Effects of Arginine Silicate and Inositol Ingestion on Cognitive and Executive Function in Gamers

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Abstract

Background Gaming or esports requires quick reactions, executive function, memory, and fine motor skills. Prior reports indicated that ingestion of arginine silicate (ASI) [1] improved the ability to perform complex cognitive tests requiring mental flexibility, processing speed and executive functioning. In addition, ingestion of ASI with 100 mg inositol (I) improved cognitive function in gamers after playing video games for one hour [2]. This study examined whether ASI+I ingestion prior to and following a 1-hour gaming challenge had effects on cognitive function.

Methods In a double blind, randomized, placebo controlled, and crossover trial, 26 healthy male and female experienced gamers (23±5 years, 171±11 cm, 73.1±21 kg, 21.1±5 kg/m^2) were randomly assigned to consume 1,500 mg of ASI plus 100 mg of I (nooLVL®, Nutrition 21) or 1,600 mg of a maltodextrin placebo control (PLA). Prior to testing participants recorded their diet for 4-days, refrained from consuming atypical amounts of stimulants as well as foods high in arginine and nitrates for 72-hours, and fasted for 8 hours prior to testing. At testing participants completed stimulant sensitivity and side effect questionnaires and performed cognitive function tests (i.e., Berg-Washington Card Sorting task test, Go No-Go test, Sternberg task test, Psychomotor Vigilance task test, Cambridge Brain Sciences Reasoning and Concentration test) and a Neurotracker light reaction test (Pre-SUPP). Participants then ingested one of the two the study treatments in a randomized manner. Fifteen minutes following ingestion, participants repeated tests (Pre-Game). Participants then played their favorite video game for 1-hour and repeated the battery of tests (Post-Game). Participants observed a 7-14-day washout period and then replicated their 4-day diet, pre-experiment controls, and the experiment while consuming the alternative treatment

Results Pairwise comparison of the Sternberg test revealed statistically significant results of treatment vs. placebo. This test specifically measures mental reasoning, reaction time and short-term memory recall with the ascending difficulty and complexity of the test, important for gamers. The analysis showed that there was significantly improved Mean Present Reaction Time (ASI+I vs. Placebo; p<0.05). In Post-Game assessments, 4-letter Absent Reaction Time (p<0.05), 6-letter Present Reaction Time (p<0.01), 6-letter Absent Reaction Time (p<0.01), Mean Present Reaction Time (p<0.02), and Mean Absent Reaction Time (p<0.03) were improved with ASI+I vs. placebo, suggesting that participants were able to store and retrieve random information from short-term memory of increasing complexity to a greater degree. Additionally, there was a non-significant trend after 15-min in Pre-Game Sternberg 4-letter Present Reaction time in ASI+I vs. placebo (p<0.07). There was also evidence from assessing mean changes with 95% CI's that ASI+I ingestion better maintained changes in Go-No-Go Mean Accuracy and Reaction Time; Psychomotor Vigilance Task Reaction Time; and Cambridge Post-Game Visiospatial Processing and Planning. However, GLM analysis of all three time points corrected for subject body weight revealed no significant treatment x time interactions in variables, additionally, no significant differences were observed in the Berg-Washington Card Sorting test, the light tracking assessments or the frequency or severity of stimulant sensitivity side effects.

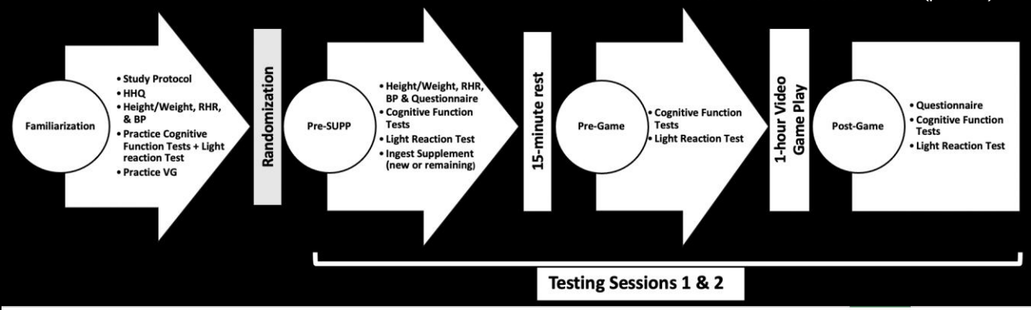
Conclusion Results provide evidence that ASI+I ingestion prior to playing video games may enhance some measures of short-term memory, reaction time, reasoning, and concentration in experienced gamers. Additional research should further examine the role of ASI+I on cognition, reasoning, and memory in gamers.

Background

Executive function, quick reaction time, memory, and fine motor skills are critical to an egamers' arsenal for prolonged esport performance. Previous data suggests ASI can improve key aspects of cognitive function. Additionally, ASI+I can improve cognitive function following an hour of playing video games.

Methods

- Double-blind, randomized, placebo-controlled, crossover
- 26 men (n=18) and women (n=8) participated in the study
- Participants met baseline characteristic criteria (23±5 years, 171±11 cm, 73.1±21 kg, 21.1±5 kg/m^2)
- Body weight, height, resting heart rate and blood pressure measures were obtained.
- Participants supplemented one of the following:
  - [Placebo] Maltodextrin (1,600 mg)
  - [ASI+I] ASI (1,500mg) & I (100 mg)



Sternberg's Memory Scanning Test

Variable	Group	N	Time Point: Pre-SUPP	Time Point: Pre-Game	Time Point: Post-Game	Mean (SEM)	Effect	p-Value	η_p^2
Letter Length 2: Absent	PLA	26	597.69 ± 171.70	569.42 ± 94.15	535.46 ± 78.10 †	570.00 ± 22.01	T	0.324	0.022
Reaction Time (Milliseconds)	nooLVL	26	571.96 ± 117.70	558.83 ± 151.89	555.42 ± 148.05	559.60 ± 22.01	W x T	0.624	0.009
	Time	52	584.83 ± 146.32	564.13 ± 125.23	545.44 ± 117.62 †	564.80 ± 15.53	G x T	0.309	0.023
Letter Length 4: Absent	PLA	26	730.19 ± 161.57	729.62 ± 186.18	721.35 ± 167.25	731.87 ± 28.34	T	0.337	0.022
Reaction Time (Milliseconds)	nooLVL	26	717.19 ± 148.63	699.40 ± 172.37	672.12 ± 152.95 †	691.42 ± 28.34	W x T	0.562	0.011
	Time	52	723.69 ± 153.84	714.51 ± 178.29	696.73 ± 160.61 †	711.64 ± 20.00	G x T	0.562	0.011
Letter Length 6: Absent	PLA	26	907.23 ± 211.59	918.27 ± 198.04	923.31 ± 204.74	923.22 ± 35.69	T	0.630	0.009
Reaction Time (Milliseconds)	nooLVL	26	904.23 ± 242.08	892.37 ± 232.47	851.88 ± 183.31	875.88 ± 35.69	W x T	0.736	0.006
	Time	52	905.73 ± 225.11	905.32 ± 214.21	887.60 ± 195.76	899.55 ± 25.18	G x T	0.292	0.025
Letter Length 2: Present	PLA	26	519.19 ± 61.17	502.90 ± 52.13	500.04 ± 82.54	508.76 ± 12.03	T	0.233	0.029
Reaction Time (Milliseconds)	nooLVL	26	525.81 ± 82.94	488.40 ± 81.15 †	484.54 ± 58.93 †	498.20 ± 12.03	W x T	0.800	0.004
	Time	52	522.50 ± 72.23	495.65 ± 67.93 †	492.29 ± 71.44 †	503.48 ± 8.49	G x T	0.349	0.021
Letter Length 4: Present	PLA	26	630.50 ± 92.07	634.27 ± 99.89	607.96 ± 90.90	627.11 ± 17.62	T	0.249	0.028
Reaction Time (Milliseconds)	nooLVL	26	626.77 ± 99.11	603.69 ± 98.77	618.85 ± 140.59	613.57 ± 17.62	W x T	0.388	0.019
	Time	52	628.63 ± 94.73	618.98 ± 99.56	613.40 ± 117.34	620.34 ± 12.43	G x T	0.192	0.033
Letter Length 6: Present	PLA	26	783.62 ± 143.04	807.37 ± 174.10	774.96 ± 145.91	793.67 ± 23.38	T	0.484	0.014
Reaction Time (Milliseconds)	nooLVL	26	769.58 ± 154.02	767.10 ± 145.76	721.65 ± 112.09 †a*	747.75 ± 23.38	W x T	0.838	0.003
	Time	52	776.60 ± 147.34	787.23 ± 160.27	748.31 ± 131.60 ‡	770.71 ± 16.50	G x T	0.514	0.013
Mean: Absent	PLA	26	745.04 ± 159.32	739.10 ± 146.24	726.71 ± 137.39	741.70 ± 27.04	T	0.232	0.029
Reaction Time (Milliseconds)	nooLVL	26	731.13 ± 160.82	716.87 ± 175.15	693.14 ± 143.95 †	708.96 ± 27.04	W x T	0.498	0.014
	Time	52	738.08 ± 158.65	727.98 ± 160.15	709.92 ± 140.35 †	725.33 ± 19.08	G x T	0.791	0.005
Mean: Present	PLA	26	644.44 ± 90.76	648.18 ± 98.57	627.65 ± 93.27 ‡	643.18 ± 16.67	T	0.153	0.038
Reaction Time (Milliseconds)	nooLVL	26	640.72 ± 98.73	619.73 ± 99.33 ‡	608.35 ± 93.10 †	619.84 ± 16.67	W x T	0.519	0.013
	Time	52	642.58 ± 93.91	633.96 ± 99.02	618.00 ± 92.78 †	631.51 ± 11.76	G x T	0.312	0.023

Data are expressed as means ± standard deviations for placebo (PLA) and nooLVL (ASI [1500mg] + nooLVL [100mg]) groups; Partial ETA squared (η_p^2). General Linear Model analysis revealed no significant overall Wilk's Lambda for Time (p=0.684), Weight [kg] x Time (p=0.986) or Group x Time (p=0.246) effects. Greenhouse-Geisser univariate p-levels are listed for time (T), weight x time (W x T), group x time (G x T) interactions effects. Significance was determined via pairwise comparison, with LSD post-hoc adjustment, indicated as differences from baseline: † = p<0.05 [‡ = 0.05<p<0.10]. Group differences are denoted as from PLA: a = p<0.05 [a* = 0.05<p<0.10].

Statistical Analyses

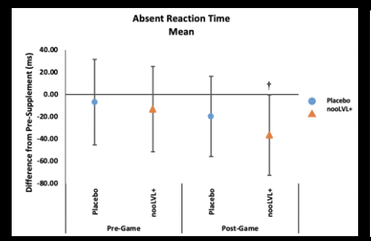
Data were analyzed by General Linear Model (GLM) univariate analyses with repeated measures using weight as a covariate, paired t-tests (not adjusted to weight), and mean changes from baseline with 95% Confidence Intervals (CI).

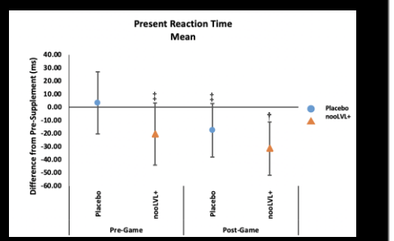
Results

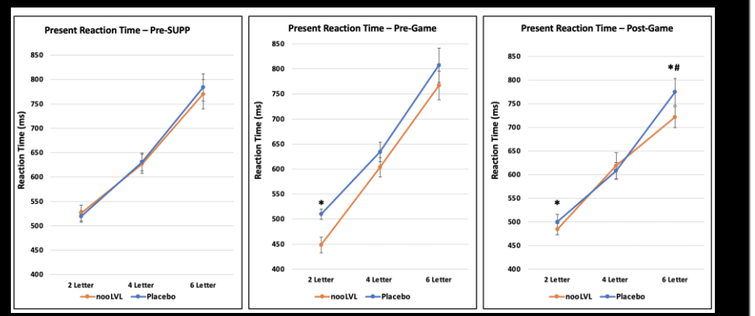
- Statistical significance was noted for several Sternberg measure.
  - Significant improvement in Mean Present Reaction Time (ASI+I vs. PLA; p<0.05)
- Statistical Significance for Post-Game assessments for ASI+I vs. PLA:
  - 4-Letter Absent Reaction Time (p<0.05)
  - 6-Letter Present Reaction Time (p<0.01)
  - 6-Letter Absent Reaction Time (p<0.01)
  - Mean Present Reaction Time (p<0.02)
  - Mean Absent Reaction Time (p<0.03)

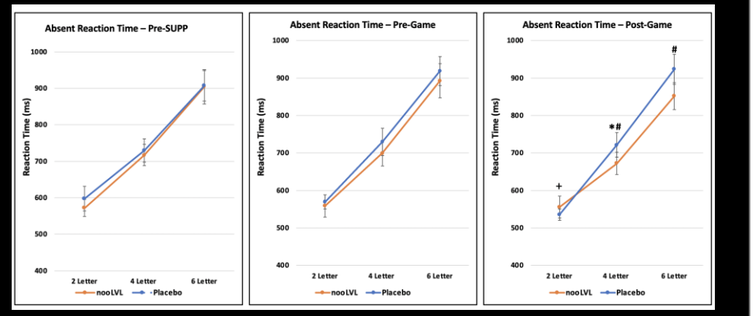
Conclusions & Applications

Previous data regarding nooLVL® supplementation have shown improvements to accuracy, decision making, and reaction time among egamers [2]. Our data provides evidence of enhanced short-term memory, reaction time (RT), reasoning, and concentration among egamers following ASI+I supplementation, which further supports the existing findings. Additionally, it is important to note that present RT was faster than absent RT, which illustrates better (faster) ability to recall information with recent memory. RT reflects the time spent searching one's short term memory to determine if the 'probe' is part of their memorized list (i.e., present) or not (i.e., absent). Additional research should examine the role of ASI+I on cognition, reasoning, and memory among gamers.









Acknowledgements & Disclosures

This study was funded as a fee for service project to the Human Clinical Research Facility at Texas A&M University by Nutrition21, Inc. (Harrison, NY, USA).