

FEATURE ARTICLE

POLYPHENOLS & EXERCISE:

A SPOTLIGHT ON OLIVE DERIVED HYDROXYTYROSOL AND PHYSICAL ACTIVITY

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ABOUT POLYPHENOLS

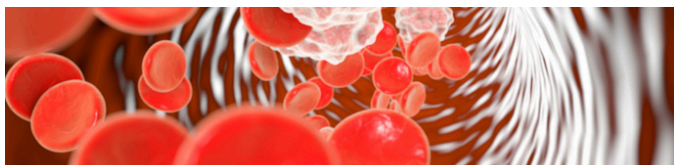
POLYPHENOLS

The term polyphenol is fortunately becoming increasingly well understood in both a sporting and general context. Their role in the governance of human health renders them an indispensable component of our diet that must not be overlooked. Acting as an antioxidant [1], regulating metabolism, body weight, chronic disease and cell proliferation [2] their anti-inflammatory and immunomodulatory effects may be pertinent to exercise, training, performance and recovery.



BRIEF OVERVIEW OF THE MECHANISMS INVOLVED

Free radicals and reactive oxygen species are the primary oxidising agents produced in different cellular biomechanical reactions (e.g., mitochondria for aerobic oxygen production) [3]. The increased oxygen supply required by skeletal muscle amid exercise results in a heightened production of free radicals. Consequently, with the increased production of reactive oxygen species, an imbalance between oxidants and antioxidants [4] induces oxidative damage, or in an exercise setting, exercise induced muscle damage, leading to delayed onset muscle soreness (DOMs). Importantly however, due to the rapid absorption of most polyphenols at a gut level and limited vigorous bioavailability research, it is currently unclear if an appropriate amount of a phenolic compound (or its secondary metabolites) reaches the tissue to therefore impact oxidative damage.



THE ANTI-INFLAMMATORY IMPACT OF POLYPHENOLS SURROUNDING EXERCISE



An inflammatory response occurs in severe perturbations of homeostasis [5]. As a protective response, inflammation is comprised of four phases: inducing (tissue damage or infection), sensing (macrophages), mediating (cytokines) and effecting (tissues) [6]. Dependent upon athlete ability, exercise type, intensity and duration, exercise bouts can initiate a cascade of inflammatory events [7]. Interactions, primarily between immune cells and cytokines, create an inflammatory milieu that is responsible for adaptation to exercise and subsequent recovery [8]. However, the excessive production of reactive oxygen species present from exercise may cause tissue injury, and/or a heightened inflammatory response [9].

The mechanisms responsible for polyphenols' antioxidant capacity have been attributed to the suppression of reactive oxygen species formation, scavenging of reactive oxygen species and the upregulation of antioxidant defences [10] ultimately exerting anti-inflammatory responses that accelerates recovery time and reducing muscle soreness. An excellent review by Rickards et al., 2021 identified that the addition of polyphenol rich food-based products (such as cocoa, tart cherry and beetroot juice) in days surrounding exercise and exercise induced muscle damage, accelerates the recovery of muscle function by up to 13% and reduces muscle soreness up to 29% [11]. Mechanisms surrounding pain reduction, DOMs and fatigue remain controversial due to their complex, multifactorial nature and specificity to exercise type [12]. However, two current theories being explored focus on reduced vasodilatory capacity [13] and impaired calcium handling and sensitivity [11], both consequences of the excessive generation of reactive oxygen species present in exercise.

HYDROXYTYROSOL, A NOVEL POLYPHENOL

Following the recent exposure of the blue zone study in mainstream media, a spotlight has been shone on certain dietary principles that may be pertinent to exercise performance and recovery, in particular, the Mediterranean diet. The discernible health benefits associated with the traditional Mediterranean diet, notorious for high phenolic intake [14], have been partly attributed to the consumption of olives and olive oil [15] and by extension one of the main polyphenols found in olives, hydroxytyrosol (HT). HT originates during the ripening and storage of olives and is abundant in the olive fruit (65.9mg·100g⁻¹ and 55.6mg·100g⁻¹ raw black and green respectively), extra virgin olive oil in the form of oleuropein (>0.77mg·100ml⁻¹) and in lower quantities, can be found in olive leaves and wine [16, 17].

Current scientific interest in this compound is compelling due its antioxidant activity [18, 19], efficient protection of vascular tissue [20] and ability to neutralise free radicals via hydrogen-donation [21]. Despite this, there is a paucity of scientific evidence pertaining to the impact of HT in an exercise setting. Initial investigation via a commercially available olive mill wastewater (OliPhenolia®) rich in HT, demonstrated evidence of therapeutic effects of an acute supplementation period on parameters of exercise performance.



OLIPHENOLIA: FORM, FUNCTION AND EVIDENCE

Fattoria La Violla is an organic and biodynamic farm in Tuscany, Italy. In 2010, La Violla established OliPhenolia® with the primary goal of enhancing the valuable substances present in the previously discarded polyphenol rich olive fruit water.



Each 25mL dose of OliPhenolia® contains >30mg of HT and 225mg of other bioavailable polyphenols (including HT metabolites) offering a potent, but more importantly natural, boost of HT. Novel research exploring HT has evidenced a positive upregulation of antioxidant defences [18] as well as effective modification of oxidative stress markers [22] that may prove pertinent to aerobic exercise performance. Recent research from our group explored the effect of OliPhenolia® on aerobic exercise, acute recovery and exercise induced oxidative stress. Interestingly, a 16-day supplementation (~56mL daily) improved running economy at low intensities and led to modest improvements in acute recovery [23]. Additionally, OliPhenolia® demonstrated modest antioxidant effects based on a reduction in superoxide dismutase activity post-exercise and at 24 h, and an increase in reduced glutathione immediately post-exercise compared with a placebo control [24]. As the first study of its kind, it has been suggested that that further investigation into alternate recovery periods (i.e., inflammatory and muscle soreness measures 1, 12, 24, and 48 h+ following damaging exercise) be undertaken to confirm initial findings and expand upon this important field of research.





PHYSICAL ACTIVITY

TRANSLATIONAL APPLICATIONS FOR PHYSICAL ACTIVITY

- 🔍 Polyphenols (including HT) are recognised as molecules with the ability to modulate pathways that regulate essential biological functions (e.g. ATP production and thermogenesis) [25], leading to an enhancement of mitochondrial function and cellular defences [26].
- 🔍 A lower respiratory exchange ratio (RER) and increase in lactate threshold has been demonstrated throughout exercise studies following HT supplementation [27, 28], correlating with a 4.7% increase in cycling time trial performance [28].
- 🔍 With the current knowledge surrounding bioavailability and metabolism of HT [29], an increase in olive derived HT via dietary sources, or a strategic supplementation method (~ 120mg·d⁻¹ for up to 6 weeks [30], or 200mg 30 minutes pre-exercise in addition to a daily dose [27]), may offer a targeted approach to limiting the negative impacts associated with excessive exercise induced oxidative stress, whilst supporting adaptive mechanisms to training that can elicit improvements in both exercise performance and recovery.

CLINICAL APPLICATION

APPLICATIONS FOR NUTRITION PRACTITIONERS

- 🔍 The emerging evidence pertaining to the potential therapeutic effects of HT in an exercise setting is promising and has been discussed, however from a nutritional therapist perspective practitioners should consider the following:
- 🔍 A strategic increase in HT via dietary sources, or a natural phytocomplex (OliPhenolia®), could offer an effective and accessible short-term strategy for people looking to engage in a lifestyle change and combat prevalent health issues such as osteoarthritis or obesity.
- 🔍 OliPhenolia® offers a natural and pragmatic approach to increasing daily dietary polyphenol intake.
- 🔍 Further research is required to continue developing knowledge surrounding the therapeutic effects associated with OliPhenolia®. Currently our group are investigating the impact acute and chronic supplementation may have on inflammatory biomarkers and functional movement. Due to the inherent link between oxidative stress and inflammation, it is anticipated the findings will provide an insight into additional areas pertinent to human health, i.e., metabolic disease such as Diabetes mellitus.
- 🔍 It is important that habitual polyphenol intake and current diet status are considered by a practitioner ahead of implementing any changes to the diet.



See pages 66-67 for references

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