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Introduction

With proper design, an exercise program can promote a healthy lifestyle that is beneficial to whomever is engaging. However, an improper exercise program can be detrimental to one's health. Exertional rhabdomyolysis (ER) is a multifactorial medical condition that may result secondary to an exercise regimen that is too much, too fast, too soon, or an exercise too novel.

Concurrent to the trendiness of high intensity exercise programs, cases of exertional rhabdomyolysis have increased, prompting the question: **Does a high intensity eccentric exercise program increase the risk of developing exertional rhabdomyolysis?**

What is exertional rhabdomyolysis?

- Breakdown of skeletal muscle secondary to exercise
- Muscle breakdown is measured as serum creatine kinase (CK)
- Defined as CK elevation > 5,000 IU/L after exercise

Clinical Presentation

- Classic triad: myalgias, generalized weakness, dark urine
- Occurs 12-48 hours post exercise
- Exam findings: ↓ muscle strength, muscle swelling, bruising

Associated Complications

- Electrolyte abnormalities, cardiac dysrhythmias, acute kidney injury, compartment syndrome

Methods

Research was conducted through PubMed, Embase and Cochrane Library. The MeSH terms consisted of "exertional rhabdomyolysis", "exercise induced rhabdomyolysis", "effect of exercise on exertional rhabdomyolysis", and "exertional rhabdomyolysis high intensity exercise". The Cochrane Risk of Bias Tool was utilized to evaluate the primary literature.

Results

- Search yielded only one primary research article and 52 case reports
- Primary Literature - Hody et al.**
- Limitations to study include small sample size and lack of subject randomization
- Experimental trial found relationship between eccentric protocols and ↑ plasma CK levels; work set = 3 sets of 30 eccentric quadricep contractions
- ↑ CK response to eccentric exercise and direct effect on muscle performance specifically during an unaccustomed eccentric workout

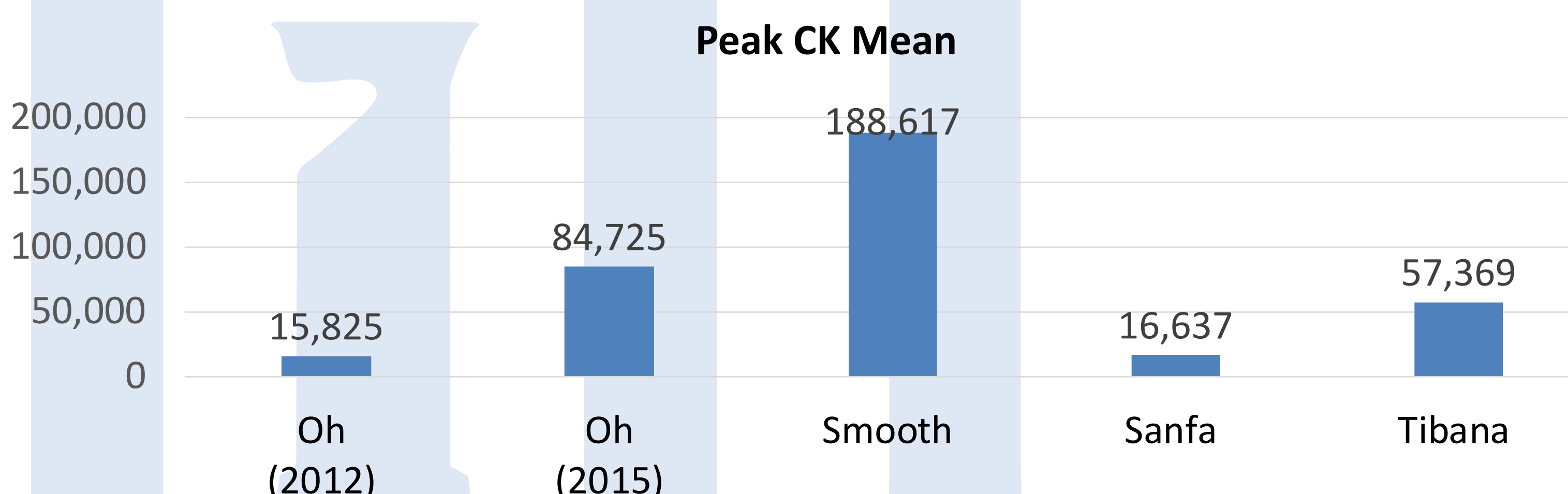


- Correlation analysis of indirect markers of CK pre/post and relationship of CK response with stiffness and soreness determined cause and effect relationship between eccentric exercise and increased CK levels

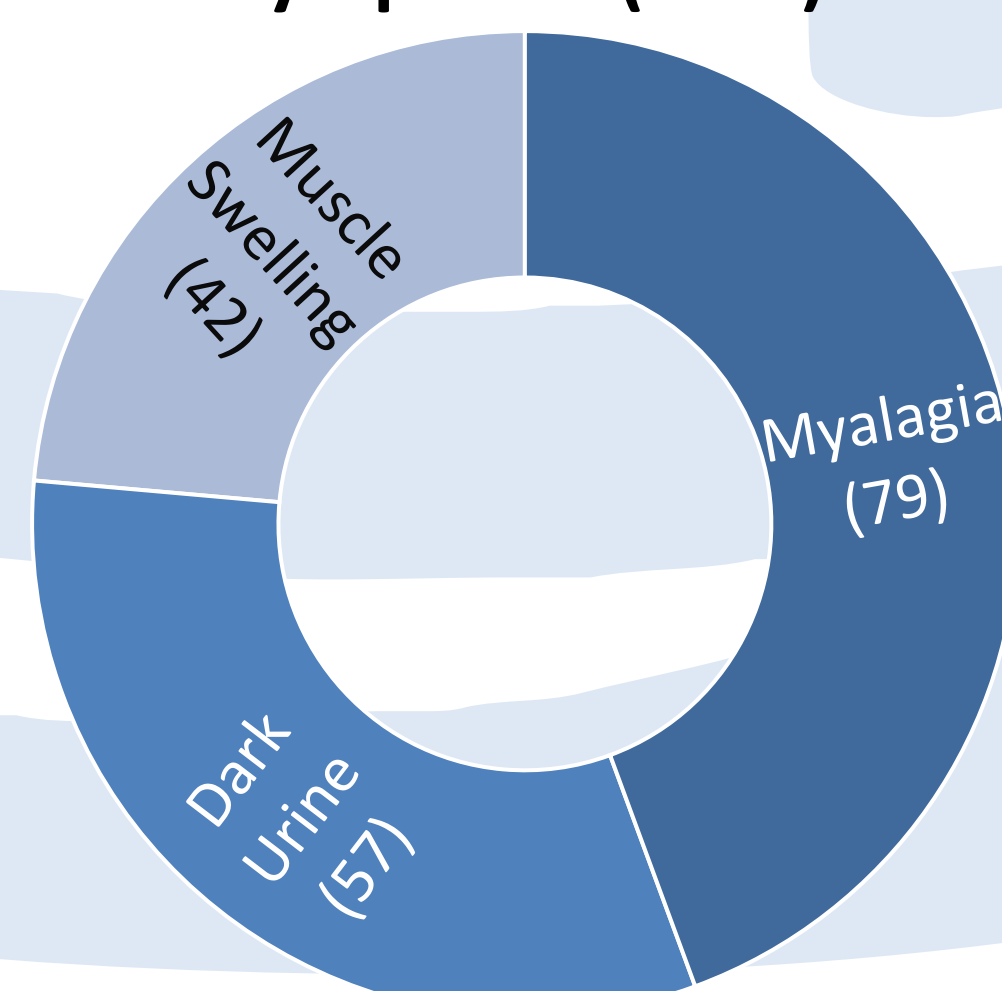
Case Reports Summary

- Type of exercise performed is key causative agent
- Common factors: unaccustomed to exercise, timed workouts, inadequate recovery time

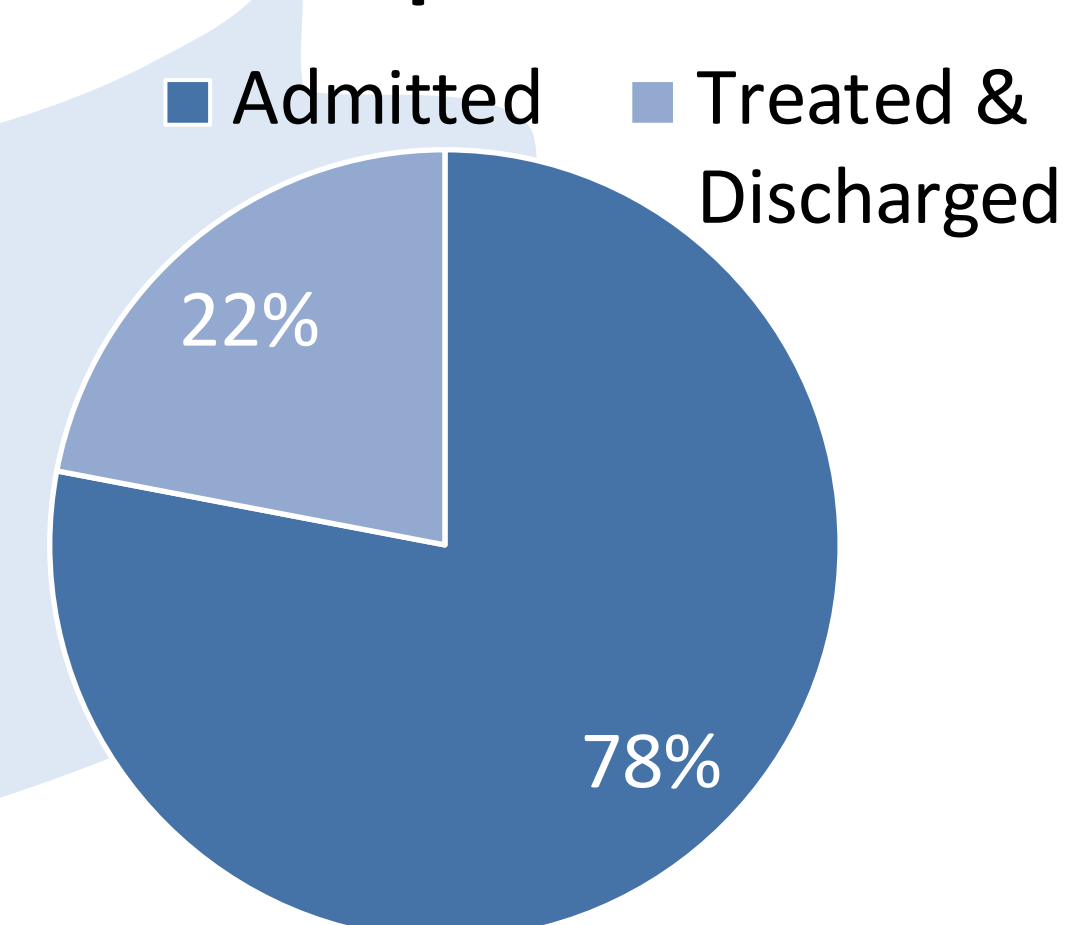
Primary Author and Published Year	Subjects
Oh, 2012 [2]	43 high school football players
Oh, 2015 [3]	30 Army personnel - Tripler Army Medical Center from Jan 2010-Dec 2012
Smooth, 2013 [4]	78 collegiate football players; 10 players provided lab results
Stanfa, 2017 [5]	34 Midwest University collegiate swimmers
Tibana, 2018 [6]	Physically active 35 year-old female



Symptoms (n:79)



Hospitalization



Conclusions

- Hody et al. supports eccentric based workouts have potential to predispose individuals to ER
- Case reports demonstrate eccentric exercises lead to ER in particular when workout unaccustomed, timed or with inadequate recovery time
- With limited primary literature, cause and effect of ER open for interpretation

A gap in the research exists due to minimal randomized control trials assessing the impact of specific exercise regimens, including eccentric protocols. The research quality is limited to case reports leading the discussion that further research is warranted to determine the cause and effect of exertional rhabdomyolysis.



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