PADUA DAYS ON MUSCLE AND MOBILITY MEDICINE 2026

International Conference

March 3rd to 6th Euganean Thermae and Padua, Italy

SIGNIFICANT DECREASE OF ADIPONECTIN PLASMATIC LEVELS FOLLOWING TWO DIFFERENT PROGRAMS OF RESISTANCE TRAINING IN HEALTHY AND WELL-TRAINED YOUNG ADULTS

Eleonora Martegani,[1|2], Luigi Marano[1|2], Sara Missaglia[1|2], Aurora Daniele[3|4], Marta Mallardo[4|5], Ersilia Nigro[4|6], Ferdinando Cereda[7], Daniela Tavian[1|2]

[1]Laboratory of Cellular Biochemistry and Molecular Biology, CRIBENS, Università Cattolica del Sacro Cuore, Milan, Italy; [2]Department of Psychology, Università Cattolica del Sacro Cuore, Milan, Italy; [3]Dipartimento di Medicina Molecolare e Biotecnologie Mediche, Università degli Studi di Napoli "Federico II" , Napoli, Italy; [4]CEINGE Biotecnologie Avanzate "Franco Salvatore" Scarl, Napoli, Italy; [5]Department of Education and Sport Sciences Università telematica Pegaso Napoli, Italy; [6]Dipartimento di Scienze e Tecnologie Ambientali, Biologiche, Farmaceutiche, Università della Campania "Luigi Vanvitelli", Caserta, Italy; [7]Department of Education, Catholic University of Sacred Heart, Milan, Italy.

Adiponectin is a hormone secreted by adipose tissue that exerts a pleiotropic effect on many tissues and organs, including skeletal muscles, bones, liver, and brain, regulating energy balance, insulin sensitivity, and inflammation processes (1,2). This adipokine is secreted into circulation in three different oligomeric forms: trimers, hexamers, and high-molecular-weight (HMW) oligomers. The HMW form is the most active in the regulation of body weight and energy balance (3). Adiponectin plays a key role in metabolic adaptation induced by physical exercise (4,5). While its regulation after aerobic exercise has been widely investigated, less is known about its short-term modulation after strength training in healthy subjects. In this study, nine resistance-trained young men have been enrolled to perform two different sessions of total-body resistance exercises. The first training session (ETS1) was characterized by high time under tension TUT (5-1-2-1 cadence, to failure), emphasizing the eccentric phase of the movement, while the second (ETS2) had moderate TUT (2-1-2-1 cadence, two repetitions in reserve), representing a traditional submaximal resistance training protocol. Adiponectin concentration was assessed by ELISA in plasma and saliva samples collected before exercise (baseline), upon 15 minutes, 24 and 48 hours of both training sessions. Muscle soreness, plasma creatine kinase (CK) and a visual analog scale (VAS) were also measured. Plasma adiponectin decreased significantly following both training sessions of approximatively 15-20% upon 24h and reaching 25% of decrease 48 hours post-exercise ($P<0.001$). No significant difference of circulating adiponectin levels was detected between ETS1 and ETS2 sessions. Western blot analyses confirmed a decrease in plasma levels of adiponectin, especially HMW oligomers. Salivary adiponectin remained unchanged following both training sessions. Correlation analyses revealed an inverse association between adiponectin and CK during recovery period. Overall, the two sessions of strength training induced a transient and rapid reduction of circulating adiponectin, independent form exercise modality, suggesting an activation of adiponectin signaling determined by acute metabolic stress. This hormone may contribute to inflammatory response during the subsequent recovery phase to repair muscle damage. Moreover, the dissociation between plasma and salivary levels of adipokine indicates its complex regulation. These findings extend existing knowledge on adiponectin and its modulation upon strength training and its potential role in metabolic homeostasis.

Keywords: *Exercise metabolism, resistance training, plasma adiponectin, muscle damage.*

PADUA DAYS ON MUSCLE AND MOBILITY MEDICINE 2026

International Conference

March 3rd to 6th Euganean Thermae and Padua, Italy

PADUA DAYS ON MUSCLE AND MOBILITY MEDICINE 2026 ABSTRACT N. 071

EXERKINES AS MEDIATORS OF HEALTH BENEFITS INDUCED BY PHYSICAL EXERCISE

TIME COURSE OF PLASMA BRAIN-DERIVED NEUROTROPHIC FACTOR RELEASE FOLLOWING SINGLE AND MULTIPLE SESSIONS OF INTERVAL CYCLING IN HEALTHY MEN

Lorena Gullà,[1|2], Ester Tommasini[1|2], Sara Missaglia[1|2], Andrea Bosio[3], Paola Vago[1|2], Ermanno Rampinini[3|4], Daniela Tavian[1|2]

[1]Laboratory of Cellular Biochemistry and Molecular Biology, CRIBENS, Università Cattolica del Sacro Cuore, Milan, Italy; [2]Department of Psychology, Università Cattolica del Sacro Cuore, 20123 Milan, Italy; [3]Human Performance Laboratory, Mapei Sport Research Centre, Olgiate Olona, Varese, Italy; [4]Sport and Exercise Discipline Group, Human Performance Research Centre, Faculty of Health, University of Technology Sydney, Moore Park, NSW, Australia.

Brain-Derived Neurotrophic Factor (BDNF) is a key molecule regulating several cellular processes involved in the maintenance of normal brain function [1], including synaptic plasticity, neuroregeneration, and neuroprotection. Reduced levels of this neurotrophin have been associated with neurodegenerative, neurological, and cardiovascular diseases [2]. BDNF is expressed in neuronal cells, including glutamatergic neurons, glial cells, and microglia [1], as well as in non-neuronal tissue, such as heart, thymus, liver, spleen, skeletal muscle, in immune system cells and in platelets [2]. It has been demonstrated that physical exercise may enhance BDNF expression, promoting neurogenesis and improving brain function [1]. Circulating BDNF levels and cognitive function decline with age, therefore regular exercise may represent a non-pharmacological strategy to support cognitive health in aging [3]. Although the role of physical exercise in increasing BDNF levels has been recognized over the past two decades, and its kinetics have been studied after a single bout of exercise, no studies have investigated the time course of plasma BDNF release over multiple weeks of aerobic training. Therefore, the aim of the study was to investigate plasma BDNF release in response to an interval cycling training program, both after a single bout of exercise and following a 6-week training period (14 sessions). Nine non-sedentary male participants (age 39 ± 11 years, VO2 peak 50.6±5.8 mL•Kg-1•min-1) were recruited and completed a 6-week training protocol consisting of 4x5-min cycling at 60% peak power output (PPO) – as determined during an incremental test to exhaustion – interspersed with 3-min recovery at 40% PPO. Blood samples were collected at baseline and at three time points – 15 minutes, 24 hours and 48 hours – after both the first training session (S1) and last session (S14). Plasma BDNF concentration was measured using an ELISA assay. A non-parametric Friedman test revealed no significant changes in BDNF levels after the first training session (S1). Following 14 training sessions (S14), BDNF levels significantly increased ($p < 0.001$) from baseline (1.8 ± 0.1 ng/mL), peaking 15 minutes post-exercise (3.2 ± 0.2 ng/mL) and remaining elevated at 48 hours (2.8 ± 0.1 ng/mL). Using the Wilcoxon test, no significant changes in baseline concentrations were observed when comparing the first (S1) and last sessions (S14). However, significant differences ($p < 0.05$) were found between S1 and S14 at 15 minutes (S1: 2.1± 0.1 vs. S14: 3.2 ± 0.2 ng/mL), 24 hours (S1: 2.4 ± 0.2 vs. S14: 2.8 ± 0.2 ng/mL), and 48 hours post-exercise (S1: 2.0 ± 0.2 vs. S14: 2.8 ± 0.1 ng/mL). Our findings show that several weeks of interval cycling training resulted in a greater BDNF release than a single bout of exercise. However, given the limited sample size and substantial inter-individual variability, further studies are required to confirm whether regular aerobic exercise, performed over time, can increase BDNF levels, which would position physical activity as a promising, low-cost, and accessible intervention to enhance cognitive performance [3].

Keywords: *plasma BDNF, aerobic exercise, interval cycling, kinetics, training.*

PADUA DAYS ON MUSCLE AND MOBILITY MEDICINE 2026

International Conference

March 3rd to 6th Euganean Thermae and Padua, Italy

PADUA DAYS ON MUSCLE AND MOBILITY MEDICINE 2026 ABSTRACT N. 072

EXERKINES AS MEDIATORS OF HEALTH BENEFITS INDUCED BY PHYSICAL EXERCISE

CIRCULATING ADIPONECTIN INCREASES IN HEALTHY INDIVIDUALS AFTER A CYCLING PROGRAM WITH NEUROMUSCULAR ELECTRICAL STIMULATION

Ester Tommasini[1|2], Eleonora Martegani[1|2], Sara Missaglia[1|2], Andrea Bosio[e], Ermanno Rampinini[3|4], Marta Mallardo[5|6], Aurora Daniele[5|7], Ersilia Nigro[5|8], Daniela Tavian[1|2]

[1]Laboratory of Cellular Biochemistry and Molecular Biology, CRIBENS, Università Cattolica del Sacro Cuore, Milan, Italy; [2]Department of Psychology, Università Cattolica del Sacro Cuore, Milan, Italy; [3]Human Performance Laboratory, Mapei Sport Research Centre, Olgiate Olona, Varese, Italy; [4]Sport and Exercise Discipline Group, Human Performance Research Centre, Faculty of Health, University of Technology Sydney, Moore Park, NSW, Australia; [5]CEINGE Biotecnologie Avanzate "Franco Salvatore" Scarl, Napoli, Italy; [6]Department of Education and Sport Sciences Università telematica Pegaso. Napoli, Italy; [7]Dipartimento di Medicina Molecolare e Biotecnologie Mediche, Università degli Studi di Napoli "Federico II", Napoli, Italy; [8]Dipartimento di Scienze e Tecnologie Ambientali, Biologiche, Farmaceutiche, Università della Campania "Luigi Vanvitelli", Caserta, Italy.

Physical activity is known to provide broad health benefits, including reducing the risk of metabolic syndrome, diabetes and obesity, and it is therefore recommended as a pillar of cardiovascular disease prevention (1). Exercise also modulates the secretion of metabolic hormones and adipokines, such as adiponectin. This hormone is mainly secreted from adipose tissue and contributes to energy homeostasis by stimulating fatty acid oxidation in skeletal muscle and by inhibiting hepatic glucose production (2). Although many studies have investigated adiponectin release following aerobic training (3-5), less is known about its modulation when neuromuscular electrical stimulation (NMES) is applied during exercise. In this study, we examined both acute and chronic responses of plasmatic adiponectin concentration following 6-week cycling program (14 sessions) with or without percutaneous NMES. Electrical stimulation was delivered by a novel technology of Adaptive Functional Electrical Stimulation Kinesitherapy (AFESK™) through the VIK8 device (AFESK™ technology, VIK8, VIKTOR S.r.l., Italy). Sixteen healthy, physically active males matched for V'O2peak and age were assigned to either a cycling group or an AFESK group. Both groups completed the same interval training: 4x5m intervals at 60% peak power output (PPO) (achieved during an incremental test to exhaustion) interspersed with 3m recovery at 40% PPO. In the AFESK group, the VIK8 device provided electrical stimulation synchronized with voluntary contraction of the targeted skeletal muscles on lower limbs. Blood samples were collected at baseline and 15 min, 24h and 48h after the first (S1) and the last (S14) training session. Plasma adiponectin levels were detected by ELISA assay. After S1, adiponectin significantly increased at 15 min in both groups (+8,6% in the cycling group; +9,6% in the AFESK group). In the AFESK group only, adiponectin levels remained elevated at 24h (+8,5% compared to baseline), returning to basal levels after 48h in both groups. After S14, adiponectin increased after 15 min and 24 h post-exercise in both groups; however, the AFESK group displayed a greater rise (up to 15%, $p<0.01$) compared to the cycling group (8,8%, $p<0.001$). These results suggest that adding electrical stimulation to cycling is associated with enhanced adiponectin release. No significant between-group differences in baseline adiponectin were observed before S1. However, after 13 training sessions, adiponectin at baseline was significantly higher in the AFESK group compared to the cycling group, probably indicating a training-induced adaptation in adipose tissue. Within the AFESK group, significant differences were also detected among the three time-points (baseline, 15 min, 24 h) when comparing S1 to S14, further supporting a chronic effect of repeated NMES-assisted training on adiponectin secretion. Overall, these data contribute to a deeper understanding of how integrating endurance exercise with NMES affects adipose tissue endocrine activity by increasing adiponectin secretion. Our findings also highlight a potential role for AFESK technology in optimizing metabolic health.

Keywords: *exercise, neuromuscular electrical stimulation, adiponectin release, endurance training.*

PADUA DAYS ON MUSCLE AND MOBILITY MEDICINE 2026

International Conference

March 3rd to 6th Euganean Thermae and Padua, Italy

EXERKINES AS MEDIATORS OF HEALTH BENEFITS INDUCED BY PHYSICAL EXERCISE

A NEUROMUSCULAR ELECTRICAL STIMULATION CYCLING PROGRAM BOOSTS THE CIRCULATING LEVELS OF BRAIN-DERIVED NEUROTROPHIC FACTOR IN HEALTHY SUBJECTS

Xhuljano Vukaj[1|2], Ester Tommasini[1|2], Sara Missaglia[1|2], Andrea Bosio[3], Paola Vago[1|2], Ermanno Rampinini[3|4], Daniela Tavian[1|2]

[1]Laboratory of Cellular Biochemistry and Molecular Biology, CRIBENS, Università Cattolica del Sacro Cuore, Milan, Italy; [2]Department of Psychology, Università Cattolica del Sacro Cuore, Milan, Italy; [3]Human Performance Laboratory, Mapei Sport Research Centre, Olgiate Olona, Varese, Italy; [4]Sport and Exercise Discipline Group, Human Performance Research Centre, Faculty of Health, University of Technology Sydney, Moore Park, NSW, Australia.

Physical activity and exercise are crucial modifiable factors that enhance cardiovascular, metabolic and brain health (1). Brain-Derived Neurotrophic Factor (BDNF) is a neurotrophin essential for neuroplasticity, regulating neuronal survival, synaptic function, learning, and memory. Considering the prevalent hypothesis that peripheral BDNF response to exercise is primarily correlated with voluntary muscle contraction (2), the current literature has also explored alternative methodologies, such as Neuromuscular Electrical Stimulation (NMES), to induce BDNF release in the absence of exercise (3). Only one study has previously investigated the interaction between exercise and NMES in BDNF response, primarily focusing on stimulating antagonistic muscles during cycling (4). The present study aimed to investigate the combined effect of NMES superimposed in synchrony with agonist muscle contraction during exercise on BDNF release. Nine active men participants (age 38.0±10.6 years, V'O2-peak 48.7 ±5.8 ml· kg-1 ·min-1) were recruited. A 6-week, 2-3 times per week (total of 14 appointments), interval training of 4x5-min at 60% peak power output (PPO) (achieved during an incremental test to exhaustion), interspersed with 3-min recovery at 40% PPO was performed. A novel technology, Adaptive Functional Electrical Stimulation Kinesitherapy (AFESK™), delivered through the VIK8 device (AFESK™ technology, VIK8, VIKTOR S.r.l., Italy), was adopted to trigger NMES in synchrony with voluntary contraction of the lower limb muscles during all the training sessions. Plasma BDNF levels, detected by ELISA assay Kit, were evaluated before (baseline) and after 15 min, 24h, 48h, the first (S1) and the last training session (S14). Non-parametric Friedman test and the Wilcoxon test were used for statistical analyses. Data are presented as mean ± standard deviation. At S1, no significant changes in plasma BDNF levels were observed for any time points. At S14 plasma BDNF levels showed a greater response at 15 min compared to baseline (4.08 ±0.27 and 2.80 ±0.010 ng/ml, respectively; $p<0.001$), compared to 24h (4.08 ±0.27 and 2.75 ±0.12 ng/ml, respectively; $p<0.001$), and compared to 48h (4.08 ±0.27 and 2.77 ± 0.13 ng/ml, respectively; $p<0.001$). After the 6 weeks of training, comparing S1 with S14, plasma BDNF levels showed a higher response at the baseline (S1: 1.95 ±0.07, S14: 2.81 ±0.10 ng/ml; $p<0.05$) and at 15 min (S1: 2.62±0.08, S14: 4.08 ± 0.27 ng/ml; $p<0.05$). No significant changes were observed for the other time points. The results showed that chronic exercise with AFESK™ in synchrony with voluntary muscle contraction during cycling can significantly increase the baseline plasma BDNF levels, suggesting a favorable long-term adaptation. Moreover, it can also increase the transient plasma BDNF response after 15 min from exercise, before returning to the baseline level. This observation suggests that combining cycle exercise with NMES of the agonist muscles may be an effective approach in promoting BDNF release. However, due to the small sample size and the high interindividual variability, more studies are needed to validate these preliminary findings and to fully elucidate the BDNF response in this context.

Keywords: *BDNF, Adaptive Functional Electrical Stimulation, Kinesitherapy (AFESK), exercise, cycling.*

PADUA DAYS ON MUSCLE AND MOBILITY MEDICINE 2026

International Conference

March 3rd to 6th Euganean Thermae and Padua, Italy

EXERKINES AS MEDIATORS OF HEALTH BENEFITS INDUCED BY PHYSICAL EXERCISE

ASSESSING HEALTH OUTCOMES IN MULTIDISCIPLINARY INTERVENTIONS THROUGH NON-INVASIVE PHYSIOLOGICAL BIOMARKERS: LINKING BIOLOGICAL MEASURES WITH PSYCHOLOGICAL WELL-BEING

Denise Vagnini[1|2], Daniela Tavian[1|3], Sara Missaglia[1|3], Emanuela Saita[1|2]

[1]Department of Psychology, Università Cattolica del Sacro Cuore, Milan, Italy; [2]Research Unit of Psychology of Inequalities in Health, Università Cattolica del Sacro Cuore, Milan, Italy; [3]Laboratory of Cellular Biochemistry and Molecular Biology, CRIBENS, Università Cattolica del Sacro Cuore, Milan, Italy.

The biopsychosocial model increasingly conceptualizes emotional processes as the outcome of dynamic interactions among psychological, relational, and physiological factors. Previous research has shown that physiological patterns, such as muscle tension, skin conductance, and peripheral temperature, can inform assessments of quality of life and overall health status of individuals exposed to different type of stressors or events. Psycho-neuro-endocrinology, which examines the interplay among the mind, brain, and endocrine system, offers a particularly promising integrative framework. In this context, the discovery and early investigations of irisin, a hormone produced by muscles during physical activity, have begun to highlight its positive effects on the health of physically active individuals, both in healthy populations and in those undergoing treatment or rehabilitation for various chronic diseases. Irisin has been shown to support metabolism, bone and muscle health, and holds potential therapeutic implications for the management of diabetes and obesity, as well as a protective role against carcinogenesis.(1) However, evidence remains limited regarding: A) the methodologies for collecting irisin and the associated challenges or concerns experienced by participants, and B) the potential relationship between irisin levels and psychological well-being across populations with diverse health conditions.(2,3) Investigating these correlations within multidisciplinary interventions requires careful reflection on ethical and methodological issues, particularly those arising from invasive or non-invasive procedures for sampling physiological biomarkers. We evaluated whether non-invasive salivary sampling (vs. invasive blood sampling) can effectively measure health-related irisin, potentially reducing participant burden while maintaining measurement validity. To our knowledge, no prior research has specifically explored this approach. This multidisciplinary cross-sectional study consisted of two phases. In the first phase, blood and saliva samples were collected from a convenience sample of ten participants, and irisin concentrations were quantified in both matrices to compare their measurement characteristics. In the second phase, semi-structured interviews explored participants' lived experiences of both sampling procedures and their preferred method, focusing specifically on subjective accounts. A Thematic Analysis was conducted to identify recurrent themes within the interview data, a widely used qualitative approach that enables a rich understanding of participants' experiences and captures subjective and relational dimensions.(4) Qualitative analysis identified three main themes: a) perceived cost-benefit of study participation, b) personal responsibility associated with the type of biological sampling, and c) engagement in scientific research, reflecting a sense of contribution to the broader social community, particularly during periods of personal challenge. In summary, the presence of a responsible professional overseeing the correct collection of biological samples was identified as the most important factor during the sampling procedure. Moreover, considering the quality of the biological data obtained, salivary sampling appears to be a valid alternative to serum-based measurements.(2,5) Finally, from a practical perspective, salivary sampling is less costly. Understanding the effectiveness and acceptability of different biological sampling methods can help researchers design less invasive and ethically sound procedures that maintain measurement validity while minimizing participants' burden and sampling costs. Such approaches may improve both the collection of physiological data and participants' psychological well-being in multidisciplinary interventions.

Keywords: *Chronic diseases, multidisciplinary intervention, salivary irisin, rehabilitation, psychophysical well-being.*