Efek Latihan Fisik Interval Intensitas Tinggi Terhadap Stres Oksidatif dan Jalur Inflamasi Pada Dinding Aorta Tikus Hiperglikemia Akibat Induksi Streptozotocin = Effect of High Intensity Interval Training on Oxidative Stres and Inflammatory Pathway in Aortic Wall of Streptozotocin-Induced Hyperglycemic Rat

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Abstrak

Diabetes mellitus (DM) adalah gangguan metabolisme yang ditandai oleh kondisi hiperglikemia kronik, yang dapat menimbulkan komplikasi ke berbagai jaringan, termasuk pembuluh darah. Latihan fisik sudah terbukti memberikan pengaruh positif pada DM melalui penekanan stres oksidatif dan inflamasi. Pada penelitian ini, ingin dilihat perbedaan efek latihan fisik interval intensitas tinggi (HIIT) dan latihan fisik kontinu intensitas sedang (MICT) terhadap stres oksidatif dan inflamasi aorta pada kondisi DM. Dua puluh empat ekor tikus wistar usia 8 minggu dibagi kedalam 4 kelompok, kontrol tanpa intevensi latihan fisik (K), kontrol hiperglikemia tanpa perlakuan (HG), hiperglikemia dengan intervensi MICT (CT), dan hiperglikemia dengan intervensi HIIT (HIIT). Hiperglikemia diinduksi dengan injeksi intraperitoneal streptozotocin dosis tunggal (40mg/BB). Hiperglikemia ditetapkan jika kadar glukosa darah 72 jam pasca injeksi >200mg/dL. Setelah 6 minggu latihan, dilakukan dekapitasi tikus, dan jaringan aorta diambil untuk dilakukan pengukuran parameter stres oksidatif dan inflamasi. Kadar MDA diukur dengan colorimetric assay kit menggunakan modifikasi metode uji asam tiobarbiturat (TBA), ekspresi SOD dikukur dengan colorimetric assay kit menggunakan prinsip WST-1, kadar TNF- diukur menggunakan teknik ELISA, ekspresi NF-kB dan MCP-1diukur menggunakan teknik qrt-PCR. Seluruh data yang diperoleh dianalisis menggunakan uji Kruskal Wallis. Hasil pengukuran memperlihatkan kadar MDA lebih rendah ($p<0,05$) antara kelompok HG dan kelompok HIIT ($p<0,05$), namun tidak terdapat perbedaan aktivitas SOD antar kelompok. Kadar TNF-a dan ekspresi NF-kB lebih rendah pada kelompok CT dan HIIT dibandingkan kelompok HG ($p<0,05$). Tidak terdapat perbedaan ekspresi MCP-1 antar kelompok. Dapat disimpulkan bahwa pada kondisi hiperglikemia, baik MICT dan HIIT memberikan efek positif yang sama pada jalur inflamasi, namun HIIT lebih mampu menekan kondisi stres oksidatif dibandingkan MICT.
.....Diabetes mellitus (DM) is a metabolic disorder characterized by chronic hyperglycemia, which can cause complications to various tissues, including blood vessels. Physical exercise has been shown to have a positive effect on DM by suppressing oxidative stres and inflammation. The objective of this study is to analyze the differences in the effects of high-intensity interval training (HIIT) and moderate-intensity continuous training (MICT) on oxidative stres and aortic inflammation in DM conditions. Twenty-four Wistar rats aged 8 weeks were divided into 4 groups, control without streptozotocin injection and exercise intervention (K), hyperglycemia without treatment (HG), hyperglycemia with MICT intervention (CT), and hyperglycemia with HIIT intervention (HIIT). Hyperglycemia was induced using intraperitoneal injection of single doze (40mg/BW) streptozotocin. Hyperglycemia was determined if blood glucose level 72 hours post injection achieved >200mg/dL. After 6 weeks of exercise, the rats were decapitated, and the aortic tissue was taken for measurement of oxidative stres and inflammation parameters. MDA levels were measured using a colorimetric assay kit using a modified thiobarbituric acid (TBA) test method, SOD expression was

measured using a colorimetric assay kit using the WST-1 principle, TNF-a levels were measured using an ELISA technique, NF-kB and MCP-1 expressions were measured using qrt-PCR technique. All data obtained were analyzed using the Kruskal Wallis test. The measurement results showed lower MDA levels ($p<0.05$) between the HG and the HIIT group ($p<0.05$), but there was no difference in SOD activity between groups. TNF-a levels and NF-kB expression were lower in the CT and HIIT groups than in the HG group ($p<0.05$). There was no difference in MCP-1 expression between groups. It can be concluded that under hyperglycemic conditions, both MICT and HIIT have the same effect to hinder inflammation, but HIIT is more capable of suppressing oxidative stres conditions than MICT.