

RINGKASAN

Kafein sejak ditemukan 4500 tahun yang lalu bisa didapatkan pada kopi, teh, minuman ringan dan minuman berenergi serta obat-obatan.

Pemberian kafein pada atlet yang melakukan latihan intensitas tinggi (mendekati maksimal) dapat meningkatkan penampilan melalui beberapa mekanisme seperti meningkatkan penggunaan lemak selama latihan sehingga terjadi penghematan terhadap cadangan glikogen di otot. Hal ini menjadi penting mengingat konsentrasi glikogen otot yang tinggi sangat berguna dalam meningkatkan penampilan pada olahraga aerobik, selain itu kafein juga merangsang lipolisis pada jaringan lemak melalui peningkatan sekresi katekolamin dan kemudian meningkatkan oksidasi asam lemak bebas oleh otot yang aktif dan akhirnya juga menghemat glikogen otot.

Penelitian para ahli menunjukkan adanya kontroversi pendapat tentang efek kafein terhadap penghematan glikogen otot seperti yang dikemukakan oleh Chesley (1998) bahwa pemberian kafein 9 mg/kg berat badan 1 jam sebelum bersepeda dengan beban 80% VO_2 max menyebabkan penghematan glikogen otot sebesar 28% tetapi Jackman (1996), Laurent (2000) dan Graham (2000) menyatakan bahwa pemberian kafein sebelum latihan tidak menghemat glikogen sehingga perlu dilakukan penelitian untuk membuktikan kontroversi tersebut.

Penelitian ini bertujuan untuk mengetahui pengaruh pemberian kafein 9 mg/kg berat badan 1 jam sebelum latihan submaksimal terhadap penghematan glikogen otot pada 33 ekor tikus *Rattus Norvegicus* Wistar jantan usia dewasa. Rancangan penelitian yang digunakan adalah *Randomized Posttest only Control Group Design* dengan kelompok 1. kontrol 2. latihan tanpa kafein 3. latihan dengan kafein yang bertujuan untuk membuktikan adanya penghematan glikogen otot pada latihan dengan kafein dibandingkan dengan latihan tanpa kafein.

Pemberian kafein dilakukan 1 jam sebelum latihan submaksimal dengan beban 3% selama 80% kemampuan renang maksimal. Setelah itu segera dilakukan pengambilan jaringan otot *Gastrocnemius* kanan dan dibuat sediaan histokimia dengan pewarnaan PAS (Periodic Acid Schiff) lalu dilakukan penghitungan skor glikogen otot menggunakan mikroskop cahaya dengan pembesaran 400 X dengan bantuan gratikulae.

Hasil skoring glikogen otot ketiga kelompok menunjukkan $p < 0,05$ ($70,9355 \pm 11,2990$, $44,1373 \pm 11,7372$, $55,4509 \pm 7,3272$) $P = 0,000$. Beda penggunaan glikogen antara kelompok kontrol dan kelompok latihan tanpa kafein adalah sebesar 26,7982 dan antara kelompok kontrol dan kelompok latihan dengan kafein adalah sebesar 15,4846 sehingga terjadi penghematan penggunaan glikogen sebanyak 15,9491% ($P = 0,013$).

Dengan demikian pemberian kafein 1 jam sebelum latihan submaksimal lebih menghemat penggunaan glikogen otot dibanding latihan submaksimal tanpa kafein.

SUMMARY

The Effect of Caffeine on Muscle Glycogen Sparing in Submaximal Exercise

Since its finding 4500 years ago, caffeine can be found in coffee, tea, soft drinks, energy drinks, and drugs. Caffeine administration for athletes who is performing high intensity (nearly maximum) sport may increase performance through several mechanisms, such as the use of fat during exercise, which results in glycogen saving in muscles. This is important since high muscular glycogen concentration is useful to improve performance in aerobic sports. Additionally, caffeine also stimulates lipolysis in adipose tissue by increasing catecholamine secretion and enhancing free fatty acid oxidation by active muscles and, finally, saving muscular glycogen.

Previous studies reveal controversy over caffeine effect on muscle glycogen sparing. Chesley (1998) found that caffeine administration 9 mg/kg body weight 1 hour before cycling with a load of 80% of VO_2 max resulted in 28% muscle glycogen sparing. However, Jackman (1996), Laurent (2000) and Graham (2000) suggested that caffeine administration before exercise did not save glycogen, so that studies are needed to solve the controversy.

The objective of this study was to identify the effect of caffeine administration of 9 mg/kg bodyweight 1 hour before submaximal exercise on muscular glycogen saving in 33 adult male Wistar strain *Rattus norvegicus*. This study used randomized posttest only control group design, involving 33 male adult *Rattus norvegicus* rats. Rats were divided into three groups: 1. control, 2. training without caffeine, and 3. training with caffeine, in order to prove glycogen sparing in exercise with caffeine as compared to exercise without caffeine.

Caffeine was given 1 hour before submaximal exercise with 3% load for 80% maximum swimming capability. Thereafter, right gastrocnemius muscle was removed to make histochemical preparations using PAS (Periodic Acid Schiff) staining. Muscular glycogen score estimation was done using light microscope with 400 x magnification with the use of graticulae.

The results of muscular glycogen scoring in three groups revealed $p < 0.05$ (70.9355 ± 11.2990 , 44.1373 ± 11.7372 , 55.4509 ± 7.3272) $p = 0.000$. The difference of glycogen use between control and group receiving exercise without caffeine was 26.7982, and between control and group receiving exercise with caffeine was 15.4846, so that the glycogen sparing was 15.9491% ($p = 0.013$). Therefore, caffeine administration 1 hour before submaximal exercise saved more muscle glycogen as compared to submaximal exercise without caffeine.

ABSTRACT**The Effect of Caffeine on Muscle Glycogen Sparing in Submaximal
Exercise**

The objective of this study was to identify the effect of caffeine administration of 9 mg/kg bodyweight 1 hour before submaximal exercise on muscular glycogen saving in 33 adult male Wistar strain *Rattus norvegicus*. This study used randomized posttest only control group design, involving 33 male adult *Rattus norvegicus* rats. Rats were divided into three groups: 1. control, 2. exercise without caffeine, and 3. exercise with caffeine, in order to prove glycogen saving in exercise with caffeine as compared to exercise without caffeine.

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Key words : Caffeine, submaximal Exercise, Muscle Glycogen Sparing.