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ORIGINAL ARTICLE

Effects of 10 weeks of high intensity interval training and green tea supplementation on serum levels of Sirtuin-1 and peroxisome proliferator-activated receptor gamma co-activator 1-alpha in overweight women

Effet de 10 semaines d'exercice intermittent à haute intensité et d'une supplémentation en thé vert sur les concentrations circulantes de Sirtuin-1 et de PGC-1 α chez des femmes en surpoids

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KEYWORDS

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Summary

Objectives. – This study aims to determine the effects of 10 weeks of high intensity interval training besides green tea supplementation on Sirtuin-1 (SIRT1) and Peroxisome Proliferator-Activated Receptor Gamma Co-activator 1-Alpha (PGC-1 α) in overweight women.

Patients and methods. – Thirty non-athlete overweight females were randomly assigned into 3 consistent and equal groups including high intensity interval training plus supplement group, high intensity interval training plus placebo, and supplementary group. The training program included 3 sessions of high intensity interval training performed per week for 10 weeks with the intensity of 85–95% HR max. The groups consuming green tea consumed 3 tablets of 500 mg after each main meal for 10 weeks. Venous blood samples at pretest and post-test was used for measuring SIRT1 and PGC-1 α . Body mass index, fat percentage, waist-to-hip ratio, and the weight of the participants were assessed before and after intervention.

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Results. – The findings showed that 10 weeks of high intensity interval training and green tea supplementation increased levels of SIRT1 (0.23 ± 0.09 to 0.46 ± 0.14) ($P=0.0001$) and PGC-1 α (18.81 ± 3.57 to 40.68 ± 7.74) ($P=0.0001$). Further, the regimen decreased weight (70.56 ± 6.19 to 65.38 ± 6.27) ($P=0.0001$), body fat percentage (34.12 ± 1.80 to 27.12 ± 1.45) ($P=0.0001$) and body mass index (27.15 ± 1.47 to 25.31 ± 1.24) ($P=0.001$). These differences were more meaningfully pronounced in the high intensity interval training plus green tea supplement group than the other two groups ($P=0.001$).

Conclusion. – Based on the findings, it can be concluded that the supplementation of green tea with high intensity interval training can significantly reduce weight, body mass index, and undesirable effects of obesity and overweight by increasing the levels of SIRT1 and PGC-1 α .

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MOTS CLÉS

HIIT ;
Catéchines ;
SIRT1 ;
PGC-1 α

Résumé

Objectifs. – Le but de la présente recherche est de déterminer l'effet de 10 semaines d'exercice intermittent de haute intensité (*high intensity interval training* [HIIT]) avec ou non supplémentation en thé vert sur les niveaux circulants de sirtuine-1 (SIRT1) et de *peroxisome proliferator-activated activateur co-receptor gamma 1-alpha* (PGC-1 α) chez des femmes en surcharge pondérale.

Patients et méthodes. – Trente femmes sédentaires en surcharge pondérale ont été réparties de façon randomisée en 3 groupes appariés, le groupe réalisant l'HIIT et prenant la supplémentation, le groupe placebo et le groupe prenant seulement la supplémentation. Le programme d'entraînement comprenait 3 séances par semaine sur une durée de 10 semaines, à une intensité de 85–95 % de la fréquence cardiaque maximale. Les groupes supplémentés en thé vert ont consommé, chaque jour, 3 comprimés de 500 milligrammes après chaque repas principal, pendant 10 semaines. Des prélèvements sanguins, pour mesurer SIRT1 et PGC-1 α , ont été réalisés avant le protocole et à l'issue de celui-ci. L'index de masse corporelle (IMC), le pourcentage de masse grasse, le rapport taille sur hanches et le poids total des femmes suivant ce protocole ont été mesurés avant et après le protocole.

Résultats. – Dix semaines d'HIIT avec supplémentation en thé vert entraînent une augmentation des concentrations de SIRT1 (de $0,23 \pm 0,09$ à $0,46 \pm 0,14$; $p=0,0001$) et de PGC-1 α (de $18,81 \pm 3,57$ à $40,68 \pm 7,74$; $p=0,0001$), une diminution significative du poids (de $70,56 \pm 6,19$ à $65,38 \pm 6,27$; $p=0,0001$), du pourcentage de masse grasse (de $34,12 \pm 1,80$ à $27,12 \pm 1,45$; $p=0,0001$) et de l'IMC (de $27,15 \pm 1,47$ à $25,31 \pm 1,24$; $p=0,001$). Ces différences sont plus importantes dans le groupe HIIT+supplémentation que dans les deux autres groupes.

Conclusion. – Ces résultats montrent qu'une supplémentation en thé vert associée à un HIIT détermine une augmentation des concentrations de SIRT1 et de PGC-1 α , associées à une diminution significative du poids, du pourcentage de masse grasse, de l'IMC, et des effets délétères de l'obésité et du surpoids.

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1. Introduction

Aging and inactive lifestyle are associated with higher risks of obesity and overweight that can cause several diseases. Identification of biomarkers helps clinicians control and treats these diseases [1]. Among the important factors involved in controlling metabolic disorders and preventing obesity are Sirtuin-1 (SIRT1) and Peroxisome Proliferator-Activated Receptor Gamma Co-activator 1-Alpha (PGC-1 α) [2]. One of the most potential approaches to identify protein markers for a disease is by analyzing human body fluid (e.g. blood, urine, saliva) proteome. Human serum proteins originate from different tissues and enter the circulation as a result of secretion and leakage. Concentration of these proteins reflects human physiological or pathological state as suggested by several earlier reports [3]. In some cases, it has been shown that serum levels of SIRT1 are associated with changes in SIRT1 expression in skeletal muscle biopsies [4].

Numerous studies have examined the mechanism of action of SIRT1 and PGC-1 α in animal tissue. Evidently however, the results of these studies are not applicable to humans. Both for this reason and because of moral constraints on human biopsy method, some studies have measured SIRT1 protein content in the serum and body fluids, including studies by Zheng et al. [5], Venkatasubramanian et al. [6], and Kumar et al. [3]. Furthermore, some researchers believe that SIRT1 levels in the blood can be a sign of changes in tissue [3,4]. As for this, these indicators were measured in the blood in the current study.

SIRT1, which is from the family of protein deacetylase, is considered a basic protein for homeostasis control [7]. SIRT1 controls inhibiting fat synthesis by regulating key genes related to metabolism such as PGC-1 α and thereby prevents the risk of obesity and related diseases such as metabolic syndrome and cardiovascular disease [7,8]. PGC-1 α is a key regulator of gluconeogenesis and fatty acids oxidation [8,9]

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