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Combined effect of beetroot, pineapple and turmeric cocktail on delayed onset muscular soreness (DOMS) in sports person: A randomized control trial

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Abstract

Purpose: Delayed onset of muscle soreness (DOMS) is one of the common conditions that is gaining popularity and attention among the fitness and rehabilitation experts. Various modalities ranging from supplementation, stretches, cryotherapy etc are proposed to deal with this condition. However, there are no substantial reports available on the effectiveness of these therapies over DOMS. The present study evaluates the role of beetroot, pineapple and turmeric cocktail on alleviating the inflammatory response and perceived pain in newly recruited sports students.

Methods: A total of 60 subjects were randomly recruited into experimental group (n=30) and control group (n=30) who received 200 ml of beetroot, pineapple and turmeric cocktail and neutral water respectively twice daily for 10 days. Assessments were done through C-reactive protein (CRP) and visual analog scale (VAS) score measured at the baseline and at the end of 10th day.

Results: A paired T-test has shown statistically significant change both in the experimental group and control group (P=0.00) when compared against pre and post values within the group. An independent T test return a significant change in the VAS scores (P=0.000), however the results are not significant in the CRP levels (P=0.05). However, the magnitude of the change measured by the mean value was more in the experimental group.

Conclusion: The results of the study indicate that combination of beetroot, pineapple and turmeric cocktail is beneficial in alleviating the symptoms of DOMS and may be used effectively in post-workout recovery programs. However large scale studies are warranted to generalize these results.

Keywords: DOMS, soreness, muscle injury, exercise, CRP, eccentric exercise

Introduction

The skeletal muscle Pain that follows novel eccentric exercise related to muscle structural damage, ion imbalance, inflammation and pain is termed as Delayed onset of muscle soreness or exercise induced muscle damage [1]. It is the most common form of musculoskeletal injury experienced by athletes and by those individuals who have been physically inactive for a longer period of time and abruptly begin with a large amount of physical activity [2]. The recovery of a sports related injury takes through three phases namely, inflammation, repair, and remodeling phase. Managing these phases with adequate nutrition shapes the outcomes of recovery to a greater extend [3].

As a physiological response to any sports injury the body produces free radicals, reactive oxygen species and other inflammatory molecules. When equilibrium between the free radicals and endogenous anti-oxidants are not established, it results in acute inflammation that may induce muscular symptoms like soreness, pain and hinder the process of recovery and wound healing if any. This warrants intake of dietary anti-oxidants that ensures early recovery [4, 5, 6]. Utilizing the phytonutrients from the natural components as an aid to treat DOMS will be an addition to the management spectrum of DOMS. Hence the present study explores the possibility of introducing a combination of beetroot, turmeric and pineapple in a cocktail form and assessing the effects of the same as an anti-inflammatory and analgesic agent. The results of this study can provide cost-effective natural remedy to improve muscle performance and alleviate the symptoms of DOMS that will facilitate early recovery in athletes.

Methods

Participants: 90 participant's aged between 18-30 years was screened considering the inclusion and exclusion criteria. 60 of them meeting the criteria were recruited for the study. The detailed demographic details are tabulated in table 1. The use of any nutritional

supplementation, anti-inflammatory medications and putative recovery treatments were prohibited. Subjects who fulfilled the inclusion and exclusion criteria were shown information sheet having details regarding the nature of study and interventions to be used. They were given the opportunity to ask any questions and if they agree to participate in study, they were asked to sign the informed consent form. Approval was obtained from institutional ethical committee. None of them had any previous history of cardiovascular, gastrointestinal, renal or metabolic syndrome and was also free from musculoskeletal injury. There was no history of food allergy as well.

Table 1: Demographic characteristics of participants

Demographic characteristics	Study group	Control group
Body Mass Index (BMI)	22.01 ± 1.84	22 ± 2.22
Age	22.26 ± 3.34	22.8 ± 3.51
No of males	15 (50%)	15 (50%)
No of females	15 (50%)	15 (50%)

Experimental design

It is a Randomized Controlled Clinical Trial, where subjects in experimental group, were given a set of eccentric exercise followed by 100 ml of beetroot, 100ml of pineapple and 20 grams of turmeric cocktail twice a day, half an hour before exercise and 15 minutes after the exercise and control group were given the same set of eccentric exercise followed by 200 ml of neutral water half an hour before exercise and 15 minutes after the exercise. Baseline and post-intervention assessment data was collected before and after the intervention on the 10th day. The data collected was tabulated and analyzed using appropriate statistical methods.

Results

Study showed reduction in the inflammation depicted by statistically significant reduction in CRP markers in the experimental group (P=0.000) and there was significant reduction in the visual analog scale score as well (P=0.000). Paired T test was conducted to find the significance between pre and post values within the group. Both control and study group had shown statistically significant change when tested for repeated measures before and after the interventions. The detailed results are tabulated in table 2, 3 and 4.

Table 2: Comparison of pre-test and post-test CRP levels in experimental group and control group

Group	Pre value	Post value	P value
Experimental Group	10.63±2.98	7.76±0.89	0.000
Control Group	11.33±3.15	9.43±1.81	0.000

Table 3: Comparison of pre-test and post-test Visual analog scale scores in experimental group and control group

Group	Pre value	Post value	P value
Experimental Group	6.66±1.29	2.4 ± 0.93	0.000
Control Group	6.83±1.31	2.9 ± 0.95	0.000

Table 4: Comparison of all parameters between experimental group and control group

Parameter	Group	Mean±SD	p-value
Visual Analog Scale Score	Experimental	6.66±1.29	0.01
	Control	9.43 ± 1.81	
CRP	Experimental	2.4±0.93	0.000
	Control	2.9±0.95	

Comparison of variables between the groups: An independent samples t-test was conducted to identify if there is any statistically significant difference between the experimental group and the control group. Both the groups had shown significant reduction in the CRP scores post intervention, however the magnitude of change is more in the experimental group. The change in the inflammation status as inferred in this experiment warrants early intervention in DOMS for an early and faster recovery. The changes observed in the mean values were statistically significant (P=0.000). Visual analog scale score which measured the subjective pain and soreness among the participants have shown statistically significant change in experimental group compared to the control group (P=0.01). The study showed a significant reduction in CRP Value and visual analog scale in the experimental group depicting the role of beetroot, pineapple and turmeric cocktail in alleviating inflammation in DOMS. Previous studies reported that following eccentric exercises there is increased muscle soreness, pain and muscle damage. Peak soreness or pain was reported to be occurring at 24-48 hours. However, the serum enzymes related to inflammation are elevated by 8-24 hours after the exercise. It is further found that the enzymes elevation is directly proportional to duration and intensity of the exercise. 143 Our study also has reported an elevation of CRP levels post the first eccentric exercise session. To the authors knowledge this is the first study exploring the use of beetroot, pineapple and turmeric cocktail in the form a direct vegetable juice in modulating the inflammatory response and symptoms in DOMS.

Beetroot, pineapple and turmeric is rich in vitamins which may be responsible for the reduction in inflammation and enhanced pain threshold as observed in our study group compared to control group [7, 8]. Fruit juices are considered to be rich in phenolic content and antioxidant activity similar to that of commercially processed. However, the fruit juices shows reduced phenolic content and antioxidant activity when juices are added with sugars [9, 10]. Beetroot juice is found to have high concentrations of nitric oxide that has beneficial cardio vascular effects, which further improves the oxygen delivery to skeletal muscles that has a beneficial impact on exercise performance [11]. It also decreases the demand of glycogen by the muscles that indicates there will lesser metabolic demand on muscles by consuming beetroot juice. These properties of beetroot juice are attributed to the mitochondrial efficiency or in contractile efficiency of skeletal muscle post consumption of the beetroot juice [12]. Beetroot juice consumption also enhance the maximal muscle power in athletes [13]. Pineapple due to presence of bromelain has shown to alleviate muscle injuries, decrease perceived fatigue induced by eccentric exercises [14, 15]. Vitamin C present in pineapple also helps in reducing the inflammation as well as improves immunity and bone health [16]. It is also rich in phytochemicals such as beta carotene, flavonoids and phenols that has got potent antioxidant activity and also helps to relieve the pain in DOMS [17, 18, 19].

Curcumin the active component in turmeric is also an important nutrient related to the inhibition of cyclooxygenase, TNF-α, and other proinflammatory agents [20]. Curcumin supplementation is considered as an alternative to non-steroidal anti-inflammatory drugs in treating muscle soreness especially in athletes [21]. A dose of 5 g/day of curcumin has shown to reduce the DOMS and

related symptoms following a high intensity unaccustomed exercise session. There was a significant reduction in inflammatory cytokines like TNF- α and IL-8 along with creatinine kinase after a high-intensity, muscle damage-inducing protocol [22]. Delecroix *et al.* also demonstrated the same effects after oral consumption of curcumin on an eccentric exercise program [23]. Turmeric can optimize performance deficits associated with eccentric exercise-induced muscle damage [24]. Curcumin is further associated alleviation of swollen and tender joints; reduces blood markers of inflammation, such as erythrocyte sedimentation rate and C-reactive protein (CRP) [25]. A systematic review on use of curcumin on physically active population reckons curcumin to reduce the subjective perception of the intensity of muscle pain; reduces muscle damage through the decrease of creatine kinase (CK); increase muscle performance; exhibit an anti-inflammatory effect by modulating the pro-inflammatory cytokines, such as TNF- α , IL-6, and IL-8; and display antioxidant effect [26]. Similar to our study curcumin has shown to improve the pain as measured by VAS scores and further reduce muscle damage and improve muscle soreness [27]. Based on these compelling evidences combining fresh pineapple, beetroot and turmeric juice in the form of a juice warrants producing clinically meaningful results as demonstrated in the current study. The predominant effects are probably due to the anti-inflammatory and anti-oxidant property of pineapple, beetroot and turmeric on the athletes [28]. Supplementing this juice before the exercise prepares the body to tackle the excessive demand from the muscles due to exercise whereas the post exercises dose rapidly early recovery.

Though there was a change in the magnitude of CRP levels, it was not statistically significant change ($P=0.06$). A larger sample size would have produced a more significant result. High-sensitivity C-reactive protein (hs-CRP) could have been used instead of CRP so that low levels of CRP also could have been detected. We have not evaluated the role of confounding factors like cool down stretches and other dietary interventions impact on the results produced. Additional inflammatory markers like TNF- α , IL-6, IL-8 could have also been tested to identify the role of fresh Pineapple, beetroot and turmeric shots in inflammation process.

Conclusion

DOMS is one of the common hindrances in the progression of exercise based regimens. This could be detrimental as exercise is regarded as one of the valuable lifestyle regimen that can prevent and alleviate lifestyle disorders like obesity, metabolic syndromes and cardiovascular diseases [29]. Introducing appropriate therapies in place to tackle DOMS are warranted as DOMS is common among almost all the athletes who are introduced to exhaustive or unaccustomed exercise, particularly those exercises involving eccentric contractions and thereby frequently results in temporary muscle damage [30]. Intake of a combination of beetroot, pineapple and turmeric shot has shown to alleviate the inflammatory reactions and perceived pain and soreness in a group of freshly recruited young athletes who are newly exposed to acute bouts of eccentric form of exercise. The changes in CRP levels and perception of symptoms are suggestive of using beetroot, pineapple and turmeric shot as a cost effective remedy to tackle DOMS.

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