Sugar, Strife, and Thinking Twice: Metacognitive Guidance in Moderating Stress Related Choice of Sugar-Sweetened Beverages

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Background

An individual's capacity to remain healthy in times of stress is exceedingly difficult, and there is sufficient support that stress contributes to poor eating habits such as consumption of high-sugar and high-calorie foods[1]. There is also evidence that maladaptive metacognition increases stress and anxiety[2]. Metacognition is regarded as thinking critically about one's own thoughts and behaviors. In educational settings, metacognitive processes are applied to promote learning, habits, and improve grades of students[3]. The impact of stress, and anxiety, can be mitigated by engaging in healthy adaptive cognitive processes such as metacognition[4]. A limited amount of research has investigated the impact(s) of adaptive metacognition on participants' food choices. However, some previous studies show that guiding metacognitive processes may decrease selection of sugar-sweetened beverages (SSBs)[5]. The goal of the present study is to determine if metacognition can moderate stress and help participants navigate everyday health choices.
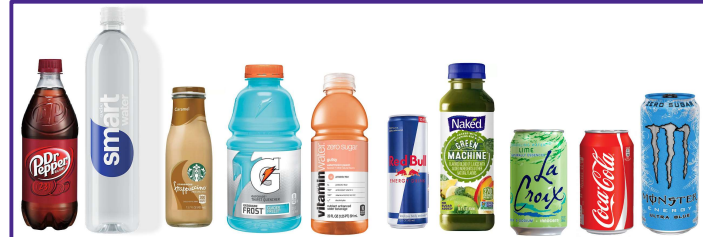
Table 1. Participants

Race & Gender	Female	Male	Non-Binary	Total Race
White	9	3	0	12
Mexican American	3	0	0	3
Black or African American	6	1	0	7
Asian	10	2	2	14
Hawaiian or Pacific Islander	0	1	0	1
White-Latin X	3	1	0	4
Other	0	1	1	2
Total Gender	31	9	3	43

Background

A total of 43 participants were recruited from the University of Washington Tacoma undergraduate research participant pool through SONA. Participants were asked to make two initial drink selections from a list of ten choices online. In the metacognitive guidance intervention, participants read an informational paragraph about SSBs health effects. Participants were tasked with an adapted metacognitive guidance intervention[3-5] in which they were asked to evaluate their monitoring, control, and thinking regarding their everyday drink choices.

Sample metacognitive guidance question: "Reflect on your beverage choices in a typical day. How would you describe your thought processes when you select a beverage to drink in your day-to-day life? What types of things do you consider when making the choice of what to drink?"

Next, participants were prompted to repeat two drink selections. Lastly, participants completed the Intuitive Eating Scale – 2 (IES – 2) , Perceived Stress Scale (PSS), and demographic questionnaires.

Figure 1. Visual display of SSBs that participants were able to choose during the experiment.

Hypothesis & Results

1- Metacognition guidance intervention would decrease selection of SSBs high in sugar

A paired-samples t-test was conducted to evaluate the influence the metacognitive guidance intervention on the participants sugar content of beverages selected. There was a statistically significant decrease in the sugar grams in participant's beverage selections from pre-test 1 ($M = 58.45$, $SD = 29.58$) to post-test 2 ($M = 39.64$, $SD = 29.70$), t (42) = 4.035, $p < .001$ (two-tailed). The mean decrease was 18.8 sugar grams with a 95% confidence interval ranging from 9.40g to 28.22g. The eta squared statistic (.63) indicated a medium effect size.

2- Positive correlation between PSS and sugar content of SSBs selected

The relationship between perceived stress as measured by the PSS and the sugar content of beverages selected (in sugar grams) was investigated by Pearson correlation coefficient. Preliminary analyses were preformed to find no violation of assumptions. No significant correlation between variables, $r = -0.117$, $p = 0.457$.

3- Higher IES - 2 score would indicate lower sugar consumption outcomes

The relationship between perceived stress as measured by the Perceived Stress Scale (PSS) and the IES – 2 was investigated by Pearson correlation coefficient. Preliminary analyses were preformed to find no violation of assumptions. There was a medium negative correlation found between the variables, $r = -0.390$, $p = 0.010$.

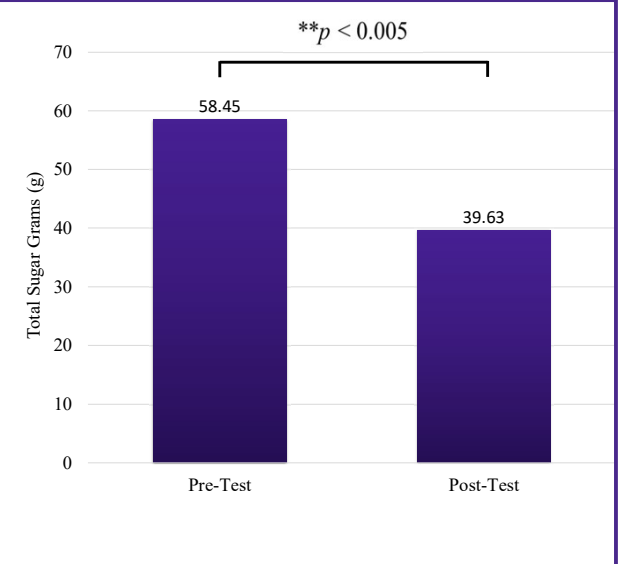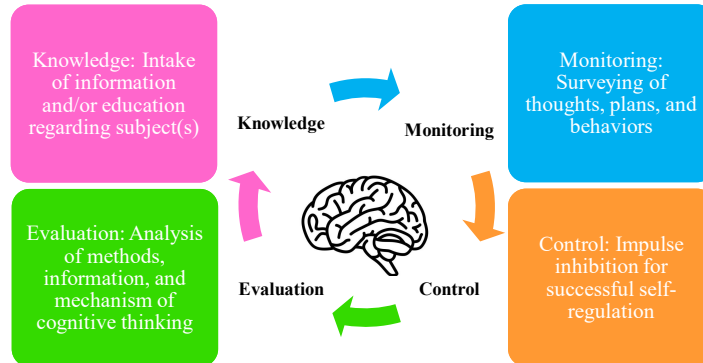Figure 2. Metacognitive cycle, addressed through the metacognitive guidance intervention.

Figure 3. **$p < 0.005$, total sugar content measured in grams (g) per two selected beverage choices pre and post metacognitive guidance intervention.

Discussion

Metacognitive guidance significantly improved participants' beverage selections by an average reduction of 18.8 sugar grams between the pre-test and post-test. The metacognitive guidance intervention of knowledge, monitor, control, and evaluate allowed participants to think more deeply about their choices thus enabling them to pick healthier drink selections.

We did not support hypotheses around perceived stress or intuitive eating. There was no significant correlation between PSS and beverage selection, but participants' mean score indicated moderate to high stress. This may indicate a ceiling effect as found in previous work from our lab in our undergraduate student sample. There were no differences in IES – 2 scores and beverage choices.

There are several limitations to consider in future work. Demand characteristics and the social desirability bias are possibly a large factor in participant's change of SSBs from pre-test to post-test as the metacognitive guidance directly asks about participants' choices and thinking about SSBs. The scope of the study was limited by practical constraints, as small sample size and online data collection limit the generalizability of our findings.

This study provides compelling initial evidence of the potential for simple metacognitive guidance exercises to improve daily health behaviors.

Further research is necessary to determine the potential for metacognitive guidance to improve health choices with more participants and a deeper scope of the metacognitive guidance intervention.