

**CAGE TEMPERATURE IN RELATION TO THE WIDTH OF BEAK OPENING
OF GELATIK JAWA (*Padda oryzivora*)**

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Abstract

Gelatik jawa (*Padda oryzivora*) is one of endemic birds that its population has been decreasing. For overcoming this problem, one of the solutions is to create a captivity that needs a knowledge of the influence of microclimate to the bird's behavior in relation to its physiological process and survival. The goal of this research was to identify the relation between the cage temperature and the width of beak opening of gelatik jawa (*Padda oryzivora*), and their body movement in relation to the change of the cage temperature. The data will be useful for protecting them from their mortality caused by heat stress. The data of the cage temperature, the width of beak opening, and the body movement of the birds were gained through observation. The relation between the cage temperatures and the width of birds' beak openings were analyzed statistically using regression. Moreover, the animals' body movement were analyzed descriptively. Based on the data gained, the width of beak opening of gelatik jawa (*Padda oryzivora*) can be predicted based on the height of the cage temperature. The equation was $y = -20.366 + 1.327x$. It means that the higher temperature of the cage, the wider opening of gelatik jawa (*Padda oryzivora*) beaks. Furthermore, in high temperatures, the body of the birds shakes frequently.

Key words: Gelatik jawa (*Padda oryzivora*), temperature of the cage, width of beak opening, bird behavior.

INTRODUCTION

Gelatik jawa (*Padda oryzivora*) is one species of endemic birds of Java, Kangean, and Bali Islands (MacKinnon *et al.*, 2010; Winasis *et al.*, 2011). This kind of birds is also predicted endemic of Madura (BirdLife International, 2012).

Previously, they were found in farm land of Java and Bali up to 1500 m of latitude (MacKinnon, 1990), however, they are difficult to be found in nature. Based on the survey of Birdlife International (2001), it is predicted that the global population of these birds is 2500-9999 individuals which tends to decrease for the next years. Since 1994, gelatik jawa includes in vulnerable category in the list of endangered birds (The IUCN Red List of Threatened of Species) (Birdlife International, 2012).

Some of factors that play important roles causing the decrease of the bird population in nature are narrowing their natural habitat, usage of pesticides, dan wild hunting (MacKinnon *et al.*, 2010; Winasis *et al.*, 2011; BirdLife International, 2012). Bird hunting tends to increase because of the incredible increase of birds for being caged animals (MacKinnon *et al.*, 2010), because they are birds that people are interested and good commodity to be exported (MacKinnon, 1990).

The decrease of its population in nature has to be prevented. In relation to the prevention of bird trade, gelatik jawa is included in CITES Appendix II. It means, since 1995, the bird trade has been limited by their quote (BirdLife International, 2012). Various efforts are very important to be carried out to maintain their existence in nature, either *in-situ* or *ex-situ* conservations. Mangunjaya (2006) and Indrawan *et al.* (2007) say that *in-situ* is a type of conservation that is conducted in their original habitat and *ex-situ* is a conservation being done outside it. An example of the last conservation is captivity.

By captivity, their reproduction can be controlled outside the original habitat. Some new individuals can be resulted and released to their natural habitat. Furthermore, the birds resulted can fulfil the need of cage birds. So that, wild catching and hunting can be reduced as recommended by IUCN (BirdLife International, 2012).

In this case, some factors are important to be prevented for the success of the captivity. One of them is their heat stress caused by their difficulties for achieving a balance between body heat production and body heat loss. Panting is a normal response to this circumstance. If heat production becomes greater than 'maximum heat loss' either in intensity, birds may die (Department for Environment, Food and Rular Affair, 2005).

Based on this reason, it is important to identify the relation between cage temperature and panting shown by the width of beak openings of gelatik jawa. The results is important to be followed by management for avoiding the birds heat stress. Hence, the goal of this research is to identify the relation between the cage temperature and the width of beak opening of gelatik jawa (*Padda oryzivora*), and their body movement showing by the birds shake. The data will be useful for protecting them from their mortality caused by heat stress.

RESEARCH METHOD

There were three data gained, i.e. the cage temperature, the width of beak opening, and the body movement (body shake) of the birds. They are obtained through observation of 27 gelatik jawa being in cages. The observation was done during two months (17 October – 10 December 2013). This research was done using *expose facto method*, the data gained naturally, without any treatment. The birds were placed in 7 cages with one thermometer each. The cage temperatures, the bird beaks openings and their body shakes were observed during the day at various time (06.00 – 18.00). The beaks openings were observed using a camera to get some pictures showing suitable position. Another way for getting the pictures is capturing them from some videos made. The openings are represented by the degree of angle made by upper and lower beaks and measured at a suitable head position (the right or left sides of the head). This birds movements showed by their body shakes were observed directly during the measurement of cage temperatures and width of beak opening or through videos made. The relation between the cage temperatures and the width of bird beak openings were analyzed statistically using regression. Moreover, the animals' body movement were analyzed descriptively.

RESULT AND DISCUSSION

The cage temperatures recorded were 26-37°C, without 29, 31, 32, and 35°C. Around this range, at lower cage temperatures (26-28°C) the beaks closed shown by 0 degree of their angle. At 30°C they started to open, then their openings got wider with the higher cage temperatures. The birds body shake happened at 37°C (Table 1).

Table 1. Cage temperatures, the width of beak openings and bird body shake of gelatik jawa (*Padda oryzivora*).

No.	Cage temperature (°C)	Width of beak opening (°)	Body shake
1.	26	0	-
2	27	0	-
3	28	0	-
4	30	5.5	-
5	33	25.5	-
6	34	17.7	-
7	36	25.7	-
8	37	28.5	√

Note: √ means observed

The relation between cage temperatures and the width of beaks openings is plotted using regression analysis. Based on the data gained, the width of beak opening of gelatik Jawa (*Padda oryzivora*) can be predicted based on the height of the cage temperature. The equation was $y = -20.366 + 1.327x$. It means that the higher temperature of the cage, the wider opening of gelatik jawa (*Padda oryzivora*) beaks. The data are shown by Figure 1.

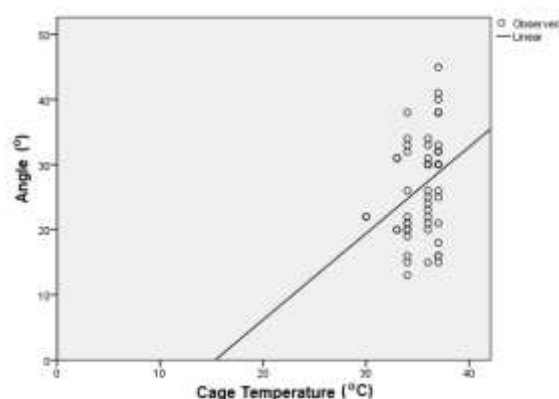


Figure 1. The relation between cage temperature and the width of beaks opening of gelatik jawa (*Padda oryzivora*).

Based on the data gained, the cage temperature relates to the beak opening of gelatik jawa (Table 1 and Figure 1). In addition, at 37°C their body start to shake (Table 1). These phenomena relate to panting, as a process to release excess heat (Donalds, 1993). North and Bell (1990) explain that birds are homeotherms, having the ability to maintain their body temperature within a narrow range. An increase in body temperature, because of an increase of ambient temperature or excessive metabolic heat production above the regulated range, can initiate thermoregulatory events that are lethal for the birds.

Figure 1 shows that at lower ambient temperature (26 -28°C) the beaks close, however, at 30°C the beaks start to open, then their openings are getting wider as the temperature increases. This phenopmenon is explained by Toyomizu *et al.* (2005) that as ambient temperature increases, birds start to pant to release the heat. Evaporative heat loss through panting is the

most important mechanism to control body temperature under heat stress. Donald (1993) also said that if the ambient temperature increases, panting is more intense. Even it can cause mortality. All of this activity is for releasing body heat actively (Randall *et al.*, 1997). The start of opening beaks at 30°C is supported by Butcher and Miles (2012) who showed the same phenomena in broilers.

At the highest cage temperature recorded (37°C), beside their beaks open and get wider, their bodies shake frequently. In this case, panting cools birds by releasing heat through evaporating moisture through respiratory way (Donald, 1993), it increases their respiratory rates 10 times (Ministry of Agriculture and Food, 2014). The increase causes higher loss of CO₂ and results the increase blood pH and disruption of acid base balance (Toyomizu *et al.*, 2005) and needs more energy (Donald, 1993). Lalhriatpuii and Haidar (2012) add that under heat stress, birds lose more water (through panting and urine) than they do when they are in the thermal comfort zone. All of this phenomena happen because the birds do not have any sweat gland. They release heat by panting that is similar to the dog. A rapid throat movement occurs. Their throat flutters move air in and out of the throat area and increases evaporation without such air entering the lungs. During a hot day this is very efficient for keeping cool (Ministry of Agriculture and Food, 2014). Their metabolism conducted is to evaporate moisture from the lining of the throat and the air-sacs. This condition also occurs in pigeon. Becoming hot, they increase their air movement over these areas by panting. The increase in air movement over the air sacs leads to a significant increase in moisture evaporation, for releasing body heat and cooling. The loss of moisture has a consequence for the birds to be dehydrated (Walker, 2012). Other evident is showed in broilers. If their body temperature rises more than 40°C, the bird will die (Department for Environment, Food and Rural Affairs, 2005).

Panting is activated by a sensory perspective, brain, body and skin thermoreceptors to change temperature and effect heat loss mechanism. In addition, Richards (1970) in Tattersall *et al.* (2006) concluded that panting, in some mammals and birds, can be controlled by central mechanisms and depending on extrinsic stimuli mediated by the vagus nerves.

Heat is one of the most important environmental stressors. Its negative effects have been observed on the members of bird group, e.g. broilers and laying hens, resulting in growth reduction and egg production, decreasing egg quality and safety (Lara *et al.*, 2013), depressing food intake, FCR, shell and internal quality of eggs (Fast, 2008 and Belayand Teeter in Kattak *et al.*, 2012), weight gain and abdominal fat, causing dehydration (Walker, 2012) and increasing mortality (Belayand Teeter, 1996 in Khattak *et al.*, 2012, Fast, 2008, and Walker, 2012). Some researches show that during this condition, metabolic pathways are diverted to homeostatic regulation rather than used for supporting growth (Lalhriatpuii and Haidar, 2012). In relation to the ambient temperature, the occurring high mortality was identified at above 32°C (Grieve, 2003).

In relation to captivity, panting is very important for identifying whether the birds get heat stress or not. If it occurs, some preventions should be done. Strategies, including environmental management (such as cage design, ventilation, sprinkling, shading), nutritional manipulation, and water supplementation, were suggested by Lara *et al.*, (2013) and Ahmad and Sawar (2006) to deal with heat stress.

CONCLUSION AND SUGGESTION

The research shows that cage temperature relate to the width of beak openings of gelatik jawa (*Padda oryzivora*). In lower cage temperature they close until 28°C. At 30°C beaks opening start to occur. The higher temperature of the cage, the wider opening of gelatik jawa (*Padda oryzivora*) beaks. At 37°C of the cage temperature, the bird body start to shake. The

phenomena show that the birds pant at higher cage temperatures that shows their body work to release heat.

Based on the results, it can be suggested that at 30°C, the animals beaks start to open showing uncomfortable ambient temperature. To prevent the negative effects, it is important to manage their environment, food, and other aspects related to decrease their ambient temperature and excess body heat. The occurrence of bird's body shake can be a sign that the birds work very hard against the stress, even it can cause their death.

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