by the sale value of the eggs and total feed consumed.

Results suggest the merit of using pre-lay feeding program (i.e. developer diet at 12-15 weeks of age, pre-lay diet at 16-18 weeks of age) to IP ducks during their growing stage.

Table 6. Comparative effects of different feeding programs during growing period on mean (±SEM) egg classification, quality and composition of IP ducks during their first 12 weeks of laying period (19-30 weeks of age).

Egg Classification	Feeding Program			LSD (0.05)	*P*-Value
	Developer (12-18 wks)	Pre-Lay (16-18 wks)	Layer (16-18 wks)		
Egg Classification[1]					
Peewee (<60g), %	28.66 ± 2.37	30.79 ± 3.02	29.74 ± 3.19	8.37	0.87
Small (61-65g), %	40.97 ± 2.65	41.99 ± 2.05	39.04 ± 1.90	6.45	0.64
Medium (66-70g), %	23.15 ± 2.53	19.95 ± 2.22	23.28 ± 3.01	7.64	0.60
Large (71-75g), %	5.31 ± 0.89	4.48 ± 0.70	5.7 ± 1.53	3.19	0.72
Extra-large (76-80g), %	0.52 ± 0.90	1.10 ± 0.57	0.54 ± 0.23	1.03	0.43
Jumbo (>80g), %	1.40 ± 0.36	1.69 ± 0.19	1.67 ± 0.63	1.26	0.87
Egg Quality and Composition					
Yolk Color	5.58 ± 0.107	5.76 ± 0.077	5.54 ± 0.074	0.24	0.19
Yolk Weight, g	19.04 ± 0.179	18.97 ± 0.209	18.96 ± 0.096	0.49	0.92
Albumen Height, mm	6.99 ± 0.065	6.88 ± 0.066	6.81 ± 0.061	0.19	0.16
Albumen Weight, mm	40.64 ± 0.168	40.29 ± 0.239	40.40 ± 0.240	0.63	0.52
Shell Thickness w/ membrane, mm	0.27 ± 0.004	0.26 ± 0.006	0.28 ± 0.005	0.014	0.39
Shell Thickness w/o membrane, mm	0.23 ± 0.004	0.23 ± 0.005	0.24 ± 0.004	0.013	0.39
Shell Weight[1], g	6.81 ± 0.048[b]	6.76 ± 0.085[b]	6.99 ± 0.044[a]	0.179	0.03

[1]Data gathered from 19-30 weeks of age.
*Means in a row with different superscripts are significantly different at 5% level.

Table 7. Comparative effects of different feeding programs during growing period on mean (±SEM) reproductive performance (19-30 weeks of age), shank and keel length of IP ducks.

Parameters	Feeding Program			LSD (0.05)	*P*-Value
	Developer (12-18 wks)	Pre-Lay (16-18 wks)	Layer (16-18 wks)		
Fertility, %	80.00 ± 11.55	93.33 ± 6.67	73.33 ± 3.33	27.46	0.27
Hatchability, %	32.77 ± 4.34	39.17 ± 5.83	45.83 ± 13.05	29.85	0.59
Shank length[1], cm	4.85 ± 0.62	4.71 ± 0.66	4.74 ± 0.43	0.168	0.22
Keel length[1], cm	11.01 ± 1.13	11.01 ± 1.23	11.01 ± 0.93	0.320	0.99

[1]Data were taken at 31 weeks of age.

Table 8. Comparative economic performance of IP ducks during their first 12 weeks of laying period (19-30 weeks of age) under different feeding programs (during growing period).

Parameters	Feeding Program			LSD (0.05)	*P*-Value
	Developer (12-18 wks)	Pre-Lay (16-18 wks)	Layer (16-18 wks)		
Eggs produced, pcs	45.50	48.45	49.55	5.49	0.31
Sale value of eggs[1], Php	263.90	281.01	287.39	31.87	0.31
Feed consumed, kg	13.63	13.68	14.13	1.31	0.69
Cost of feed consumed[2], Php	259.40	260.20	268.77	25.04	0.69
IOFC, Php	4.50 ± 14.84	20.81 ± 15.13	18.62 ± 14.96	43.46	0.71

[1]Price per fresh egg is Php5.80.

[2]Price per kg of layer diet Php19.02/kg.

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