

IR – PERPUSTAKAAN UNIVERSITAS AIRLANGGA

RESEARCH THESIS

**EFFECT OF HIGH CARBOHYDRATE DIET BREAK ON RESISTANCE
TRAINING LOAD IN CALORIE RESTRICTED RATS (*Rattus norvegicus*)**



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The writer realizes that the writing of this thesis still needs improvement, therefore the writer expects positive suggestions and criticisms from the readers. With this thesis, the writer hopes that it can provide benefits for all parties in need.

SUMMARY

EFFECT OF HIGH CARBOHYDRATE DIET BREAK ON RESISTANCE TRAINING LOAD IN CALORIE RESTRICTED RATS (*Rattus norvegicus*)

Losing bodyweight to a certain point is not a new thing, but to achieve it without losing the athletic performance or strength is a challenge to a regular person all the way to professional athletes. To compromise this obstacle, many trying to accommodate anabolic steroid or extra testosterone injection in their body weight reduction plan. The idea behind this research was to see how far athletic performance and strength can be maintain during calorie restriction phase. A restored muscle glycogen hypothetically would perform better in exercise than depleted muscle glycogen in individual with prolonged ER. Thus, this research aim to see the difference of strength in calories restricted rats between the rats with restored muscle glycogen in the form of added carbohydrate maltodextrin and the rats with depleted muscle glycogen which is the rats with continuous diet.

This research categorized as an experimental laboratory study with a randomized control group design with posttest using twenty seven male male rats, wistar strains, aged 3 months, 140-165 g, as subjects. The subjects were acclimatized for one week, given a standard diet ad libitum and introduced to ladder climbing exercise. During the four weeks treatment, the KN (n=9, standard diet), KP (n=9, 75% calories intake compared to KN) and K1 (n=9, 65% calories intake compared to KN and diet break and extra maltodextrin). The research was conducted for 5 weeks in Biochemistry Animal Laboratory, Faculty of Medicine, Universitas Airlangga. The statistical data was analyzed using IBM SPSS with Chi Square, Fisher Exact, Independent T-Test, Saphiro-Wilk and Mann-Whitney method.

The result gathered from 28 days of treatment is the mean body weight of the rats which is KN (168 ± 11.99) grams increased to (182.33 ± 23.61) grams, KP (167.56 ± 20.71) grams increased to (181.56 ± 24.23), and K1 (156.11 ± 10.39) grams increased to (177.44 ± 15.46) grams. Those results shows no significant difference between each groups with ($p > 0.05$). The strength performance test was conducted pre and post using maximum carrying weight test which is attaching weight on the rats tail according to the average test subject weight and the number of the weight percentage in this research is 75% of the average test subject weight. It is shown that the results break the initial hypothesis. During the posttest, 17 succeed with 8 out of 9 rats from KP group succeed which break the initial hypothesis that K1 should be better than KP.

In conclusion, when compared to the non-calorie restricted group and the steady continuous calorie restricted group, a short term (4 weeks) weekly diet break with additional carbohydrate consumption in the form of maltodextrin 1,125g/day for two days has no significant effect on resistance training performance.

RINGKASAN

PENGARUH ISTIRAHAT DIET TINGGI KARBOHIDRAT TERHADAP PERFORMA LATIHAN BEBAN PADA TIKUS YANG DIBATASI KALORI (*Rattus norvegicus*)

Menurunkan berat badan sampai titik tertentu bukanlah hal yang baru, tetapi untuk mencapainya tanpa kehilangan performa atau kekuatan atletik merupakan tantangan bagi orang biasa hingga atlet profesional. Untuk mengatasi hambatan ini, banyak yang mencoba mengakomodasi steroid anabolik atau injeksi testosteron ekstra dalam rencana penurunan berat badan mereka. Ide di balik penelitian ini adalah untuk melihat sejauh mana kinerja dan kekuatan atletik dapat dipertahankan selama fase pembatasan kalori. Glikogen otot yang dipulihkan secara hipotetis akan tampil lebih baik dalam latihan daripada glikogen otot yang terkuras pada individu dengan ER yang berkepanjangan. Oleh karena itu, penelitian ini bertujuan untuk melihat perbedaan kekuatan pada tikus yang dibatasi kalori antara tikus dengan glikogen otot yang dipulihkan berupa maltodekstrin karbohidrat yang ditambahkan dan tikus yang mengalami deplesi glikogen otot yang merupakan tikus dengan diet yang terus menerus.

Penelitian ini termasuk penelitian eksperimental laboratorium dengan rancangan acak kelompok kontrol dengan posttest menggunakan dua puluh tujuh ekor tikus jantan galur wistar, umur 3 bulan, 140-165 g, sebagai subjek penelitian. Subyek diaklimatisasi selama satu minggu, diberikan diet standar ad libitum dan diperkenalkan latihan memanjat tangga. Selama empat minggu perlakuan, KN (n=9, diet standar), KP (n=9, 75% asupan kalori dibandingkan dengan KN) dan K1 (n=9, 65% asupan kalori dibandingkan dengan KN dan istirahat diet dan ekstra maltodekstrin). Penelitian dilaksanakan selama 5 minggu di Laboratorium Biokimia Hewan Fakultas Kedokteran Universitas Airlangga. Data statistik dianalisis menggunakan IBM SPSS dengan metode Chi Square, Fisher Exact, Independent T-Test, Saphiro-Wilk dan Mann-Whitney.

Hasil yang diperoleh dari 28 hari perlakuan didapatkan rerata bobot badan tikus yaitu KN ($168 \pm 11,99$) gram meningkat menjadi ($182,33 \pm 23,61$) gram, KP ($167,56 \pm 20,71$) gram meningkat menjadi ($181,56 \pm 24,23$), dan K1 ($156,11 \pm 10,39$) gram meningkat menjadi ($177,44 \pm 15,46$) gram. Hasil tersebut menunjukkan tidak ada perbedaan yang signifikan antara masing-masing kelompok dengan ($p > 0,05$). Uji unjuk kekuatan dilakukan sebelum dan sesudah menggunakan uji bobot angkut maksimum yaitu bobot tempel pada ekor tikus sesuai dengan rata-rata bobot subjek uji dan jumlah persentase bobot dalam penelitian ini adalah 75% dari rata-rata bobot subjek uji. Hasil tersebut terbukti mematahkan hipotesis awal. Selama posttest hanya 17 yang berhasil dengan 8 dari 9 tikus dari kelompok KP yang berhasil mematahkan hipotesis awal bahwa K1 harus lebih baik dari KP.

Dapat disimpulkan bahwa, jika dibandingkan dengan kelompok pantangan kalori dan kelompok pembatasan kalori terus menerus stabil, pemberhentian diet mingguan jangka pendek (4 minggu) dengan tambahan konsumsi karbohidrat berupa maltodekstrin 1,125g/hari selama dua hari tidak berpengaruh signifikan pada kinerja pelatihan resistensi.

ABSTRACT

EFFECT OF HIGH CARBOHYDRATE DIET BREAK ON RESISTANCE TRAINING LOAD IN CALORIE RESTRICTED RATS (*Rattus norvegicus*)

Muhammad Irfan Indiar¹, Irfianyah Irwadi¹, Lina Lukitasari²

Background: Research on intermittent energy restriction (IER) is conducted to reduce the adverse effect of chronic severe energy restriction. It is found that IER are much superior to continuous energy restriction in weight loss efficiency, metabolic adaptation, preserved lean body mass, and training performance. Due to inadequate studies regarding the impact IER against the performance of exercise specifically resistance training exercise, this research aims to determine the impact of high carbohydrate diets on calorie restricted *Rattus norvegicus* against the performance resistance training exercise.

Objective: To analyze the effect of high carbohydrate diet break for 28 days on the resistance training performance for calorie restricted male Wistar Rats.

Method: 27 male wistar strains rats, divided into 3 groups randomly and assigned as KN, KP and K1 with food intake as the independent variable lasting for 28 days. Posttest of resistance training exercise was performed and weighed before the test conducted. The statistical data was analyzed using SPSS.

Results: The results gathered from 28 days of treatment is the mean body weight of the rats which show no significant difference between each group with ($p>0.05$). The strength performance test was conducted post treatment using maximum carrying weight test. During posttest only 17 succeed with 8 out of 9 rats from KP group succeed which break the initial hypothesis that K1 should be better than KP.

Conclusion: When compared to the non-calorie restricted group and the steady continuous calorie restricted group, a short term (4 weeks) weekly diet break with additional carbohydrate consumption in the form of maltodextrin 1,125g/day for two days has no significant effect on resistance training performance.

Keywords: Diet break; Carbohydrates; Ladder climbing exercise; Calorie restriction

ABSTRAK

PENGARUH ISTIRAHAT DIET TINGGI KARBOHIDRAT TERHADAP PERFORMA LATIHAN BEBAN PADA TIKUS YANG DIBATASI KALORI (*Rattus norvegicus*)

Muhammad Irfan Indiartho, Irfianyah Irwadi, Lina Lukitasari

Latar Belakang: Penelitian tentang pembatasan energi intermiten (IER) dilakukan untuk mengurangi efek samping dari pembatasan energi berat kronis. Ditemukan bahwa IER jauh lebih unggul daripada pembatasan energi berkelanjutan dalam efisiensi penurunan berat badan, adaptasi metabolik, massa tubuh tanpa lemak yang diawetkan, dan kinerja pelatihan. Dikarenakan belum memadainya penelitian mengenai dampak IER terhadap kinerja latihan khususnya latihan ketahanan, maka penelitian ini bertujuan untuk mengetahui pengaruh diet tinggi karbohidrat pada *Rattus norvegicus* dengan pembatasan kalori terhadap kinerja latihan ketahanan.

Tujuan: Menganalisis pengaruh istirahat diet tinggi karbohidrat selama 28 hari terhadap kinerja latihan ketahanan tikus Wistar jantan pembatasan kalori.

Metode: 27 ekor tikus jantan galur wistar, dibagi menjadi 3 kelompok secara acak dan ditetapkan sebagai KN, KP dan K1 dengan asupan makanan sebagai variabel bebas selama 28 hari. Posttest latihan ketahanan dilakukan dan ditimbang sebelum tes dilakukan. Data statistik dianalisis menggunakan SPSS.

Hasil: Hasil yang diperoleh dari 28 hari perlakuan adalah rerata bobot badan tikus yang menunjukkan tidak ada perbedaan bermakna antara masing-masing kelompok dengan ($p > 0,05$). Uji unjuk kekuatan dilakukan sebelum dan sesudah menggunakan uji beban angkut maksimum. Selama posttest hanya 17 yang berhasil dengan 8 dari 9 tikus dari kelompok KP yang berhasil mematahkan hipotesis awal bahwa K1 harus lebih baik dari KP.

Kesimpulan: Jika dibandingkan dengan kelompok pembatasan kalori non kalori dan kelompok pembatasan kalori kontinyu stabil, istirahat diet mingguan jangka pendek (4 minggu) dengan tambahan konsumsi karbohidrat berupa maltodekstrin 1.125g/hari selama dua hari tidak berpengaruh signifikan terhadap kinerja latihan ketahanan.

Kata kunci: Istirahat diet; Karbohidrat; Latihan memanjat tangga; Pembatasan kalori

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LIST OF ABBREVIATIONS

ACh	= Acetylcholine
a-MSH	= a-Melanocyte-Stimulating Hormone
AT	= Anaerobic Threshold
ATP	= Adenosine Triphosphate
BMR	= Basal Metabolic Rate
CCK	= Cholecystokinin
ER	= Energy Restriction
FFM	= Fat Free Mass
GH	= Growth hormone
GLP-1	= Glucagon-like Peptide 1
HIIT	= High-Intensity Interval Training
IER	= Intermittent Energy Restriction
J	= Joule
NPY	= Neuropeptide Y
NTS	= Nucleus Tractus Solitarius
POMC	= Opioid Pro Melanocortin
TDEE	= Total Daily Energy Expenditure