EFFECTS OF EMOTIONAL REGULATION ON BLOOD SUGAR

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Abstract

Numerous studies support that a person who uses his will power consumes the body’s glucose resources. In this study we aimed to answer the following questions. Could a person’s effort to suppress his emotion be measured? Can we measure the effort that we make when we try to show the opposite of the emotion that we experience? What happens to the blood glucose level when a person suppress their emotions or displays the opposite / a different emotion from what they experience at that moment? To answer these questions we divided the participants into three experimental groups. Each group had to watch a group of emotional stimuli for 28 minutes. The first group was asked to watch the stimuli without being instructed regarding emotional regulation. Those in the second group were asked to suppress their emotions and display a neutral attitude. Those in the third group were asked to display the opposite of the emotion they feel after watching the stimuli. The blood sugar level was measured before and after the test using Accu Check Active gluco-meter. The facial expressions of the participants were filmed. The participant’s psycho-physiological parameters were measured using the Lafayette LX 4000 polygraph. Each participant had his rights and a description of the experiment presented and after that their consent to participate was obtained.

Cuvinte cheie: reglare emotionala, glicemie, glucoza, suprimare, emotii

Keywords: emotion regulation, glucose, blood glucose levels, suppressing, emotions

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1. INTRODUCTION

Gailliot and Baumeister (2007) presented an analysis of several works in order to highlight the link between blood glucose levels and the individual’s ability to manifest his will power. They argue that glucose is an important energy source of self-control. Loss of self-control occurs when glucose cannot be mobilized efficiently to the brain. For example: when insulin level decreases or when the body is resistant to insulin. Many behaviors can be explained on the basis of this pattern. Controlling attention, emotion regulation, smoking cessation, stress resistance, controlling impulsivity, refraining an aggressive behavior.

From a physiological point of view the self-control involves prefrontal cerebral cortex activation, specifically the anterior cingulate cortex (Kandel, Schwartz, Jessell 2000). Self-control seems to be vital for the smooth realization of human activity both individually and collectively.

Glucose is the fuel the brain. Brain activity relies almost exclusive on glucose as an energy source (Siesjo 1978). The blood glucose is metabolized in certain brain regions that perform certain tasks. For example: using light stimulation increases glucose metabolism in the visual cortex (McNay, McCarty and Gold 2001). Negative moods are the most important triggers of poor self-regulation (Marlott and Gordon 1985; Sinha 2009). When people become frustrated they tend to behave aggressively (Anderson and Bushman 2002), to spend excessively (Bruyneel 2009) to undertake risky activities (Somerville, 2010), to consume alcohol, drugs or compulsive eating to calm themselves (Heatherton 2011; Magid et. al. 2009) and generally tend to fail their tasks. Emotional regulation is a set of automatic and controlled processes involved in the initiation, maintenance and alteration of occurrence/context/circumstances, intensity and duration of emotional states (Eisenberg, Fabes, Guthrie, & Reiser, 2000; Gross & Thompson, 2007).

Grandey (2000) analyzing the literature explains that emotional regulation processes that an employee who interacts with customers is forced to make. The employee is forced to control the emotions that he expresses so that they can be appropriate and in accordance with the rules of the company. In this way facial expressions are carefully controlled and this requires a high effort. For a good interaction and productivity for the company the employee is forced to regulate their emotions. It is not enough to only control the facial expression but ideally the emotion experienced by the subject must be congruent. The two processes
described are found in the literature as "surface acting" - to manage facial expressions and "deep acting" for regulating emotional feelings".

Grandey (2003) argues that a company that wants satisfied customers would be ideal to select employees able to deliver their emotions. Grandey tested what happens when the facial expressions that the employee displays are not in accordance with his feelings. When an individual tries to show an emotion that is not congruent with what he really feels we are talking about the phenomenon of emotional dissonance and in this case the emotional effort made it is much higher (Mann, 2004). In conclusion it would be ideal for the employee to regulate their emotional feelings for lower emotional effort.

Segerstrom (2007) and his research team observed that a person who exercises self-control at thoughts level has a more irregular pulse. People whose pulse is least variable have more energy available for obtaining a high performance in the laboratory tasks involving a high degree of persistence than those with a stable pulse.

2. OBJECTIVE AND HYPOTHESES

2.1. OBJECTIVE

- Objective 1: To examine how glucose resource consumption varies when the subject suppresses their emotions, displays an emotion opposite to the experienced emotion, or expresses exactly what they feel.
- Objective 2: Registration and analyzing the changes that occur in the facial expressions when emotions are suppressed or when simulating an expression.
- Objective 3: Identification of a pattern in the psycho-physiological response when suppressing and displaying a different emotion, using the polygraph.
2.2. HYPOTHESES

- Hypothesis 1: Those who suppress their emotions will have a higher glucose consumption than those who genuine express the emotions experienced.
- Hypothesis 2: Those who need to display a different and opposite emotion to the emotion they feel will have a higher consumption of the glucose reserve than those who express genuine emotions.
- Hypothesis 3: Suppressing emotions will produce a rise in the measured psycho-physiological parameters.
- Hypothesis 4: Emotional expressions simulated by participants will not be authentic.

3. METHOD

3.1. PARTICIPANTS/SUBJECTS

The study involved 60 (42 female and 18 male) students of the Faculty of Psychology and Educational Sciences aged between 21 and 37 years. Participants were randomly assigned to three experimental groups.

3.2. INSTRUMENTS/APPARATUS/STIMULI/MATERIALS

To perform this experiment we used the following instruments. With Accu Check Active gluco-meter we measured the blood glucose levels before and after the subjects exposure to emotional stimuli.

With LX 4000 Lafayette polygraph we measured the psycho-physiological parameters like amplitude and rhythm of breathing (abdominal and thoracic), pulse, blood pressure, RED electro-dermal response.

With the help of JVC - Everio Hybrid Camera GZ-MG330HE video recorder were recorded the changes in the subject’s facial expressions and the degree to which participants were able to follow the training received regarding the suppression or display of different emotions.

The emotional stimuli used are represented by five short films. The first two films cause sadness, the third one causes disgust, the fourth causes sadness and
finally a film that causes joy. Total exposure was 28 minutes with a 3 seconds break between films.

For exposure of the stimuli was used a computer (desktop PC) Acer Veriton and the Asus LED monitor with a 27" (inch) diagonal. The Open Sesame software was used to present the stimuli

3.3. PROCEDURE

The participants right were presented to the subjects. Participants received information about how the experiments will be conducted and had the opportunity to ask questions and receive the answers needed. The next step was to complete the participation agreement and a form concerning their health status, how many hours have passed since their last meal, whether they were diagnosed with diabetes and other information needed in interpreting the results.

Participants were randomly distributed into three experimental groups and had to watch a series of emotional stimuli for 28 minutes. Each group was instructed on how to manage the emotions produced by the stimuli. In each group were 14 female and 6 male participants.

All participants did not eat and did not consume sugary drinks, coffee or energy drinks with at least 4 hours before the beginning of the experiment. They all declared that they are healthy, have not been diagnosed with diabetes and have slept at least 7 hours a night before.

The blood sugar level of the participants was measured by a gluco-meter before and immediately after exposure to stimuli terminated. After the initial measurement of glucose levels the participant was connected to the polygraph. With the help of a beep (sound) the video recording of the polygraph measurement and the exposure to stimuli were synchronized.

Participants in the first group were asked to pay attention to the stimuli. They had the freedom to express the emotions experienced. Those in group 2 were asked to suppress their emotions displaying a neutral emotion so if anyone would watch the video recordings cannot figure out what emotion they experienced in those moments. Those in group 3 were asked to simulate the opposite emotion provoked by the stimuli. If what they saw caused them sadness they were forced to display joy (smile). If they caused disgust they were forced to look excited, interested in what they saw.
After the final measurement of blood glucose levels the participants answered to several questions about how they felt, how the experiment was conducted, the emotional impact of the stimulus, task difficulty.

4. RESULTS

For the interpretation of the results the SPSS 18 program was used. For the three experimental groups the difference between the initial and final levels of blood glucose was calculated. The differences registered for each participant were compared between groups. The differences made by those who have suppressed their emotions (group 2) were compared with those who were authentic (group 1). The differences made by those who have simulated the opposite emotion to the one experienced (group 3) were compared with those who were authentic (group 1). For both comparisons the t test for independent groups was used.

<table>
<thead>
<tr>
<th>Dif</th>
<th>Levene's Test for Equality of Variances</th>
<th>t-test for Equality of Means</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>Sig.</td>
</tr>
<tr>
<td>Equal variances assumed</td>
<td>1.123</td>
<td>.296</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td></td>
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</tbody>
</table>

Differences between the initial and final glucose level for those in group 2 who were forced to suppress emotions (M = 9.20, SD = 6.005) were significantly higher (t = -2.66, df = 38, p bidirectional = 0.011) than the differences of those in group 1 who genuine expressed their emotions (M = 4.6, SD = 4.87).

<table>
<thead>
<tr>
<th>Dif</th>
<th>Sig. (2-tailed)</th>
<th>t-test for Equality of Means</th>
<th>Std. Error Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equal variances assumed</td>
<td>.011</td>
<td>-4,600</td>
<td>1,729</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>.012</td>
<td>-4,600</td>
<td>1,729</td>
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</tbody>
</table>

For equal variances, t is 2660 with 38 degrees of freedom which is significant at 0.011 for the bidirectional level. The t test value is Mean difference ( -4,600 ) divided by the Std. Error Difference ( 1,729 ), resulting -2660.
Table 3. t-test for Equality of Means (95% Confidence Interval of the Difference) between group 1 and group 2

<table>
<thead>
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<th>95% Confidence Interval of the Difference</th>
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<tbody>
<tr>
<td></td>
<td>Lower</td>
</tr>
<tr>
<td>Dif</td>
<td></td>
</tr>
<tr>
<td>Equal variances assumed</td>
<td>-8,100</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>-8,105</td>
</tr>
</tbody>
</table>

There is a statistically significant difference between the averages glucose levels consumption between Group 1 and Group 2. Those who suppress their emotions recorded a higher consumption of blood glucose than those who have expressed genuine emotion caused by the stimuli.

Table 4. Levene’s Test for Equality (F & Sig.) of Variances and t-test for Equality of Means (t & Df) between group 1 and group 3

<table>
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<tr>
<td>Dif</td>
<td>Equal variances assumed</td>
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<td></td>
<td>Equal variances not assumed</td>
</tr>
</tbody>
</table>

Differences registered by those in group 3 who were in a position to simulate an emotion different from the one that hey experienced (M = 8.30, SD = 7.38) were significantly higher (t = -1.87, df = 38, p bidirectional = 0.69) than those recorded by the first group (M = 4.6, SD = 4.87).

Table 5. t-test for Equality of Means (Sig., Mean Difference and Std. Error) between group 1 and group 3

<table>
<thead>
<tr>
<th>Sig. (2-tailed)</th>
<th>Mean Difference</th>
<th>Std. Error Difference</th>
</tr>
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<tbody>
<tr>
<td>Dif</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equal variances assumed</td>
<td>.069</td>
<td>-3,700</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>.070</td>
<td>-3,700</td>
</tr>
</tbody>
</table>

For equal variances, t is -1,870 wich with 38 degrees of freedom is statistically significant at 0.069 for the bidirectional level. The value of the t test is Mean Difference (-3,700) divided by the Std. Error Difference (1,978), resulting -1,870.

Table 6. t-test for Equality of Means (95% Confidence Interval of the Difference) between group 1 and group 2

<table>
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<td>Lower</td>
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<tr>
<td>Dif</td>
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<tr>
<td>Equal variances assumed</td>
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<td>Equal variances not assumed</td>
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There is a statistically significant difference between the averages of blood glucose levels consumption between Groups 1 and 3. Those who had to express the opposite emotion of the emotions experienced recorded a higher blood glucose
consumption than those who have expressed genuine emotional emotions caused by the stimuli.

Certain patterns in the fluctuation of the psycho-physiological parameters were identified using the polygraph. When the stimulus intensity was increased the subjects from group 2 and 3 tended to pause for a few seconds after they exhaled before they inhaled again (Fig. 1). They actually stopped their respiratory rate for a few seconds for increased concentration (Fig 2 and 3).

Figure 1

Figure 1 - Sample of physiological reactivity of one participant to research from group 2

On their electro-dermal reaction chart elevated levels appear before the scenes with high intensity as a form of anticipation and preparation of the body (Fig. 4).
For these groups the pulse is irregular pulse and the blood pressure is elevated.

Figure 2 - Sample of physiological reactivity of one participant to research from group 3

Figure 3 - Sample of physiological reactivity of one participant to research from group 3
Regarding the facial expressions, those in group 2 (suppression) although it had the task of displaying a neutral emotion a facial muscle tension especially on the forehead and around the eyes can be noticed. Those in group 3 have a tendency to flush red on cheeks and claimed that their cheeks feel tense. It can be observed that the smiles and expressions displayed were not authentic but it is important that the participants were involved and respected their training.

5. CONCLUSIONS

Previous research took place in the laboratory of Experimental Psychology "Gh Zapan" regarding emotions triggered by the recognition of unfamiliar human faces (Anitei & Chraif, 2011) and emotions produced by exposure to violent visual and auditory stimuli (Anitei & Chraif, 2011a; Chraif & Anitei, 2011). This study aims to highlight the fluctuations in blood glucose levels in three emotional regulation situations. Three different situations having three groups of participants.

Although we expected that the group 2 and 3 to record an increased consumption of glucose levels and glucose levels to be implicit smaller, it was not so. More than three quarters of the participants had higher glucose levels after exposure to stimuli. We can claim that the body tried to compensate the glucose loss by mobilizing the glucose reserves from the tissues. Although the participants did not eat for at least 4 hours before the experiment was recorded the blood
glucose levels increased. As the emotional impact of the stimuli was stronger the tendency to have high blood sugar levels at the end were higher. A limitation of this study is that we do not know what happened with the blood glucose level while the participants were exposed to stimuli. We only have the two values - before and after.

6. ACKNOWLEDGMENT

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REFERENCES


REZUMAT

Numerose studii sustin că o persoana care își folosește voia (autocontrolul/will power) consuma din resursele de glucoza ale organismului. în acest studiu ne-am propus să raspundem la următoarele întrebări. Poate fi masurat efortul depus de o persoana pentru a își suprima o emoție? Efortul depus pentru a afișa o emoție opusă celei pe care o trăim poate fi masurat? Ce se întâmplă cu nivelul glicemiei atunci când o persoana își suprimă emoțiile traite sau să afișează o emoție opusă / diferită de ceea ce trăiește în acel moment? Pentru a raspunde la aceste întrebări am impartit participanții în trei grupuri experimentale. Fiecare grupă a avut de urmat stimulii cu încarcătura afectogenă timp de 28 de minute. Primul grup a fost rugat să urmeze stimulii fără a primi un instructaj privind reglarea emoțiilor. Cei din grupul doi au fost rugați să își suprimă emoțiile și să afișeze o emoție neutră. Cei din grupul trei au fost rugați să afișeze o emoție opusă celei pe care o resimt fără de stimuli afectogeni prezentati. Nivelul glicemiei a fost masurat înainte și după folosind glucometrul Accu. Expresiile faciale ale participanților au fost filme. Cu ajutorul poligrafului Lafayette LX 4000 au fost înregistratii parametrii psigofiziologici. Fiecarui participant i-au fost prezentate drepturile participanțului și felul în care se va desfășura experimentul după care a fost obținut acordul acestora de a participa.