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The Productivity Improvement and Population Growth of Payakumbuh Duck (*Anas platyrhynchos* domestication) Using a Simple Aspirator Tool on Artificial Insemination (AI) Technology

Peningkatan Produktivitas dan Pertumbuhan Populasi Itik Payakumbuh (*Anas platyrhynchos* domestication) Menggunakan Alat Aspirator Sederhana pada Teknologi Inseminasi Buatan (AI)

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ABSTRACT

This study aimed to determine the effect of IB frequency using different simple aspirator on fertility, weight loss and hatchability of Payakumbuh duck (*Anas platyrhynchos* domestication) eggs. This study used 8 male and 20 female ducks, 90% egg production. In this study, all hatched the hatched eggs. This study used an experimental method with a completely randomized design (CRD) with 4 treatments and 5 replications. The treatments consisted of: P1 is 1 x 2 days, P2 is 1 x 4 days, P3 is 1 x 6 days, P4 is 1 x 8 days; the parameters observed were fertility, weight loss and hatchability. The results of the analysis of variance showed that different AI frequencies had a significant effect ($P < 0.05$) on the fertility of hatching eggs, but had no significant effect ($P > 0.05$) on weight loss and hatchability. It can be concluded that P2 had a significant effect ($P < 0.05$) on fertility because fertile eggs were higher than other treatments. The characteristics of Payakumbuh ducks (*Anas platyrhynchos* domestication) spermatozoa are milky white and yellowish white, thick and watery consistency, specific odor, volume 0.24±0.05 ml, pH 7.37±0.51, mass movement +, ++ and +++, live percentage 79.06±3.68%, concentration 2.342 billion cells/ml, motility 75.00±7.56% and abnormality 12.06±0.82%. The results of the analysis of variance showed that different AI frequencies had a significant effect ($P < 0.05$) on the fertility of hatching eggs, but had no significant effect ($P > 0.05$) on weight loss and hatchability. The frequency of IB 1 x 4 days had the highest fertility rate, namely 67.72 ± 7.99%. A simple Aspirator can function properly with the need for repairs and upgrades in several parts of the tool such as current source, and fan capacity.

Keywords : *Anas platyrhynchos* domestication, Productivity, Artificial Insemination Technology

ABSTRAK

Penelitian ini bertujuan untuk mengetahui pengaruh frekuensi IB menggunakan aspirator sederhana yang berbeda terhadap fertilitas, penurunan bobot dan daya tetas telur itik Payakumbuh (*Anas platyrhynchos* domestication). Penelitian ini menggunakan itik jantan 8 ekor dan itik betina 20 ekor, produksi telur 90%. Dalam penelitian ini, semua telur yang menetas. Penelitian ini menggunakan metode eksperimen dengan Rancangan Acak Lengkap (RAL) dengan 4 perlakuan dan 5 ulangan. Perlakuan terdiri dari: P1 1 x 2 hari, P2 1 x 4 hari, P3 1 x 6 hari, P4 1 x 8 hari; parameter yang diamati adalah fertilitas, bobot dan daya tetas. Hasil analisis varians menunjukkan bahwa perbedaan frekuensi AI berpengaruh nyata ($P < 0,05$) terhadap fertilitas tetas telur, tetapi tidak berpengaruh nyata ($P > 0,05$) terhadap pertumbuhan bobot dan daya tetas. Dapat disimpulkan bahwa P2 berpengaruh nyata ($P<0,05$) terhadap fertilitas karena telur fertil lebih tinggi dibandingkan perlakuan lainnya. Ciri-ciri spermatozoa itik Payakumbuh (*Anas platyrhynchos* domestication) putih susu dan putih kekuningan, konsistensi kental dan berair, bau khas, volume 0,24±0,05 ml, pH 7,37±0,51, gerakan massa +, ++ dan +++, persentase hidup 79,06±3,68%,

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konsentrasi 2,342 miliar sel/mL, motilitas 75,00±7,56% dan kelainan 12,06±0,82%. Hasil analisis varians menunjukkan bahwa perbedaan frekuensi AI berpengaruh nyata (P < 0,05) terhadap fertilitas tetas telur, tetapi tidak berpengaruh nyata (P > 0,05) terhadap susut bobot dan daya tetas. Frekuensi IB 1 x 4 hari memiliki angka fertilitas tertinggi yaitu 67,72 ± 7,99%. Aspirator sederhana dapat berfungsi dengan baik dengan kebutuhan perbaikan dan peningkatan pada beberapa bagian alat seperti sumber arus, dan kapasitas kipas.

Kata Kunci : *Anas platyrhynchos* domestication, Produktivitas, Teknologi Inseminasi Buatan

INTRODUCTION

Payakumbuh duck (*Anas platyrhynchos* domestication) is one type of poultry that has great potential as a producer of eggs and meat. The duck population is widely spread throughout Indonesia, both in urban and rural areas. Duck meat is also very popular with the people of Indonesia. In all corners of the archipelago there are many different types of ducks, according to Simajuntak (2002) there are at least 15 types of ducks in Indonesia. The names and types of ducks are based on their regional origin. In West Sumatra, there are some species of ducks that are often cultivated by the community, including Pitalah ducks, Kamang ducks, Bayang ducks, and Payakumbuh ducks. According to the West Sumatra Provincial Statistics Agency (2020) the total population of ducks in West Sumatra in 2019 was recorded at 1,143,702. However, there is one type of duck whose population has decreased, namely the Payakumbuh duck.

According to the West Sumatra Provincial Statistics Agency (2020), the number of ducks in the Payakumbuh area has decreased in population. In 2018 the population of ducks was 63,608, while in 2019 the population was 54,090 (West Sumatra Provincial Statistics Agency 2020). The problem of why the local duck population is declining is due to several factors, including competition with other types of ducks that grow faster and do not require expensive costs, for example Mojosari ducks. Mojosari ducks are mostly cultivated because they have great potential as egg producers. The Mojosari duck that is widely developed by the people of West Sumatra now. As a result, there are several types of local ducks that are less developed, one of which is the Payakumbuh duck.

Apart from the fact that other species of ducks have entered the local area, there are also other factors, namely the difficulty of finding pure ducks. Because the Payakumbuh duck has been crossed with many other types of ducks, the population of the original Payakumbuh duck has decreased. Even though this Payakumbuh duck is a native duck from the Payakumbuh area, precisely in Kenagarian Koto Baru Payobasuang. This duck should not be allowed to become extinct; therefore there must be an effort to re-develop this type of duck. One of the efforts to develop the population of Payakumbuh ducks is by using Artificial Insemination (AI) technology.

Artificial Insemination (AI) is a technique of spraying semen on the reproductive tract artificially (Toelihere, 1993). The reason for choosing (AI) is due to its ability to produce superior Payakumbuh later. According to Afiati *et al*. (2013) AI has advantages including: Improving the ability of female birds to produce hatching eggs, accelerating the procurement of superior seeds because they come from selected females and males, increasing the ability of males with superior production quality to marry a number of female AI. Artificial Insemination (AI) is usually carried out on large livestock such as cows, goats and other types of large livestock. In this study it was done on poultry, namely ducks. The implementation of Artificial Insemination (IB) in poultry has its advantages and disadvantages. The advantage is that it can increase egg fertility. Meanwhile, the drawback is that the sperm produced can only be stored for a maximum of 30 minutes after ejaculation (Jayasamudera and Cahyono, 2005). According to Sastrodiharjo and Resnawati (2003) there are several factors that influence the success of AI including: handling of sperm since it is ejaculated, dilution, storage, the person carrying out IB, and the fertility of sperm while in the female reproductive tract.

Frequency is a measure of the number of repetitions per event in a certain unit. According to Toelihere (1993) the frequency of ejaculation that occurs in natural marriages or the frequency of semen storage during IB implementation will affect the volume and concentration of semen. Meanwhile, according to Wayan *et. al* (2018) the frequency of ejaculation that is too frequent in too short a time unit will reduce the concentration of spermatozoa per-ejaculate and increase spermatozoa abnormalities. Every time you carry out AI, it is necessary to determine how

many doses of spermatozoa. The results of previous studies conducted showed that the use of a dose of 150 million spermatozoa produced the longest fertility, reaching four days (Setioko *et al*., 2000) and it was recommended to use a dose of 150 million inseminated spermatozoa with a frequency of insemination twice per week.

Simple Aspirator Tool is a device assembled by researchers. Used in this study for semen retrieval by sequencing method. In accordance with previous studies, semen collection was carried out on males by massaging the male's back until the male showed signs of wanting to excrete semen (Sidabutar, 2009). Males that already have signs will show by raising the tail when held. After the male is ready to expel semen, the copulation organ is directly pressed until it comes out. Take cement with the help of a simple aspirator, this aspirator is like a vacuum suction device. The aspirator consists of a driving dynamo and a fan that functions as the main suction, the suctioned cement flows directly into the collecting tube and the end is a funnel which will be directed to the copulation organ. Duck semen volume in one ejaculation is 0.3 ml. This is in accordance with the opinion of Hafez (1987) which states that the volume of semen ejaculate in poultry ranges from 0.1-0.5 ml depending on the breed and size of the livestock. Duck semen is usually attached along the copulation organ in the form of a twisted spiral, so the aspirator is very effectively used as a cement suction device around the male duck's copulation organ.

The research aimed to increase the population and productivity of Payakumbuh ducks through Artificial Insemination (IB) technology using a simple aspirator. In order to see the best frequency in the implementation of Artificial Insemination (IB) on the productivity of Payakumbuh ducks. This study aims aimed to determine the effect of IB frequency using different simple aspirator on fertility, weight loss and hatchability of Payakumbuh duck eggs.

MATERIALS AND METHOD

Research Material

Trial Ducks

In this study, the species of poultry was used, namely Payakumbuh ducks from Zulkarnain farm with a total of 32 ducks, consisting of 12 males and 20 females. The age of the Payakumbuh duck (*Anas sp domestication* is 18 months with a female duck egg production of around 90%.

Equipment and Materials for the Implementation of Artificial Insemination (IB)

For the implementation tools themselves, namely: syringes without syringes, thermometers, scales, label paper, calculators, stationery, flashlights, cement storage tubes, 4 incubators, aspirators for taking cement, rags (tissue). The materials used in this study were: semen of Payakumbuh ducks, clean water, physiological NaCl, egg yolk, penicillin, and streptomycin, 241 eggs hatched.

Simple Aspirator Assembly

The additional tool used is a simple aspirator whose properties are like a vacuum device used to suck cement. The propulsion device used is a small dynamo, you can also use a toy car dynamo, attach it to the end of the dynamo in the form of a pre-assembled fan, the fan functions as the main suction, close the fan with a bottle cap and give a hole around the fan cover. The way it works is the same as a vacuum cleaner, the reservoir tube is placed at the bottom, and the front of the tool is in the form of a hose that will later be attached to the copulation organ (Figure 1).

Duck Cement Storage

Choose one of the male ducks that has previously been put in a battery cage for one week, the goal is to leave it for one week in a battery cage so that it doesn't experience stress when the semen is taken. In this study, the authors took cement using a vacuum suction device that had been assembled. Position the male as relaxed as possible with the tail forward, after the duck is confirmed to be calm then the sequence is carried out, until there are signs of the duck being aroused, and the reproductive organs are shaped like a spring, pointing the vacuum tool to the male reproductive organs to suck the semen around the reproductive organs. After entering the reservoir tube, it is directly inserted into the diluent tube to be diluted. On the first day, 5 male ducks were taken for semen.

Fresh Semen Evaluation

Fresh semen was evaluated macroscopically and microscopically.

Providing Cement Diluent

The diluent for duck semen was made in the Laboratory of Reproduction, Faculty of Animal Husbandry, Andalas University. The first step is to prepare physiological NaCl and egg yolks which will later be mixed, enter into a tube with a dose of 80% physiological NaCl and 20% egg yolk, also prepare other additional ingredients, namely penicillin and streptomycin. Mix all the ingredients until 100% then swirl around to form a number 8 until all ingredients are evenly mixed (homogeneous).

Implementation of Artificial Insemination (AI)

Prepare the female ducks for AI, clean the ducks, especially the tail so that there is no dirt that will interfere with the AI process later. Also sterilize the AI device, namely a syringe without a needle, take semen with a syringe that has previously been mixed with 0.3 ml of diluent, position the duck's tail towards the front, then inject semen into the female cloaca.

Egg Collection

The end result of Artificial Insemination (IB) can be seen its success through the eggs. Eggs will be hatched using an incubator, collection begins the day after the female ducks are in AI, and ends on day 5, before being put into the incubator, the eggs are labeled to make it easier to calculate the variables in this study.

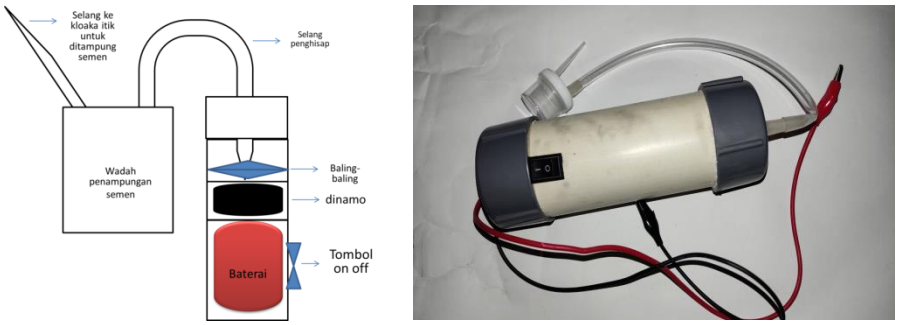

Figure 1. The Simple Aspiratory assembled

Research methods

The method used in this research is Completely Randomized Design (CRD), with 4 treatments and 5 replications. Each experimental unit (combination between treatments and experimental replications) was completely randomized in the study cage: Treatment 1 (P1): Artificial Insemination (IB) 1x2 days, Treatment 2 (P2): Artificial Insemination (IB) 1x4 days Treatment 3 (P3): Artificial Insemination (IB) 1x6 days, Treatment 4 (P4): Artificial Insemination (IB) 1x8 days

RESULT AND DISSCUSSION

Overview of the Semen Extraction Aspirator

In this study, semen was collected using the sequencing method. In accordance with previous research, semen collection was carried out on males by massaging the male's back until the male showed signs of wanting to excrete semen (Sinabutar, 2009). Males that already have signs will show by raising the tail when held. After the male is ready to expel semen, the copulation organ is directly pressed until it comes out. Take the cement with the help of a simple aspirator, this aspirator is like a vacuum suction device. The aspirator consists of a driving dynamo and a fan that functions as the main suction, the suctioned cement flows directly into the collecting tube and the end is a funnel which will be directed to the copulation organ. Duck semen volume in one ejaculation is 0.3 mL. This is in accordance with the opinion of Hafez (1987) which state that the volume of semen ejaculation of poultry ranges

from 0.1-0.5 ml depending on the breed and size of the livestock. Duck semen is usually attached along the copulation organ in the form of a twisted spirally, so the aspirator is very effective to use as a semen suction device around the male duck's copulation organ.

Results of Macroscopic Quality Evaluation of Payakumbuh Duck Semen

The results of macroscopic evaluation of the quality of Payakumbuh duck semen (color, odor, volume, viscosity and pH) can be seen in Table 1.

Table 1 Results of Macroscopic Quality Evaluation of Payakumbuh Duck Semen

Parameter	Payakumbuh duck (n=8 head)
Color	Milk white, yellowish white
Smell	Specific
Thickness	Thick, watery
Volume	0,24 ± 0,05
PH	7.37 ± 0.51

Note; n= Payakumbuh duck (*Anas sp domestication*) mate

The average volume of Payakumbuh duck semen was 0.24±0.05 mL. The semen volume of Payakumbuh ducks in this study was lower than the volume of Mojosari ducks according to the research of Adriani *et al.* (2014) which was 0.8 mL. The average pH of Payakumbuh duck semen was 7.37±0.51. This is in accordance with the opinion expressed by Suprijatna *et al*. (2008) that the pH of poultry semen is between 7 – 8 and the opinion of Garner and Hafez (2000), namely the pH of poultry semen is between 7.2 – 7.6. Semen that has alkaline conditions, can be caused by fluid or seminal plasma containing various organic, inorganic and water substances.

Results of Microscopic Quality Evaluation of Payakumbuh Duck Semen

The results of microscopic evaluation of Payakumbuh duck semen quality (mass movement, survival percentage, concentration, motility and abnormalities) can be seen in Table 2

Table 2. Results of Microscopic Evaluation of the Quality of Payakumbuh Duck Semen

Parameters	Payakumbuh duck (n=8 head)
Mass movement	+, ++ and +++
Survival percentage	79.06
Concentration	Thick, watery
Mortality	0,24 ± 0,05
Abnormalities	7.37 ± 0.51

The mass movement of spermatozoa in Payakumbuh duck and Mojosari ducks varied, namely (+) not good, (++) good and (+++) very good. Ulupi *et a*l., (2015) stated that Mojosari ducks have very good mass movement (+++) and (++++). Good quality spermatozoa will look like big, thick, dark and active waves like black clouds that move quickly and move around. Mardalestari (2005) suggested that the mass movement of spermatozoa reflects the movement of individual spermatozoa. The more spermatozoa that move, the better the mass movement or the thicker the mass and the faster the movement.

The average percentage of live spermatozoa of Payakumbuh ducks was 79.06±3.68%. This result is lower than the percentage of live spermatozoa of Mojosari ducks research by Naji (2006) which is 81.65±6.64%. Partodiharjo (1992) also added that good semen contains 60% or more live spermatozoa. Payakumbuh duck semen concentration is 234 x 107 per ml. Payakumbuh duck semen concentration is lower than research by Garner and Hafes (2008) which states that the concentration of poultry spermatozoa in general ranges from 3-7 billion cells/ml. Differences in concentration can be caused by factors of age, light, genetics, nutrition, frequency of shelter and maintenance methods (Supriyatna *et al*., 2005). The average motility of Payakumbuh duck semen was 75.00±7.56%. Setioko *et al.,* (2002) stated that the motility of local duck spermatozoa was 66-72%. Motility is the motility of spermatozoa that can be used as a measure of the ability to fertilize an ovum. Sperm motility is needed when spermatozoa are inside female sex cells to reach the site of fertility (Danang *et al*., 2012). The mean of spermatozoa

abnormalities in Payakumbuh ducks was 12.06±0.82%. This is in accordance with the opinion of Ardiani *et al*., (2015) which stated that the abnormality of spermatozoa in ducks was 12.5%. However, this result is lower than the results of research by Ulupi *et al*., (2015), namely the spermatozoa abnormalities of Mojosari ducks ranged from 19.28 to 22.08%. According to Tolihere (1998) that the level of abnormality of spermatozoa in poultry ranges from 5-20%.

The Effect of AI Frequency on Payakumbuh Ducks

The average effect of IB frequency on fertility, weight loss, and hatchability of hatched Payakumbuh duck eggs can be seen in Table 3.

Table 3. The Average Fertility, Weight Loss and Hatchability of Payakumbuh ducks (*Anas sp domestication*) AI results

Treatment	Average Fertility	Weigh loss	Hatchability
P1	$64,42 \pm 21,55^{ab}$	$9,71 \pm 2,68$	$51,33 \pm 15.21$
P2	$67,72 \pm 7,99^{Aa}$	$13,39 \pm 3,26$	$45,44 \pm 8,31$
P3	$46,52 \pm 13,84^{bc}$	$10,98 \pm 1,00$	$46,66 \pm 10,28$
P4	$39,32 \pm 5,86^{Bc}$	$11,20 \pm 1,30$	$43,23 \pm 13,75$

Note: Different capital letters in the same column indicate a very significant ($P < 0.01$); Different lowercase letters in the same column indicate significantly ($P < 0.05$)

Table 3 shows that different AI frequencies have a significant effect ($P < 0.05$) on the fertility rate of Payakumbuh duck eggs. The average fertility with different AI frequencies shows that the highest fertility is in P2, which is 67.72%, while the lowest is in P4, which is 39.32%. The results of the multiple follow-up DMRT test showed that P1 was not different ($P>0.05$) from P2 and P3, but significantly different ($P<0.05$) to P4. While P2 was significantly different ($P<0.05$) with P3. However, P2 was significantly different ($P<0.01$) against P4. While P3 is not different ($P> 0.05$) against P4.

The results of this study indicate that the frequency of IB 1 x 4 days (P2) has the highest fertility rate when compared to other treatments. P2 has high fertility because the time from the first IB to the next is not too long, so semen in the reproductive organs are still able to fertilize, ducks also do not experience stress which can cause a decrease in egg production. This statement is in accordance with Sastrodiharjo and Resnawati (2003) which states that the interval and frequency of IB during the production period can increase the fertility of the sperm, this occurs because the frequency of IB is related to the increase in the number of sperm in the female oviduct during the production period. While P4 low fertility because the interval and frequency of IB is too far away. According to Rasna (2006) the storage period of sperm in the female reproductive organs is 7 days. So at P4 the fertility rate is low because in the female reproductive organs the sperm is dead.

The fertility rate at the frequency of AI 1 x 4 days (P2) is 67.72% higher than the results of the study by Sinabutar (2009) which found a fertility rate of 61.67% with the frequency of AI 2 times a week. This is influenced by several factors including the concentration of cement used when ducks are in AI. In the previous study, the cement used was gout cement, according to Zabiq *et. al* (2017) the concentration of duck semen is 1.35x109/ml, while in this study Payakumbuh duck semen was used with a concentration of about $2.92x10^9$/mL.

The average weight loss with different AI frequencies shows the average weight loss ranges from 9.71% - 13.39%. Different AI frequencies gave no significant effect ($P > 0.05$) on egg weight loss. The highest average weight loss was found in treatment P2 of 13.39% and the lowest was in treatment P1 of 9.71%. Among the 4 treatments, it was seen that it was still within the maximum limit of egg weight loss. According to Rahn *et al.* (1981) who stated that water loss is a normal process during incubation, during the incubation process the water content will disappear 12-14%. Loss of water content is the main factor affecting weight loss. The average hatchability with different AI frequencies showed that the hatchability ranged from 43.23% -51.33%. Different AI frequencies had no significant effect ($P > 0.05$) on hatchability. The highest hatchability was found at P1 at 51.33% and the lowest at P4 at 43.23%. This is the same as the results of Sinabutar's (2009) study on AI treatment 2 times a week and 3 times a week which resulted in the highest hatchability, namely 52.22% and 58.26%, respectively.

CONCLUSION

Spermatozoa characteristics of Payakumbuh ducks are milky white and yellowish white, specific odor typical of livestock, thick and watery consistency, volume 0.24± 0.05 ml, pH 7.37± 0.51, mass movement +, ++ and +++, live percentage 79.06±3.68%, concentration was 2.342 billion cells/mL, motility was 75.00±7.56% and abnormality was 12.06±0.821%. Treatment with AI frequency 1x4 days gave the highest fertility. Different AI frequency treatments had a significant effect ($P < 0.05$) on fertility, but had no significant effect ($P > 0.05$) on weight loss and hatchability. The aspirator device that is designed can be used and functions properly when collecting Payakumbuh duck semen. This study aimed to determine the effect of AI frequency using different simple aspirator on fertility, weigh loss, and hatchability of Payakumbuh duck eggs

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