# Mood Mediates the Effect of Caloric Deprivation on Executive Functions

*Evidence from the Stroop Task*

Oshin Vartanian
DRDC – Toronto Research Centre

Kristen Blackler
DRDC – Toronto Research Centre

Harris R. Lieberman
The U.S. Army Research Institute of Environmental Medicine

**Defence Research and Development Canada**

Scientific Report
DRDC-RDDC-2017-R021
February 2017

**IMPORTANT INFORMATIVE STATEMENTS**

This research was supported by WBE 04KI04 entitled Studies on Human Effectiveness in Sustained and Adverse Environments under the leadership of Oshin Vartanian.

Portions of this research were presented in the annual meeting of the Association for Psychological Science (APS) in Chicago, IL, in May 2015

Data collection as part of this study was approved by Defence Research and Development Canada's Human Research Ethics Committee and the Institutional Review Board of the U.S. Army Research Institute of Environmental Medicine.

The views, opinions, and findings in this report are those of the authors and should not be construed as an official Department of Defense or Army position, policy, or decision, unless so designated by other official documentation. Citations of commercial organizations and trade names in this report do not constitute an official Department of the Army endorsement or approval of the products or services of these organizations. The investigators have adhered to the policies for protection of human subjects as prescribed in DOD Instruction 3216.02 and the research was conducted in adherence with the provisions of 32 CFR Part 219.

## Abstract

Considerable empirical evidence suggests that lower levels of glucose impair performance on tests of executive functions. The mechanism advanced to explain this effect involves self-control—one's ability to control or override cognitive and behavioral tendencies to attain a goal. However, research has also shown that caloric deprivation impairs mood. We used a double-blind, placebo-controlled, crossover design to test the hypothesis that the effect of caloric deprivation on executive functions is mediated by mood. As predicted, caloric deprivation reduced interstitial glucose levels and impaired mood, and it was associated with more errors on incongruent than congruent trials of the Stroop task. Critically, mood fully mediated the effect of caloric deprivation on performance on incongruent trials. Our results are consistent with previous findings showing that positive affect can help improve self-regulation following ego depletion, and suggest mood as a mechanism whereby caloric deprivation can impair executive functions.


## Significance to defence and security

Cognitive performance in the context of Canadian Armed Forces (CAF) operations sometimes occurs against the backdrop of caloric deprivation. However, the mechanism whereby caloric deprivation exerts its effects on cognitive performance is not well understood. Here we have demonstrated experimentally that caloric deprivation impairs cognitive performance indirectly via its effect on mood. This finding is important for the development of countermeasures because it suggests that the effect of caloric deprivation on cognitive performance could be mitigated by buffering its effect on mood.

# Résumé

De nombreuses données empiriques semblent indiquer qu’un faible taux de glucose nuit à la performance aux tests des fonctions exécutives. Le mécanisme avancé pour expliquer cet effet met en cause la maîtrise de soi, c’est-à-dire la capacité d’un individu de contenir ou de transcender les tendances cognitivo-comportementales pour atteindre un but. Toutefois, les recherches montrent également que la privation calorique altère l’humeur. Nous avons utilisé un plan d’étude croisé à double insu contre placebo afin de vérifier l’hypothèse selon laquelle l’effet de la privation calorique sur les fonctions exécutives est induit par l’humeur. Comme prévu, la privation calorique a réduit le taux de glucose interstitiel et a altéré l’humeur, en plus d’être associée à un nombre d’erreurs plus élevé lors des essais non congruents que lors des essais congruents sur la tâche de Stroop. Essentiellement, l’humeur a complètement induit l’effet de la privation calorique sur la performance aux essais non congruents. Nos résultats concordent avec les constatations d’études antérieures qui montrent qu’un affect positif peut aider à améliorer l’autocontrôle après la déplétion du moi, et donnent à penser que l’humeur est un mécanisme par lequel la privation calorique peut nuire aux fonctions exécutives.

# Importance pour la défense et la sécurité

Dans le cadre des opérations des Forces armées canadiennes (FAC), le rendement cognitif évolue parfois en situation de privation calorique. Toutefois, le mécanisme par lequel la privation calorique exerce ses effets sur le rendement cognitif n’est pas bien compris. Nous avons ici démontré expérimentalement que la privation calorique nuisait indirectement au rendement cognitif à cause de son effet sur l’humeur. Cette constatation est importante pour l’élaboration de contre-mesures, car elle semble indiquer que l’effet de la privation calorique sur le rendement cognitif pourrait être atténué en amortissant son effet sur l’humeur.

# Table of contents

## List of figures



## List of tables

# 1 Introduction

Considerable empirical evidence suggests that lower levels of glucose are associated with impaired performance on tests of executive functions that necessitate controlled, effortful processes for optimal performance. The mechanism advanced to explain this effect involves self-control—one's ability to control or override cognitive and/or behavioural tendencies to attain a goal (Baumeister, Vohs, & Tice, 2007). It has been proposed that maintaining self-control depends on availability of energy, and that glucose provides this energy. As such, when glucose is reduced, the brain has less energy available to exert the desired level of self-control for optimal performance (see also Kurzban, 2010).

For example, data based on the Stroop task—a classic measure of executive functions used to assess self-control (e.g., Richeson & Shelton, 2003; von Hippel & Gonsalkorale, 2005)—have shown that low glucose is associated with impaired performance on trials that necessitate self-control for overriding a prepotent response (i.e., incongruent trials) but not otherwise (i.e., congruent trials) (Benton, Owens, & Parker, 1994). More directly, Gailliot et al. (2007) have shown that depletion of glucose as a function of engagement in a self-control task resulted in impaired subsequent performance on the Stroop task—measured by the time to complete the task or the number of errors on incongruent trials (Experiment 3).

An independent line of research has also shown that caloric deprivation can impair mood. For example, 24-hour food deprivation resulted in worse mood, nervousness, and jittery feelings (Green, Elliman, & Rogers, 1995; Uher, Treasure, Heining, Brammer, & Campbell, 2006). Therefore, it is possible that rather than exerting its effect on executive functions by depleting self-control, the effect of glucose on executive functions might be mediated by mood. If so, this would represent an alternative mechanism for how caloric deprivation could impair executive functions. Our proposal is consistent with the idea that emotions track internal regulatory states (Cosmides & Tooby, 2000; Tooby & Cosmides, 2008), and that low levels of blood glucose represent an adaptive problem that can trigger negative and potentially problematic emotions (Orquin & Kurzban, 2016). We tested our hypothesis by conducting a double-blind, placebo-controlled, crossover design, assessing interstitial glucose levels continuously over a 3-day study during which data on executive functions and mood were collected at six time points. We predicted that (a) caloric deprivation would impair accuracy on incongruent trials more so than on congruent trials of the Stroop task, and (b) this effect would be mediated by mood.

# 2 Methods

The present data were collected as part of a larger study conducted at the U.S. Army Research Institute of Environmental Medicine (USARIEM). A complete description of the procedures of that study can be found in Lieberman et al. (2017).

## 2.1 Participants

Twenty-three participants (17 men aged 20.5 ± 0.7 and weighing 79 kg ± 2.3; and 6 women aged 23.3 ± 1.4 and weighing 58.4 kg ± 3.0) completed the study after providing informed consent. The research protocol was approved by the institutional review board of the U.S. Army Research Institute of Environmental Medicine (USARIEM) and Defence Research and Development Canada's Human Research Ethics Committee (DRDC HREC).

## 2.2 Design

A double-blind, placebo-controlled, mixed-factorial design was employed to test our hypothesis. Each volunteer completed the 51-hour (i.e., 2.5 d) experimental phase (Table 1) twice—calorie-deprived and fully-fed (in counterbalanced order).

## 2.3 Diets

The principal "food" for the calorie-deprivation condition consisted of hydrocolloid-based gels with artificial sweeteners and flavors, diet gels, hard candies with only a few kcal, artificially sweetened drinks, and commercially-available, very low kcal noodles made from an indigestible fiber and served with a very low kcal sauce. The principal food for the fully-fed condition consisted of starch/maltodextrin based gels/dispersions. Double-blind caloric deprivation studies can be conducted using such foods (Lieberman et al., 2008). Water and non-caffeinated diet beverages were available ad libitum.

## 2.4 Materials and procedures

Mood was assessed using the Profile of Mood States (POMS) (McNair et al., 1971)—a widely used, standardized inventory of mood states that yields six sub-scales (tension-anxiety, depression-dejection, anger-hostility, vigor-activity, fatigue-inertia, and confusion-bewilderment). It typically requires less than 5 minutes to complete. The question format was "how are you feeling right now?" in response to 65 separate mood-state adjectives. The sub-scale scores are used to calculate a Total Mood Disturbance score (TMD, the sum of each of the sub-scales, with vigor weighed negatively). Executive functions were assessed using the Stroop task (Stroop, 1935). On each trial the participant was presented with a word, and asked to press a button corresponding to the colour of the presented stimulus. Whereas on *congruent* trials there was a match between the word and the colour in which it appeared (e.g., the word "BLUE" appeared in blue colour), on *incongruent* trials there was a mismatch between the word and the colour in which it appeared (e.g., the word "BLUE" appears in green colour). Critically, on incongruent trials there is a characteristic increase in reaction time and/or decrease in accuracy in performance. In each session we administered 80 congruent and 80 incongruent trials involving four colors (yellow, red, green, blue). The Stroop task and the POMS were administered six times under fully-fed and six times under calorie-deprived conditions using the Cognitive Test Software (Grushcow, 2008) (see Table 1).

***Table 1:*** *Testing schedule.*

| Time | Day 0 | Day 1 | Day 2 | Day 3 |
|---|---|---|---|---|
| 0530 | | | | Wake Up |
| 0600 | | Wake Up | Wake Up | Testing |
| 0700 | | Exercise | Exercise | |
| 0800 | | Meal | Meal | |
| 0900 | | Testing | Testing | Meal |
| 1000 | | | | |
| 1100 | | Aerobic Exercise | Aerobic Exercise | |
| 1200 | | | | Meal |
| 1300 | | Meal | Meal | Release |
| 1400 | | | Aerobic Exercise | |
| 1500 | | Aerobic Exercise | Testing | |
| 1600 | | | | |
| 1700 | Arrival | Meal | Meal | |
| 1800 | Practice/ Baseline Testing | Testing | | |
| 1900 | | | | |
| 2000 | | | | |
| 2100 | | Snack/Exercise | | |
| 2200 | | | | |
| 2300 | Lights Out | Lights Out | | |
| 2400 | | | Lights Out | |

Notes: The above 2.5-day testing schedule was completed twice in counterbalanced order by each participant (i.e., fully-fed and calorie-deprived). The Stroop task and POMS (Profile of Mood States) were administered at each Testing session (i.e., six times under fully-fed and six times under calorie-deprived conditions). Interstitial glucose levels were measured continuously throughout (see Methods).

Interstitial glucose levels were measured by a Continuous Glucose Monitoring System (CGMS; Medtronic MiniMed iPro®2 Professional Continuous Glucose Monitoring System, Northridge, CA) (see Lieberman et al., 2008). The wireless sensor was inserted into the subcutaneous tissue of the lower back. It analyzed data every 10 seconds and reported values every 5 minutes.

# 3 Results

As a manipulation check, we began our analysis by assessing the effect of Condition (calorie-deprived, fully-fed) on glucose levels. As expected, glucose levels were higher in the fully-fed ($M$ = 91.46, $SD$ = 11.78) than in the calorie-deprived ($M$ = 73.05, $SD$ = 9.26) condition, $t(20) = 9.01$, $p < .001$, $d = 1.70$. Next, we examined the effect of Condition on POMS sub-scale and overall scores. As expected, compared to participants in the fully-fed condition, participants in the calorie-deprived condition registered higher scores on the sub-scales of depression-dejection ($M$ = 4.81, $SD$ = 7.59, vs. $M$ = 1.90, $SD$ = 3.34, $t[20] = 2.62$, $p = .016$, $d = .32$), confusion-bewilderment ($M$ = 5.52, $SD$ = 2.90, vs. $M$ = 3.80, $SD$ = 1.33, $t[20] = 3.11$, $p = .006$, $d = .69$), tension-anxiety ($M$ = 10.87, $SD$ = 3.67, vs. $M$ = 8.32 $SD$ = 1.57, $t[20] = 4.12$, $p = .001$, $d = .72$), fatigue-inertia ($M$ = 7.44, $SD$ = 3.65, vs. $M$ = 3.97, $SD$ = 2.98, $t[20] = 5.91$, $p < .001$, $d = 1.02$) and anger-hostility ($M$ = 4.28, $SD$ = 6.11, vs. $M$ = 2.22, $SD$ = 2.72, $t[20] = 2.14$, $p = .045$, $d = .32$). There was no difference between the two conditions on vigor-activity ($M$ = 9.28, $SD$ = 4.41, vs. $M$ = 10.11, $SD$ = 6.10, $t[20] = -1.13$, $p = .272$, $d = -.14$). This overall pattern was reflected in greater TMD scores in the calorie-deprived ($M$ = 23.64, $SD$ = 20.43) than the fully-fed ($M$ = 10.10, $SD$ = 10.31) condition, $t(20) = 4.32$, $p < .001$, $d = .66$.

Next, we tested our first prediction by examining the interaction of Condition (calorie-deprived, fully-fed) and Congruency (congruent, incongruent) on the number of errors in the Stroop task. The results demonstrated a main effect for Congruency ($F[1, 20] = 25.18$, $p < .001$, partial $\eta^2 = .56$), and for Condition ($F[1, 20] = 6.11$, $p = .023$, partial $\eta^2 = .23$) (Figure 1). Critically, there was also a significant Condition × Congruency interaction such that there were more errors as a function of caloric deprivation on incongruent than congruent trials, $F(1, 20) = 6.97$, $p = .016$, partial $\eta^2 = .26$.

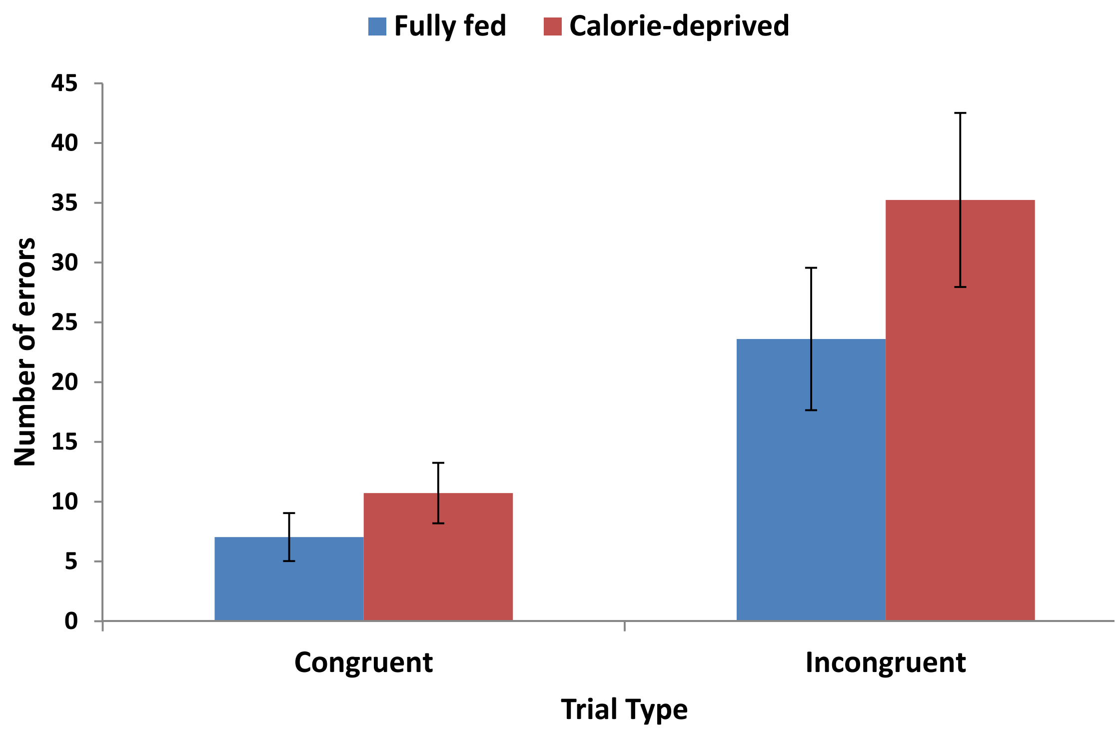


***Figure 1:*** *Performance on the Stroop task as a function of caloric deprivation and congruency. Notes: Bars represent standard errors of the mean (SEM).*

Having established that the effect of caloric deprivation on Stroop performance is stronger on incongruent trials, and that caloric deprivation affects TMD, we then tested the mediation model whereby the effect of caloric deprivation on performance on incongruent trials is mediated by mood. Indeed, confirming our second prediction, TMD mediated this effect. Caloric deprivation predicted performance on incongruent trials of the Stroop task such that errors were higher in the calorie-deprived than in the fully-fed condition. And, controlling for TMD scores, the effect of caloric deprivation on performance on incongruent trials was no longer significant, Sobel Test $z = 3.42$, $p < .001$ (Figure 2). Given that the effect of caloric deprivation on executive functions was no longer significant after controlling for TMD, it was concluded that mood is a full mediator of this relation. In addition, in terms of specific POMS subscales, the same relation (i.e., full mediation) was established for depression-dejection (Sobel Test $z = 2.94$, $p$=.003), tension-anxiety (Sobel Test $z = 3.08$, $p = .002$), anger-hostility (Sobel Test $z = 2.78$, $p$= .005) and confusion-bewilderment (Sobel Test $z = 2.98$, $p = .003$).

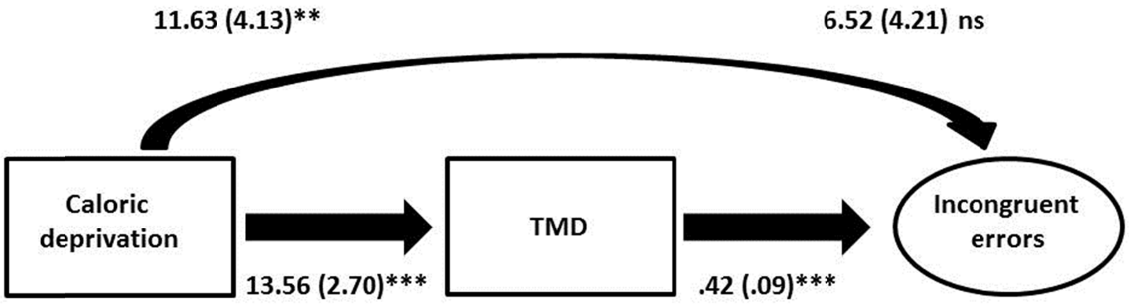


***Figure 2:*** *The effect of caloric deprivation on performance on incongruent trials is mediated by mood. ** = p < .01, *** = p < .001.*

# 4 Discussion

Our results demonstrated that caloric deprivation brings about a negative affective state, which in turn drives performance impairments on the incongruent trials of the Stroop task. This finding suggests that there is a close relationship between affect and performance on tasks that necessitate controlled, effortful processing. Consistent with this inference, positive affect has been shown to improve self-regulation following ego depletion (Tice, Baumeister, Shmueli, & Muraven, 2007), although it remains unclear whether positive affect actually replenishes the depleted resource, or whether it makes participants more willing or motivated to continue self-regulating despite their depleted state. Although these two possibilities remain to be decoupled in future studies, there is recent meta-analytic evidence to suggest that low blood glucose levels can trigger emotions that in turn lead to a lower willingness to exert effort on any non-food-related activity (Orquin & Kurzban, 2016). In this sense, studying the effect of caloric deprivation on motivation warrants closer scrutiny. Extending Tice et al. (2007), our results suggest that positive mood induction represents a candidate countermeasure for mitigating the deleterious effects of caloric deprivation on executive functions.

Finally, it is important to note that executive functions consist of three distinct subcomponents, namely (1) updating, (2) inhibition, and (3) set shifting (Miyake et al., 2000). Whereas the Stroop task has been shown to tap the inhibition subcomponent of executive functions, the n-back working memory task taps its updating subcomponent. Lieberman et al. (2017) have recently shown that two days of caloric deprivation did not impact n-back performance. The combined results of the present report and Lieberman et al. (2017) suggest that tasks that tap the inhibition subcomponent of executive functions (e.g., Stroop task) might be more susceptible to the effects of caloric deprivation than tasks that tap the updating subcomponent of executive functions (e.g., n-back). The differential susceptibility of various subcomponents of executive functions to caloric derivation warrants further investigation.

This page intentionally left blank.

# References


Baumeister, R. F., Vohs, K. D., & Tice, D. M. (2007). The strength model of self-control. *Current Directions in Psychological Science, 16*, 351–355.

Benton, D., Owens, D. S., & Parker, P. Y. (1994). Blood glucose influences memory and attention in young adults. *Neuropsychologia, 32,* 595–607.

Cosmides, L., & Tooby, J. (2000). Evolutionary psychology and the emotions. In M. Lewis & J. M. Haviland-Jones (Eds.), *Handbook of emotions* (2nd ed., pp. 91–115). New York: Guilford Press.

Gailliot, M. T., Baumeister, R. F., DeWall, C. N., Maner, J. K., Plant, E. A., & Tice, D. M., Brewer, L. E., & Schmeichel, B. J. (2007). Self-control relies on glucose as a limited energy source: Willpower is more than a metaphor. *Journal of Personality and Social Psychology, 92*, 325–336.

Green, M. W., Elliman, N. A., & Rogers, P. J. (1995). Lack of effect of short-term fasting on cognitive function. *Journal of Psychiatric Research, 29*, 245–253.

Grushcow, M. (2008). *Cognitive Test Software (Version 2.0)* [Computer software]. North York, ON: NTT Systems Inc.

Kurzban, R. (2010). Does the brain consume additional glucose during self-control tasks? *Evolutionary Psychology, 8,* 244–259.

Lieberman, H. R., Bukhari, A. S., Caldwell, J. A., Wilson, M. A., Mahoney, C. R., Pasiakos, S. M., McClung, J. P., & Smith, T. J. (2017). Two days of calorie deprivation induced by underfeeding and aerobic exercise degrades mood and lowers interstitial glucose but does not impair cognitive function in young adults. *The Journal of Nutrition, 147*, 110–116.

Lieberman, H. R., Caruso, C. M., Niro, P. J., Adam, G. E., Kellogg, M. D., Nindl, B. C., & Kramer, F. M. (2008). A double-blind, placebo-controlled test of two days of caloric deprivation: Effects on cognition, activity, sleep and interstitial glucose levels. *American Journal of Clinical Nutrition, 88*, 667–676.

Miyake, A., Friedman, N. P., Emerson, M. J., Witzki, A. H., Howerter, A., & Wager, T. D. (2000). The unity and diversity of executive functions and their contributions to complex "Frontal Lobe" tasks: a latent variable analysis. *Cognitive Psychology, 41*, 49–100.

McNair, D. M., Lorr, M., & Droppleman, L. F. (1971). *Profile of Mood States manual*. San Diego, CA: Educational and Industrial Testing Service.

Orquin, J. L., & Kurzban, R. (2016). A meta-analysis of blood glucose effects on human decision making. *Psychological Bulletin, 142*, 546–567.

Richeson, J. A., & Shelton, J. N. (2003). When prejudice does not pay: Effects of interracial contact on executive function. *Psychological Science, 14*, 287–290.

Stroop, J. R. (1935). Studies of interference in serial verbal reactions. *Journal of Experimental Psychology, 18*, 643–662.

Tice, D. M., Baumeister, R. F., Shmueli, D., & Muraven, M. (2007). Restoring the self: Positive affect helps improve self-regulation following ego depletion. *Journal of Experimental Social Psychology, 43*, 379–384.

Tooby, J., & Cosmides, L. (2008). The evolutionary psychology of the emotions and their relationship to internal regulatory variables. In M. Lewis, J. M. Haviland-Jones, & L. F. Barrett (Eds.), *Handbook of emotions* (pp. 114–137). New York: Guilford.

Uher, R., Treasure, J., Heining, M., Brammer, M. J., & Campbell, I. C. (2006). Cerebral processing of food-related stimuli: effects of fasting and gender. *Behavioral and Brain Research, 169*, 111–119.

von Hippel, W., & Gonsalkorale, K. (2005). “That is bloody revolting!” Inhibitory control of thoughts better left unsaid. *Psychological Science, 16,* 497–500.

## DOCUMENT CONTROL DATA

(Security markings for the title, abstract and indexing annotation must be entered when the document is Classified or Designated)

1. ORIGINATOR (The name and address of the organization preparing the document. Organizations for whom the document was prepared, e.g., Centre sponsoring a contractor's report, or tasking agency, are entered in Section 8.)

DRDC – Toronto Research Centre
Defence Research and Development Canada
1133 Sheppard Avenue West
P.O. Box 2000
Toronto, Ontario M3M 3B9
Canada

2a. SECURITY MARKING (Overall security marking of the document including special supplemental markings if applicable.)

UNCLASSIFIED

2b. CONTROLLED GOODS

(NON-CONTROLLED GOODS)
DMC A
REVIEW: GCEC DECEMBER 2013

3. TITLE (The complete document title as indicated on the title page. Its classification should be indicated by the appropriate abbreviation (S, C or U) in parentheses after the title.)

Mood Mediates the Effect of Caloric Deprivation on Executive Functions: Evidence from the Stroop Task

4. AUTHORS (last name, followed by initials – ranks, titles, etc., not to be used)

Vartanian, O.; Blackler, K.; Lieberman, H.R.

5. DATE OF PUBLICATION (Month and year of publication of document.)

February 2017

6a. NO. OF PAGES (Total containing information, including Annexes, Appendices, etc.)

18

6b. NO. OF REFS (Total cited in document.)

18

7. DESCRIPTIVE NOTES (The category of the document, e.g., technical report, technical note or memorandum. If appropriate, enter the type of report, e.g., interim, progress, summary, annual or final. Give the inclusive dates when a specific reporting period is covered.)

Scientific Report

8. SPONSORING ACTIVITY (The name of the department project office or laboratory sponsoring the research and development – include address.)

DRDC – Toronto Research Centre
Defence Research and Development Canada
1133 Sheppard Avenue West
P.O. Box 2000
Toronto, Ontario M3M 3B9
Canada

9a. PROJECT OR GRANT NO. (If appropriate, the applicable research and development project or grant number under which the document was written. Please specify whether project or grant.)

9b. CONTRACT NO. (If appropriate, the applicable number under which the document was written.)

10a. ORIGINATOR'S DOCUMENT NUMBER (The official document number by which the document is identified by the originating activity. This number must be unique to this document.)

DRDC-RDDC-2017-R021

10b. OTHER DOCUMENT NO(s). (Any other numbers which may be assigned this document either by the originator or by the sponsor.)

04KI04

11. DOCUMENT AVAILABILITY (Any limitations on further dissemination of the document, other than those imposed by security classification.)

Unlimited

12. DOCUMENT ANNOUNCEMENT (Any limitation to the bibliographic announcement of this document. This will normally correspond to the Document Availability (11). However, where further distribution (beyond the audience specified in (11) is possible, a wider announcement audience may be selected.))

Unlimited

13. ABSTRACT (A brief and factual summary of the document. It may also appear elsewhere in the body of the document itself. It is highly desirable that the abstract of classified documents be unclassified. Each paragraph of the abstract shall begin with an indication of the security classification of the information in the paragraph (unless the document itself is unclassified) represented as (S), (C), (R), or (U). It is not necessary to include here abstracts in both official languages unless the text is bilingual.)

Considerable empirical evidence suggests that lower levels of glucose impair performance on tests of executive functions. The mechanism advanced to explain this effect involves self-control—one's ability to control or override cognitive and behavioral tendencies to attain a goal. However, research has also shown that caloric deprivation impairs mood. We used a double-blind, placebo-controlled, crossover design to test the hypothesis that the effect of caloric deprivation on executive functions is mediated by mood. As predicted, caloric deprivation reduced interstitial glucose levels and impaired mood, and it was associated with more errors on incongruent than congruent trials of the Stroop task. Critically, mood fully mediated the effect of caloric deprivation on performance on incongruent trials. Our results are consistent with previous findings showing that positive affect can help improve self-regulation following ego depletion, and suggest mood as a mechanism whereby caloric deprivation can impair executive functions.

---------------------------------------------------------------------------------------------------------------

De nombreuses données empiriques semblent indiquer qu'un faible taux de glucose nuit à la performance aux tests des fonctions exécutives. Le mécanisme avancé pour expliquer cet effet met en cause la maîtrise de soi, c'est-à-dire la capacité d'un individu de contenir ou de transcender les tendances cognitivo-comportementales pour atteindre un but. Toutefois, les recherches montrent également que la privation calorique altère l'humeur. Nous avons utilisé un plan d'étude croisé à double insu contre placebo afin de vérifier l'hypothèse selon laquelle l'effet de la privation calorique sur les fonctions exécutives est induit par l'humeur. Comme prévu, la privation calorique a réduit le taux de glucose interstitiel et a altéré l'humeur, en plus d'être associée à un nombre d'erreurs plus élevé lors des essais non congruents que lors des essais congruents sur la tâche de Stroop. Essentiellement, l'humeur a complètement induit l'effet de la privation calorique sur la performance aux essais non congruents. Nos résultats concordent avec les constatations d'études antérieures qui montrent qu'un affect positif peut aider à améliorer l'autocontrôle après la déplétion du moi, et donnent à penser que l'humeur est un mécanisme par lequel la privation calorique peut nuire aux fonctions exécutives.

14. KEYWORDS, DESCRIPTORS or IDENTIFIERS (Technically meaningful terms or short phrases that characterize a document and could be helpful in cataloguing the document. They should be selected so that no security classification is required. Identifiers, such as equipment model designation, trade name, military project code name, geographic location may also be included. If possible keywords should be selected from a published thesaurus, e.g., Thesaurus of Engineering and Scientific Terms (TEST) and that thesaurus identified. If it is not possible to select indexing terms which are Unclassified, the classification of each should be indicated as with the title.)

Glucose; Nutrition; Executive Functions; Mood