

**PENGARUH PENGATURAN ASUPAN KALORI
TERHADAP KADAR SERUM KOLESTEROL TOTAL
DAN TRIGLISERIDA TIKUS WISTAR JANTAN**

SKRIPSI

**Untuk Memenuhi Persyaratan
Memperoleh Gelar Sarjana Kedokteran**



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FAKULTAS KEDOKTERAN

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ROMMY KAMAJAYA

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RINGKASAN

Rommy Kamajaya. Fakultas Kedokteran, Universitas Islam Malang. Pengaruh Pengaturan Asupan Kalori Terhadap Kadar Serum Kolesterol Total dan Trigliserida Tikus Wistar Jantan. **Pembimbing 1:** Yudi Purnomo. **Pembimbing 2:** Rima Zakiyah.

Pendahuluan: *Overfeeding (OF)* meningkatkan resiko terjadinya hiperlipidemia dan komplikasinya. Hiperlipidemia dapat dicegah dengan cara *intermittent fasting (IF)* dan restriksi kalori (RK). Kombinasi dari keduanya belum pernah dilakukan dan diharapkan dapat menjadi pencegah hiperlipidemia dan komplikasinya lebih kuat dibandingkan bentuk tunggalnya. Penelitian ini memiliki tujuan untuk mengetahui pengaruh *IF*, RK, kombinasi *IF*-RK, dan *OF* terhadap kadar kolestetol total (KT) dan trigliserida (TG) tikus wistar jantan.

Metode: Penelitian quasi eksperimental laboratorium dengan rancangan *post test-only control group design* pada tikus Wistar jantan berumur 8 minggu, berat 160-180 gram yang terbagi dalam 5 kelompok ($n=5$). Kelompok kontrol normal (KN) dan *IF* diberikan pakan normal 10% BB, kelompok RK dan kombinasi *IF*-RK diberi pakan 5% BB, sedangkan kelompok *OF* pakan 20% BB yang dilakukan selama 6 minggu. Kadar KT dan TG serum diukur dengan spektrofotometri berturut-urut dengan metode CHOD-PAP dan metode GPO-PAP. Data dianalisis dengan *One way Anova* dilanjut dengan uji Beda Nyata Terkecil dengan nilai signifikansi $p<0,05$.

Hasil: Perlakuan *IF*, RK, dan kombinasi *IF*-RK menurunkan kadar KT berturut-urut sekitar 20%, 40%, dan 70% dibandingkan dengan kelompok kontrol ($p<0,05$), sementara kadar TG berkurang berturut-urut sekitar 20%, 40%, dan 60% ($p<0,05$). Sedangkan *OF* meningkatkan kadar KT dan TG serum berturut-urut sebesar 30% dan 80% dibandingkan dengan kelompok kontrol ($p<0,05$). Hasil uji korelasi menunjukkan hubungan signifikan antara asupan pakan (AP) dengan berat badan (BB), KT, dan TG dengan arah korelasi positif ($p<0,05$). Tingkat keeratan hubungan sangat kuat antara AP-BB, KT-TG, dan AP-TG berturut-urut $r = 0,902$, $r = 0,911$ $r = 0,957$, serta kuat untuk hubungan antara AP-KT, BB-KT, dan BB-TG berturut-urut $r = 0,877$ $r = 0,822$ $r = 0,820$.

Simpulan: Pengaturan asupan kalori berpengaruh terhadap kadar serum KT dan TG. Kombinasi *IF*-RK menurunkan kadar KT dan TG lebih kuat dibandingkan dengan perlakuan *IF* atau RK. Sedangkan *OF* meningkatkan kadar serum KT dan TG.

Kata Kunci : *restriksi kalori; intermittent fasting; overfeeding; kolesterol total; trigliserida.*

SUMMARY

Rommy Kamajaya. Faculty of Medicine, Islamic University of Malang. The Effect of Calorie Intake Regulation on Serum Levels of Total Cholesterol and Triglycerides in Male Wistar Rats. **Supervisor 1:** Yudi Purnomo. **Supervisor 2:** Rima Zakiyah.

Introduction: Overfeeding (OF) increases the risk of hyperlipidemia and its complications. Hyperlipidemia can be prevented through intermittent fasting (IF) and caloric restriction (CR). However, the combination of both approaches has not been previously studied and is hypothesized to provide stronger preventive effects against hyperlipidemia and its complications compared to individual interventions. This study aims to investigate the effects of OF, IF, CR, and the IF-CR combination on total cholesterol (TC) and triglyceride (TG) levels in male Wistar rats.

Method: Laboratory quasi-experimental research with post-test-only control group design on 8-week-old male Wistar rats weighing 160-180 grams divided into 5 groups ($n = 5$). The normal control (KN) and IF groups were given normal feed of 10% BW, the RK and IF-RK combination groups were given feed of 5% BW, while the OF group was given feed of 20% BW for 6 weeks. Serum KT and TG levels were measured by spectrophotometry sequentially with the CHOD-PAP method and the GPO-PAP method. Data were analyzed by One-way Anova followed by the Least Significant Difference test with a significance value of $p < 0.05$.

Results: The treatments of IF, CR, and the combination of IF-CR reduced TC levels by approximately 20%, 40%, and 70%, respectively, compared to the control group ($p < 0.05$), meanwhile TG levels decreased by approximately 20%, 40%, and 60%, respectively ($p < 0.05$). In contrast, the OF group exhibited a marked increase in serum TC and TG levels, reaching 30% and 80% higher than the control group, respectively ($p < 0.05$). The results of the correlation test showed a significant relationship between feed intake (AP) and body weight (BB), KT, and TG with a positive correlation direction ($p < 0.05$). The level of closeness of the relationship was very strong between AP-BB, KT-TG, and AP-TG respectively $r = 0.902$, $r = 0.911$ $r = 0.957$, and strong for the relationship between AP-KT, BB-KT, and BB-TG respectively $r = 0.877$ $r = 0.822$ $r = 0.820$.

Conclusion: Regulation in calorie intake affect serum levels of total cholesterol (TC) and triglycerides (TG). The combination of intermittent fasting (IF) and caloric restriction (CR) reduces TC and TG levels more effectively than either IF or CR alone. Conversely, overfeeding (OF) increases serum levels of TC and TG.

Keywords: *caloric restriction; intermittent fasting; overfeeding; total cholesterol; triglycerides.*

BAB I

PENDAHULUAN

1.1 Latar Belakang

Hiperlipidemia merupakan salah satu faktor risiko terjadinya penyakit kardiovaskular. Hiperlipidemia adalah gangguan metabolisme lipid yang ditandai peningkatan kadar kolesterol total (KT), trigliserida (TG), dan low-density lipoprotein (LDL) serum (Stewart et al., 2020). Berdasarkan data WHO tahun 2008, prevalensi global hiperlipidemia meningkat pada orang dewasa yaitu 37% untuk pria dan 40% untuk wanita, sementara di Indonesia prevalensi hiperlipidemia pada pria sebesar 32,8% dan pada wanita sebesar 37,2% (WHO, 2011). Asupan kalori yang berlebihan atau *overfeeding* (OF) dapat menjadi pemicu terjadinya hiperlipidemia (Stone, 1994). Menurut data statistik dunia, terdapat 9,4 juta kematian setiap tahun yang disebabkan penyakit kardiovaskuler akibat komplikasi dari hiperlipidemia (Ghani & Novriani, 2016).

Gangguan metabolisme lipid berkontribusi terhadap peningkatan resiko penyakit kardiovaskular. Hiperlipidemia menimbulkan komplikasi kardiovaskuler seperti aterosklerosis, stroke, dan penyakit jantung koroner yang merupakan penyebab utama kematian (Ghani & Novriani, 2016; Stewart et al., 2020). Peningkatan kadar LDL kolesterol yang teroksidasi berperan dalam pembentukan sel busa dan proses inflamasi (Agustina et al., 2023). Penumpukan sel busa dan plak aterosklerosis menimbulkan penyumbatan arteri dan gangguan aliran darah (Agustina et al., 2023). Penurunan pasokan darah pada arteri koronaria menyebabkan penyakit jantung koroner, sedangkan pada arteri karotis akan memicu stroke (Alloubani et al., 2020; Santosa & Baharuddin, 2020). Salah satu

upaya untuk pencegahan hiperlipidemia dan komplikasinya adalah dengan pengaturan asupan makanan dalam tubuh.

Salah satu metode pengaturan asupan makanan atau kalori adalah *intermittent fasting* (IF). Metode IF adalah pengaturan pola makan normal diselingi dengan periode puasa pada waktu yang ditentukan (Templeman et al., 2018). IF dibagi menjadi *alternative day fasting (ADF)* dan *time-restricted feeding (TRF)* (Malinowski et al., 2019). ADF terdiri dari hari puasa dan hari makan dengan mengacu pada hitungan hari dalam seminggu, sedangkan TRF berfokus pada pola makan yang terbatas dalam jangka waktu tertentu dalam satu hari (Dong et al., 2020; Malinowski et al., 2019). TRF dapat dilakukan dengan cara berpuasa selama 16 jam serta waktu makan normal 8 jam seperti yang diterapkan oleh umat muslim pada saat puasa ramadhan (Tsitsou et al., 2022). TG di jaringan adiposa akan dipecah pada saat glikogen di hepatosit habis setelah 12-34 jam puasa (Wang & Wu, 2022). Pada penelitian sebelumnya menunjukkan bahwa IF mampu menurunkan kadar TG darah sebesar 11%, namun kadar kolesterol total tidak mengalami penurunan yang bermakna (Ibrahim et al., 2009). Penurunan kadar KT dapat dilakukan dengan pembatasan jumlah intake makanan.

Restriksi kalori (RK) atau pembatasan jumlah asupan kalori merupakan terapi non farmakologi untuk memperbaiki metabolisme lipid dalam tubuh. RK adalah pengurangan jumlah kalori dari makanan yang masuk tanpa membuat malnutrisi (Kökten et al., 2021). RK dianggap efektif dalam mencegah penyakit degeneratif seperti hiperlipidemia dengan cara memperbaiki profil lipid dalam tubuh (Brzek et al., 2016; Chen et al., 2014). RK menurunkan ketersediaan bahan baku yang diperlukan untuk sintesis TG dan kolesterol di hati sehingga mengurangi

produksi kedua senyawa tersebut (Parry & Hodson, 2017). RK dapat menurunkan kadar KT sekitar 7,3% dan kadar TG kurang lebih 20% (Huffman et al., 2022).

Pembatasan asupan kalori dapat memperbaiki metabolisme lemak. *IF* dan RK digunakan untuk mengurangi kondisi hiperlipidemia dengan menurunkan TG dan KT. Kombinasi antara *IF* dan RK diharapkan mampu menurunkan kadar lemak jenuh lebih kuat dibandingkan tanpa kombinasi. Metode kombinasi *IF* dan RK diprediksi mampu menangani kasus hiperlipidemia berat atau individu yang tidak berespon dengan metode tunggal. Hingga kini penelitian tentang kombinasi *intermittent fasting* dan restriksi kalori terhadap individu normal belum banyak dilakukan dan data yang diperoleh belum lengkap. Sehingga penelitian tentang pengaruh variasi asupan kalori terhadap kadar kolesterol total dan trigliserida perlu dilakukan.

1.2 Rumusan Masalah Penelitian

1.2.1 Rumusan Masalah Umum

Adapun permasalahan umum yang ingin diangkat pada penelitian ini adalah: Apakah pengaturan asupan kalori mempengaruhi kadar kolesterol total dan trigliserida serum tikus wistar jantan?

1.2.2 Rumusan Masalah Khusus

Adapun permasalahan khusus yang ingin diangkat pada penelitian ini adalah:

1. Apakah *intermittent fasting* menurunkan kadar kolesterol total dan trigliserida serum tikus wistar jantan ?
2. Apakah restriksi kalori menurunkan kadar kolesterol total dan trigliserida serum tikus wistar jantan ?

3. Apakah kombinasi restriksi kalori dan *intermittent fasting* menurunkan kadar kolesterol total dan trigliserida serum tikus wistar jantan ?
4. Apakah asupan kalori berlebih meningkatkan kadar kolesterol total dan trigliserida serum tikus wistar jantan ?

1.3 Tujuan Penelitian

1.3.1 Tujuan Penelitian Umum

Adapun tujuan umum yang ingin dicapai dari penelitian ini adalah:
Membuktikan pengaruh pengaturan asupan kalori terhadap kadar kolesterol total dan trigliserida serum tikus wistar jantan.

1.3.2 Tujuan Penelitian Khusus

- Adapun tujuan khusus yang ingin dicapai dari penelitian ini antara lain:
1. Membuktikan pengaruh *intermittent fasting* terhadap penurunan kadar kolesterol total dan trigliserida serum tikus wistar jantan.
 2. Membuktikan pengaruh restriksi kalori terhadap penurunan kadar kolesterol total dan trigliserida serum tikus wistar jantan.
 3. Membuktikan pengaruh kombinasi restriksi kalori dan *intermittent fasting* terhadap penurunan kadar kolesterol total dan trigliserida serum tikus wistar jantan.
 4. Membuktikan pengaruh *overfeeding* terhadap peningkatan kadar kolesterol total dan trigliserida serum tikus wistar jantan

1.4 Manfaat

1.4.1 Manfaat Teori

Hasil penelitian ini diharapkan menjadi suatu landasan teori tentang pengaruh pembatasan asupan kalori terhadap perbaikan metabolisme lemak khususnya kadar kolesterol total dan trigliserida serum yang nantinya dapat menjadi dasar pengetahuan terkait pencegahan hiperlipidemia serta pengaruh perlakuan *overfeeding* terhadap kadar kolesterol total dan trigliserida yang nantinya bisa menjadi dasar pengetahuan terkait resiko terjadinya hiperlipidemia dan komplikasinya.

1.4.2 Manfaat Praktis

Hasil penelitian ini diharapkan menjadi suatu acuan bagi tenaga kesehatan dalam mengedukasi masyarakat terkait penerapan pembatasan asupan kalori terhadap pencegahan hiperlipidemia dan obesitas serta penerapan *overfeeding* sebagai faktor resiko terjadinya hiperlipidemia dan obesitas.



BAB VII

KESIMPULAN DAN SARAN

7.1 Kesimpulan

Dengan mempertimbangkan penelitian yang sudah dilaksanakan, dapat disimpulkan bahwa

1. Perlakuan *IF*, *RK*, dan kombinasi *IF-RK* menurunkan kadar *KT* dan *TG* serum pada tikus *Wistar* Jantan, dimana perlakuan kombinasi *IF-RK* lebih kuat menurunkan *KT* dan *TG* dibandingkan *IF* atau *RK*.
2. Perlakuan *OF* meningkatkan kadar *KT* dan *TG* serum tikus *Wistar* Jantan.
3. Perlakuan *IF* lebih disarankan pada individu sehat sebagai upaya pencegahan hiperlipidemia.

7.2 Saran

Berdasarkan hasil penelitian ini, perlu dilakukan

1. Melakukan penelitian lebih lanjut kepada individu yang beresiko seperti obesitas dan hiperlipidemia.
2. Melakukan pengukuran *blood gas analysis* untuk mencegah terjadinya ketoasidosis akibat dari pembatasan asupan kalori.

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