

# The Effects of Dry and Liquid Magnesium Carbonate on Pinch Grip Muscular Endurance

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## Introduction

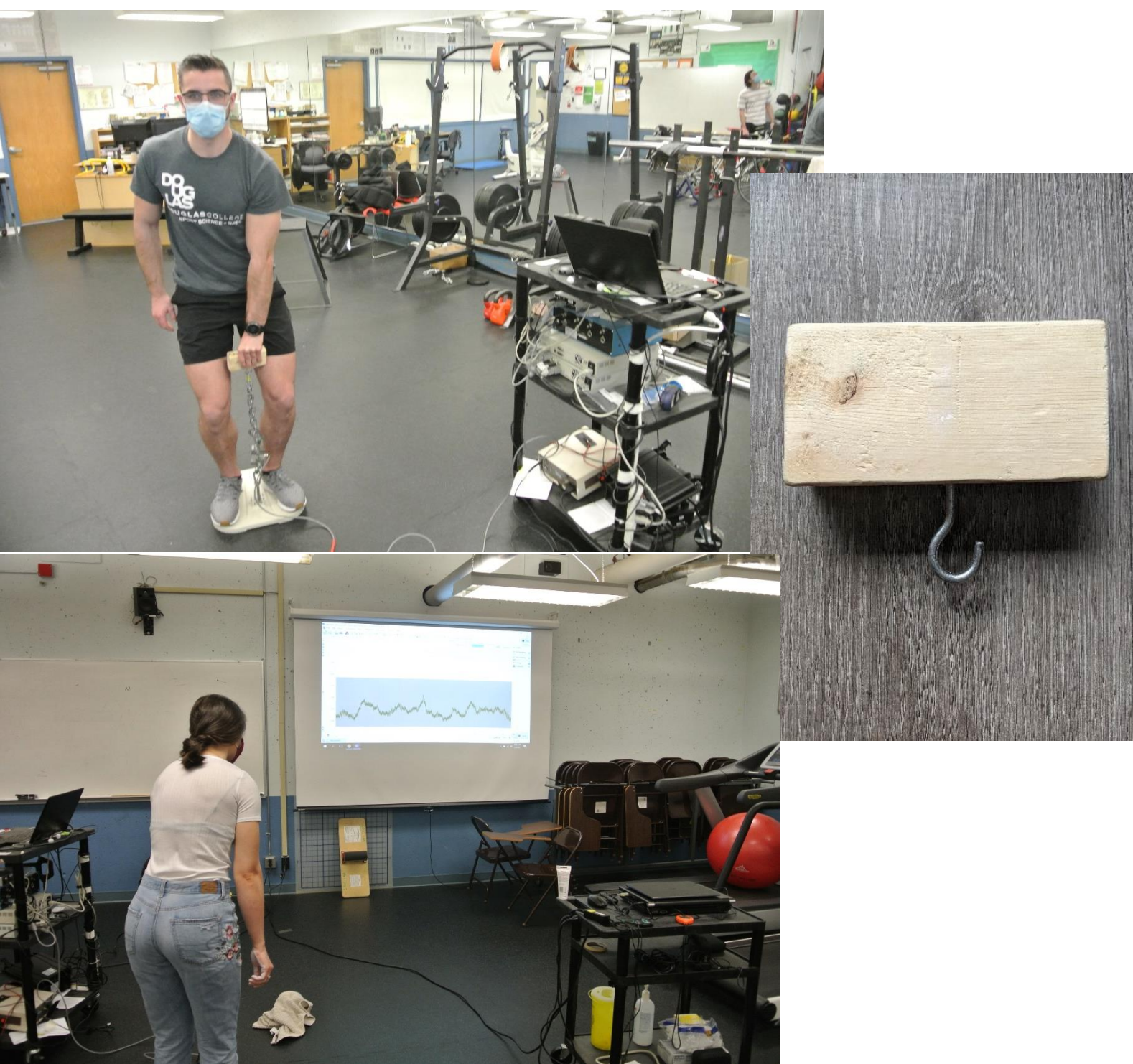
The goal of rock climbing is to maintain contact with the holds and surface to complete the route. This requires a maintaining friction throughout the combination of coordinated and efficient movements performed. Participant's use dry or liquid magnesium carbonate (Climbing chalk) to increase their friction and prevent slipping.

## Purpose

The objective was to determine the effects of dry and liquid chalk on muscular endurance. Specifically, if liquid chalk provides different performance results to dry chalk, as its use has increased due to its hand sanitizer qualities during COVID-19

## Methods

Participants pulled up on a 1.5-inch-wide wood block, 5.5 inches above the top of their patella in mid thigh position. Using an omega load cell, they performed an isometric pull at 70%-80% of their max for as long as they could for three trials; dry hands- no chalk, dry hands – dry chalk and dry hands - liquid chalk



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## Results

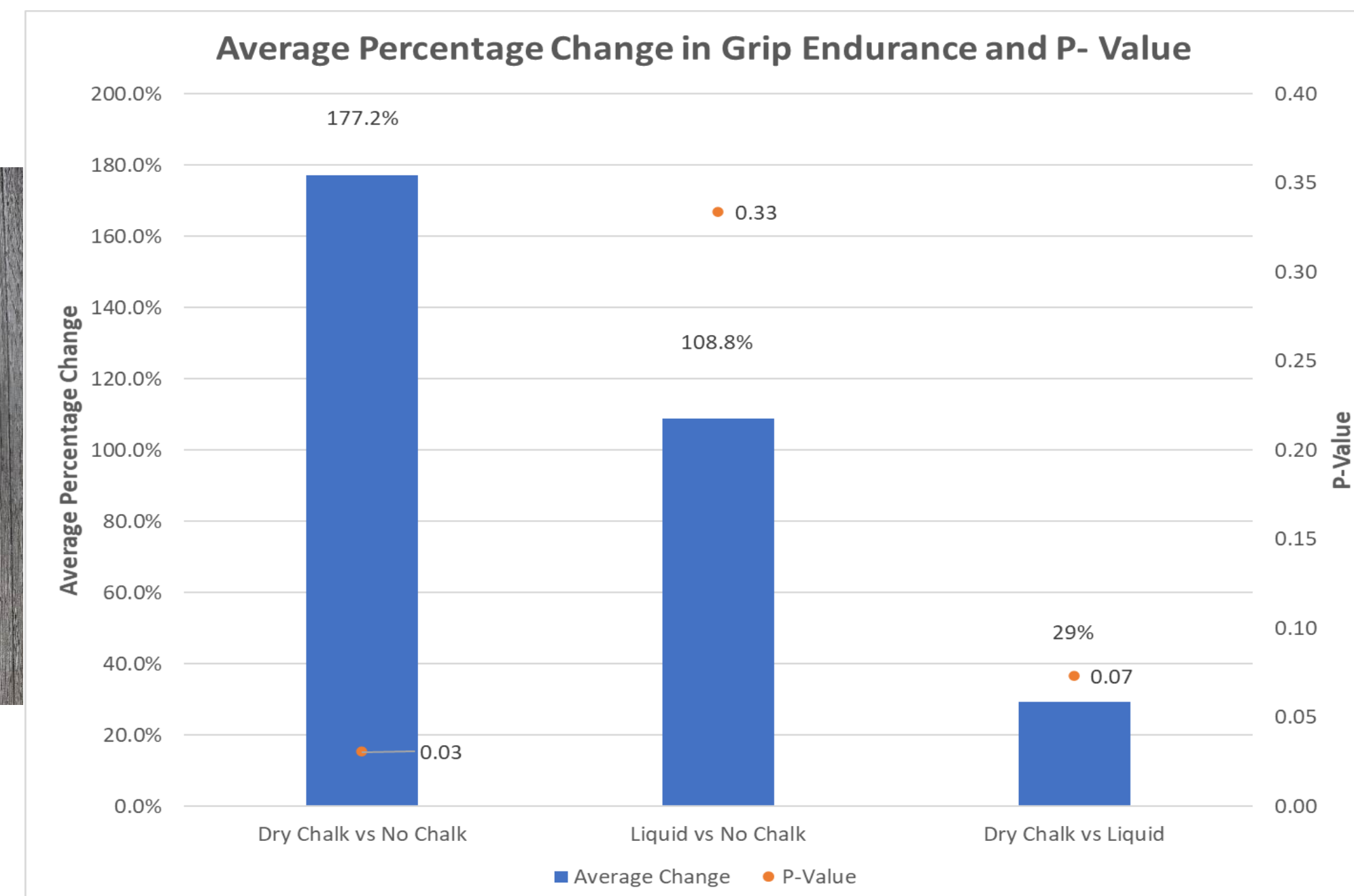
**Dry Chalk vs No Chalk:** The use of dry chalk during the pinch provided on average a 177.2% increase in pull duration at 70% to 80% of the participant's max. Changes in grip duration were statistically significant (p=0.03)

**Liquid Chalk vs No Chalk:** The use of liquid chalk increased participants pinch grip duration by 108.8% on average. These changes in grip duration were not statistically significant (p=0.33)

**Dry Chalk vs Liquid Chalk:** Dry chalk provided on average a 29% longer duration hold then liquid chalk. This change in hold duration was not statistically significant (p=0.07).

**Figure 1:**  
Participants pinch grip duration in seconds

Participants Pinch Pull at 70%-80% Effort Durations in Seconds			
Participant	No Chalk Time (s)	Dry Chalk Time (s)	Liquid Chalk Time (S)
1	21.806	43.739	18.589
2	10.939	52.440	36.531
3	58.979	70.514	45.261
4	11.815	50.309	50.069
5	41.509	66.619	51.669



**Figure 2:** Average percentage change between the use of no chalk, dry chalk and liquid and the significance of its change expressed at a p-value

## Acknowledgments

This researches equipment (Dry and Liquid Chalk) were supplied by Flashed

## Discussion

The use of dry chalk provided the greatest benefit to muscular endurance while pinch gripping a wood block compared to no chalk or liquid chalk. Also seen in Amca, Vigouroux, Aritan, & Berton (2012) study, dry chalks use during high friction sport situations provides longer duration efforts while contradicting its coefficient of friction properties. Dry chalk has been shown to decrease the coefficient of friction by acting at a solid lubricant (Li, Margetts, & Fowler, 2001 & Carré, Tomlinson, Collins, & Lewis, 2012). However, with the extra force applied by the hand while pinching an object the use of chalk may have improved their friction. With more friction participants conserved energy by repositioning their hand less frequently, requiring less pinching force to maintain 70%-80% pf their max pull, and maintaining consistent force easier. By conserving energy throughout the effort, they delayed the onset of muscular fatigue therefore increasing the duration of their effort. The use of chalk while gripping a wood surface allow participants to maintain pulling force by using less effort to improve muscular endurance performance.

## Conclusion

Dry chalk provides significant changes in pinch grip pull duration at 70%-80% max on a wooden block. We recommend dry chalk use over liquid or no chalk during situations requiring more friction and muscular endurance on wooden surfaces with pinch grips. Liquid chalk provided greater duration hold durations then that of not using chalk, however further research is required to determine significant changes in hold duration. The use of liquid chalk may be a suitable substitute for dry chalk on regards of muscular endurance benefits during COVID-19 to ensure hygiene safety. With Rock climbing's introduction into the 2021 Tokyo Olympics, developing best practices for chalk use for our athletes may be the factor that determines podium finishing.

## References

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