Original Article

DOI: http://dx.doi.org/10.16926/par.2017.05.01

Effects of Exercise on Risk-Taking

Authors' Contribution:

A – Study Design
B – Data Collection
C – Statistical Analysis
D – Manuscript Preparation
E – Funds Collection

Dean Culpepper[1ABCD], **Lorraine Killion**[2AD]

[1]Texas A&M University-Commerce
[2]Texas A&M University-Kingsville

Abstract

Introduction: Research has shown that exercise increases levels of dopamine in certain sub-cortical brain regions. Increased dopamine activity in the brain has been linked to increased risk-taking. The purpose of this study was to determine if an increase in risk-taking is apparent in male athletes and non-athletes after strenuous exercise. Method: Ten athletes (age: 20.2±SD year) and ten non-athletes (age: 20.7±SD) in a university setting completed the BART (a validated protocol to asses risk-taking behavior) either after exercise or at rest. Result: Athletes obtained total 24.92±10.99 pumps and Non-Athletes 42.76±16.45 pumps. Discusion: ANCOVA's showed that there was significant difference between athletes and non-athletes (p<0.01) on the risk behavior test. Post hoc tests showed that for non-athletes there was also a significant difference for those that exercise immediately before the risk behavior test, p=0.003. This was not the case with athletes, p=0.683. Results indicate that while exercise increased risk-taking in the non-athlete subjects, it did not have an effect on the athlete population.

Keywords: *exercise*, *risk-taking*, *athletes*

Address for correspondence:

Dean Culpepper, Ph.D. -Texas A&M University-Commerce, P.O. Box 3011, Commerce, TX 75429, email: dean.culpepper@tamuc.edu

Recevied: 07.09.2016; Accepted: 01.10.2016; Published online: 4.01.2017

INTRODUCTION

Regular physical activity is associated with decreased all-cause mortality, higher quality of life and overall well-being [1]. There is evidence to support physical activity's impact on positive mental health too, yet it is premature to conclude a direct connection [2]. However, whatever the connection, regular physical activity is recommended by the American Psychological Association to aid in the treatment of mental health and increased mood [2]. Regular exercise has been associated with the reduction of physical and mental disorders across the lifespan and leads to increased mental well-being, psychological benefits and reductions in depressive symptoms [3]. Bernstein and McNally [4] found that exercise attenuated negative moods after exercise and in a meta-analysis conducted by Ensari, Greenlee, Motl, and Petruzzello [5] that analysized 131 articles, they found that acute bouts of exercise yeild a small reduction in state anxiety. Exercise has also shown to reduce urges for substance abuse and risk-taking behaviors.

Medina et al., [6] found that after exercise, subjects have shown a decrease in cravings for alcohol and tobacco after a bout of exercise which is consistent with prior research [7,8]. In addition Garza et al., [9] showed that exercise reduces the risk-taking behaviors of cocaine users and has been recommended as a non-drug treatment [10].

In measuring the aspects of improved mood after exercise, various neurobiology has been examined, which include endogenous opioids and their interaction with other neurotransmitters. Out of this, research has shown that exercise increases levels of dopamine and endorphons in certain sub-cortical brain regions [11,12]. This increased level of dopamine and endorphins has been shown to increase reward-seeking behavior and as Black, Hochman, & Rosen [13] note, even if it involves risk.

Black, Hochman, Rosen [13] conducted a study to evaluate exercise's effect on risk-taking behavior in adolescent male athletes. They found that a single bout of intense, competition based exercise [tennis] increased risk-taking in adolescent athletes. Their findings were not in agreement with prior research on exercise's lessening effect for risk behavior. As they noted, "The current study's findings are inconsistent with those highlighting exercise's attenuating effects on substance-related risk behavior and suggests exercise may differentially impact different types of risk-taking behaviors. Alternatively, the difference may be explained by the different populations tested and exercise may increase risk-taking in healthy adolescent athletes, but not in people who are substance-using or adults [13].

Thus, the effects of exercise on risk-taking behavior is not clear. It is also unclear whether athletes, who have high physiological outputs, are different than healthy non-athletes. The use of competition may have affected the risk taking behaviors of the subjects as well. Competition has been shown to alter both neuroactive hormones, neurotransmitters [14] and dopamine [15]; which can lead to increased risk-taking behaviors. Research is unclear as to whether exercise should reduce the risk-taking behaviors of healthy individuals. The purpose of this study was to examine the risk-taking behaviors of athletes and healthy non-athletes in a general exercise session.

METHOD

Subject

Twenty male: 10 athletes (average age: 20.2±SD year) and 10 non-athletes (average age: 20.7±SD) subjects from an NCAA Division II university participated in the study. IRB approval was obtained and subjects signed the voluntary consent form.

Protocol

Subjects were exposed to two study conditions: rest, and exercise. To control for sequence effects, the order of condition was varied by the participant, with the first five athletes enrolled assigned to rest first and the second five to exercise first. Likewise, the first five non-athletes were assigned to rest first and the second five to exercise first. The exercise was defined as participation in a bout of non-competitive cardiovascular activity (e.g., jogging on a treadmill] at 60-75% effort. During the rest, subjects quietly sat for 20 minutes with the study author. To account for differences in perceived exercise intensity, participants rated the intensity of the structured exercise using Borg 6-20 RPE [16].

Risk-taking was assessed through The Balloon Analogue Risk Task [BART], a validated behavioral assessment of risk-taking. It was administered immediately following each study condition [17]. BART involves the accumulation of points by inflating balloons on a computer program. Overinflating and popping of the balloons results in point loss. To ensure valid participation, subjects were awarded five cents for each point earned. Each subject completed 10 trials, and the mean number of pumps was recorded. Balloons that popped were not included in the analysis. The BART has been validated, and the reliability across trials is r=.86 [17]. BART has also been correlated with real-world risk-taking behaviors [17].

Statistical analysis

The differences between comparable groups have been assessed on the basis of ANCOVA's test and Scheffe Post hoc tests. Statistical validity was assumed at the level of $p<0.05$. All calculations have been done with the use of SPSS version 22.

RESULTS

The results are presented in Table 1 with the mean and standard deviations of the BART score presented. Effect size was determined using Hedges's g and Alpha was set at 95%.

Table 1. Descriptive statisctics for the BART-Y

Subjects		Risk-Taking Score # of pumps M	Risk-Taking Score # of pumps SD	ES (Hedges g*)
Athletes	Total	24.92	10.99	0.73
	Run	26.88	13.66	
	Rest	23.94	10.32	
Non-Athletes	Total	42.76*	16.45	
	Run	56.45*	11.24	
	Rest	29.08*	12.72	

DISCUSSION

ANCOVA's showed that there was a significant difference between athletes (M=24.92) and non-athletes (M=42.76), $p<0.009$ on the risk behavior test. Scheffe Post hoc tests showed that for non-athletes, there was also a significant difference for those who exercise immediately before the risk behavior test, p=0.003. This was not the case with athletes, p=0.683. Results indicate that while exercise increased risk-taking in the non-athlete subjects, it did not have an effect on the athlete population.

Black, Hochman, & Rosen [13] conducted a study to determine if exercise increased risk-taking behavior. Their study revealed that participation in a single bout of intensive, competitive exercise resulted in increased risk-taking in a sample of adolescent athletes. The current study's findings are both consistent and inconsistent with those highlighting exercise's attenuating effects on substance-related risk behavior. This study was similar in that the non-athlete group increased their score on the risk-taking protocol. However, NCAA Divison II athletes did not significantly increase nor decrease their score on the protocol. This would lead support to Black et. al's [13] discussion that exercise may increase risk-taking in healthy individuals, but not athletes.

The authors believe this current study does lend support to the proposal by Black and colleagues [13] that athletes may be more tolerant of post-exercise increases in dopamine, however; this study did not support their conclusion in which athletes seek additional stimulation through risk-taking. This study contradicts those conclusions. The athletes in this study show no increases in risk-taking behaviors. This may be due to the age of the subjects and the differences in adolescents vs adults. Additional research should be conducted to establish these congruent findings.

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Cite this article as:
Culpepper D, Killion L. Effects of Exercise on Risk-Taking, Phys Activ Rev 2017, 5:1-5