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Effect of Acute Consumption of Coconut and Palm Oil on Swimming Capacity Endurance of Mice (*Mus musculus*)

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Abstract: Coconut oil is composed of mainly medium chain fatty acid and dominated by medium chain triglyceride (MCT), but palm oil is dominated by long chain fatty acids and called long chain triglyceride (LCT). Different from LCT such as palm oil, MCT oil (coconut oil) is much more rapidly digested and quickly absorbed into liver and rapidly oxidized into energy so that it can increase metabolism and stamina. The aim of this study was to investigate the effect of acute consumption of coconut and palm oils on swimming capacity endurance of mice.

In this study, virgin coconut oil (VCO) product of AZMI® and Palm oil product of SUNCO® were used. Caffeine solution containing 13 mg/10 ml distilled water was prepared. Before treatments, mice were acclimatized and then motoric test was conducted to select appropriate mice for the experiment. Selected mice (40) were divided into 8 groups, each consisting of 5 mice. Tested oil was administrated orally one dose (acute administration) to the mice. Group I was given distilled water 0.2 ml /20 g bw (as negative control); group II, III and IV was given VCO 0.1 ml/20 g bw, 0.2ml/20 g bw and 0.4 ml/20 g bw, consecutively. Group V, VI and VII was given palm oil 0.1 ml/20 g bw, 0.2 ml/20 g bw and 0.4 ml/20 g bw consecutively. Group VII was given 0.2 ml caffeine solution/20 g bw (as positive control). After feeding, the mice were subjected to swim in aquarium. The total swimming period until exhaustion was measured and used as index of swimming capacity.

Research result shows that the higher dose of the tested oils the longer swimming time and with better stamina. Swimming time of mice consuming coconut oil with dose of 0.1 ml/20 g bw,0.2 ml/20 g bw,0.4 ml/20 g bw are 339 seconds, 372.4 seconds, 551.8 seconds, which is significantly higher than those swimming time of mice treated with palm oil, namely with dose of 0.1 ml/20 g bw,0.2 ml/20 g bw,0.4 ml/20 g bw are 194.8 seconds, 216.4 seconds, 254 seconds. Aquadest (negative control) is 182.4 seconds and caffein 13 mg/kg bw (positive control) is 591 seconds. Data obtained analyzed statistically use one way ANOVA method. Results from this study suggest that acute consumption of virgin coconut oil is more effective than palm oil to increase swimming capacity endurance of mice.

Keywords: virgin coconut oil, palm oil, mice, swim capacity.

Introduction

There are several components derived from plants and animals that can increase stamina including alkaloids, flavonoids in some plants. Ginsenoside contained in ginseng, caffeine contained in coffee cola nuts, and medium chain triglycerides (MCT) [1,2,3,4,5].

Medium chain triglycerides (MCT) are hydrolyzed by lingual and gastric lipase into free fatty acids and directly delivered into heart through portal vein and quickly oxidized to produce energy. On the other hand, long chain triglycerides (LCT), is not hydrolyzed in stomach, but in small intestine LCT is hydrolyzed by pancreatic lipase, and then converted back into triglycerides and transported as chylomicron through lymphatic system in to blood circulation, and hence, LCT may increase fat deposition on the inner wall of blood vessel. LCT is slower and less oxidized into energy[6,7].

Virgin coconut oil (VCO) is coconut oil obtained from coconut meat of fresh mature coconut fruit processed at low temperature. VCO is composed of fatty acids dominated by medium chain fatty acids, especially lauric acid, so that VCO belongs to MCT. In mouth and stomach will be hydrolyzed into free fatty acids of short chain and medium fatty acids and monoglycerides (MAG). Hydrolyzed product is rapidly absorbed via portal vein immediately to the liver and quickly oxidized into energy and increases metabolism that can maintain stamina, because the increase in fat oxidation would promote glycogen sparing effect, and therefore delay the time to exhaustion[8]. While fats containing long chain fatty acids (LCT) such as palm oil is not digested in the stomach, but it will be hydrolyzed in small intestine, then converted back to triglycerides and transported in lipoprotein through lymphatic system in to blood circulation. Therefore, palm oil is slower and not directly converted to energy compared to MCT [7,9]. Previous studies reported that the effect of MCT by acute administration on the physical performance is not conclusive[8]. However, swimming endurance capacity of mice was increased by MCT chronic consumption for six weeks[2]. The aim of this study was to investigate the effect of coconut oil (VCO) and Palm Oil (PO) on swimming capacity of mice by acute administration.

Materials and Methods

Equipments

The tools used in this research were electrical balance (Vibra), the animal scales (Presica GW-1500), glass aquarium, syringe for oral feeding, flask 10 ml, stopwatch, hairdryer, animal box, syringe 1 ml, funnel, pipette, parchament, spatula, thermometer, air pump and ruler.

Materials

Materials used in this study were virgin coconut oil (AZMI®), palm oil (SUNCO®), caffeine BPFI (Indonesian Pharmacopeia grade), and distilled water. A solution containing 13 mg caffeine in 10 ml distilled water was prepared.

Acclimatization of Experimental Animals

The experimental animals were housed in standard cages with the same condition, diet and under controlled conditions. Acclimatization of the experimental animals was conducted for seven days in order to be accustomed with the experimental condition. Good adaptation of mice was characterized by constant changes in body weight[10].

Motoric test

After acclimatization process, then motoric test (swim capacity test) was conducted. This test was preformed to select mice those found to have similar capacity to swim. Mice were placed in the aquarium for ten minutes and the mice which can not swim properly were not included in the experiment. From this test, 40 male mice weighing 20-40 g of about 2-3 months of age were used in this study[10].

Effect of Treatments on Swim Capacity of Mice

Before treatments, mice were fasting for 12 hours. Experimental animals were divided into 8 groups, each consisted of 5 mice. Treatment was done by feeding mice only once (acute consumption). Test animals were given virgin coconut oil (VCO), palm oil (PO) with acute oral dose. Group I (negative control) was given distilled water at 1 % of body weight (0.2 ml/20 bw); group II was given VCO at 0.1 ml/20 g bw; group III was given VCO at 0.2 ml/20 g bw; group IV was given VCO at 0.4 ml/20 g bw. Group V, VI, VII were given PO with the same doses of that with VCO. Group VIII was given caffeine (positive control) with 13 mg/kg bw (0.2 ml caffeine solution/20 g bw). After feeding, mice were allowed to break for 30 minutes and then the mice were placed in to empty aquarium with air pump, then water was poured into the aquarium. The mice were subjected

to swim in the aquarium to see the effect of each treatment on the swimming endurance capacity by measuring the time spent by mice to swim. The total swimming period until exhaustion was measured and used as index of swimming capacity.

Results and Discussion

Characteristic of Experimental Animals

The characteristic of the mice as an experimental animal by the body weight from day 0 to day 7 during acclimatization can be seen in at Table 1.

Table 1. Weight change of mice during acclimatization

No.	Group	Body weight (g) (n = 5)		
		Day 0	Day 3	Day 7
1	I	26.9 ± 6.10	27.7 ± 6.28	28.0 ± 6.57
2	II	31.2 ± 4.56	31.8 ± 4.65	31.8 ± 4.74
3	III	32.2 ± 2.27	33.8 ± 2.24	34.3 ± 2.22
4	IV	30.8 ± 3.59	31.6 ± 3.55	31.8 ± 3.32
5	V	27.4 ± 4.51	27.8 ± 3.97	28.2 ± 3.38
6	VI	31.3 ± 2.11	32,8 ± 1.63	32,5 ± 1.69
7	VII	31.9 ± 5.74	32.4 ± 5.93	32.4 ± 5.92
8	VIII	30.4 ± 4.28	31.1 ± 4.27	31.2 ± 4.25

Based on the above data in Table 1, it can be seen an average body weight of mice increased from 0.4 to 1.6 g which means that mice have been accustomed to the experimental environment[10].

Motoric test was done to determine initial capability of mice to swim. Swim capacity criteria of mice was being able to move both back legs with a balanced movement followed both front legs and floating in the water[10]. Swim capacity of the mice on each group was known as negative control group presented in Table 2.

Table 2. Swim Capacity of Mice in Motoric Test before Treatment

Groups	Time of Swim capacity (seconds) (n = 5)
I	185.4 ± 8.018
II	180.4 ± 6.767
III	187.8 ± 7.823
IV	185.6 ± 2.067
V	185.6 ± 5.458
VI	190.0 ± 6.595
VII	191.4 ± 6.066
VIII	186.7 ± 6.329

From the data in Table 2, it appears that inter-group mice have swim capacity to swim with the same relative resistance which is about 180 seconds.

Test animals were orally given virgin coconut oil, palm oil at different doses with acute consumption, then mices were allowed to break for 30 minutes and then tested swimming endurance to see the effect of each treatment and comparing the results between treatment groups. Results of swimming endurance of mice after treatment presented in Table 3 and Figure 1.

Table 3. The Effect Treatments on Swimming Capacity Endurance of Mice

Treatments	Swim Capacity (seconds) (n =5)	
	Virgin Coconut Oil (VCO)	Palm Oil (PO)
0.1 ml/20 g bw	339.0 ± 7.496 [a]	194.8 ± 11.467 [b]
0.2 ml/20 g bw	372.4 ± 4.615 [a]	216.4 ± 7.681 [a]
0.4 ml/20 g bw	551.8 ± 16.278 [a]	254.0 ± 15.023 [a]
13 mg caffein/kg bw as positive control (0.2 ml caffeine solution/20g bw)	591.0 ± 20.408 [a]	
1 % distilled water/bw as negative control (0.2 ml distilled water/20 g bw)	182.4 ± 12.521	

Notes: a = significantly different from the negative control
b = not significantly different from the negative control

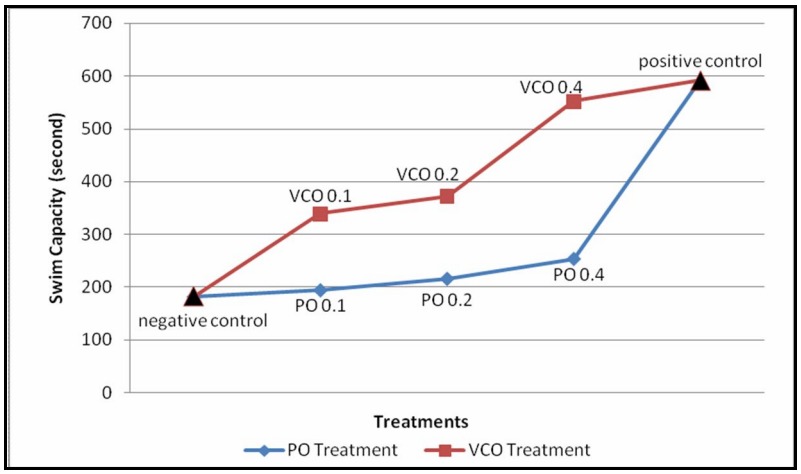

Figure 1. The Effect of Treatments on Swimming Capacity Endurance of Mice

Based on data in Table 3 and Figure 1, it is shown that acute consumption of coconut oil and palm oil increased swim capacity endurance of tested mice. The higher the dose of the oil consumed, the greater the swim capacity of the mice. It shows that the acute administration of coconut oil has the significantly higher effect than the stamina enhancement by palm oil. All treatments have a greater swimming endurance compared with a negative control (distilled water) that is 182.4 seconds. At the dose of 0.4 ml/20 g bw virgin coconut oil has the endurance to swim around 551.8 seconds which is close to the effect by caffeine as positive control (591 seconds), while swimming endurance affected by palm oil with the same dose (0.4 ml/20 g bw) is only 254 seconds. The values between groups were compared with the negative control group (distilled water) is statistically evaluated by ANOVA parametric test.

The different effect of tested oils on the swim capacity of tested animals in this study is due to the difference in metabolism of MCT and LCT. MCT is hydrolyzed in mouth and stomach and directly delivered in the form of free fatty acids into the liver via portal and quickly oxidized to produce energy that can be used to increase swim capacity. LCT was hydrolyzed by pancreatic lipase in small intestine by pancreatic lipase[6,7]. The fatty acids and monoglycerides produced by hydrolysis are converted back into triglycerides in the small intestine mucosa and transported as chylomicron through lymphatic system in to the blood circulation; it is not directly oxidized to produce energy. On the hand, MCT is hardly present blood stream, and the energy produced delay the time to exhaustion and therefore increasing dose is directly proportional to the increase in the capacity of endurance (stamina)[2,8].

Conclusion

The results showed that the acute administration of virgin coconut oil (MCT) and palm oil (LCT) increased swimming capacity of tested animals, but the effect of coconut oil was significantly higher than that caused by palm oil. The effect of coconut oil with dose of 0.4 ml/20 g bw has similar effect to that by positve control with caffeine 13 mg/kg bw. Results from this study suggest that acute consumption of virgin coconut oil increase swimming capacity endurance of mice.

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