Effect of Raspberry Ketone (Razpberi-K®) and Acute Resistance Exercise on Post-exercise Caloric Energy Expenditure

Final Statistical Report

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SUMMARY

Purpose: The main purpose of this study was to determine if a single dose of raspberry ketone (RK) magnified the post-exercise increase in metabolic rate and/or fat oxidation (EPOC). A secondary purpose was to assess the safety profile of this ingredient after 30-days of continuous use. **Methods**: After giving informed consent and being cleared for participation, ten healthy subjects (eight men, two women) performed two EPOC trials in counterbalanced order. During the EPOC trials, subjects performed 3 sets of 6 exercises (squat, bench, stiff-legged dead-lift, bent-over row, shoulder press, and upright row) at a 10-12 repetition maximum weight load. Rest periods and exercise duration were standardized during both trials. Metabolic rate (via indirect calorimetry) and substrate oxidation (via respiratory exchange ratios) were measured twice during a pre-exercise baseline period (from 0-10 minutes before RK or placebo ingestion and from 20-30 minutes after RK or placebo ingestion), as well as 0-30 minutes post-exercise. After both EPOC trials were complete, all 10 subjects continued supplementing with 200 mg RK per day (in an open-label format) for 30-days. At the end of the 30-day period, subjects had a final blood draw to determine the effect of RK on standard clinical chemistry profiles. **Results**: As expected, resistance exercise significantly increased metabolic rate and carbohydrate oxidation relative to baseline, (via ANOVA, Figures 1 and 2) however, ingestion of RK did not appear to augment these responses compared to placebo. One possible exception is the trend towards an increase in fat oxidation ($P<0.15$) that occurred 30-minutes post exercise during the RK trial (via ANCOVA, Figure 3). No significant changes in blood chemistry were noted after 30-days of RK supplementation, and all values remained within normal clinical limits (via Wilcoxon, Table 2). **Discussion**: These preliminary data indicate that: 1) a 200 mg dose of RK, when taken 30 minutes prior to whole-body resistance exercise, does not affect post-exercise metabolic rate; 2) a 200 mg dose of RK, when taken 30 minutes prior to whole-body resistance exercise, may enhance fat oxidation late into the recover period (i.e., 30 minutes or after); and 3) daily supplementation with 200 mg RK does not adversely affect clinical chemistry profiles. Although promising, we recommend follow-up studies using larger sample sizes, a higher dose of RK, and a longer timeframe between ingestion and the initiation of exercise (i.e., at least 60 minutes) in order to more fully comprehend the effects of this unique ingredient on human physiology.

Table 1. Descriptive Statistics

Raz-K Trial (A)	Valid N	Mean	Min	Max	SD	SE
RMR Base	10	0.3360	0.2900	0.4500	0.05232	0.01655
RMR 30 post ingestion	10	0.3390	0.2900	0.4600	0.05724	0.01810
RMR 10 min post exercise	10	0.4160	0.3100	0.5700	0.09823	0.03106
RMR 20 min post exercise	10	0.3470	0.2600	0.4600	0.07227	0.02285
RMR 30 min post exercise	10	0.3410	0.2400	0.4700	0.08279	0.02618
RER Base	10	0.7990	0.6500	0.8700	0.06437	0.02036
RER 30 post ingestion	10	0.7810	0.6400	0.8500	0.06190	0.01958
RER 10 min post exercise	10	0.9110	0.7800	1.0400	0.08412	0.02660
RER 20 min post exercise	10	0.7600	0.6200	0.8300	0.05617	0.01776
RER 30 min post exercise	10	0.7470	0.5600	0.8100	0.06977	0.02206
Placebo Trial (B)						
RMR Base	10	0.327000	0.260000	0.370000	0.033015	0.010440
RMR 30 post ingestion	10	0.330000	0.270000	0.420000	0.049216	0.015563
RMR 10 min post exercise	10	0.407000	0.320000	0.530000	0.065498	0.020712
RMR 20 min post exercise	10	0.374000	0.270000	0.450000	0.065862	0.020827
RMR 30 min post exercise	10	0.341000	0.250000	0.420000	0.060083	0.019000
RER Base	10	0.797000	0.660000	0.860000	0.053135	0.016803
RER 30 post ingestion	10	0.785000	0.630000	0.820000	0.057975	0.018333
RER 10 min post exercise	10	0.907000	0.820000	1.030000	0.064644	0.020442
RER 20 min post exercise	10	0.795000	0.670000	0.880000	0.057203	0.018089
RER 30 min post exercise	10	0.765000	0.600000	0.830000	0.064850	0.020507
Safety Data						
Glucose (pre)	10	89.2000	79.0000	99.0000	6.39097	2.02100
Glucose (post)	10	87.6000	77.0000	105.0000	8.26236	2.61279
BUN (pre)	10	17.3000	13.0000	24.0000	3.59166	1.13578
BUN (post)	10	17.9000	13.0000	24.0000	3.75500	1.18743
Creatinine (pre)	10	1.0000	0.8000	1.3000	0.18856	0.05963
Creatinine (post)	10	1.0100	0.7000	1.2000	0.19692	0.06227
BUN/Creat ratio (Pre)	10	17.9000	13.0000	30.0000	5.34270	1.68951
BUN/Creat ratio (Post)	10	18.3000	12.0000	24.0000	3.94546	1.24766
Sodium (Pre)	10	139.4000	137.0000	142.0000	1.50555	0.47610
Sodium (Post)	10	140.4000	139.0000	144.0000	1.64655	0.52068
Potassium (Pre)	10	4.3000	3.7000	4.7000	0.27889	0.08819
Potassium (post)	10	14.2400	3.6000	105.0000	31.89159	10.08501
Chloride (pre)	10	102.4000	98.0000	106.0000	2.50333	0.79162
Chloride (post)	10	94.6000	21.0000	106.0000	25.94952	8.20596

CO2 (pre)	10	24.8000	22.0000	28.0000	2.34758	0.74237
CO2 (post)	10	23.1900	9.9000	28.0000	4.85626	1.53568
Calcium (pre)	10	9.5800	9.2000	9.9000	0.22010	0.06960
Calcium (post)	10	9.4300	7.5000	10.3000	0.79449	0.25124
Protein (Pre)	10	7.0800	6.6000	7.5000	0.34254	0.10832
Protein (post)	10	7.2200	6.2000	7.8000	0.49844	0.15762
Albumin (Pre)	10	4.3300	4.1000	4.6000	0.15670	0.04955
Albumin (post)	10	4.4600	4.1000	4.8000	0.24129	0.07630
Globulin (Pre)	10	2.7500	2.2000	3.1000	0.32404	0.10247
Globulin (post)	10	2.7600	2.1000	3.2000	0.32387	0.10242
A/G Ratio (pre)	10	1.6000	1.4000	2.0000	0.21082	0.06667
A/G Ratio (post)	10	1.6300	1.4000	2.0000	0.18886	0.05972
Bilirubin (pre)	10	0.4900	0.2000	0.8000	0.23781	0.07520
Bilirubin (post)	10	0.4500	0.2000	0.7000	0.18409	0.05821
Alkaline Phos (pre)	10	69.8000	45.0000	114.0000	19.75292	6.24642
Alkaline Phos (post)	10	69.2000	38.0000	102.0000	19.87628	6.28543
AST (Pre)	10	27.8000	16.0000	58.0000	11.98888	3.79122
AST (Post)	10	36.3000	16.0000	98.0000	22.75009	7.19421
ALT (Pre)	10	28.2000	15.0000	61.0000	14.14842	4.47412
ALT (Post)	10	28.8000	13.0000	57.0000	12.54149	3.96597
Chol (Pre)	10	169.3000	113.0000	213.0000	30.32802	9.59056
Chol (post)	10	182.5000	119.0000	236.0000	33.88625	10.71577
TAG (Pre)	10	77.6000	57.0000	122.0000	18.87503	5.96881
TAG (post)	10	97.6000	40.0000	142.0000	38.48290	12.16936
HDL (Pre)	10	59.7000	49.0000	100.0000	15.37711	4.86267
HDL (Post)	10	56.9000	38.0000	102.0000	18.66935	5.90377
VLDL (pre)	10	15.5000	11.0000	24.0000	3.80789	1.20416
VLDL (post)	10	19.5000	8.0000	28.0000	7.56086	2.39096
LDL (Pre)	10	94.1000	43.0000	130.0000	26.21895	8.29116
LDL (Post)	10	106.1000	49.0000	160.0000	34.50749	10.91223

Figure 1. Comparison of Raspberry Ketone (Trial A) vs. Placebo (Trial B) on Resting Metabolic Rate (RMR)

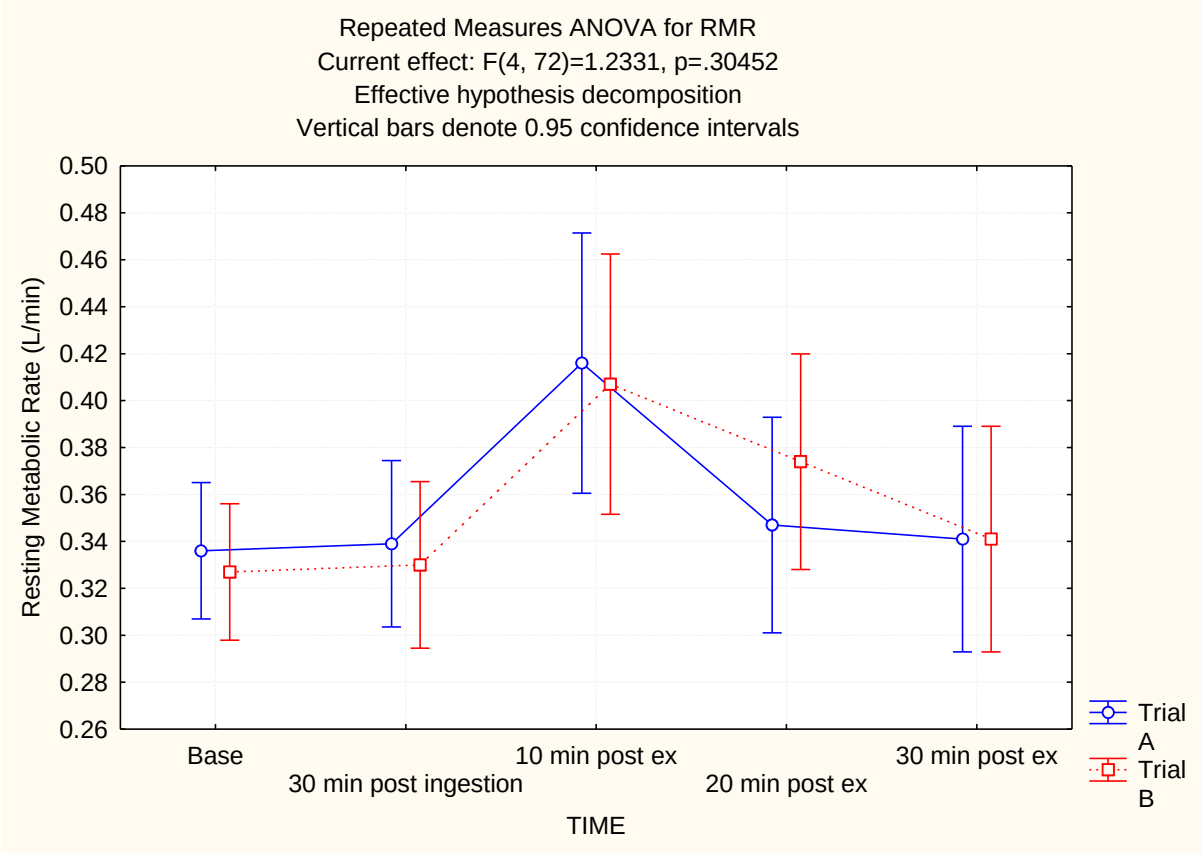


Figure 2. Comparison of Raspberry Ketone (Trial A) vs. Placebo (Trial B) on Substrate Oxidation (RER) at All Time Points

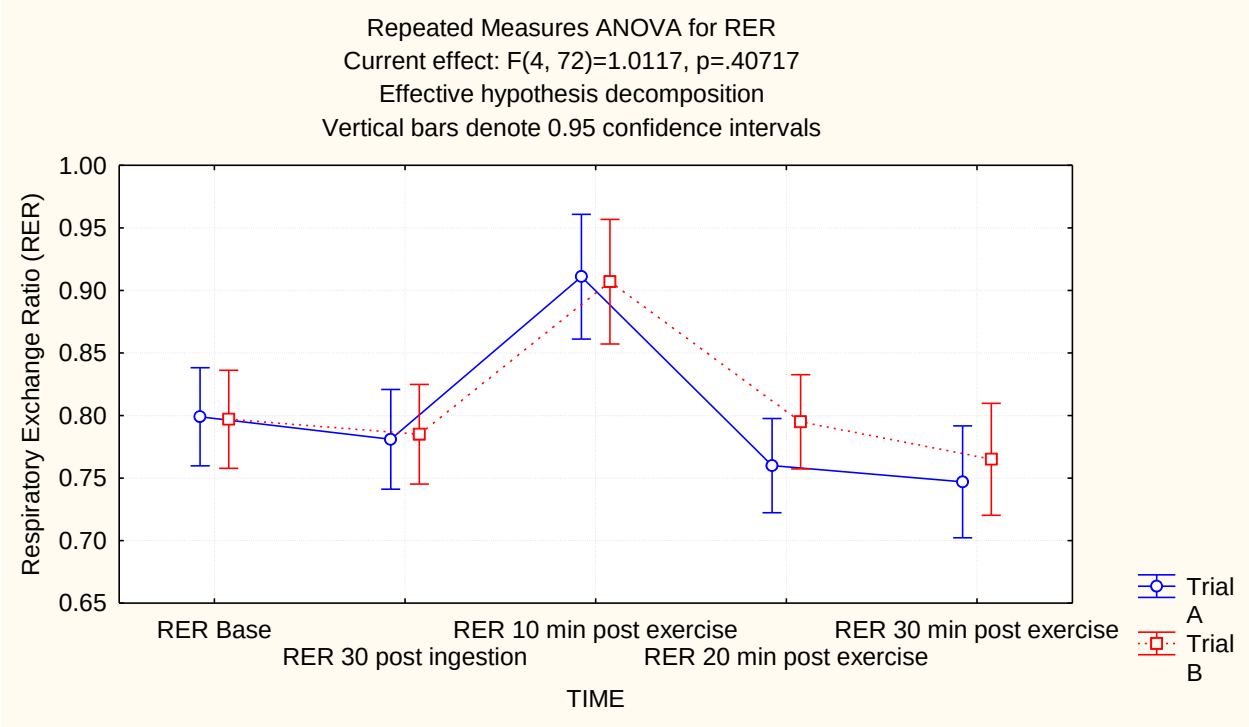
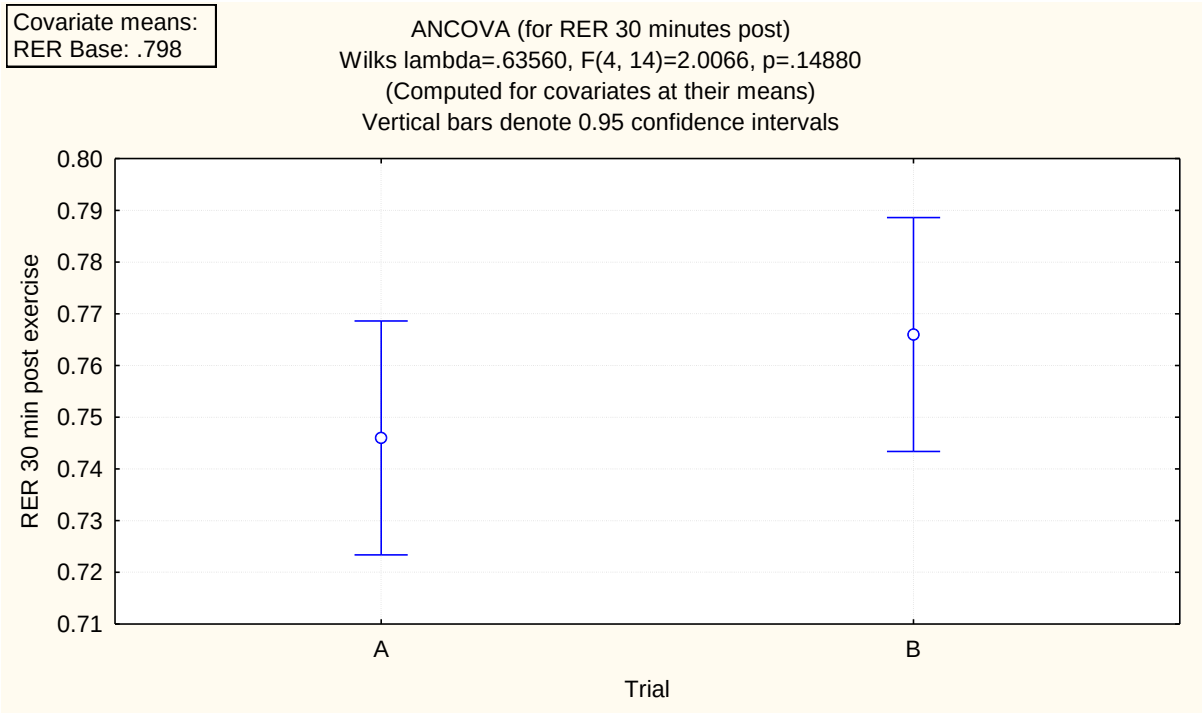


Figure 3. Comparison of Raspberry Ketone (Trial A) vs. Placebo (Trial B) on Substrate Oxidation (RER) at 30 min post exercise



*** Lower RER reflects a greater reliance on fat as the metabolic fuel.**

Table 2. Pre vs. Post Differences for Phase II (30-day safety)

Results: No changes from pre to post in any variable were noted.

Wilcoxon Matched Pairs Test (Razz data (final)

	Valid	T	Z	p-level
Glucose (pre) & Glucose (post)	10	21.50000	0.611577	0.540818
BUN (pre) & BUN (post)	10	20.00000	0.296174	0.767097
Creatinine (pre) & Creatinine (post)	10	13.50000	0.630126	0.528613
BUN/Creat ratio (Pre) & BUN/Creat ratio (Post)	10	25.50000	0.203859	0.838464
Sodium (Pre) & Sodium (Post)	10	7.00000	1.540308	0.123486
Potassium (Pre) & Potassium (post)	10	18.50000	0.917365	0.358952
Chloride (pre) & Chloride (post)	10	19.00000	0.414644	0.678403
CO2 (pre) & CO2 (post)	10	24.50000	0.305788	0.759766
Calcium (pre) & Calcium (post)	10	20.00000	0.296174	0.767097
Protein (Pre) & Protein (post)	10	13.50000	1.066228	0.286321
Albumin (Pre) & Albumin (post)	10	13.00000	1.477977	0.139415
Globulin (Pre) & Globulin (post)	10	18.00000	0.000000	1.000000
A/G Ratio (pre) & A/G Ratio (post)	10	9.50000	0.760639	0.446873
Bilirubin (pre) & Bilirubin (post)	10	10.00000	0.676123	0.498963
Alkaline Phos (pre) & Alkaline Phos (post)	10	27.00000	0.050965	0.959354
AST (Pre) & AST (Post)	10	8.00000	1.717812	0.085832
ALT (Pre) & ALT (Post)	10	26.50000	0.101929	0.918813
Chol (Pre) & Chol (post)	10	12.00000	1.579906	0.114129
TAG (Pre) & TAG (post)	10	16.00000	1.172189	0.241122
HDL (Pre) & HDL (Post)	10	19.00000	0.866400	0.386271
VLDL (pre) & VLDL (post)	10	11.00000	1.362402	0.173072
LDL (Pre) & LDL (Post)	10	15.50000	1.223153	0.221273

Note: p-values (via dependent t-test) for Sodium = 0.12; Albumin = 0.13; AST = 0.28; Chol = 0.18. These trends are difficult to interpret because there was no placebo group for comparative purposes (i.e., they could reflect normal variability). Nonetheless, all differences were small and all values remained well within normal clinical limits.