Comparison of a Plasma Modified Non-Hydrolyzed Whey Protein Isolate Supplement and a Standard Processed High DH Hydrolyzed Whey Protein Isolate Supplement on Bioavailability in Resistance-Trained Males

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ABSTRACT

Background
Plasma modification (PM) is a surface treatment technique and is currently being investigated for use in biomaterials. The purpose of this study was to explore PM on dry whey protein isolate (WPI) powder and its effects on altering the bioavailability of oral WPI supplementation in humans.

Materials and Methods
10 resistance-trained males (26.6±6.0years; 181.4±4.0cm; 88.4±9.9kg) participated in this randomized, double-blind investigation. In crossover fashion, participants reported to a Quest Diagnostics facility 2 times separated by 7-days. After a baseline blood sample was taken, participants ingested 25g of a WPI powder that was processed with PM technology (Plasma) or standard processed high DH hydrolyzed WPI (Standard). Further samples were taken at 30min, 1hr, 2hrs, 3hrs, and 4hrs post-ingestion and analyzed for essential amino acids (EAA) concentrations. Time course data were analyzed via a 2-factor [2x6] within-subjects repeated measures ANOVA and total EAA concentrations and EAA area under the curve (AUC) data were analyzed via paired samples t-test.

Results
The repeated measures ANOVA revealed a significant main effect for time for all EAAs ($p<0.001$) and a treatment x time interaction ($p\leq0.017$) for all EAA's (with the exception of histidine). Baseline-adjusted individual plasma-EAA concentrations are summarized in Table 1. With the exception of histidine, PM treated non-hydrolyzed WPI resulted in significantly greater bioavailability as compared to the standard high DH hydrolyzed WPI dietary supplement. There was also a significant difference between the treatments for total EAA, BCAA, and EAA and BCAA area under the curve (table 2), with PM resulting in significantly greater plasma EAA and BCAA concentrations.

Conclusions
In resistance trained males, a plasma modified non-hydrolyzed whey protein isolate dietary supplement is more bioavailable than a standard hydrolyzed whey protein isolate dietary supplement.

BACKGROUND

Plasma modification (PM) is an effective surface treatment technique for many different materials, and there is growing interest in its use on organic materials like protein. To this point, research on the use of PM to promote surface changes of organic materials has focused largely on experiments using aqueous solutions, particularly as they relate to end-use applications in pharmacological development.

The purpose of this study was to explore PM on dry whey protein isolate (WPI) powder and its effects on altering the bioavailability of oral WPI supplementation in humans.

METHODS

10 resistance-trained males (26.6±6.0years; 181.4±4.0cm; 88.4±9.9kg) participated in this randomized, double-blind investigation. In crossover fashion, participants reported to a Quest Diagnostics facility 2 times separated by 7-days. After a baseline blood sample was taken, participants ingested 25g of a WPI powder that was processed with PM technology (Plasma) or standard processed high DH hydrolyzed WPI (Standard). Further samples were taken at 30min, 1hr, 2hrs, 3hrs, and 4hrs post-ingestion and analyzed for essential amino acids (EAA) concentrations. Time course data were analyzed via a 2-factor [2x6] within-subjects repeated measures ANOVA and total EAA concentrations and EAA area under the curve (AUC) data were analyzed via paired samples t-test.

RESULTS

The repeated measures ANOVA revealed a significant main effect for time for all EAAs ($p<0.001$) and a treatment x time interaction ($p\leq0.017$) for all EAA's (with the exception of histidine). Baseline-adjusted individual plasma-EAA concentrations are summarized in Table 1. With the exception of histidine, PM treated non-hydrolyzed WPI resulted in significantly greater bioavailability as compared to the standard high DH hydrolyzed WPI dietary supplement. There was also a significant difference between the treatments for total EAA, BCAA, and EAA and BCAA area under the curve (table 2), with PM resulting in significantly greater plasma EAA and BCAA concentrations.

CONCLUSION

In resistance trained males, a plasma modified non-hydrolyzed whey protein isolate dietary supplement is more bioavailable than a standard hydrolyzed whey protein isolate dietary supplement.

Table 1: Baseline Adjusted Plasma EAA Concentrations (μmol/L)

	Baseline	30-min	1hr	2hr	3hr	4hr	Treatment x Time
Plasma-Leucine	0	145±68	174±54	61±33	24±22	15±22	p = 0.001
Standard-Leucine	0	160±48	82±31	20±17	-1±18	4±19	
Plasma-Isoleucine	0	114±51	119±41	39±28	11±14	4±19	p = 0.012
Standard-Isoleucine	0	112±35	61±23	14±11	-2±9	-3±11	
Plasma-Valine	0	113±60	141±57	48±37	14±22	-2±26	p = 0.014
Standard-Valine	0	110±45	69±32	13±17	-2±25	-7±22	
Plasma-Histidine	0	10±10	14±9	4±5	-1±8	2±15	p = 0.724
Standard-Histidine	0	14±10	11±7	2±7	-1±13	-1±6	
Plasma-Threonine	0	83±39	95±41	49±26	30±16	24±15	p = 0.013
Standard-Threonine	0	78±25	55±19	25±16	12±14	8±15	
Plasma-Methionine	0	19±9	18±8	4±4	0±2	-1±2	p = 0.017
Standard-Methionine	0	17±5	9±4	1±2	-1±3	-2±3	
Plasma-Phenylalanine	0	13±10	13±4	-3±6	-11±2	-9±7	p = 0.001
Standard-Phenylalanine	0	16±10	1±12	-7±5	-9±9	-7±8	
Plasma-Tryptophan	0	30±23	46±20	20±15	5±15	-1±12	p = 0.003
Standard-Tryptophan	0	33±13	27±9	15±8	3±13	-2±13	
Plasma-Lysine	0	108±62	130±27	50±32	23±18	22±20	p < 0.001
Standard-Lysine	0	135±46	75±18	30±12	16±13	9±21	

Table 2. Total EAA, BCAA (μmol/L) and EAA, BCAA Area Under the Curve Comparisons

	Total EAA	p-value	AUC	p-value
Plasma-EAA	7,575±1,063	0.02	1,784±521	0.007
Standard-EAA	6,932±911		1,200±246	
Plasma-BCAA	3,961±641	0.039	1,012±333	0.009
Standard-BCAA	3,543±407		634±207	

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