Effects of Single and Combined Extracts of Cinnamomum burmannii, Zingiber officinale, and Curcuma longa on Creatine Kinase, Blood Lactate, and VO2Max in Athlete: A Double-Blind Sequential Study

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Abstract

Exercise-induced muscle damage raises serum creatine kinase (CK) and blood lactate and can slow recovery in athletes. Cinnamon, ginger, and turmeric have anti-inflammatory and antioxidant properties, but fixed-ratio combinations of their extracts have not been tested in athletes. The aim of the research is to evaluate extracts of *Cinnamomum burmannii*, *Zingiber officinale*, and *Curcuma longa*, alone and combined, on CK, lactate, and VO_2max in young Indonesian athletes. Forty-eight athletes aged 17–18 years took capsules twice daily for seven days after exercise in a double-blind, non-randomized sequential design. Eight formulations were tested: three single extracts, four combinations (1:1:1, 2:1:1, 1:2:1, 1:1:2), and a placebo. Values before and after supplementation were compared with paired *t*-tests. CK decreased significantly only with the cinnamon-dominant combination (−17.2%, p = 0.047) and increased with the 1:1:1 combination (+4.3%, p = 0.029). Lactate decreased significantly only with turmeric alone (−5.8%, p = 0.041). VO_2max did not change (p = 0.057–0.793). We concluded that effects were limited and inconsistent. Because analyses were within-treatment and formulation order was not randomized, the findings show no evidence of synergy or superiority of any formulation and are exploratory. Randomized, counterbalanced, placebo-controlled trials are needed

Keyword: exercise-induced muscle damage; creatine kinase; blood lactate; polyherbal supplement; athlete recovery.

Introduction

High-intensity training places substantial mechanical and metabolic stress on skeletal muscle and may lead to exercise-induced muscle damage (EIMD). Elevated creatine kinase (CK), increased blood lactate, and impaired recovery can limit an athlete's ability to train consistently, increase injury risk, and compromise performance across successive training cycles. Although anti-inflammatory drugs are sometimes used to manage exercise-related symptoms, their potential adverse effects highlight the need to investigate safe, permissible, and evidence-based recovery strategies. Cinnamon (*Cinnamomum burmannii*), ginger (*Zingiber officinale*), and turmeric (*Curcuma longa*) have each been studied for their potential effects on inflammation, oxidative stress, muscle damage, or glucose metabolism. However, evidence for these ingredients largely concerns their use individually. The effects of combining their dry extracts in a fixed-ratio capsule, and whether this combination offers benefits beyond those of the individual extracts, remain insufficiently examined in athletes. This gap is especially relevant given Indonesia's rich diversity of medicinal plants and the need to evaluate their potential applications using systematic research. Therefore this study to evaluate extracts of *Cinnamomum burmannii*, *Zingiber officinale*, and *Curcuma longa*, alone and combined, on CK, lactate, and VO_2max in young Indonesian athletes.

Research Method

This double-blind, sequential study evaluated eight capsule formulations containing cinnamon, red ginger, and turmeric extracts, alone or in combination, as well as a placebo. The capsule formulation investigated in this study was registered as an intellectual property work (HKI.3-HI.05.01.02.P00202608577/2026) since August 2026. Forty-eight active athletes aged 17–18 years participated and were stratified by age. Capsules were taken twice daily for seven consecutive days.

Formulations A–D were administered in Week 1 and E–H in Week 2, with a two-week washout period between them. The formulations included three single extracts, four combinations at different ratios, and a placebo.

Serum creatine kinase (CK), blood lactate, and VO_2max were assessed before and after supplementation. Within each formulation, pre- and post-supplementation values were compared using paired *t*-tests, with statistical significance set at $p < 0.05$. Formulations were not directly compared with one another.

Results

Table 1. *Serum creatine kinase (U/L) before and after supplementation in Weeks 1 and 2.*

Week	Code	Composition	Pre	Post	Δ (%)	p	Significant
1	A	Cinnamon 100%	345.9	287.4	−16.9	0.088	No
	B	Red ginger 100%	375.9	267.8	−28.8	0.113	No
	C	Turmeric 100%	356.7	270	−24.3	0.22	No
	D	**Combination 1:1:1**	**255.6**	**266.7**	**4.3**	**0.029**	**Yes**
2	E	Turmeric-dominant (1:1:2)	370.75	356.33	−3.9	0.722	No
	F	**Cinnamon-dominant (2:1:1)**	**360.75**	**298.58**	**−17.2**	**0.047**	**Yes**
	G	Red ginger-dominant (1:2:1)	312.17	357.33	14.5	0.128	No
	H	Placebo	381.67	335.17	−12.2	0.289	No

Note. Δ (%), percentage change from pre- to post-supplementation. *p* values are from paired *t*-tests; values in bold indicate $p < 0.05$. Combination ratios are *C. burmannii* : *Z. officinale* : *C. longa*.

Table 2. *Blood lactate (mmol/L) before and after supplementation in Weeks 1 and 2.*

Week	Code	Composition	Pre	Post	Δ (%)	p	Significant
1	A	Cinnamon 100%	8	7.8	−2.5	0.508	No
	B	Red ginger 100%	8.6	8.2	−4.7	0.272	No
	C	**Turmeric 100%**	**8.6**	**8.1**	**−5.8**	**0.041**	**Yes**
	D	Combination 1:1:1	8.4	8	−4.8	0.136	No
2	E	Turmeric-dominant (1:1:2)	9	8.51	−5.4	0.25	No
	F	Cinnamon-dominant (2:1:1)	9.49	8.35	−12.0	0.057	No
	G	Red ginger-dominant (1:2:1)	8.9	9.44	6.1	0.404	No
	H	Placebo	9.18	9.04	−1.5	0.776	No

Note. Δ (%), percentage change from pre- to post-supplementation. p values are from paired t-tests; values in bold indicate p < 0.05. Combination ratios are C. burmannii : Z. officinale : C. longa.

Table 3. *VO_2max (mL/kg/min) before and after supplementation in Weeks 1 and 2.*

Week	Code	Composition	Pre	Post	Δ (%)	p	Significant
1	A	Cinnamon 100%	42.6	42.3	−0.7	0.267	No
	B	Red ginger 100%	42.4	42.5	0.2	0.608	No
	C	Turmeric 100%	42.2	42.1	−0.2	0.25	No
	D	Combination 1:1:1	42.6	42.3	−0.7	0.139	No
2	E	Turmeric-dominant (1:1:2)	42.89	43.04	0.3	0.082	No
	F	Cinnamon-dominant (2:1:1)	42.96	43.15	0.4	0.057	No
	G	Red ginger-dominant (1:2:1)	42.6	42.67	0.2	0.793	No
	H	Placebo	43.13	43.33	0.5	0.458	No

Note. Δ (%), percentage change from pre- to post-supplementation. p values are from paired t-tests; values in bold indicate p < 0.05. Combination ratios are C. burmannii : Z. officinale : C. longa.

Conclusion

In young Indonesian athletes, single and combined extracts of *C. burmannii*, *Z. officinale*, and *C. longa* produced limited and inconsistent changes in serum CK and blood lactate and no change in VO_2max. A significant CK decrease was observed with the cinnamon-dominant combination and a significant lactate decrease with turmeric alone, but the design does not allow either result to be attributed to a superior or synergistic formulation. These findings are exploratory. Future studies should use randomized or counterbalanced designs with a placebo comparator, direct between-formulation comparisons, adequate sample sizes, additional sampling times, and longer supplementation periods.