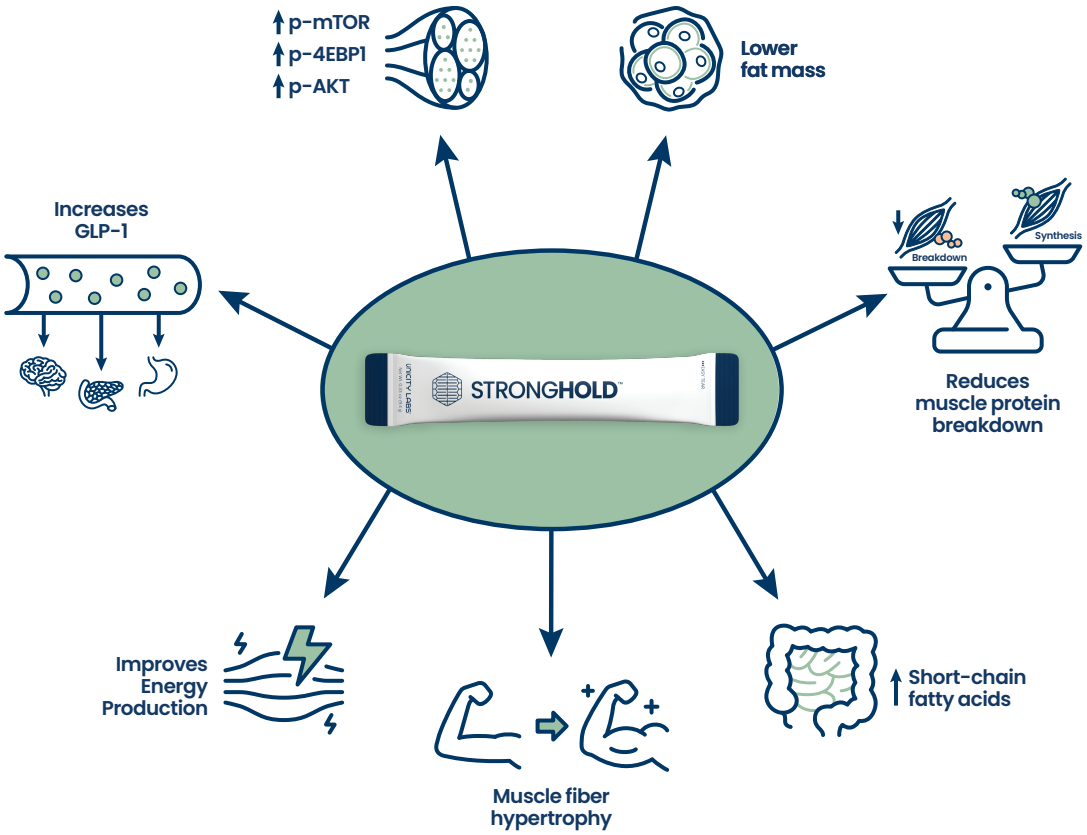
STRONGHOLD:

a novel supplement for *muscle growth* and *metabolic health*

SUMMARY

In this study, the short-and long-term effects of STRONG**HOLD** on muscle and metabolic health were evaluated by measuring anabolic signaling, GLP-1, fat mass, muscle mass, and other metrics of metabolic function. STRONG**HOLD** robustly promoted muscle growth, reduced muscle breakdown, enhanced energy production, and elevated GLP-1 levels without any negative impacts on glucose or insulin homeostasis. STRONG**HOLD** poses a promising and accessible nutritional intervention to counteract anabolic resistance, protect lean mass, and support metabolic health, especially as part of healthy aging or structured weight-loss programs.

Key Study Outcomes:



AUTHORS:
Elijah Cooper-Leavitt[1], Dr. Stephanie Kung[2], and Dr. Benjamin Bikman[1]
[1]Department of Cell Biology and Physiology, Brigham Young University, Provo, UT
[2]Research and Development, Unicity International, Provo, UT

BACKGROUND

Aging and catabolic stressors such as caloric restriction and inactivity contribute to anabolic resistance—the diminished capacity of skeletal muscle to respond to anabolic stimuli, contributing to muscle loss and metabolic dysfunction. While resistance training is an effective intervention, it may be inaccessible or insufficient in some populations, highlighting the need for alternative or adjunctive strategies. Nutritional interventions targeting anabolic and anti-catabolic pathways offer a promising approach. In this preclinical study, STRONG**HOLD**, a novel multi-ingredient supplement designed to combat anabolic resistance, was evaluated for its potential to promote muscle and metabolic health, both after a single serving and with long-term intake.

METHODS

Healthy, middle-aged male mice (n = 4 per group) were randomly divided into experimental groups and administered STRONG**HOLD** or water (Control), with assessments performed after one serving of STRONG**HOLD** or after long-term daily supplementation (30 days, twice daily). Anabolic signaling, cellular respiration, tissue mass, and fiber cross-sectional area (CSA) were measured in the muscle. Fatty tissue was collected and weighed. Assessments of overall metabolic health included blood glucose, insulin, glucagon-like peptide-1 (GLP-1), C-reactive protein (CRP), and short-chain fatty acids (SCFAs).

Data are presented as the means ± SEM. The differences between Control and STRONG**HOLD** were compared using Student's t-test. Significance was determined as being at $p < 0.05$, a trend toward significance signaled by $p < 0.1$.

RESULTS

Muscle Anabolic Signaling

One hour after ingestion, STRONG**HOLD** significantly increased cellular signals (p-mTOR, p-AKT, and p-4EBP1) in the muscle, regulating protein synthesis, muscle growth and repair, and glucose metabolism (Figure 1A). With continual STRONG**HOLD** intake, these cellular signals (p-mTOR and p-AKT) even persisted following a brief fast, indicating that the product elevated the baseline anabolic potential of the muscle (Figure 1B).

Figure 1A:

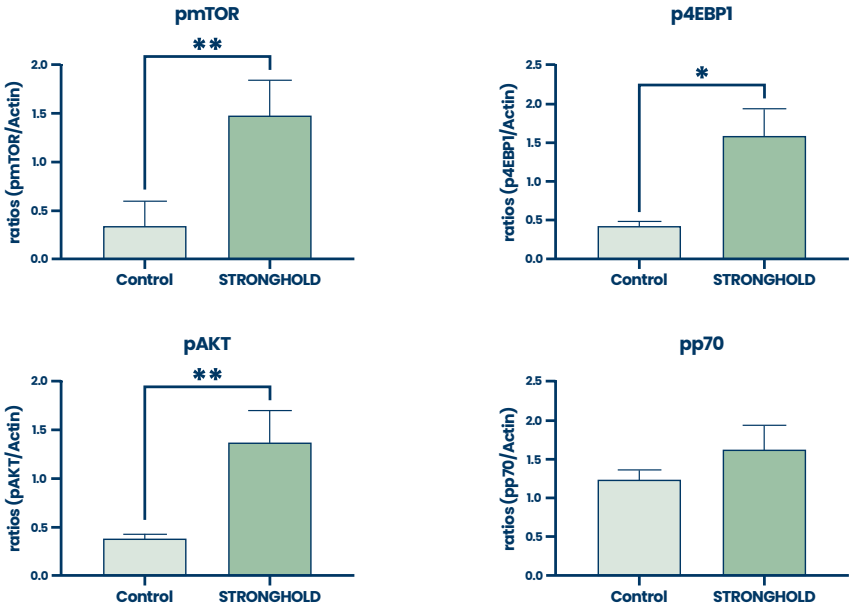


Figure 1B:

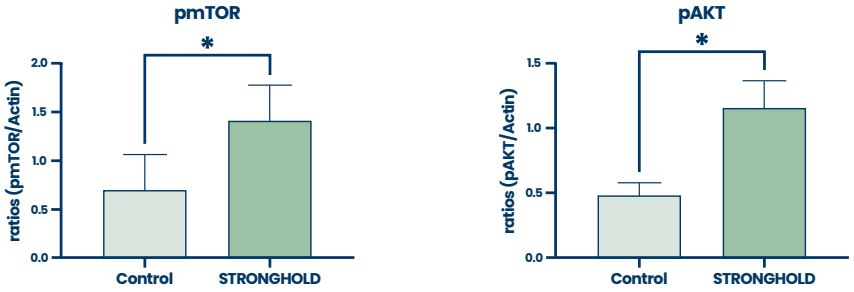


Figure 1. STRONG**HOLD** increases markers of anabolic signaling, protein synthesis, and glucose metabolism in the muscle after A, one serving, and B, long-term intake. (Control, n = 4; STRONG**HOLD**, n = 4. *p < 0.05, **p < 0.01)

Incretin and Systemic Metabolic Response

GLP-1, an incretin hormone, plays a role in insulin sensitivity, appetite regulation, weight management, and brain health. STRONG**HOLD** significantly increased GLP-1 levels both after one serving and after a short fast with long-term intake (Figure 2A and 2B). Additionally, long-term intake increased levels of acetate and propionate, SCFAs linked to a myriad of beneficial metabolic health outcomes (Figure 3). No differences in blood glucose, insulin, or CRP were observed, suggesting that STRONG**HOLD** does not negatively affect glycemic control or inflammation.

Figure 2A:

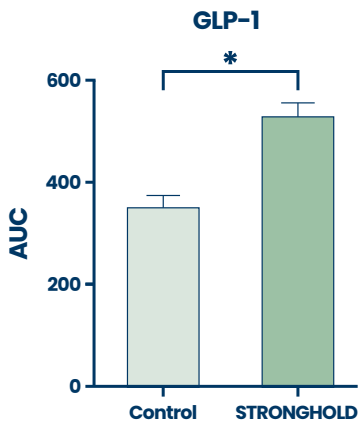


Figure 2B:

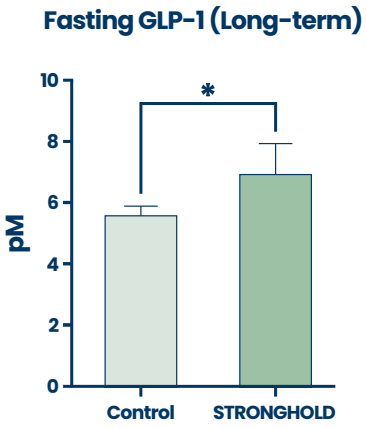


Figure 2. STRONG**HOLD** increases GLP-1 levels after A, one serving, and B, long-term intake. (Control, n = 4; STRONG**HOLD**, n = 4. *p < 0.05)

Figure 3:

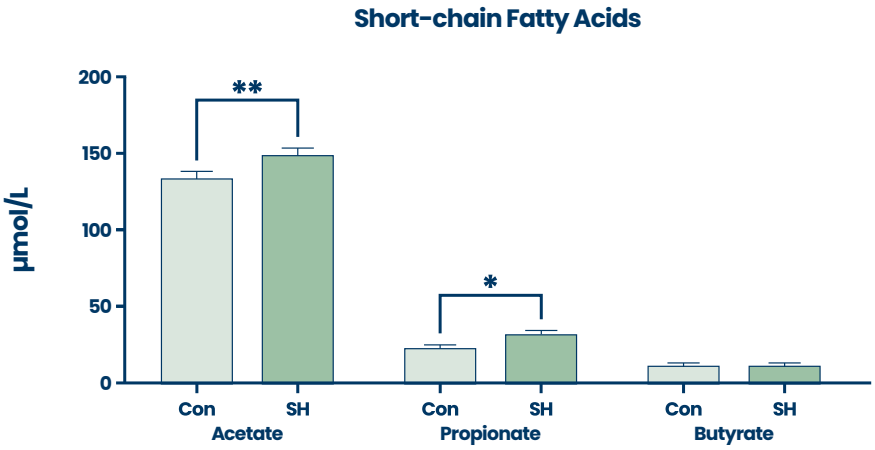


Figure 3. Long-term intake of STRONG**HOLD** increases levels of the SCFAs acetate and propionate. (Control, n = 4; STRONG**HOLD**, n = 4. *p < 0.05, **p < 0.01)

Tissue-specific Changes in the Muscle and Fat

Relative to Control, long-term STRONG**HOLD** intake elicited several positive adaptations, with no observed changes in food intake or physical activity. First, long-term STRONG**HOLD** intake resulted in greater muscle mass and fiber size, alongside reduced fat accumulation (Figure 4). Consistent with this result, fasted levels of branched chain amino acids (BCAAs) in the plasma were also significantly lower, suggesting that STRONG**HOLD** exhibits a protective effect on protein turnover, whereas the higher levels of plasma BCAAs in the Control group suggest a state of anabolic resistance (Figure 5). Finally, STRONG**HOLD** significantly increased cellular respiration, reflecting improved energy production in the muscle (Figure 6).

Figure 4A:

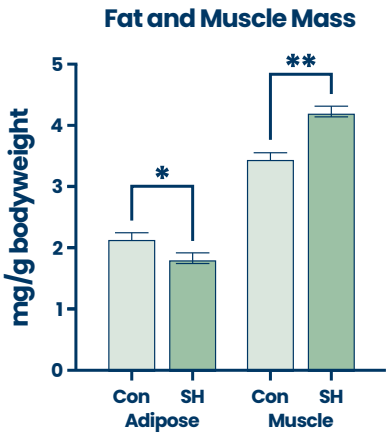
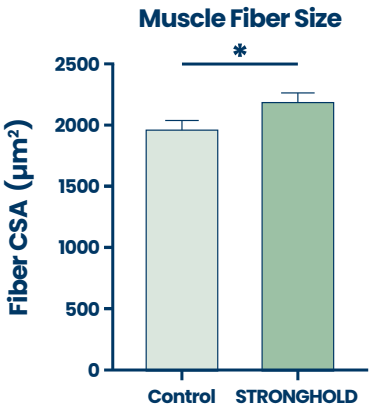
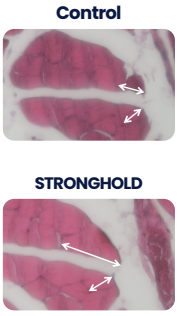


Figure 4B:





Cross-sectional imaging of muscle tissues showed that STRONG**HOLD** significantly increased muscle fiber diameter (white arrows).

Figure 4. STRONG**HOLD** consumption increased muscle mass while reducing fat accumulation (A). Muscle fiber CSA was significantly greater with STRONG**HOLD** versus Control (B). (Control, n = 4; STRONG**HOLD**, n = 4. *p < 0.05, **p < 0.01)

Figure 5:

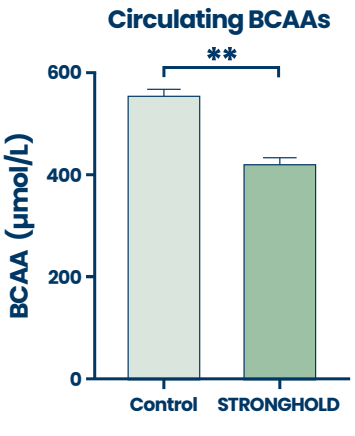


Figure 5. A reduction in fasted plasma BCAAs relative to Control strongly suggests that protein breakdown is significantly lower with long-term STRONG**HOLD** use. (Control, n = 4; STRONG**HOLD**, n = 4. **p < 0.01)

Figure 6:

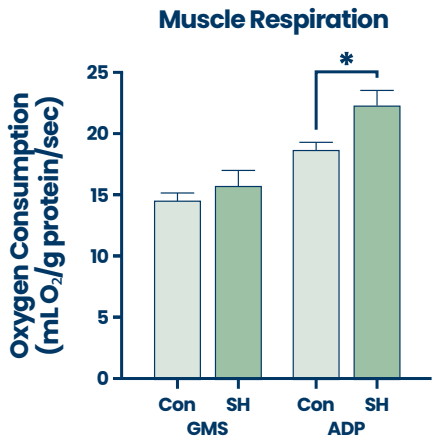


Figure 6. STRONG**HOLD** consumption increased cellular respiration, suggesting improved energy production in the muscle. (Control, n = 4; STRONG**HOLD**, n = 4. *p < 0.05)

CONCLUSION

STRONG**HOLD** is a promising all-in-one nutritional intervention for improving body composition, muscle maintenance, and overall metabolic health–all relevant factors in anabolic resistance. Relative to placebo, both short- and long-term intake of STRONG**HOLD** resulted in significant activation of skeletal muscle anabolic signaling pathways. In addition, long-term intake of STRONG**HOLD** increased muscle mass and fiber size while concurrently reducing fat mass and protein breakdown, promoting a favorable shift in body composition. Notably, STRONG**HOLD** enhanced levels of GLP-1 even after a brief fast, suggesting an improved adaptive state. As GLP-1 has known roles in satiety, glucose regulation, and weight management, this finding suggests a broader benefit beyond the muscle. Thus, STRONG**HOLD** is an accessible means of protecting the body from the effects of anabolic resistance and metabolic dysfunction even amid catabolic stressors.

REFERENCES

1. Paulussen KJM, McKenna CF, Beals JW, Wilund KR, Salvador AF, Burd NA. Anabolic Resistance of Muscle Protein Turnover Comes in Various Shapes and Sizes. Front Nutr. 2021;8:615849. Published 2021 May 5. doi:10.3389/fnut.2021.615849

2. Hodson N, West DWD, Philp A, Burd NA, Moore DR. Molecular regulation of human skeletal muscle protein synthesis in response to exercise and nutrients: a compass for overcoming age-related anabolic resistance. Am J Physiol Cell Physiol. 2019;317(6):C1061-C1078. doi:10.1152/ajpcell.00209.2019