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The Relationship between Mental Fatigue and the Perceived Health of Foods

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Abstract

Mental fatigue seems to have a wide variety of effects on the body and mind based on current literature. This study explores the research question: Does mental fatigue have an influence on the perceived health of foods and does socioeconomic status (SES) moderate this relationship? Participants were college students aged over 18, currently attending a state university in northern Ohio and were recruited by email (N = 30). Participants were randomly assigned to one of two conditions: mental fatigue condition or non-mental fatigued condition (control). Participants completed a self-report survey on mental fatigue, then the experimental group took an N-back test and second mental fatigue survey, and then a survey on the perceived health of foods where they viewed pictures of food from the food pics database and rated the pictures healthiness and calories. Findings do not show the experimental group having any significant data in regards to p value. However, looking at the differences between the mental fatigue group and the control group, there are slight, but not significant differences. It is recommended that a study replicating this one would be conducted as a larger sample size may yield more significant data.

The Relationship between Mental Fatigue and the Perceived Health of Foods

Mental fatigue is a biological and psychological state that occurs after experiencing exposure to challenging cognitive tasks (Marcora, Staiano, & Manning, 2009). Marcora, Staiano, and Manning (2009) used electrocardiography, respirometry, and self-report to measure physical activity and mental fatigue. Their results indicated that individuals who were mentally fatigued perceived themselves as having put more effort into exercise than the cardiorespiratory data showed. Mehta and Parasuraman (2014) performed a study that used both psychophysiological methods and self-report examinations to determine if a relationship between physical fatigue and mental fatigue existed, and found that as a person's mental fatigue increased, their physical fatigue increased as well. These studies provide strong evidence that being mentally fatigued leads to decreased physical performance.

Beyond affecting the body, mental fatigue seems to also have an influence on psychological states. Faber, Maurits, and Lorist (2012) examined the effects of mental fatigue on selective visual attention using event-related potentials. The study found that as a person's mental fatigue increased, their ability to ignore unnecessary visual stimuli decreased. Zizheng et al. (2018) found that individuals who experienced a greater level of mental fatigue had a decreased ability to ignore unneeded stimuli in many sensory modalities, including vision.

Mental fatigue seems to have a wide variety of effects on the body and mind based on current literature. As mental fatigue has negative effects on people's abilities it seemed reasonable to suggest that it may also have a negative effect on people's perception of the health of foods. Clarke and Best (2017) conducted a correlational study that found a relationship between eating behavior and the perceived health of foods. Participant's perceptions of the

healthiness of foods changed with the type of diet they were on. So based on the prior research that shows high levels of mental fatigue increase physical fatigue and decrease response inhibition, it seemed likely that participants with high levels of mental fatigue would misjudge the healthiness of foods when mentally fatigued.

The current study evaluates the relationship between mental fatigue and perceptions of food. The purpose of the study is to observe the possible interaction between the two variables: mental fatigue and the perceived health of foods. It explores the research question: Does mental fatigue have an influence on the perceived health of foods and does socioeconomic status (SES) moderate this relationship? The independent variables are the level of mental fatigue and the dependent variable is one's perceived health of foods. Mental fatigue was operationalized as being a sociobiological state caused by prolonged periods of demanding cognitive activity (Marcora et al, 2009). Our experimental groups were divided randomly into groups of mental fatigued and not mentally fatigued.

The first hypothesis is that participants in the mentally fatigued group will rate common healthy foods as less healthy than participants in the control group. Additionally, participants would rate unhealthy foods as healthier than participants in the control group. This hypothesis is based on research that found that people who are mentally fatigued have weakened abilities to control attention (Faber, Maurits, & Lorist, 2012), the more mentally stressed a person becomes they also becomes more physically fatigued (Yoshikawa, Tanaka, Ishii, & Watanabe, 2014), and mental stress and emotional eating as well as fatigue and emotional eating increase together (Yoshikawa, Tanaka, Ishii, & Watanabe, 2014).

The second hypothesis is that individuals that have higher socioeconomic status will have more accurate perceptions of the healthiness of foods. Hannstein, Keqiang, and Hongmei (2014) found that, in people shopping at grocery stores, socioeconomic status was positively correlated with demand for high quality and healthy food.

Socioeconomic status was also predicted to be a moderator of the relationship between mental fatigue and perceived health of foods. It was expected that those who are mentally fatigued will be less accurate in their perceived health of foods and that members of high socioeconomic status will be more accurate. When looking at these relationships together, the effect of mental fatigue on perceived health of foods will be weakest in members of high socioeconomic status, moderate in those of a middle socioeconomic status, and strongest in those of a low socioeconomic status.

Method

Participants

Participants were college students above the age of 18, currently attending a state university in northern Ohio. They were recruited by email (N = 30). The demographic breakdown was White n = 29; Black n = 1 and Female n = 20; Male n = 10. Participants were randomly assigned to one of two conditions: mental fatigue condition or non-mental fatigued condition (control). Participants were offered SONA credit or the option to be entered into a raffle with a 1 in 30 chance to win a \$50 amazon gift card for their participation.

Procedures

For this project, participants were asked to refrain from eating or drinking anything one hour before taking the survey (water is permitted). Participants completed a series of online surveys through Qualtrics.

The first page of the experiment was an informed consent page. By selecting next, they agreed to the terms of the study. Next, participants took a self-report survey on mental fatigue. Then participants in the mental fatigue condition took the N-back test. This is a memory test that will be used to induce mental fatigue. The participants then took the same mental fatigue self report survey again. Participants in the control group did not take the N-back test or second self report survey.

Next, participants took a survey on the perceived health of foods. They viewed pictures of food from the food pics database and rated the pictures based on their healthiness on a Likert scale from zero to ten (zero being extremely unhealthy and ten being extremely healthy). They also answered how many calories they believed were in the food picture. Then, they took a demographics survey asking their age, gender, marital status, race/ethnicity, education level, employment, socioeconomic status, health (lifestyle and food choices, height, weight, and grade point average). Finally, participants were asked if they would like 1 SONA credit or a chance to be entered into a raffle for a \$50 Amazon gift card.

Results

An independent samples t-test was run to determine if there was a significant difference between the mental fatigue group and the control group. The results indicate that there is no

difference between the mental fatigue group (M=83.3, SD=34.6) and the control group (M=105, SD=31.3), $t(15)=-1.34$, $p=.20$. This indicates that the experimental group did not differ from the control group in level of mental fatigue, which may be due to a weak manipulation or to a low sample size.

Table 1

High Calorie Foods Group Differences

	<i>F</i>	<i>df</i>	<i>p</i>	η_p^2	Calories <i>M (SD)</i>
Experimental Group	0.63	1, 13	.44	.05	749 (297) ¹ 815 (393) ²
SES	1.66	1, 13	.22	.11	720 (341) ³ 937 (324) ⁴
Experimental Group*SES	0.38	1, 13	.55	.02	- (-)

Note. 1= Mental Fatigue Group, 2=Control Group, 3=Middle Class, 4=Lower Class

To determine if the groups differed in their perception of how many calories are in low-calorie foods, a 2 (Experimental Group: Mental Fatigue and Control) x 2 (SES: Middle and Lower) ANOVA was run. No main effect was found experimental group, indicating no significant difference between the mental fatigue group (M=749 calories, SD=297) and the control group (M=815, SD=393), $F(1,13)=.63$, $p=.44$. No main effect was found for socioeconomic status, indicating no significant difference between middle socioeconomic status (M=720, SD=341) and lower socioeconomic status (M=937, SD=324), $F(1,13)=1.66$, $p=.22$. No significant interaction between experimental group and socioeconomic status was found, $F(1,13)=.39$, $p=.55$.

Table 2

Low Calorie Food Group Differences

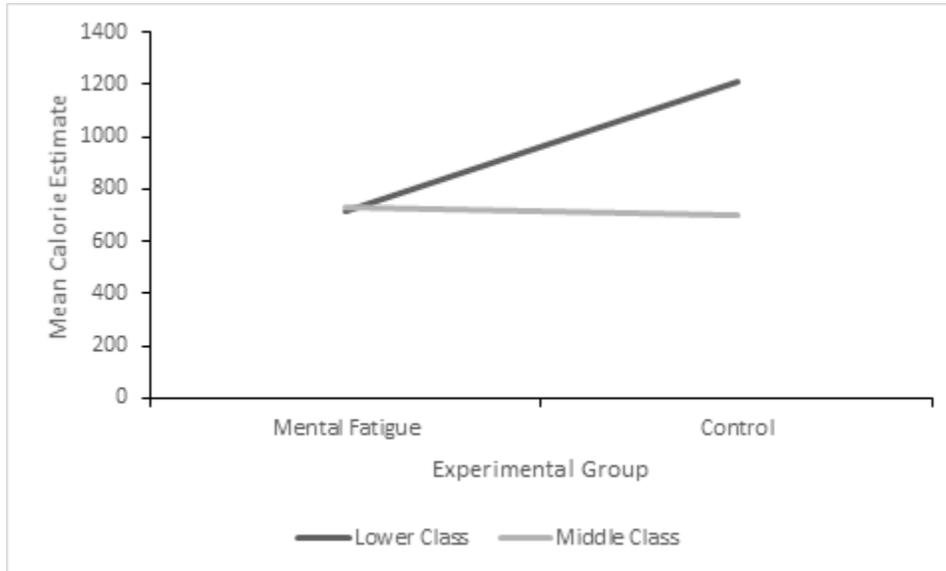
	<i>F</i>	<i>df</i>	<i>p</i>	η_p^2	Calories <i>M (SD)</i>
Experimental Group	2.41	1, 13	.14	.16	726 (278) ¹ 812 (321) ²
SES	2.83	1, 13	.12	.18	712 (231) ³ 914 (408) ⁴
Experimental Group*SES	3.14	1, 13	.10	.19	- (-)

Note. 1= Mental Fatigue Group, 2=Control Group, 3=Middle Class, 4=Lower Class

To determine if the groups differed in their perception of how many calories are in low-calorie foods, a 2 (Experimental Group: Mental Fatigue and Control) x 2 (SES: Middle and Lower) ANOVA was run. No main effect was found experimental group, indicating no significant difference between the mental fatigue group (M=726 calories, SD=278) and the control group (M=812, SD=321), $F(1,13)=2.41$, $p=.14$. No main effect was found for socioeconomic status, indicating no significant difference between middle socioeconomic status (M=712, SD=231) and lower socioeconomic status (M=914, SD=408), $F(1,13)=2.83$, $p=.12$. No significant interaction between experimental group and socioeconomic status was found, $F(1,13)=3.14$, $p=.10$.

Figure 1

Relationship Between Mental Fatigue and Socioeconomic Status



Note. This figure demonstrates the observed relationship between mental fatigue and socioeconomic status. The interaction is not significant at the $p < .05$ level.

Discussion

Group Differences

Findings do not show the experimental group having any significant data in regards to p value. However, looking at the differences between the mental fatigue group and the control group, we are able to see slight, but not significant differences. The findings reject the initial hypothesis (H1: Participants who are mentally fatigued will rate unhealthy foods as being healthy more than participants who are not mentally fatigued), because in both the high and low calorie foods the participants within the mental fatigue group do not rate more foods as more healthy than they actually are in comparison to the control group. There is a perceivable difference, but not significant enough to be applicable to a meaningful finding.

In investigating if SES acts as a moderator for the relationship between mental fatigue and the perceived health of foods, there is an insignificant finding within the interaction between the experimental group and SES in both calorie groups.

Features of Mental Fatigue

In prior studies, researchers investigating mental fatigue (Faber et al, 2012) and (Clarke and Best, 2017) to name a few of the more recent studies conducted, have been able to identify that mental fatigue can have a vast variety of effects on the mind as well as the body.

Deducible effects on one's efficiency of visual perception and attention have led to the formulation of this current study; something to take into account is just how extensive the array of effects may be, in the sense that variables not included in the study (i.e lengthy exposure to mental fatigue, exploration of different types of mental fatigue) may have increased the significance of the overall findings.

The study has limitations such as a small sample size. Originally the sample size was projected to be 100 students but recruitment was most likely affected by the Covid-19 pandemic that began at the same time that data was collected for this study. Furthermore, there is a weak construct validity in the conceptualization of mental fatigue for our study and participant demographics were skewed.

Conclusions & Future Study

In the field of psychology, mental fatigue is a highly understudied topic when food and eating are concerned. As stated, there is plenty of research to imply that mental fatigue and food-related behaviors are related, but the field has not looked very deeply into this relationship. It is

recommended that a study replicating this one would be conducted as a larger sample size may yield more significant data. More research should be supported to explore if the effects of socioeconomic status on the relationship between mental fatigue and the perceived health of foods can be eliminated or reduced in those in lower socioeconomic classes. Studies concerning mental fatigue may be of importance to everyday life (e.g. school curriculum and structure, job tasks, etc). These types of studies could potentially be beneficial in explaining for things such as forgetfulness or misnaming, which is common in most, if not all individuals. Mental fatigue can have an affect on all types of people, future research should investigate the variable of duration and rigor of the mental fatigue task to further prove this.

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