

## The Effect of Stress Induction on the Inhibition System, Mental Processing/Storage and Cognitive Failure in Women: The Moderator Role of Emotion Suppression

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### Abstract

The present research investigated the effect of stress induction on women's inhibition system (IS), working memory, and cognitive failure (CF), regarding the moderator role of suppression. The research method was quasi-experimental and had a fixed factorial design (2×2). The research population was the women of Abadeh, 112 were selected as the sample and divided into two groups based on suppression: high (HSG) and low suppression group (LSG). The groups were evaluated in two stages (no stress and stress induction), using Jackson's Five-Factor Questionnaire, Working Memory Test, and Cognitive Failure Questionnaire, and the data were analyzed by mixed analysis of variance test. The findings showed that the mean of IS in the HSG is higher than in the LSG. After stress induction, the mean of processing in the LSG, the mean of storage in the HSG, and the mean of CF in both groups decreased.

**Keywords:** Cognitive failure, inhibition, stress induction, suppression, working memory

### Introduction

The neurocognitive and cognitive functions of women are affected by the stages of the menstrual cycle (Le, et al., 2020). Therefore, the current research focused on three important and related functions, including the inhibition system, working memory, and cognitive failures of women. The inhibition system, because of the increase in attention, can be related to the functioning of working memory as well as cognitive failure. Cognitive functions can be affected by stress (Marko, et al., 2018). But the impact of stress is not always the same because the stress response can be affected by individual differences, including suppression (Raymond, et al., 2019); which itself can affect cognitive functions. However, the review of studies on the association of stress with cognitive functions shows conflicting evidence (Lukasik, et al., 2019). The conflicts of previous studies may be due to inattention to the role of possible moderating variables related to emotion (such as suppression). Therefore, the researchers hypothesized that stress induction and suppression have two main linear effects and one interactive effect (stress × suppression) on inhibition, working memory, and cognitive failures.

### Method

The current research used a quasi-experimental method and a 2x2 mixed factorial design (stress and suppression). The population was the adult women of Abadeh and 112 people

were selected by convenience sampling. Based on the score of  $Z < -1$  and  $Z > +1$  the suppression, two groups with 25 participants in each group were defined (LSG<-1, HSG>1). Before stress induction, each group responded to questionnaires. Then, after 4 weeks, they were exposed to the stress induction task and re-evaluated. The data were analyzed by mixed two-factor analysis of variance. Tools were included:

**Jackson-5 Scales:** This scale developed by Jackson (2009) has 30 items. Hasani et al. (2012) reported internal consistency by Cronbach's alpha in the range of 0.72 to 0.88 and the internal correlation of the items from 0.11 to 0.53. Cronbach's alpha in the present study was 0.71.

**Working Memory Test (WMT):** This test developed by Daneman et al. (1980) has 27 items. Its correlation with the information processing index was 0.88, and the Kuder-Richardson coefficient was 0.87 and 0.85 (Asadzadeh, 2009). In the present study, Cronbach's alpha of mental processing and storage was 0.69 and 0.74.

**Cognitive Failure Questionnaire (CFQ):** This was developed by Broadbent et al. (1982) and has 25 items. Abolghasemi (2016) reported internal consistency and retest reliability of 0.89 and 0.77. Cronbach's alpha in the present study was 0.76.

**Stress induction task:** In the research of Sharifi, et al. (2017), this task was subjected to a pilot evaluation. This task uses a three-part box. The participant was told that three of the four things that will be mentioned (including crumpled paper, chocolate, insect, and pencil eraser) are located in three parts of the box, and he must touch and name each one with his eyes closed. This ambiguity was to induce stress.

## Results

Based on the results, the assumptions of variance analysis were confirmed. According to Table 1, the mean inhibition in the HSG was significantly higher ( $F=10.16, P=.003$ ). After stress induction, mental processing ( $F=15.26, P=.001$ ), mental storage ( $F=5.86, P=.019$ ), and cognitive failure ( $F=174.85, P=.001$ ) decreased significantly. The findings showed that in the LSG, after the stress induction, the mental processing decreased significantly ( $P<.001$ ). In HSG, the mental storage after stress induction decreased significantly ( $P<.05$ ). In both HSG and LSG, cognitive failure decreased significantly after stress induction ( $P<.05$ ).

**Table 1. Results of mixed two-factor analysis of variance**

Source	Dependent	Sum of Squares	df	Mean Square	F	Sig.	Eta Squared	
Between Groups	Mental processing	242.02	1	242.02	.69	.411	.014	
	suppression	Mental storage	11.09	1	11.09	.04	.844	.001
	Inhibition	288.28	1	288.28	10.16	.003	.175	
	Cognitive failure	.07	1	.07	.04	.848	.001	
Error	Mental processing	16898.33	48	352.05				
	Mental storage	13542.22	48	284.21				
	Inhibition	1361.76	48	28.37				

		<b>Cognitive failure</b>	90.67	48	1.89		
<b>Within Group</b>	<b>Stress</b>	<b>Mental processing</b>	1975.18	1	1975.18	15.26	.001 .24
		<b>Mental storage</b>	466.30	1	466.30	5.86	.019 .11
		<b>Inhibition</b>	7.46	1	7.46	1.71	.198 .03
		<b>Cognitive failure</b>	1300.75	1	1300.75	174.85	.001 .79
	<b>Stress × Suppression</b>	<b>Mental processing</b>	343.03	1	343.03	2.65	.110 .05
		<b>Mental storage</b>	49.39	1	49.39	.62	.435 .01
		<b>Inhibition</b>	6.65	1	6.65	1.52	.223 .03
		<b>Cognitive failure</b>	78.69	1	78.69	10.58	.002 .18
	<b>Error</b>	<b>Mental processing</b>	6214.11	48	129.46		
		<b>Mental storage</b>	3817.60	48	79.53		
		<b>Inhibition</b>	209.85	48	4.37		
		<b>Cognitive failure</b>	357.08	48	7.44		

## Discussion and Conclusion

The finding that inhibition is significantly higher in HSG may be because the inhibition system reduces the subjective dimension of negative emotions. The significant decrease in mental processing in LSG is probably due to the low mental processing of the LSG at the same baseline, so they show a slight drop after stress induction. However, after stress induction, the significant decrease in storage in the HSG could be due to the excessive use of suppression and the use of cognitive resources to push back unpleasant emotions. In both LSG and HSG, a significant decrease in cognitive failure after stress induction may be due to the role of stress in increasing the arousal of a person's attention and concentration toward the work he is doing. The generalization of the results to chronic stress is limited. Therefore, we recommend, researchers to examine the effects of chronic stress, and paying attention to the effects of interventions based on stress and suppression that might improve cognitive functions.

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### **Acknowledgments**

All the research participants and other people who made the present research possible are thanked and appreciated.

### **Financial support**

This article had no sponsor.

### **Conflicts of interest**

Authors found no conflict of interests.



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