Comparison of the effectiveness of whey protein hydrolysate and milk-based formulated drinks on recovery following acute strength training

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Introduction

Since many elite athletes perform multiple daily training sessions, the efficient recovery of muscle function following strength training is essential for the maintenance of quality training output (Gee et al., 2012). Research has shown that both whey protein hydrolysate and milk-based drinks are effective at enhancing recovery of muscle function following strength training (Buckley et al., 2010; Cockburn et al., 2010). However, surprisingly no research has compared the recovery eliciting effects of these two drink types following training of any kind. It has been speculated that a combination of whey hydrolysate and high-glycaemic carbohydrates provide the optimal post-exercise recovery drink (Manninen 2006). Nutritional mixtures containing whey protein hydrolysates greatly argument plasma amino-acids concentrations and insulin response compared to milk-based or casein protein mixtures when ingested at rest (Pennings et al, 2011). These effects would theoretically lead to an increase in protein synthesis and potentially a more rapid and complete restoration of muscle function following stressful training. This study aimed to compare the effectiveness of whey protein hydrolysate and milk-based formulated drinks on recovery of muscle function following acute strength training.

Methods

Participants

Thirty resistance-trained males were recruited (mean ± SD, age: 25.2 ± 5.5 years, body mass: 79.4 ± 8.4 kg, stature: 1.77 ± 0.45 m).

Procedure

The study followed a within and between group randomised double-blind design. Participants were randomly assigned to one of the three groups: (i) whey hydrolysate-based drink (WH), (ii) milk-based drink (MB; *commercially available For Goodness Shakes*) (iii) flavoured dextrose (placebo) (Table 1). Participants initially completed baseline assessments of; perceived muscle soreness, countermovement (CMJ), static squat jump (SSJ), seated medicine ball throws (MBT) and isokinetic assessments of peak torque, peak power and mean work across five maximal knee extension and flexion actions at 60°/s using the dominant leg. Participants then completed three consecutive daily sessions; beginning with the strength training session and subsequent ingestion of the experimental supplemental drink, after this two further follow up testing sessions, identical to baseline testing, were performed at 24 h and 48 h post strength session respectively.

Table 1. Nutritional content of supplemental drinks

	Whey hydrolysate + dextrose	Milk-based protein carbohydrate drink	Placebo - Dextrose
Energy (Kcal)	533	532	531
Protein (g)	32.6	32.8	0
Carbohydrate (g)	98.3	98.4	132.7
of which sugars (g)	97.6	96.8	132.7
Fat (g)	1.1	0.6	0

Strength session (ST)

The ST (Table 1) comprised of a series of multi-joint, barbell, structural strength training exercises (Figure 1). The featured exercises were selected based on their replication of the structural lifts often performed during athletic strength training programmes (Gee et al, 2011). Upon completion of the session, participants were administered with their respective nutritional supplemental drink.

Table 2. Strength training session and mean ± SD of 1-RM achieved by participants on exercises featured.

Exercise	Sets x reps	% 1-RM resistance	1-RM achieved (kg)
Squat	4 x 8	75%	105 ± 26
Bench press	4 x 8	75%	81 ± 17
Deadlift	4 x 8	75%	136 ± 24
Military press	4 x 8	75%	48 ± 8
Bench pull	4 x 8	75%	74 ± 11

Figure 1. Deadlift as featured in the strength training session. An exercise commonly prescribed within athletic training programmes

Statistical analysis

Changes in assessed measures (SSJ, CMJ, MBT, isokinetic measures, perceived soreness) across the three trials (baseline, 24 h, 48 h post strength training) were analysed using two-way (group x trial) repeated measures ANOVA tests. The alpha level for significance was set at $P < 0.05$ for all analyses and the LSD correction was used for pairwise comparisons.

Results

There were no between-group changes for all assessed measures ($P > 0.05$). Regarding within-group changes, all groups experienced increases in muscle soreness at both 24 h and 48 h ($P < 0.001$). However, for dynamic power measures (SSJ, CMJ and MBT) placebo experienced a within-group decrease for only CMJ at 48 h, whereas WH and MB experienced significant decreases across SSJ, CMJ and MBT ($P < 0.05$). All groups experienced decreases in isokinetic extension torque at both 24 h and 48 h, however, flexion torque was decreased for placebo only at these time-points ($P < 0.05$). Isokinetic extension peak power and work were significantly decreased for both WH and placebo at 24 h and 48 h ($P < 0.05$), however, no decreases occurred for MB. Flexion peak power was significantly decreased for the placebo group only at 24 h and 48 h ($P < 0.05$). Decreases in flexion work occurred across all conditions at 48 h, but only for placebo at 24 h ($P < 0.05$).

Table 3. Comparison of perceived muscle soreness and strength and power tests across baseline, 24 h post and 48 h post follow up trials for all groups.

** = Significantly differently from baseline trial (P < 0.05).*

	WH			MB			Placebo		
Measure	Baseline	24 h	48 h	Baseline	24 h	48 h	Baseline	24 h	48 h
Soreness (0-200 scale)	19 [19]	102* [39]	99* [52]	25 [22]	106* [51]	94* [59]	26 [17]	91* [33]	84* [51]
SSJ (cm)	48.4 [6.3]	45.4* [4.3]	46.2 [4.8]	46.7 [5.9]	44.1* [4.7]	44.7* [5.7]	43.8 [5.6]	42.5 [6.3]	41.8 [5.9]
CMJ (cm)	50.8 [6.2]	48.4* [4.7]	49.2 [5.1]	50.4 [6.3]	46.8* [4.9]	47.2* [7.0]	46.3 [5.2]	44.9 [5.9]	44.5* [6.4]
MBT (m)	5.35 [0.90]	5.26 [0.70]	5.10* [0.71]	5.54 [0.42]	5.21* [0.47]	5.16* [0.50]	5.37 [0.58]	5.37 [0.68]	5.31 [0.63]
Peak Torque Extension (N.m)	189 [33]	159* [33]	168* [27]	195 [23]	179* [20]	177* [16]	193 [39]	173* [37]	173* [41]
Peak Torque Flexion (N.m)	105 [17]	101 [16]	100 [15]	113 [21]	108 [15]	106 [18]	118 [25]	108* [21]	105* [23]
Peak Power Extension (w)	136 [26]	118* [25]	123* [25]	135 [17]	131 [14]	134 [16]	140 [26]	125* [27]	126* [27]
Peak Power Flexion (w)	78 [11]	76 [12]	76 [10]	89 [17]	83 [14]	84 [16]	87 [17]	80* [11]	81* [15]
Work Extension (J)	213 [53]	183* [40]	191* [47]	209 [36]	200 [22]	203 [26]	218 [43]	194* [45]	190* [41]
Work Flexion (J)	120 [19]	119 [21]	114* [21]	138 [34]	128 [23]	123* [25]	135 [29]	124* [22]	122* [28]

Summary and conclusion

Consumption of WH or MB had no effect on recovery of dynamic power producing ability or soreness compared to placebo. Indeed, the placebo group had fewer significant decreases across the dynamic power assessments. However, ingestion of WH and MB seemingly had positive effects on recovery of isokinetic muscle function when compared to recovery following placebo. When summarising the findings, there is seemingly no clear advantage to ingestion of WH over MB or protein + carbohydrate drinks compared to a carbohydrate drink for promoting recovery of muscle function following acute strength training.

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