

## Effects of Polygonum Cuspidatum Containing Resveratrol on Inflammation in Male Professional Basketball Players

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### ABSTRACT

**Background:** Exercise can lead to acute oxidative stress, which can result in oxidative damage and induce inflammation. Resveratrol may reduce the levels of inflammatory cytokines. Thus, we investigated the effects of this compound on the plasma levels of tumor necrosis factor- $\alpha$  (TNF- $\alpha$ ) and interleukin 6 (IL-6) in male professional basketball players.

**Methods:** Twenty healthy male professional basketball players were randomized into two groups (10 each). For 6 weeks, they received daily either 200 mg of polygonum cuspidatum extract (PCE) standardized to contain 20% trans-resveratrol equivalent to 40 mg trans-resveratrol or placebo. Indices of inflammation were measured before and after 6 weeks of supplementation.

**Results:** There was a significant reduction in plasma levels of TNF- $\alpha$  and IL-6 after 6 weeks of supplementation; while no change was observed in these markers in the control group.

**Conclusions:** Present study shows that 6 weeks of PCE containing resveratrol supplementation reduces the inflammation in male professional basketball players.

**Keywords:** Cytokines, interleukin-6, inflammation, polygonum cuspidatum, resveratrol, tumor necrosis factor- $\alpha$

### INTRODUCTION

It is now recognized that both acute aerobic and anaerobic exercise can cause to production of free radicals that lead to acute oxidative stress, which can result in oxidative damage and induce inflammation.<sup>[1]</sup>

Recent studies have demonstrated that there is a link between plasma concentration of inflammatory mediators and pathogenesis of insulin resistance, hypertension, obesity, and complications of diabetes such as retinopathy.<sup>[2,3]</sup> Furthermore, there are some evidences about the association of low-grade inflammation and cardiovascular risk.<sup>[4]</sup>

Resveratrol is a natural anti-oxidant polyphenol that is present in red wines, grapes, and roots of polygonum cuspidatum that has received noticeable attention in recent years.<sup>[5,6]</sup> This strong

polyphenolic compound has shown several biological functions such as anti-inflammatory and anti-oxidant.<sup>[7]</sup> It has been revealed to exert some health-enhancing properties like protection against cardiovascular disease and inhibition of cancer.<sup>[8]</sup>

So far, most studies about resveratrol have focused on animal models; however, there are some works shown the beneficial effects of this compound on human, however, its strong anti-inflammatory properties have not been investigated in professional athletes. Thus, we have hypothesized that the extracts of *Polygonum cuspidatum* containing resveratrol can reduce inflammation levels in male professional basketball players.

The aim of this study was to investigate the effects of *Polygonum cuspidatum* extract (PCE) containing resveratrol on inflammation in male professional basketball players.

## METHODS

Twenty healthy professional basketball players (aged 17-35 years) were randomized into two groups (10 each). For 6 weeks, they received either 200 mg of PCE standardized to contain 20% trans-resveratrol equivalent to 40 mg trans-resveratrol (Pure Encapsulations Inc., Sudbury, MA) or placebo daily. The subjects were instructed not to take any anti-oxidant supplements, and anti-inflammatory drugs during, and 2 weeks before the study. Exclusion criteria included the incidence of any diseases especially those that involve immune system.

Venous blood samples were collected after and 2 h of intensive endurance exercise between 6 and 7 pm at the baseline and after 6 weeks of treatment with resveratrol. Ethical approval from the Medical Ethics Committee of Tehran University of Medical Sciences was obtained and participants signed informed consent.

The serum levels of tumor necrosis factor- $\alpha$  (TNF- $\alpha$ ), and interleukin 6 (IL-6) were measured by enzyme immunometric assay kits using the kits of assay designs (Ann Arbor, MI).

Nutritionist 4 (First Data Bank, San Bruno, CA, USA) was used to perform nutrient calculations for 3d dietary records that obtained before and after the intervention. The statistical tests were conducted using SPSS (version 16; SPSS, Inc., Chicago, IL, USA). Data were represented as means and standard deviations.  $P < 0.05$  was considered as statistically significant.

## RESULTS

Twenty-four athletes were recruited but 20 of them completed the intervention for 6 weeks. Incidence of diseases and personal reasons were the main reasons of their withdrawal of the study. Baseline characteristics and some nutrients intake of participants are shown in Table 1. Mean (SD) plasma levels of TNF- $\alpha$  and IL-6 are seen in Table 2.

As Table 1 shows, there were no significant differences between the groups with regard to weight, body mass index and dietary intake. IL-6 and TNF- $\alpha$  decreased significantly in resveratrol group and there were significant differences between the two groups after intervention [Table 2].

## DISCUSSION

The present study, investigated the effect of PCE containing resveratrol on plasma level of TNF- $\alpha$ , and IL-6 in male professional basketball players.

In this randomized double-blind placebo-controlled clinical trial study, intake of PCE containing resveratrol for 6 weeks was demonstrated to reduce the plasma concentration of TNF- $\alpha$  and IL-6 significantly ( $P < 0.05$ ). These findings confirmed the results of previous studies of Bujanda *et al.*,<sup>[9]</sup> Ghanim *et al.*<sup>[10,11]</sup> in rats and healthy humans. In 2008, Bujanda *et al.* demonstrated that production of TNF- $\alpha$  decreased in rats treated with resveratrol.<sup>[9]</sup> Furthermore, this author proposed that anti-TNF- $\alpha$  effect of resveratrol could be related to decreasing liver damage in a model of liver steatosis. Ghanim *et al.* in 2010 found that intake of PCE containing resveratrol suppressed plasma concentration of TNF- $\alpha$ , IL-6, and C-reactive protein after 6 weeks in healthy humans while they did not observe any changes in these indices in the control group.<sup>[10]</sup> On the other hand, Ghanim *et al.* in 2011 have shown the anti-inflammatory effects of resveratrol and polyphenol preparation supplement in healthy humans.<sup>[11]</sup>

It is now recognized that both acute aerobic and anaerobic exercise can cause production of free radicals that lead to acute oxidative stress, which can result in oxidative damage and induces inflammation.<sup>[1]</sup> In addition, strenuous exercise can lead to sequential release of TNF- $\alpha$  and IL-6 in the blood that is comparable to that observed in relation to bacterial diseases.<sup>[12]</sup>

**Table 1:** Baseline characteristics and some nutrients intake throughout the study<sup>a</sup>

Variables	Group	Baseline	After intervention	P value <sup>b</sup>
Weight (kg)	Resveratrol	95.73±15.83	95.97±15.17	0.397
	Placebo	90.6±8.94	90.53±9	0.553
	P value <sup>c</sup>	0.38	0.447	
BMI	Resveratrol	25.25±3.22	25.33±3.06	0.387
	Placebo	26.88±5.51	26.86±5.46	0.38
	P value	0.43	0.315	
Energy (kcal)	Resveratrol	2492.6±354.28	2558.2±362.68	0.551
	Placebo	2564.5±340.71	2572.7±398.43	0.775
	P value	0.64	0.941	
Carbohydrate (g)	Resveratrol	308.06±88.5	321.48±86.96	0.6
	Placebo	312.07±57.9	309.54±65.87	0.752
	P value	0.9	0.701	
Protein (g)	Resveratrol	93.35±24.57	85.24±17.14	0.317
	Placebo	90.68±18.24	89.96±23.38	0.864
	P value	0.78	0.976	
Fat (g)	Resveratrol	101.06±17.12	111.66±17.66	0.537
	Placebo	105.01±16.37	113.07±16.3	0.48
	P value	0.19	0.279	
Vitamin C (mg)	Resveratrol	76.56±55.48	81.3±62.07	0.319
	Placebo	67.56±47.5	81.1±39.99	0.166
	P value	0.7	0.609	
Vitamin E (mg)	Resveratrol	28±3.75	28.41±4.22	0.525
	Placebo	25.78±3.18	26.2±3.3	0.099
	P value	0.17	0.189	
β-carotene (μg)	Resveratrol	408.91±509.51	414.1±508.98	0.402
	Placebo	325.01±522.07	201.85±306.03	0.347
	P value	0.8	0.14	
Zinc (mg)	Resveratrol	10.25±2.12	11.02±1.69	0.402
	Placebo	10.23±1.68	10.98±2.42	0.083
	P value	0.97	0.708	
Selenium (mg)	Resveratrol	0.05±0.02	0.05±0.01	0.469
	Placebo	0.04±0.02	0.05±0.02	0.313
	P value	0.28	0.604	
Fiber (mg)	Resveratrol	14.8±4	16.04±4.86	0.328
	Placebo	15.03±5.62	14.81±5.08	0.61
	P value	0.93	0.448	

<sup>a</sup>Data are presented as mean±standard deviation. BMI=Body mass index, <sup>b</sup>To test for statistical difference between the two study groups independent-samples *T* test was used. <sup>c</sup>To test for statistical difference between two intervals within a group paired-samples *T* test was used

One of the suggestive mechanisms for this effect includes down-regulation of inflammatory response via inhibition of production and release of pro-inflammatory markers by its suppressive effect on nuclear factor-κB or the activator protein.<sup>[13-15]</sup>

To our knowledge, this is the first study to investigate the effects of this supplement in male

professional basketball players; however, there were some limitations. The major limitation is that it has been conducted in a small number of professional athletes because of the limitation in accessing to them. Another one is the short length of the intervention. On the other hand, the blood level of resveratrol was not measured in this study.

**Table 2:** Tumor necrosis factor- $\alpha$  and interleukin-6 levels of participants during the study<sup>a</sup>

Variables	Group	Baseline	After intervention	P value <sup>c</sup>
TNF- $\alpha$ (pg/mL)	Resveratrol	9.73 $\pm$ 0.25	9.31 $\pm$ 0.2	0.001
	Placebo	9.78 $\pm$ 0.15	9.83 $\pm$ 0.25	0.322
	P value <sup>b</sup>	0.597	0.001	
IL-6 (pg/mL)	Resveratrol	75 $\pm$ 8.3	70.8 $\pm$ 7.27	0.001
	Placebo	79.5 $\pm$ 8.21	77.7 $\pm$ 7.79	0.179
	P value	0.239	0.048	

TNF- $\alpha$ =Tumor necrosis factor- $\alpha$ , IL-6=Interleukin-6.

<sup>a</sup>Data are presented as mean $\pm$ standard deviation. <sup>b</sup>To test for statistical difference between the two study groups independent-samples *T* test was used. <sup>c</sup>To test for statistical difference between two intervals within a group paired-samples *T* test was used

## CONCLUSIONS

In conclusion, this study indicates that PCE containing resveratrol has suppressive effects on some of immune system factors, including TNF- $\alpha$  and IL-6 plasma levels.

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## REFERENCES

- Cubriilo D, Djordjevic D, Zivkovic V, Djuric D, Blagojevic D, Spasic M, *et al.* Oxidative stress and nitrite dynamics under maximal load in elite athletes: Relation to sport type. *Mol Cell Biochem* 2011;355:273-9.
- Dandona P, Aljada A, Bandyopadhyay A. Inflammation: The link between insulin resistance, obesity and diabetes. *Trends Immunol* 2004;25:4-7.
- Vaziri ND, Rodríguez-Iturbe B. Mechanisms of disease: oxidative stress and inflammation in the pathogenesis of hypertension. *Nat Clin Pract Nephrol* 2006;2:582-93.
- Davi G, Falco A. Oxidant stress, inflammation and atherogenesis. *Lupus* 2005;14:760-4.
- Ikizler M, Ovali C, Dernek S, Erkasap N, Sevin B, Kaygisiz Z, *et al.* Protective effects of resveratrol in ischemia-reperfusion injury of skeletal muscle: A clinically relevant animal model for lower extremity ischemia. *Chin J Physiol* 2006;49:204-9.
- Murase T, Haramizu S, Ota N, Hase T. Suppression of the aging-associated decline in physical performance by a combination of resveratrol intake and habitual exercise in senescence-accelerated mice. *Biogerontology* 2009;10:423-34.
- Wang Y, Xu H, Fu Q, Ma R, Xiang J. Protective effect of resveratrol derived from *Polygonum cuspidatum* and its liposomal form on nigral cells in parkinsonian rats. *J Neurol Sci* 2011;304:29-34.
- Juan ME, Vinardell MP, Planas JM. The daily oral administration of high doses of trans-resveratrol to rats for 28 days is not harmful. *J Nutr* 2002;132:257-60.
- Bujanda L, Hijona E, Larzabal M, Beraza M, Aldazabal P, García-Urkiá N, *et al.* Resveratrol inhibits nonalcoholic fatty liver disease in rats. *BMC Gastroenterol* 2008;8:40.
- Ghanim H, Sia CL, Abuaysheh S, Korzeniewski K, Patnaik P, Marumganti A, *et al.* An anti-inflammatory and reactive oxygen species suppressive effects of an extract of *Polygonum cuspidatum* containing resveratrol. *J Clin Endocrinol Metab* 2010;95:e1-8.
- Ghanim H, Sia CL, Korzeniewski K, Lohano T, Abuaysheh S, Marumganti A, *et al.* A resveratrol and polyphenol preparation suppresses oxidative and inflammatory stress response to a high-fat, high-carbohydrate meal. *J Clin Endocrinol Metab* 2011;96:1409-14.
- Pedersen BK, Ostrowski K, Rohde T, Bruunsgaard H. The cytokine response to strenuous exercise. *Can J Physiol Pharmacol* 1998;76:505-11.
- De la Lastra CA, Villegas I. Resveratrol as an anti-inflammatory and anti-aging agent: Mechanisms and clinical implications. *Mol Nutr Food Res* 2005;49:405-30.
- Rahnama N. Preventing sport injuries: improving performance. *Int J Prev Med* 2012;3:143-4.
- Asgari SA, Mohammadi M. The role of intraprostatic inflammation in the acute urinary retention. *Int J Prev Med* 2011;2:28-31.

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