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# Reproductive and growth performances in female giant freshwater prawn following inhibition of gonadal maturation using dopamine and medroxyprogesterone hormone

# Performa reproduksi dan pertumbuhan pascapenghambatan pematangan gonad udang galah betina secara hormonal menggunakan dopamin dan *medroxyprogesteron*

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## ABSTRACT

One of the main problem in giant river prawn (GFP) culture is early gonadal maturation in female resulting a reduced growth performance. This problem cause economic losses. When GFP at gonadal maturation, somatic growth will be inhibited because energy is used for reproduction. A factorial experimental design using two factors, namely dopamine and medroxyprogesterone, with each factor consist of three levels was applied. Three dopamine levels were 0, $10^{-5}$ mol/shrimp, and $10^{-10}$ mol/shrimp, while the medroxyprogesterone levels were 0, 75 mg/1.5 mL/bodyweight, and 150 mg/3 mL/bodyweight with a density 15 individual/tank. The utilization of dopamine and medroxyprogesterone in GFP (initial bodyweight : 11.27 ± 0.97 g) through injection at the third periopod was done three times at week 0, 2nd, and 4th with two weeks interval. The results showed that hormone inhibitor treatments affected both growth and reproductive performances in female GFP. The treated individuals showed a lower gonadal maturity indicator values and faster growth rate than control. Gonadal maturity, as shown by gonad histology, in all treatments were lower (previtelogenic and vitellogenic stages) than that in control which is in mature stage. Estradiol concentration premix dopamine $10^{-10}$ mol/shrimp and medroxyprogesterone 150 mg/3 mL/bodyweight treatments are lower than control. In conclusion, dopamine and medroxyprogesterone administration could suppres GSI and gonad development, and also increase growth rate.

Keywords: *Macrobrachium rosenbergii*, dopamine, medroxyprogesterone, gonad development, growth.

## ABSTRAK

Kematangan gonad dini induk udang galah *Macrobrachium rosenbergii* betina dapat merugikan. Saat udang matang gonad, pertumbuhan somatik terhambat disebabkan energi untuk pertumbuhan akan digunakan untuk reproduksi. Penelitian ini bertujuan mengevaluasi penggunaan hormon dopamin dan *medroxyprogesterone* sebagai penghambat pematangan gonad. Penelitian ini menggunakan rancangan acak lengkap faktorial dengan dua perlakuan yaitu pemberian dopamin dan *medroxyprogesterone*. Dosis dopamin yang digunakan yaitu 0, $10^{-5}$ mol/udang, dan $10^{-10}$ mol/udang, sedangkan *medroxyprogesterone* dengan dosis 0, 75 mg/1,5 mL/bobot udang, dan 150 mg/3 mL/bobot udang dengan kepadatan 15 ekor/bak. Udang galah betina (bobot awal:11,27 ± 0,97 g) diberi perlakuan berupa dopamin dan *medroxyprogesterone* sebanyak tiga kali pada minggu ke-0, 2, dan 4 dengan interval waktu dua minggu sekali. Hasil penelitian ini menunjukan perlakuan dopamin dan *medroxyprogesterone* memiliki nilai indeks kematangan gonad (IKG) yang rendah dan laju pertumbuhan yang lebih cepat dibandingkan kontrol. Histologi gonad pada semua perlakuan berada pada tahap *previtellogenic* dan *vitellogenic* dibandingkan kontrol yang berada pada tahap *mature*. Konsentrasi estradiol pada perlakuan premix dopamin $10^{-10}$ mol/udang dan *medroxyprogesterone* 150 mg/3 mL/bobot udang lebih rendah dibandingkan kontrol. Pemberian dopamin dan *medroxyprogesterone* dapat menekan IKG, perkembangan gonad, dan meningkatkan laju pertumbuhan.

Kata kunci: *Macrobrachium rosenbergii*, dopamin, *medroxyprogesterone*, pertumbuhan, perkembangan gonad.

## INTRODUCTION

Giant freshwater prawn *Macrobrachium rosenbergii* is freshwater species with high economic value. A rapid gonad maturation on the female broodstock becomes constraint in giant freshwater prawn production. Ra'anan *et al.* (1991) stated that a female giant freshwater prawn reached the first gonad maturation in 18–26 g. It disrupts the giant prawn production because of the low energy allocation for growth when the gonad is matured. The somatic growth is disrupted since the major energy allocation will be on the reproduction process (Cavalli *et al.,* 2001).

The gonad development of female giant freshwater prawn is naturally affected by several hormone mechanisms (Swetha *et al.,* 2011). Gonad stimulating hormone (GSH) and methyl farnesoate (MF) are the gonadotropin hormones which essentially work in the reproduction glands activity and progesterone in female giant freshwater prawn. The production of GSH and MF are naturally inhibited by the gonad inhibiting hormone (GIH) activity and mandibular organ inhibiting hormone (MOIH) which is produced by X-organ located in the eyestalk (Thongbuakaew *et al.*, 2019).

The crustaceans growth is controlled by the ecdysteroid hormones (molting hormone) located in the Y-organ. The Y-organ will synthesize and secrete ecdysteroids to the growth cells, such as eyestalk and hepatopancreas (Nagaraju, 2011). According to Chang and Mykles (2011), the function of molt-inhibiting hormone (MIH) is to regulate molting process in crustaceans, whereas the crustacea hyperglemic hormone (CHH) provides the carbohydrates and lipids to fulfill the energy requirement of crustaceans (Vinagre & Chung, 2016). The methyl farnesoate stimulates growth in crustaceans. It is supported by Allayie *et al.* (2010) who stated that the provision of mandibular organ extract was able to rise weight gain in yellowish brown crab *Charybdis lucifera*.

Hormonal engineering is one of the solution to inhibit gonad maturation and increase growth rate. Accordingly, this study used the hormonal engineering through dopamine and medroxyprogesterone induction as gonad maturation inhibitor in female broodstock. Dopamine is a hydrophilic neurotransmitter located in central nerve system and crustaceans ovary (Tinikul *et al*., 2009). O'Connell *et al*. (2013) mentioned that dopamine in vertebrates acts as neurotransmitter which contributes in hypothalamus and pituitary function and also inhibits gonad development. Fingerman (1997) stated that dopamine perfoms to inhibit gonad maturation in prawn through X-organ neuroendocrine cell in terminal medulla in eyestalk to synthesize gonad inhibiting hormone (GIH).

Medroxyprogesterone acetate is a steroid hormone produced by the ovary, adrenal cortex, and placenta in human pregnancy (Suherman, 2008). Medroxyprogesterone is lipophilic (Steele *et al.,* 2013). Daido *et al.* (2014) mentioned that medroxyprogesterone depressed ovulation in inhibiting hypophysis to secrete luteinizing hormone (LH) and folicle stimulating hormone (FSH). This study aimed to evaluate dopamine and medroxyprogesterone utilization as gonad maturation inhibitor in female broodstock of giant freshwater prawn.

## MATERIALS AND METHODS

### Experimental prawn

The experimental prawn was giant freshwater prawn Asahan strain. The average weight was 11.27 ± 0.97 g. The prawn was four-month old, healthy, no defect, complete body organ, and pathogen-free. Dopamine hydrochloride powder (Sigma Aldrich), medroxyprogesterone, and Estradiol kit (USA) were utilized in laboratory analysis.

### Experimental treatment

The gonad maturation inhibition was conducted through dopamine and medroxyprogesterone injection on the female broodstock. This study applied factorial completely randomized design because it consisted of two factors, i.e. dosage 0, $10^{-5}$ mol/ind, and $10^{-10}$ mol/ind, also *medroxyprogesterone* in dosage 0, 75 mg/1,5 mL/ body weight, and 150 mg/3 mL/ body weight. Thus, nine treatments were applied, i.e. control (NaCl 0,1 mL), D1 (dopamine $10^{-5}$ mol), D2 (dopamine $10^{-10}$ mol), M1 (medroxyprogesterone 1,5 mL), M2 (*medroxyprogesterone* 3 mL), D1M1 (dopamine $10^{-5}$ mol + medroxyprogesterone 1,5 mL), D2M1 (dopamine $10^{-10}$ + medroxyprogesterone 1,5 mL), D1M2 (dopamine $10^{-5}$ mol + medroxyprogesterone 3 mL), and D2M2 (dopamine $10^{-10}$ + medroxyprogesterone 3 mL).

The female giant freshwater prawn (initial weight: 11.27 ± 0.97 g) were treated using

dopamine and medroxyprogesterone three times on week-0, week-2, and week-4. The dopamine and medroxyprogesterone were injected on the third walking leg. The rearing was managed for three months in a concrete tank sized in 1.5×1×1 $m^3$ with 15 ind/tank of stocking density. The hormone injection was done in the morning at 7 a.m.. During the rearing, the experimental prawn was fed using commercial feed with 35% of protein content. The feeding rate was 5% of biomass and it was delivered three times a day.

**Parameters observation and sample collection**

*Estradiol analysis*

Estradiol analysis was managed by collecting 0.3 mL hemolymph sample on the third walking leg using syringe 0.1 mL rinsed using coagulant. The sample was centrifuged and stored in -20°C storage. The estradiol measurement calculation was conducted using ELISA (enzyme-linked immunosorbent assay) method (kit DRG® Estradiol ELISA (EIA–2693). The estradiol analysis was done at the beginning and at the end of the study.

*Gonado somatic index* (GSI)

*Gonado somatic index* (GSI) was observed at the beginning and the end of the study using the following formula (Effendie, 2002) :

$$GSI\ (\%) = \frac{\text{Gonad weight}}{\text{Body weight}} \times 100$$

*Gonad histology*

Gonad histology was monitored to observe the gonad microscopic. The method was hematoxyline and eosin staining. It was examined at the beginning and end of the study.

*Specific growth rate*

The specific growth rate was measured at the end of the study using the following formula (Effendi, 2004) :

$$SGR\ (\%/day) = \left[\sqrt[t]{\frac{Wt}{Wo}} - 1\right] \times 100$$

Note :
Wo = Initial weight (g)
Wt = Final weight (g)
n = rearing period (day)

*Survival rate* (SR)

Survival rate is a percentage of final population compared with initial population. The calculation was done using this following formula (Effendie, 2002) :

$$SR\ (\%) = \frac{Nt}{No} \times 100$$

Note :
SR = Survival rate (%)
Nt = Final population (individual)
No = Initial population (individual)

Table 1. Production and reproduction performance post-gonad maturation inhibition.

| Treatments | Estradiol concentration (ng/mL) (n=3) | GSI (%) (n = 2) | Gonad histology (n = 2) | SGR (%/day) (n = 3) | SR (%) (n=15) |
|---|---|---|---|---|---|
| Control | 1.52 ± 0.04$^{ab}$ | 3.97$^{a}$ | Mature | 0.90 ± 0.20$^{c}$ | 46.67 |
| D1 | 1.66 ± 0.03$^{a}$ | 0.25$^{b}$ | Previttelogenic | 1.11 ± 0.09$^{abc}$ | 20 |
| D2 | 1.38 ± 0.14$^{abc}$ | 0.24$^{b}$ | previtellogenic | 1.55 ± 0.06$^{a}$ | 60 |
| M1 | 1.36 ± 0.11$^{abc}$ | 0.71$^{b}$ | previtellogenic | 1.12 ± 0.36$^{abc}$ | 33.33 |
| M2 | 1.26 ± 0.11$^{bc}$ | 0.42$^{b}$ | previtellogenic | 1.50 ± 0.23$^{ab}$ | 33.33 |
| D1M1 | 1.30 ± 0.10$^{bc}$ | 0.58$^{b}$ | previtellogenic | 1.39 ± 0.10$^{abc}$ | 20 |
| D2M1 | 1.61 ± 0.18$^{ab}$ | 1.74$^{b}$ | vitellogenic | 1.02 ± 0.14$^{bc}$ | 26.67 |
| D1M2 | 1.71 ± 0.22$^{a}$ | 0.39$^{b}$ | previtellogenic | 1.18 ± 0.04$^{abc}$ | 33.33 |
| D2M2 | 1.06 ± 0.06$^{c}$ | 0.33$^{b}$ | previtellogenic | 1.16 ± 0.18$^{abc}$ | 46.67 |

Note: Different superscript in the same column indicates significant difference amongst treatments (P<0.05). D1 (dopamine $10^{-5}$ mol); D2 (dopamine $10^{-10}$ mol); M1 (medroxyprogesterone 1.5 mL); M2 (medroxyprogesterone 3 mL); D1M1 (dopamine $10^{-5}$ mol + medroxyprogesterone 1.5 mL); D2M1 (dopamine $10^{-10}$ mol + medroxyprogesterone 1.5 mL); D1M2 (dopamine $10^{-5}$ mol + medroxyprogesterone 3 mL); D2M2 (dopamine $10^{-10}$ mol + medroxyprogesterone 3 mL). GSI : gonado somatic index; SGR : specific growth rate; SR : survival rate.

**Data analysis**

The data were analyzed using factorial completely randomized design with two factors, i.e. dopamine and medroxyprogesterone. Data were tabulated using Ms. Excel 2010 and analysis of variance was done using Minitab 16. A significant result would be analyzed further with Tukey test. Gonas histology, survival rate, maturation period, and water quality parameters were described descriptively.

## RESULTS AND DISCUSSIONS

**Result**

*Production and growth performance of post-induction inhibitory*

The parameters consisted of estradiol concentration, gonado somatic index, gonad histology, daily growth rate, and survival rate. The result of gonad maturation inhibition using dopamine and medroxyprogesterone presented that D2, M2, and D2M2 were prominent compared with the other treatments (Table 1). It is described by the estradiol concentration and gonado somatic index result. The three particular treatments showed previtellogenic phase and the growth rate was significantly higher than the other treatments.

*Estradiol concentration*

Particularly, Figure 1 shows that the D2M2 treatment (dopamine $10^{-10}$ mol + medroxyprogesterone 3 mL) presented a lower concentration of estradiol (1.06 ng/mL) compared with control (1.52 ng/mL) ($P<0.05$). It indicated that dopamine and medroxyprogesterone significantly affected estradiol-17β concentration.

*Gonado somatic index (GSI)*

The initial GSI level was 0.26%. At the end of the study, the GSI level of dopamine and medroxyprogesterone treatments were

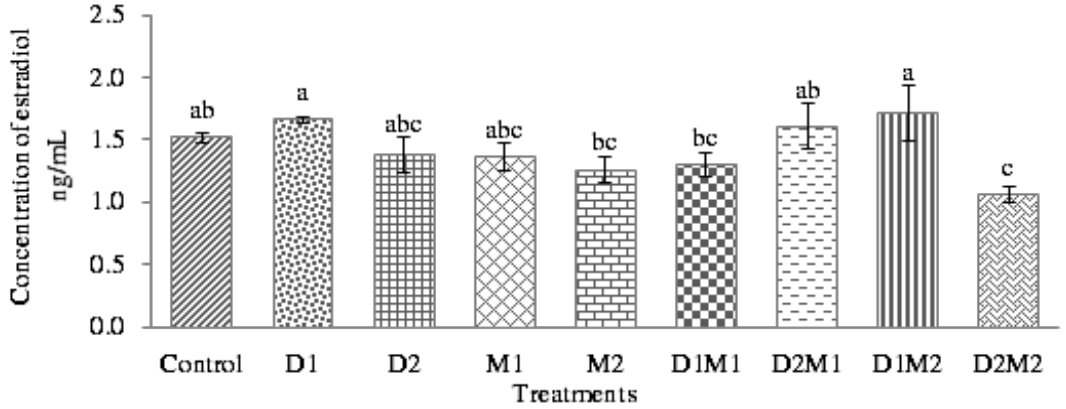


Figure 1. Concentration of estradiol-17β. Different superscript indicates significant difference amongst treatments ($P<0.05$). D1 (dopamine $10^{-5}$ mol); D2 (dopamine $10^{-10}$ mol); M1 (medroxyprogesterone 1.5 mL); M2 (medroxyprogesterone 3 mL); D1M1 (dopamine $10^{-5}$ mol + medroxyprogesterone 1.5 mL); D2M1 (dopamine $10^{-10}$ mol + medroxyprogesterone 1.5 mL); D1M2 (dopamine $10^{-5}$ mol + medroxyprogesterone 3 mL); D2M2 (dopamine $10^{-10}$ mol + medroxyprogesterone 3 mL).

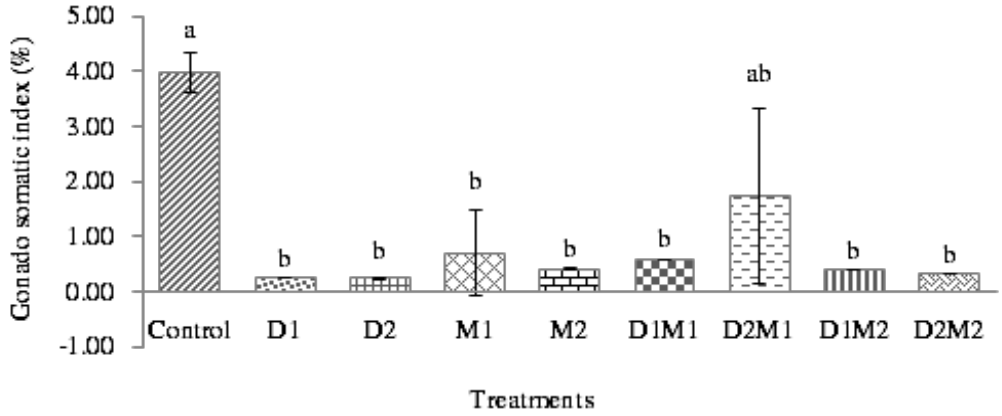


Figure 2. Gonado somatic index at the end of the study. Different superscript indicates significant difference amongst treatments ($P<0.05$). D1 (dopamine $10^{-5}$ mol); D2 (dopamine $10^{-10}$ mol); M1 (medroxyprogesterone 1.5 mL); M2 (medroxyprogesterone 3 mL); D1M1 (dopamine $10^{-5}$ mol + medroxyprogesterone 1.5 mL); D2M1 (dopamine $10^{-10}$ mol + medroxyprogesterone 1.5 mL); D1M2 (dopamine $10^{-5}$ mol + medroxyprogesterone 3 mL); D2M2 (dopamine $10^{-10}$ mol + medroxyprogesterone 3 mL).

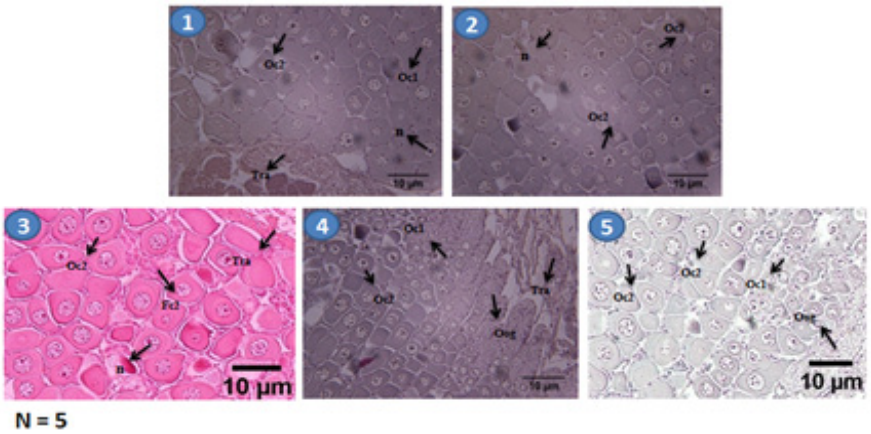


Figure 3. The gonad histology of giant freshwater prawn before treated (magnification 400×). Note: 1, 2, 3, 4, 5; the initial gonad histology in the previtellogenic phase, n = nucleus; Tra = trabecular; Fc = follicular cell type 1 and 2; li = lipid droplet; Oog = oogonia; Oc1 = late previtellogenic oocyte; Oc2 = early previtellogenic oocyte.

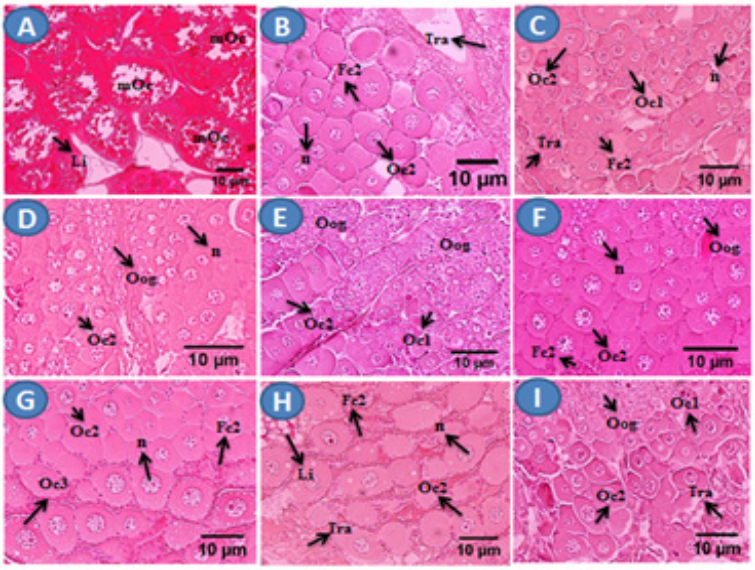


Figure 4. Gonad histology of giant freshwater prawn after treated using dopamine and medroxyprogesterone (magnification 100×). A ; control , B ; D1 (dopamine $10^{-5}$ mol + medroxyprogesterone 0), C ; D2 (dopamine $10^{-10}$ mol + medroxyprogesterone 0 mL), D ; M1 (dopamine 0 mol + medroxyprogesterone 1.5 mL), E ; M2 (dopamine 0 + medroxyprogesterone 3 mL), F ; D1M1 (dopamine $10^{-5}$ + medroxyprogesterone 1.5 mL), G ; D2M1 (dopamine $10^{-10}$ + medroxyprogesterone 1.5 mL), H ; D1M2 (dopamine $10^{-5}$ mol + medroxyprogesterone 3 mL), I ; D2M2 (dopamine $10^{-10}$ + medroxyprogesterone 3 mL). n; nucleus, Tra; trabecula, Fc; follicular cell type 1 and 2, Li; lipid droplet, Oog; oogonia, Oc1; late previtellogenic oocyte, Oc2; early previtellogenic oocyte, Oc3; late vitellogenic oocyte, Oc4; early vitellogenic oocyte, mOc; mature oocyte.

significantly lower than the control ($P<0.05$). The overall result ranged from 0.24–1.74% and the highest was the control (3.97%).

*Gonad histology*

Gonad histology was observed in the initial and final period of the study. In the beginning of the study, the gonas histology showed previtellogenic phase (Figure 3), i.e. oval oocyte, nucleolus surrounded by the nucleus, and noticeable follicle cell. The dopamine and medroxyprogesterone treatments presented previtellogenic and vitellogenic phase. On the contrary, the control showed mature phase (Figure 4). On the vitellogenic phase, oocyte appears bigger than previtellogenic phase. There is the nucleolus surrounded by the nucleus, the follicle which surrounded oocyte, and it contains lipid granules. On the contrary, the matured phase, oocyte reached double size compared to the vitellogenic phase and the ovary was full of matured oocyte.

*Specific growth rate*

The specific growth rate of D2 (dopamine $10^{-10}$ mol) and M2 (medroxyprogesterone 3 mL) presented a significant result compared to the

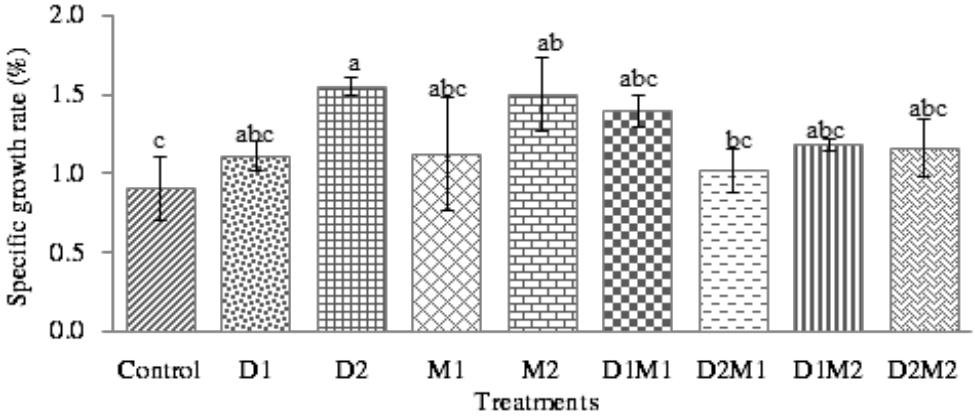


Figure 5. Specific growth rate of 42-day of rearing. Note: Different superscript indicates significant different (P<0.05). D1 (dopamine $10^{-5}$ mol + medroxyprogesterone 0), C ; D2 (dopamine $10^{-10}$ mol + medroxyprogesterone 0 mL), D ; M1 (dopamine 0 mol + medroxyprogesterone 1.5 mL), E ; M2 (dopamine 0 + medroxyprogesterone 3 mL), F ; D1M1 (dopamine $10^{-5}$ + medroxyprogesterone 1.5 mL), G ; D2M1 (dopamine $10^{-10}$ + medroxyprogesterone 1.5 mL), H ; D1M2 (dopamine $10^{-5}$ mol + medroxyprogesterone 3 mL), I ; D2M2 (dopamine $10^{-10}$ + medroxyprogesterone 3 mL).

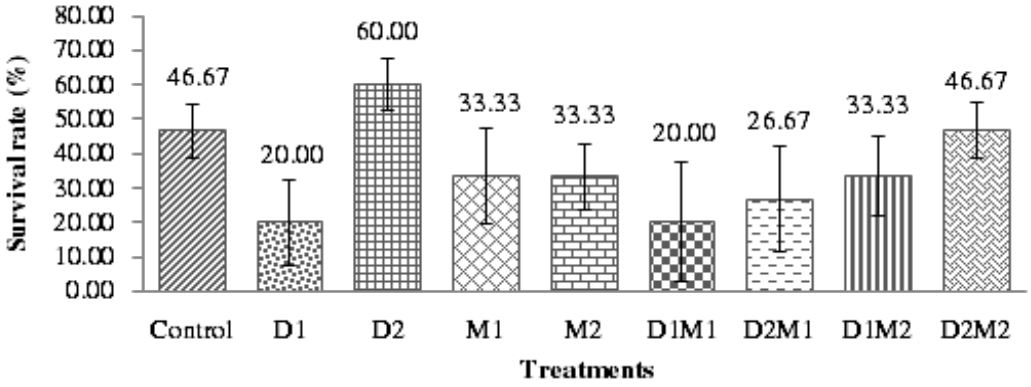


Figure 6. Survival rate of the experimental female broodstock of giant freshwater prawn. Note: Different superscript indicates significant different (P<0.05). D1 (dopamine $10^{-5}$ mol + medroxyprogesterone 0), C ; D2 (dopamine $10^{-10}$ mol + medroxyprogesterone 0 mL), D ; M1 (dopamine 0 mol + medroxyprogesterone 1.5 mL), E ; M2 (dopamine 0 + medroxyprogesterone 3 mL), F ; D1M1 (dopamine $10^{-5}$ + medroxyprogesterone 1.5 mL), G ; D2M1 (dopamine $10^{-10}$ + medroxyprogesterone 1.5 mL), H ; D1M2 (dopamine $10^{-5}$ mol + medroxyprogesterone 3 mL), I ; D2M2 (dopamine $10^{-10}$ + medroxyprogesterone 3 mL).

control (P<0.05). The D1 (dopamine $10^{-5}$ mol), M1 (medroxyprogesterone 1.5 mL), D1M1 (dopamine $10^{-5}$ + medroxyprogesterone 1.5 mL), D2M1 (dopamine $10^{-10}$ + medroxyprogesterone 1.5 mL), D1M2 (dopamine $10^{-5}$ mol + medroxyprogesterone 3 mL), and D2M2 (dopamine $10^{-10}$ + medroxyprogesterone 3 mL) showed a higher result, however it was not different significantly (P>0.05). It indicated that the application of dopamine and medroxyprogesterone was potential to boost the growth hormone in the female broodstock of giant freshwater prawn.

*Survival rate*

The survival rate of D2 treatment (60%) was higher than the other treatments. On the contrary, D1 (dopamine $10^{-5}$ mol), M1 (medroxyprogesterone 1.5 mL), D1M1 (dopamine $10^{-5}$ + medroxyprogesterone 1.5 mL), D2M1 (dopamine $10^{-10}$ + medroxyprogesterone 1.5 mL), D1M2 (dopamine $10^{-5}$ mol + medroxyprogesterone 3 mL), and D2M2 (dopamine $10^{-10}$ + medroxyprogesterone 3 mL) treatment ranged from 20–46.67% .

**Discussion**

Dopamine and medroxyprogesterone induction in giant freshwater prawn affected the estradiol-17β concentration. In Figure 1, the D2M2 treatment had the lowest estradiol concentration compared with the other treatments. It is supported by Tinikul *et al*. (2008), who found that application a certain dosage of dopamine ($2.5 \times 10^{-6}$ and $2.5 \times 10^{-7}$) was able to decrease vitellogenin content in GSI IV compared with the control. In

addition, 1.25 mg of medroxyprogesterone was potential to inhibit gonad maturation in male rat Sprague Dawley strain (Yurnadi *et al*., 2011). Dopamine and medroxyprogesterone induction in giant freshwater prawn decline the estradiol-17β concentration in the hemolymph. It was presumed that the $10^{-10}$ mol of dopamine premix and 3 mL of medroxyprogesterone was able to repressed the estradiol concentration. It is in line with Fingerman (1997) who stated that dopamine holds a certain role as a gonad maturation inhibitor in prawn through X organ neuroendocrine cell stimulation in medulla terminal in the eyestalk and then synthesize the GIH.

The collection of gonad sample was managed to observe the gonad development. The GSI value at the end of the study showed declining point when dopamine and medroxyprogesterone were delivered. The statement is supported by Daido *et al.* (2014). Medroxyprogesterone has a certain role to repress ovulation by inhibiting hypophysis to secrete gonad maturation hormone (LH and FSH). Tinikul *et al.* (2009) stated that dopamine inhibits the gonad maturation process and oocyte development in giant freshwater prawn. On the contrary, Chen *et al.* (2018) mentioned that dopamine was able to surpress the synthesis and secretion of gonadotropin in teleost. Supporting the later statement, Ciechanowska *et al*. (2018) also described that dopamine restrains the GnRH biosynthesis process in goat.

The gonad histology at the end of the study explained that dopamine and medroxyprogesterone were in the previtellogenic and vitellogenic phase. It can be seen from Figure 4 that several oogonia cells were in the early stage and developed oocytes were spotted because of the cytoplasm development compared to the control treatment which the nucleus was fused. According to the gonad histology by Ngernsoungnern *et al.* (2009), in the previtellogenis phase, oocyte was on the oval-shaped, nucleolus was surrounded by nucleus, and follicle cell was spotted. Compared to the vitellogenic phase, oocyte appeared bigger than the previtellogenic phase, nucleolus was surrounded by the nucleus as well, and there were fatty follicle cell surrounding the oocyte. The control treatment presented bigger oocyte in the vitellogenic phase and ovarium was full of matured oocyte. The particular character was considered as matured individual (Soonklang *et al*., 2012; Kankuan *et al.,* 2017).

The specific growth rate in the D2 treatment (dopamine $10^{-10}$ mol) was higher that the others. It was preassumed that a low dosage of dopamine was adequately effective to boost a higher growth. According to Jin and Hashizume (2014), dopamine is involved in growth hormone and prolactin regulation mechanism in goat. Dopamine restrained the somatostatin hormone in hypothalamus, thus the growth hormone releasing hormone (GHRH) was able to be stimulated to secrete growth hormone.

The declined survival rate at the end of the study was presumably caused by stress condition during the injection. Stress affects the immune system through metabolic mechanism (Yeh *et al.,* 2010 ; Leland *et al.,* 2013). Chang *et al.* (2007) stated that two hours after dopamine injection in dosage $10^{-6}$, $10^{-7}$, and $10^{-8}$ mol, the oxyhemocyanin decreased significantly. Oxyhemocyanin is a blue pigment formed by the oxygen and hemocyanin in ratio 1:2 (Cheng *et al.,* 2013), while hemocyanin is a glycoprotein contained copper and it is usually found in the hemolymph (Zheng *et al.,* 2016). The declined oxyhemocynanin disrupted the metabolism, osmoregulation, and resporation system which later caused stress and unable to adapt to the environment (Chang *et al.,* 2016). Adding the previous statement, Camacho-Jimenez *et al.* (2017) reported that a $2 \times 10^{-6}$ mol of dopamine potentially controlled the osmoregulation system in the whiteleg shrimp *Litopenaeus vannamei.* Osmoregulation is a homeostatis system to maintain the milieu intérieur stability through osmotic balance regulation amongst intracell and extracell (Maghfiroh *et al.,* 2019).

Molting is the detachment of older cuticula and forms a new cuticula layer (Rocha *et al.,* 2012). The molting process is usually followed by the length, weight, and width changes (Fujaya *et al*., 2011). In crustaceans, molting is triggered by several factors, i.e. growth, reproduction, and stress (Hess, 2014). The giant freshwater prawn is a cannibal (Mendler *et al.,* 2015). When molting occurs, it lacks of strength. It provokes the stronger and not-experiencing-molting individual to attack them. This leads to death for those which experiencing molting at a certain time (Mendler *et al.,* 2015).

## CONCLUSION

The provision of dopamin $10^{-10}$ mol/ind, medroxyprogesterone 150 mg/3 mL/body

weight, and $10^{-10}$ mol/ind of dopamine premix and medroxyprogesterone 150 mg/3 mL/body weight effectively inhibited reproduction and escalated growth rate through estradiol repression.

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