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MULTI-AGE DUCK FARMING SYSTEM IN PONDS, COMPARING ITS PRODUCTION AND PROFIT: A CASE STUDY AT TAKALAR DISTRICT OF INDONESIA

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ABSTRACT
The study was aimed to draw a comparison between the production and proft of duck eggs in the multi-age duck farming in brackishwater ponds. Multi-age is defined as layer ducks in two or three age group (level 2 or 3) that is farmed collectively in one cage. Evaluative method was applied to 110 ducks in each level. The ducks in level 2 consist of two age groups: 6-14 and 15-23/24 months, 36 ducks each. Level 3 has three age groups: 6-11, 12-17 and 18-23/24 months containing 36, 38 and 36 ducks, respectively. Each level was contained in a $20m^2$ cage in the same pond with a 100m gap between cages. The ducks are allowed a natural environment to freely swim in the pond and rest in the cage. The ducks are kept for four months. The t test statistics was used to compare the production and profit of duck eggs in level 2 and 3. The result showed a non-signficant difference in egg production betweel level 2 and 3 ($p<0.05$); however, ducks in level 2 produced more eggs than those in level 3 by 1.80%. A significant difference in profit ($p>0.05$) was identified where level 2 gave a higher profit by IDR 308,000 (USD 21,63) than level 3. Based on the comparison in egg production and profit, it is concluded that the multi-age duck farming level 2 and 3 deserves perpetuation or development.

KEY WORDS
Multi-age, farming system, pond, duck.

Farming ducks in brackishwater pond is one of the integrated fish-based farming systems/aquatic farming (Latifa and Rini, 2014; Munjunatha, 2014; Renie and Budi, 2015; Madry et al., 2016). In this system, fish is the main product and the ducks are the byproduct. Duck feces functions as the fertilizer for the brackishwater pond and stimulate the growth of zooplankton and phytoplankton (Dritan and Bejo, 2014; Mehedi et al., 2015). Ducks farming in brackishwater pond can benefit the fish by improving the fertility of the pond and providing feed source for the ducks from the pond biota that grows well from the ducks' feces (Popp et al., 2018). The study of duck farming in brackishwater pond has been done in Bangladesh (Latifa et al, 1993, Mehediet et al., 2015), Egypt (Ramdhan, 2007), Uttarakhand, India (Mishra, 2007; Soliman et al, 2000; Gangwara et al., 2013; Singh, 2013; and Satyaprakash et al., 2014), Hungary (Popp et al., 2016), France (Broyer and Laurence, 2012*)* and Nigeria *(*Nnaji, 2014). However, the studies have not discussed the multi-age duck farming system—layer ducks categorized in two or three age groups (level 2 or 3) that are farmed collectively in one cage. In Indonesia, especially Takalar regency, the system has been applied by the brackishwater pond farmer for 15 years as a diversification venture. The system was planned purposively by the farmers to maintain the amount of egg supply to the market. The type of ducks for the farming system is the local duck—crossbred of several duck strains that have long been bred (Budaiharjo, 2014).

The farmers initially practiced one age group while hatching and breeding the young ducks as the replacement to the previous ducks. When the first ducks have to be culled for being unproductive (usually over 24 months old), the sibstitute ducks have been 5-6 months old and started laying eggs. One age group-system then evolved into multi-age system. To date, some farmers apply and maintain the multi-age systems; 2 age groups (level 2) and 3 age groups (level 3). Level 2 includes age groups 6-14 months and 15-23/24 months, and level 3 includes 6-11, 12-17 and 18-23/24 months.

The drawback of this multi-age system is the difficulty to tell production stage I from stage II that are physiologically connected to the level of egg production. Stage I starts at 5-6 months of age with 10-15% production, then peaks (80-90%) at 8-12 months and diminishes on average 40% at 13-14 months. (Palmer, 2007; Triana et al., 2012). Stage II starts at 15-16 months with production under 40% and lasts until 23-25 months (Purba et al., 2005). The production stage was closely related to molting—common among poultries. Molting occurs at 14 to 15-month old and lasts for 1.5 to 2 months (Triana, 2015). Egg production drastically declines even ceases completely during molting (Palmer, 2007). Besides molting, the ducks undergo production stage II with as low as 40% egg yield (Purba et al., 2005; Palmer, 2007; Margono, 2015); therefore, deemed inefficient to maintain.

In other words, multi-age system discovers the combination between the high-producing ducks (Stage I) and low-producing ducks (Stage II). The impact is on the duck-day production, operational costs and profit. Accordingly, this study aims to compare the level of egg production and profit between the multi-age brackishwater-farmed ducks in level 2 and level 3. The result of the study is expected to provide additional information for further study and for the farmers to evaluate the long-existing multi-age duck farming system.

MATERIALS AND METHODS OF RESEARCH

The study was conducted for four months (June – September 201) in Takalar regency, South Sulawesi Province, Indonesia. The study used evaluative method which calculates the benefits of multi-age duck farming level 2 and level 3 using the criteria of production and profit. Previous studies reported that the number of farmers that breed multi-age ducks at level 2 and 3 was 200 and 165, respectively, and each level evaluated 20 farmers as the sample. From each level, 100 layer ducks and 10 drakes were taken based on the age group as presented in Table 1.

Table 1 – Sample criteria based on level and age group

Multi-age	Age group	Sex		Total sample	
		Female	Male	Total	%
Level 2	6-14 months	50	5	55	50.00
	15-23/24 months	50	5	55	50.00
	Total	100	10	110	100.00
Level 3	6-11 months	33	3	36	32.72
	12-17 months	34	4	38	34.55
	18-23/24 months	33	3	36	32.73
	Total	100	10	110	100.00

Ducks in level 2 and 3 were allotted to one brackishwater pond area with two 20m^2-cages. Between cages for level 2 and 3 was a 100 m-gap. The ducks were freely swimming in the pond and resting around the cages to be exposed to the natural environment. The ration was composed of the regular feedstuff for daily feeding such as ricebran, corn and fish waste (all minced) using 50:40:10 ratio. Result of proximate analysis of the ration's nutrient content is presented in Table 2. Feed was offered two times—in the morning prior to open range in brackishwater area, and in the afternoon before the ducks were caged. The average feed consumption was 150g/duck/day.

Table 2 – Result of proximate analysis of nutrient content in the ration for multi-age ducks.
Rations for multi-age duck (Level 2 and 3)

Component	Average
Water (%)	14,127
Ash (%)	23.644
Crude Fat (%)	10.771
Crude Protein (%)	17.259
Gross Energy (Kcal)	2917.522

Result of proximate analysis in laboratory of feed, Department of Animal Science, UIN-Alauddin Makassar.

According to Ketaren (2002), the ration for adult layer ducks requires 19-20% protein and 2700-2900 kcal per kg; therefore, the protein content in the ration in this study (Table 2) was below standard. However, free ranging ducks during the day is expected to meet protein and other nutrients requirements. Previous study reported that brackishwater pond provided natural feeding habitat for the ducks such as phytoplankton, zooplankton, low-level vegetation including grass, moss and water hyacinth, and high-level vegetation like mangrove (Tia, et al., 2012; Popp, et al., 2018). Ducks are omnivorus animal so the entire biota in brackishwater pond ecosystem provides source of nutrients for ducks.

Daily egg production (DD) in percentage (%) was calculated (1) (Margono, 2015). Daily profit was calculated using equation (2) (Hanafi and Halim, 1995).

Duck Day (DD) $= \frac{\textbf{\textit{Total egg production}}}{(\textbf{\textit{total live duck}})\ x\ (\textbf{\textit{days}}))}\ X\ 100$ (Margono, 2015 (1)

Profit = TR-OC (2)

Where: TR is Q (P) where Q is egg production and P is selling price/transaction; OC is the total production cost (feed, medicine, labour, depreciation rates of cage and equipments).

Data were subject to t test using SPSS version 16 to see the different production (DD) and profit between duck farming in multi-age level 2 and level 3. Significant difference is p<0.05.

RESULTS AND DISCUSSION

This section contains the statistical summary and the result of normality and homogeneity test as the prerequisite for t test. The summary of the variables in t test is presented in Table 3.

Table 3 – Statistical summary

Variable	Multi-age	Mean	Std. Deviation
Duck day (%)	Level 2	65.565	2.035
	Level 3	57.758	3.642
Profit (million IDR)	Level 2	4.237	1.289
	Level 3	3.894	1.497
Mortality (duck)	Level 2	4.000	0.022
	Level 3	7.000	0.025

The average egg production and profit in level 2 were higher than those in level 4. The smaller standar deviation from the same variables indicates that the majority DD or OC value (profit) from the same multi-age level are almost similar to the mean value. In contrast, the highest standard deviation showed a significant difference from one farmer to another. The unit for egg production is duck-day (DD) calculated by the formula: daily egg production divided by the total live layer duck. The unit for profit in Indonesian Rupiah (IDR) is calculated using the formula (2). Total mortality during the span of study was 4 and 7 for level 2 and 3, respectively.

Normality test is the prerequisite of t test in order to ensure the data being normally distributed and representative to the population. Since dependent varibles measured were derived from 2 groups of independent sample, the normaility test used in this study was adalah Kolmogorov Smirnov and Shapiro Wilk (Ghazali, 2014). The criteria established by Kolmogorov-Smirnov and Shapiro Wilk stated that if p-value >0.05, the data were normally distributed and representing the population. Table 4 shows that duck day or profit from level 2 and level 3 had Kolmogorov-Smirnov and Shapiro Wilk value >0.05 (p>0.05). Therefore, the data from both groups (level 2 and level 3) are normally distributed or representing the population.

Homogeneity test is also the prerequisite of t test to whether a different variant exists in both level of data (level 2 and level 3). In t test, quality data have a minuscule difference of variance (Ghozali, 2014). The test is using Levene's Test that categorized homogenous data if p-value >0.05. Table 5 shows p-value>0.05 in both duck day and profit, indicating data homogeny between groups.

Table 4 – Normality test

Variable	Multi-age	Kolmogorov-Smirnov			Shapiro-Wilk		
		Statistic	df	p-value	Statistic	df	p-value
Duck Day (%)	Level 2	.151	34	.047	.925	34	.022
	Level 3	.211	31	.001	.866	31	.001
Profit (%)	Level 2	.305	34	.000	.703	34	.000
	Level 3	.363	31	.000	.669	31	.000

Table 5 – Test of Homogenety of Variance

		Levene Statistic	p-value
Duck Day (%)	Based on Mean	1.751	.190
Profit (%)	Based on Mean	8.316	.065

Homogenity of p-value>0.05.

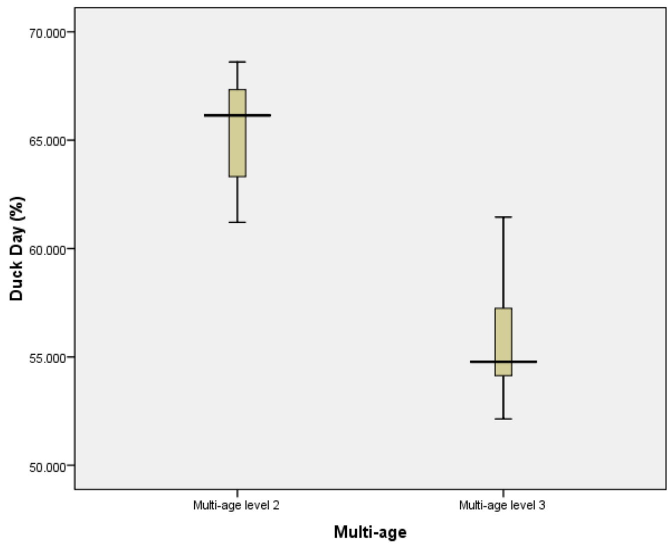

Figure 1 – Box-plot egg production, duck day

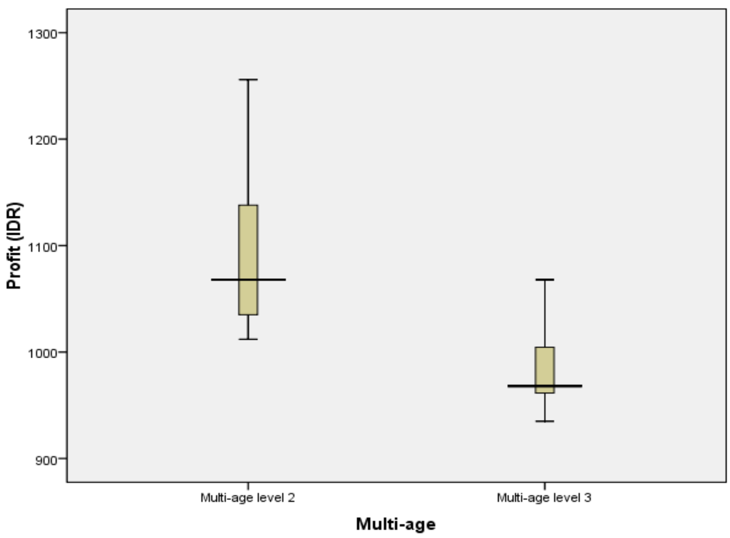

Figure 2 – Box-plot profit (million IDR)

Homogeneity also translates into data without outlier—a set of data that distinguish themselves from other data due to error during data measurement or data collection. Outlier can be visually detected using box-plot (Figure 1 and 2). Both graphs do not show the upper plots or under the box plot; therefore, outlier is non exsistent. Therefore, the data of this study showed homogeneity that is qualified for comparison using independent t test.

Table 6 – T test result of egg production and profit

Independent Samples Test					
Variabel	Levene's Test for Equality of Variances		t-test for Equality of Means		
	F	p-value	t	p-value (2-tailed)	Mean Difference
Duck Day (%)	1.751	.390	16.850	.106	1.806
Profit (millon IDR)	2.316	.405	11.647	.000	0.308

Note: P-value of Levene's Test for Equality of Variances for duck day (0.390) and profit (0.405) are both (p>0.05), indicating homogeneity with the previous homogeneity test.

T test result showed that the difference of duck-day in level 2 and level 3 was non-significant (p>0.05); however, the mean difference showed that DD level 2 was slightly higher (1.80%) than that of level 3. The difference may due to production cycle or the hatching period. Young ducks (6-12 months) generally have a production cycle that lasts from 6 to 8 months which declines to 4-5 months when reaching 12-13 months of age (Margono, 2015). Level 2 includes two age groups; 6-12 and 13-24 months, each with 50 ducks. Level 3 includes three age groups; 6-11, 12-17 and 18-23/24 months, with 33, 34 and 33 layers, respectively (Table 1).

According to the researcher's note, from 34 ducks in level 2, there are 3 ducks in 12-17 months age group, 11 in 12-month group and 23 in over 12-month group. Therefore, the number of 6-12 months old ducks in level 3 is 44 ducks (33+11) and 56 are over 12 months old. In other words, 44 ducks are 6-8 month of production cycle and 56 are in low production cycle (under 6 months). It is evidenced that there are more layers in level 2 that survive in long production cycle (50) than those in level 3 (44). The different cycle resulted in a slightly higher egg production in level 2 than that in level 3.

Previous studies have evaluated duck farming system in brackishwater pond with additional feed that resulted in egg production as much as 66.67% in khaki Campbel (Latif et all. 1993), 55.67% in Bangladesh nageswari duck (Bhuiyan, et.al., 2017) and 60-70% in Indonesian local duck *anas javanicus sp* (Widiyaningrum et all. 2016). The current study on local ducks reported average egg production 65.56% and 57.75% in level 2 and level 3, respectively.

Table 6 also showed a significantly different profit in level 2 and level 3 (p<0.05) where level 2 is IDR 0.308 million higher than level 3. The difference is due to a slighty higher mean of egg production (duck day) in level 2 (1.80%) that yields higher revenue and thus affects profit gap. It was in line with Majhi (2018) that Integrated Duck-cum-Fish Farming in India gained profit as much as 29290/month, equal to IDR 6,058,503. ICAR (2018) reported that duck farmers' average income in India is Rs 20000/month, equal to IDR 4,101,404.80. Adzitey and Adzitey (2011) stated that duck production has a potential to reduce poverty among rural households in Asian communities. It is difficult to compare the profit across regions because it involves price and cost. However, the experts have agreed that ducks farming in brackishwater pond shows a promising profit. Therefore, multi-age duck farming (level 2 and 3) in brackishwater that have long been existing is considered worthy of perpetuation or development.

CONCLUSION

It is concluded that egg production in level 2 and level 3 is non-significant (p>0.05); however, mean difference showed that level 2 had a slightly higher egg production (1.80%) than that of level 3. Profit comparison between level 2 and 3 is significant (p<0.05), mean difference showed that profit level 2 is higher by IDR 308,000 (USD 21,63) than that of level 3. The difference may due to the slightly higher duck day in level 2 which resulted in a higher revenue that affects profit gap. Based on the rates of egg production and profit, multi-age duck farming (level 2 and 3) in brackishwater pond in the location of the study is deemed sustainable and developable.

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CONFLICT OF INTERESTS

The authors certify that they have no “conflict of interest” in the research, from undertaking the field research to writing the manuscript.

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