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AGGRESSIVE BEHAVIOR OF RATS INDUCED BY HIGH TESTOSTERONE DIET

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ABSTRACT

Some foods have been researched to trigger the production of testosterone, including egg yolks and honey. This study aims to study the effect of egg yolks and honey on aggressive behavior of rats. This study is a pre-experimental study with pre-posttest design. Rats fed egg yolks were painted on their rat fur with red and black marks. Rats fed honey were painted in blue and yellow mark. Aggressive behavior is seen from cardboard, Styrofoam, and stalk damage. The behavior of aggressive interventions among rats was also observed. The results of this study indicate both egg and honey increase the aggressive behavior of rats. However, aggressive intervention among rats was shown in a group of rats fed egg yolks.

Keywords: Egg yolk, honey, aggressive, behavior, testosterone.

1. INTRODUCTION

Testosterone acts as a key hormone in differentiating men and women biologically. It is one of hormones that belong to the class of steroid hormones. Testosterone regulates many physiological processes, including muscle protein metabolism, sexual and cognitive functions, secondary sex characteristics, erythropoiesis, plasma lipids and bone formation [1].

Testosterone is produced by Leydig cells in the testes. Testosterone is released from the gland cells in response to stimuli both from inside and outside. Foods that can stimulate the release of this hormone are egg yolks and honey. Egg is the largest source of animal protein consumed in Indonesia. Cholesterol in the yolk works as a precursor for the biosynthesis of steroid hormones [2]. In the yolk, testosterone is in high level and is correlated with the reproductive behavior of birds [3]. Egg yolks increase the anabolism of testosterone indirectly [4].

Traditionally, Indonesian people consume honey as a nutrient as well as to increase fertility. Some honey is taken from farms and some from the wild. Honey can increase the sperm count by increasing testosterone production, as evidenced by elevated plasma testosterone after treatment with all doses of honey [5]. Honey is proven to be able to increase testosterone level in Rats with diabetes mellitus [6]. Cifti et al suggest that high content of chrysene (5e, 7-dihydroxyflavone), natural flavonoids in honey, is proven to raise serum levels of testosterone in Rats [5].

The relationship between testosterone and psychic changes has been widely studied, including its effects on negative mood, depression, self-esteem and motor aggressiveness [7]. A variety of researches conducted by Eisenegger et al show that testosterone plays an important role in modulating aggressive behavior in many animal species [8]. However, its relationship with human aggressiveness remains controversial. The increase of testosterone levels is found to affect the aggressiveness in Rats from California [9]. Meta-analysis of various studies has revealed a significant association between initial testosterone concentrations and various measures of aggressive human behaviors. This study is limited since testosterone concentrations are not static, but rapidly fluctuate in the context of competitive interactions. The relationship between testosterone reactivity and aggressive behavior is found only in men [8].

Egg yolks and honey are two types of food often consumed by Indonesian with for improving the reproductive function of males. Therefore, there is a phenomenon occurring in the community, namely a lot of men consuming egg yolks and honey in a large amount. There is no study analyzing aggressiveness in men consuming a lot of egg yolks and honey. This study is a preliminary study aiming to learn the impact of motoric aggressiveness of male

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Rats fed testosterone–boosting foods such as egg yolks and honey. This study not only observed aggressive behavior for each rat, but also the intervention of aggressive behavior among rats.

2. METHODOLOGY

Research Design

This research is a preliminary study to reinforce the desire of experimental research concerning on differences in aggressive behavior in relation to cholesterol-boosting foods such as egg yolks and honey. This preliminary study is important due to many issues in consuming these two types of foods in a large amount by men in Indonesia. Pre-posttest design was used as a basis for the initial answer due to controversies over testosterone-boosting food and its relationship to aggressive behavior.

Research Objects and Materials

This research object is male *Rattus norvegicus* rats at puberty age about 39-47 days, with 150-200 grams weight. The materials used in this study include egg yolks, pure honey, tree branches, plates, Styrofoam and cardboard made from thick carton cut into small size 4 x 3 cm, fresh twigs, knives, stopwatch, wire cage for rats, measurement data form, stationery, ruler, and medicine dropper.

Research Procedure

This study used four male rats labeled by using different color paint. Rats fed egg yolks were painted on their rat fur with red and black marks. Rats fed honey were painted in blue and yellow mark. Black and red male rats were put in together in one cage while yellow and blue male rats were in another cage.

During the first 3 days, all rats' motoric aggressive behavior against Styrofoam, carton, and wooden sticks was observed. Assessment was also made on the intervention of aggressive behavior among rats.

The treatment was performed after obtaining baseline for motoric aggressiveness in egg yolk and honey group. For the egg yolks group, 2.5 ml of egg yolk it was given every 15 minutes. For the honey group, 2.5 ml of pure honey was given every 15 minutes. All changes in aggressive behavior were observed every 15 minutes.

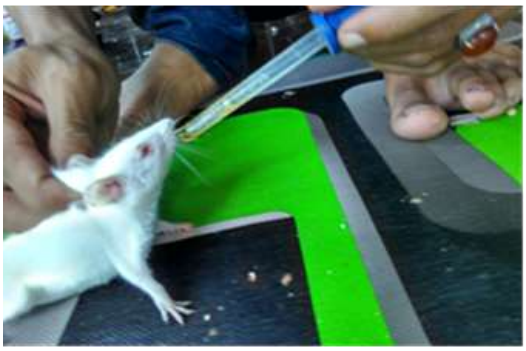

Figure 1. How to Feed Testosterone-Boosting Foods to Rats

Figure 1 shows how rats are fed by egg yolks or honey. The nape of the mouse is pulled slightly so that the position of the mouse mouth is pointing up. Rats were fed by using a dropper made of thick plastic. Whenever the dose was increased, Styrofoam, cartons and logs were replaced with new ones. As for the measurement of aggressiveness changes observed in rats, it is categorized in Tables 1 and 2 below.

Table 1. Measurement Category of Rats' Motoric Aggressiveness against Objects

Category	Aggressiveness against Objects	Score
Low	Becoming quiet without any attitude (passive)	0
	Moving near objects without destroying	1
Medium	Biting or scratching objects (0.5 – 1 cm)	2
	Biting or scratching objects (1 – 1.5 cm)	3
	Biting or scratching objects (1,5 - 2 cm)	4
High	Biting or scratching objects (2 - 2.5 cm)	5
	Biting or scratching objects (2.5 - 3 cm)	6

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	Biting and eating objects (>3 cm)	7

Table 2. Measurement Category of Rats' Interactive Aggressiveness against other Rats

Category	Aggressiveness against other rats	Score
Low	Becoming quiet without any attitude (passive)	0
	Touch each other	1
Medium	Wriggle and disturb other rats	2
	Hit other rat	3
High	Rage and hurt other rats	4
	Bite and override	5

Data analysis

The data obtained from this research are analized through chart of time series trend in each rat.

3. RESULTS AND DISCUSSION

All The results of motoric aggressiveness changes of rats feed egg yolks are shown in Figure 2.

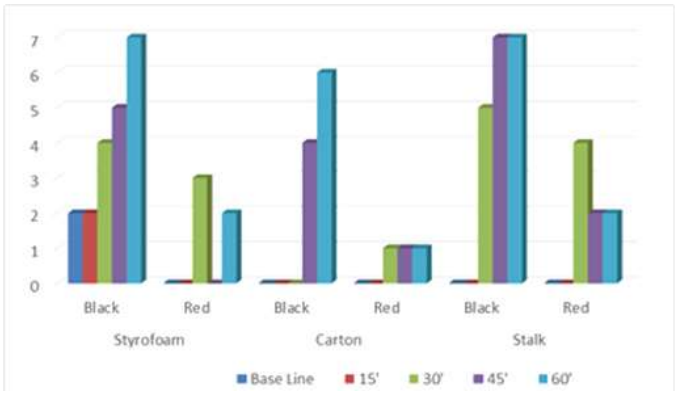

Figure 2. Motoric Aggressiveness In Rats Fed by Egg Yolks

Figure 2 shows an increase in the aggressiveness of both rats against the stimulus in the form of objects given, with the order of damage target Styrofoam-carton-logs. Black rats are more aggressive than red rats. Black rats begin to experience aggressiveness increase from minute 15 to the end of minute 60 of the observation. Red rats begin to experience aggressiveness increase at minute 15 and continue to increase until minute 30, and then experience a decrease from minute 45 to minute 60 even though the value is still higher than baseline. Furthermore, the aggressiveness of rats put in together in one cage is shown in Figure 3.

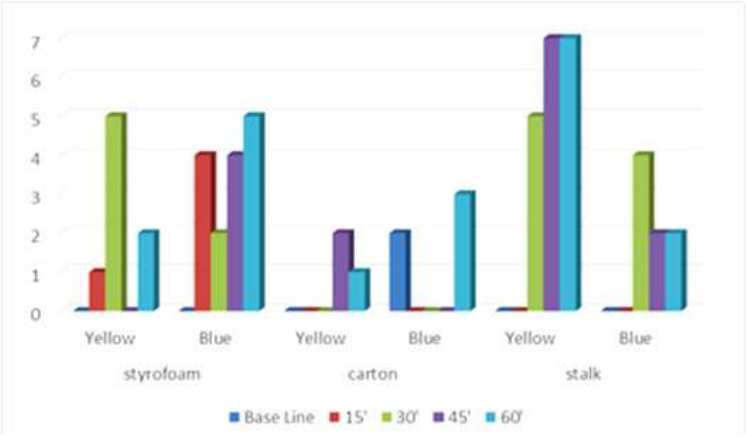

Figure 3. Motor Aggressiveness Of Rats Fed by Honey

Figure 5 illustrates the data of aggressive increase in rats fed honey. Rats fed honey experienced an increase in aggressiveness in the 30th minute. Blue and yellow rats appear to show an increase in aggressive behavior against

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stimulus of Styrofoam and logs, and only slightly against the carton. Furthermore, the aggressiveness of rats put in together in one cage and fed honey is shown in Figure 4.

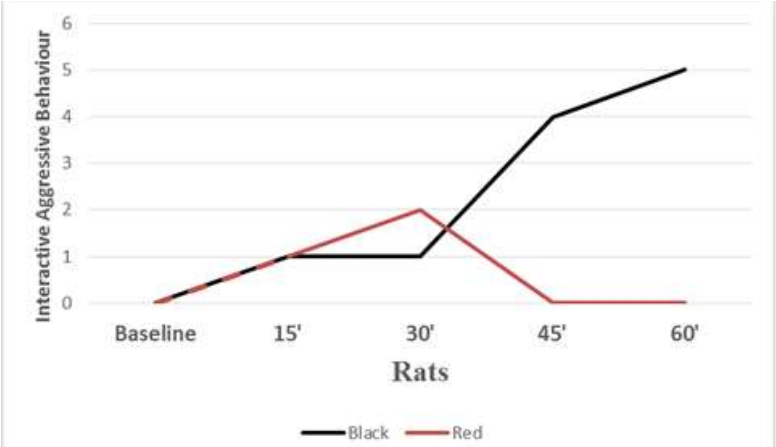

Figure 4. Interaction Of Motoric Aggressiveness Of Mice Fed Egg Yolks

Figure 4 shows an increase in the aggressiveness of both rats starting at minute 30. Red rat show their aggressiveness first. In the 30th minute, physical contact between the red and black rats occurs. Red rat begin physical contact with black rat. In the 45th minute, the black rat begin to disturb the red rat, and the red rat do not resist. Black rat seemed to dominate the situation and scare red rats. Red rat became quiet until the end of the observation, while black rats become increasingly aggressive and dominate the cage. Meanwhile, the aggressiveness of interaction between rats given honey is shown in Figure 5 below.

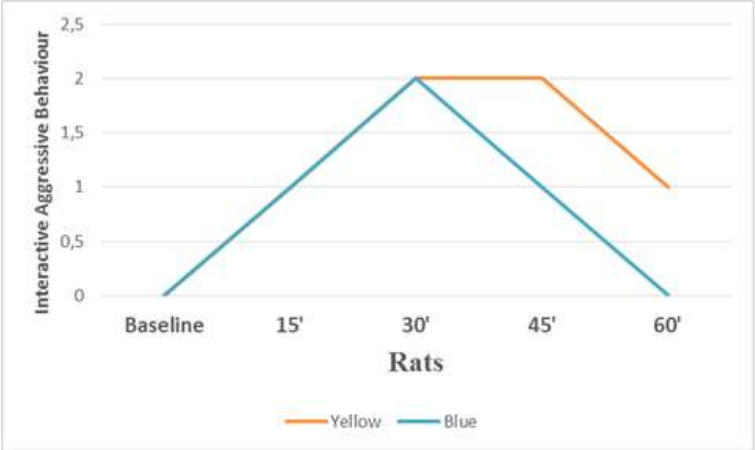

Figure 5. Interaction Of Motoric Aggressiveness Of Mice Fed Honey

In the 30th minute there was physical contact between the blue mouse and the yellow mouse. In the 45th minute the blue mouse appeared silent with a curled position, while the yellow rat did not interfere. In the 60th minute the blue mouse seemed struggling but did not disturb the yellow mouse, then the blue mouse experienced diarrhea and returned to calm. Yellow mice are only silent and after 60 minutes experience vomiting. After that the two mice calm down without being seen doing aggressive behavior.

This research on rats shows that the aggressiveness increase of rats fed egg yolks is higher than those fed honey. All rats showed aggressive behavior responses to stimulus objects with the order of damage target Styrofoam-carton-stalks. Stalks are the last target of their aggressiveness. The hard-enough texture of stalks cause rats uninterested in destroying them. A description of possible causes of the higher aggressiveness increase in those rats fed egg yolks is because testosterone biosynthesis requires a high concentration of cholesterol and essential fatty acids. Egg yolk is rich in cholesterol. Furthermore, the effect of testosterone can increase the number of adults' red blood cells from 15% to 20%. Giving testosterone from outside the body increases basal metabolism

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by as much as 15% [10]. This condition supports the aggressiveness increase.

In the group of rats fed egg yolk, there is dominance and assault from rats put in the same cage. The results of this study are in line with a research by Carre et al who find that the testosterone response predicts the competitive interaction of future aggressive behavior among men [8]. The interaction between dominance and changes in testosterone concentration emerges as a significant predictor of aggressive behavior for the winning male. For black rats fed egg yolks, this dominating behavior arises and causes red rats put in the same cage to appear depressed.

In the group of rats fed honey, there is no dominant behavior arising in the cage. The aggressiveness increase of rats fed honey is lower than those fed egg yolks'. When given high doses of honey, rats appear to show anxious behavior but do not disturb other rats put in the same cage. Giving a high concentration of honey to rats causes them to have stomachache and diarrhea.

The composition of honey varies due to various sources of flora as well as climatic and environmental conditions. Generally, honey contains sugars like glucose and fructose; enzymes like catalase and glutathione-reductase; iron, copper, zinc and calcium minerals; vitamins like vitamin A, C and E; and some flavonoids and phenolic acids as well [11]. This preliminary research also observes the rejection of the rat bodies when given large amount of honey. The body tries to remove the excess honey through digestive system so that the excess amount of honey is not all absorbed by the body and it will not stimulate the production of excess testosterone. Various research dealing with the relation between honey, the reproductive system and testosterone still show controversial results. Moreover, researches in Malaysia and Palestine show that testosterone increases sperm count in rats but does not have an effect on testosterone. In contrast, a research by Salman in Nigeria proves there is an increase in all testosterone of rats at all doses of honey.

4. CONCLUSION

Egg yolks and honey as a food source trigger testosterone, increase the aggressiveness of test rats. The egg yolks group shows higher motoric aggressiveness than honey group. Giving Styrofoam, carton, and stalks are able to make tested rats give aggressiveness response. There is a dominant behavior of interactive aggressiveness in rats fed egg yolk but not in rats fed honey.The rat's body will respond to remove honey when the honey dose is increased, so that the aggressiveness decreases under conditions of high doses. In contrast to rats that were fed a source of egg yolk testosterone triggers, the rats became aggressive in line with increasing doses. When there was physical contact between the rats, dominant rats attacked and suppressed other rats.

5. FUTURE SCOPE

There are still many mysteries about the relationship between honey, testosterone, and aggressive behavior. It requires measurement of cholesterol levels in the given egg yolk and cholesterol in rats' blood, measurement of hemoglobin (Hb), and basal metabolism in relation to aggressive behavior. In addition, measurement of rat tolerance of the maximum limit of honey is also required.

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