European Neuropsychopharmacology (2011) xx, xxx–xxx

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When endocrinology and democracy collide: Emotions, cortisol and voting at national elections

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Received 10 January 2011; accepted 6 March 2011

KEYWORDS
Cortisol;
Voting;
Decision-making;
Negative affect

Abstract

Faced with stressful experiences, such as uncertainty or novelty, the adrenal glands secrete glucocorticoid hormones to help us cope with stress. Since many decision-making situations are stressful, there is reason to believe that voting is a stressful event. In this study, we asked voters in Israel's national election (N=113) to report on their general affective state immediately before entering the polling place using the Positive Affect Negative Affect Schedule (PANAS) and to provide us with a saliva sample through which we could evaluate their cortisol levels. Compared to a second sample of voters who reported their affective state on election night (N=70), we found that voters at the ballot box had higher positive and negative affect. Moreover, our voters at the polling place exhibited cortisol levels that were significantly higher than their own normal levels obtained on a similar day, and significantly higher than those of a second control group sampled the day after the elections (N=6). Our data demonstrate that elections are exciting, yet stressful events, and it is this stress, among other factors, that elevates the cortisol levels of voters. Since elevated cortisol has been found to affect memory consolidation, impair memory retrieval and lead to risk-seeking behavior, we discuss how these outcomes of elevated cortisol levels may affect voting in general and the field of electoral studies in particular.

1. Introduction

Faced with stressful experiences, such as uncertainty, novelty and lack of control, the adrenal glands secrete glucocorticoid hormones, which, together with other components, facilitate our ability to cope with stress (Hennessy and Levine, 1979). For this reason cortisol is sometimes called the stress hormone, because its main function is to help the body cope with a potential threat. Obviously, increases in cortisol occur not only in a fighting situation. In fact, research has documented such increases in many other situations involving decision-making tasks, from students taking exams (al'Absi, et al., 1994) to

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0924-977X/$ - see front matter © 2011 Elsevier B.V. and ECNP. All rights reserved.
doi:10.1016/j.euroneuro.2011.03.003

traders making financial decisions (Coates and Herbert, 2008). Increases in cortisol can even take place in anticipation of stressful events (Lacey et al., 2000; Martinek et al., 2003).

Emotions have been found to play a major role during elections. Marcus et al. (2000) found that while enthusiasm reflects and reinforces individuals' preferences, anxiety leads people to interrupt their habitual behavior and seek new information. However, given that National Election Studies do not test these emotions directly, but rather voters' anxiety and enthusiasm about the candidates, it is most likely the voters' evaluations that influence their feelings towards the candidates (Ladd and Lenz, 2008).

Is voting itself an exciting or an anxious event? Given that stress is a key element in many decision-making situations in which much is at stake, and choosing one alternative over the other involves risk and uncertainty (Janis and Mann, 1977), there is reason to believe that voters will feel anxious and exhibit higher than normal cortisol levels. These levels should be higher among those who expect greater losses (Janis and Mann, 1982), such as supporters of parties likely to lose an election, and those in a state of decisional conflict (Janis and Mann, 1977), debating among themselves who they should vote for.

In a recent study, Stanton et al. (2010) show that on the 2008 election night in the United States, those who voted for John McCain experienced increases in post-outcome cortisol levels, while Barack Obama supporters had stable cortisol levels. This finding seems to suggest that stress and hormonal levels (other than testosterone) may be related to political decisions. However, to our knowledge, this hypothesis has never been tested directly, either by asking voters at the ballot box to report their general affective state or by probing biomedical measures such as serum or salivary cortisol. Moreover, if cortisol is indeed elevated at the time of voting, what may be its implications on voting itself?

The 2009 Israeli national election presented us with an opportunity to test this hypothesis. Israeli elections are always emotional ordeals. However, this election was particularly emotional, coming on the heels of two wars in less than three years. The election was also a struggle between two camps, with Kadima and Labor pushing for a two-state solution, and Likud and Israel Beiteinu calling for an amorphous regional solution, understood by many as the continuation of the status quo. Hence, the election was the perfect proving ground for testing our hypotheses.

2. Experimental procedures

2.1. Subjects

The study was conducted on Israel's national election day in 2009 in Omer, a small southern town 70 miles from Tel Aviv. This location was chosen due to harsher weather conditions elsewhere.[1] The main group of subjects was recruited on Election Day at the town's sole polling place (n=113; 70 (61.9%) male; age range 20–84; mean 46, SD 15.95). Each participant completed a survey and submitted a biomedical sample. Forty percent of them volunteered to participate in a second wave conducted 21 months after the elections (n=46; 27 (58.7%) male; age range 23–84; mean 45, SD 17.2). Fifty percent of the second wave participants also completed the biomedical component of the study (n=23; 18 (78.3%) male; age range 26–83; mean 54, SD 13.7) (Fig. 1).

A second group of participants was recruited on the evening of Election Day through a random telephone survey sample of eligible voters conducted in the very same town (response rate=37.9%). Of these participants, 70 stated that they had already voted and another 7 indicated that they intended to do so later that evening (n=77; 30 (36.6%) male; age range 22–84; mean 55, SD 13.8).

To ensure that cortisol levels were not the product of recent local stressful events,[2] the following day we collected saliva samples from a third group of randomly selected residents from the same town (n=6; 3 (50%) male; age range 38–62; mean 50.2 SD 8.9).

All of the participants were told that participation was voluntary and that their participation confirmed their consent. The study was approved by the local Committee for Ethical Research and the Protection of Human Participants.

2.2. Experimental procedure

Local election personnel allowed us to set up our stand about a dozen yards from the voting booths' entrance. All adults who entered the polling place were invited to participate in the study — prior to voting. Those who agreed were informed that they would be asked to complete a short questionnaire and provide us with a saliva sample through which we could evaluate their affective state prior to voting. People who were smoking or chewing gum were excluded from the study, as were non-eligible voters or individuals not fluent in Hebrew who would be unable to fill out the questionnaire. Using a screening question we further excluded voters who had experienced a major traumatic event, such as a divorce, terrorism or the terminal disease or death of a loved one in the six months prior to the election. Voters receiving steroid treatment for any medical condition or suffering from any endocrine disorder affecting steroid levels were excluded as well. All those who agreed to participate in the study were asked to fill a small vial with saliva and complete the questionnaire. Data were gathered between 8:30 in the morning and 2:00 in the afternoon. Saliva examples were stored at −20 °C before assay. The evening control group was recruited through a random telephone survey conducted among eligible voters in the very same town between 1700 h and 1900 h. To match the majority of our Election Day sample, the cortisol control group samples were collected the day after the election between 1100 h and 1300 h.

To ensure that the second wave of participants was identical to the first in all but the act of voting itself, we coordinated the visits with our respondents on their day off from work around the same time they were sampled during wave one. Since diurnal cortisol levels decrease considerably in the first few hours after awakening, we insisted that wave one early voters (those who voted prior to 10:00 h) be sampled at the same time or earlier than they were sampled in wave one (n=8; mean −30.3 minutes; SD 22.27). For later voters, where the difference between the average person's 10:00 cortisol level is only 2 ng/ml higher than his 16:00 h level (Yehuda et al., 2003, 354), we allowed respondents to participate before and after their original sample time, with the majority completing it within an hour of their original time (n=27; mean+41.6 minutes; SD: 42.7).

2.3. Questionnaire

To capture the mood of voters prior to casting their ballot we used the Positive Affect Negative Affect Schedule (PANAS). Developed by

[1] The Israeli Metrological Service reported that the weather was the second worst in Election Day history, with rain in most of the country except southern Israel.

[2] Twenty days before the election Israel completed Operation Cast Lead, a three-week long war against the Palestinians in southern Israel and the Gaza Strip.

Please cite this article as: Waismel-Manor, I., et al., When endocrinology and democracy collide: Emotions, cortisol and voting at national elections, Eur. Neuropsychopharmacol. (2011), doi:10.1016/j.euroneuro.2011.03.003

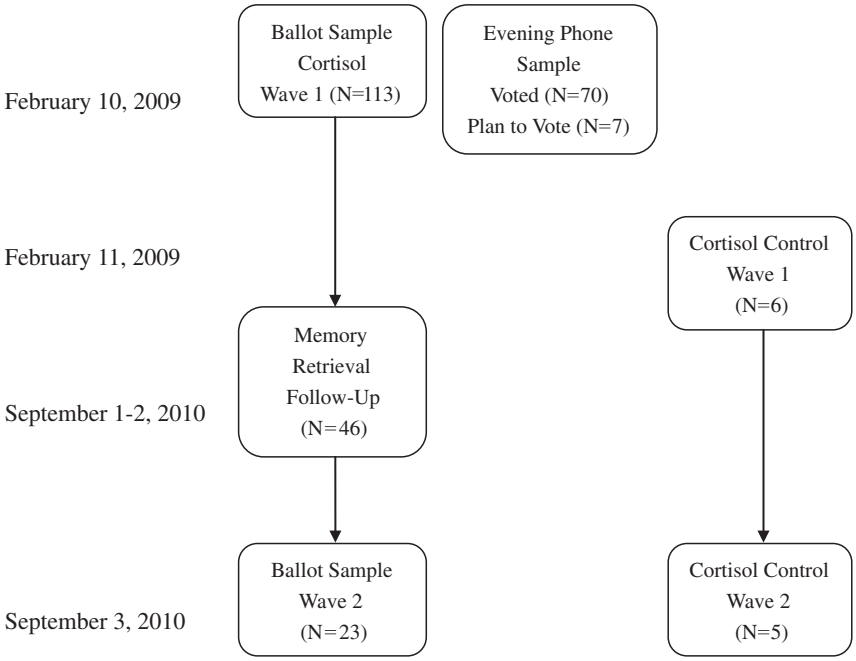

Figure 1 Study's flow chart.

Watson et al. (1988) and validated in thousands of studies including in Hebrew (Biron, 2010), it is a psychometric scale used to measure constructs of positive affect (PA) such as alert and inspired, and negative affect (NA) such as ashamed and nervous. Since respondents were recruited on their way to voting and had to fill out our survey while standing, we adopted the short 10-item form of the PANAS developed by Thompson (2007). Participants were also asked to report their voting intentions and provide us with common socio-demographic information. The evening telephone survey respondents were asked to answer the same questionnaire.

2.4. Evaluation methods

Biomedical analysis of free cortisol in saliva was performed with EIA (Diagnostic System Laboratories, Inc., Webster, TX, USA) that used a competitive enzyme-linked immunosorbent assay method in accordance with the manufacturer's instructions. Cortisol assays were performed in duplicate. The intra- and inter-assay coefficients of variation (CVs) were both <6%. Sixteen samples were lost due to insufficient sample volume in wave one (n=113). No samples were lost in wave two (n=23).

To assess whether the polling place group was more excited or stressed than the evening telephone sample, we conducted independent sample t-tests of their PANAS values. P-values smaller than or equal to .05 are considered significant; values between 0.1 and .05 are considered trend. All statistics are two-tailed. To determine what drives the PA and NA scores and cortisol levels we ran regression analyses. The full models included all of the variables, but variables that were not statistically significant were then removed (stepwise) based on their t-values. Explanatory variables that did not cause a significant increase in deviance were then left out.

3. Results

Our daytime sample was quite similar to the sampled population, if somewhat more left-leaning politically, while the evening sample was moderately older (see Table 1). Median household income was about the same, placing all groups in the upper middle class bracket.

As Fig. 2 shows, Israeli voters exhibited significant higher positive affect (PA) levels (21.74; SD=4.52; n=113) than our evening phone sample of individuals who had already voted (15.64; SD=4.23; $p<.001$; n=70), and those who stated that they still planned to vote (16.42; SD=6.74; $p<.005$; n=7). Negative affect (NA) (11.47; SD=4.60; n=113) was significantly higher than our evening sample of voters (8.32; SD=4.94; $p<.001$; n=70) and those who stated that they still planned to vote (7.14; SD=3.93; $p<.005$; n=7).

The best fit model for positive affect ($R^2=.15$) included two predictors with a significant effect size: sense of efficacy ($\beta=.325$; SD=.18; t=1.81; p=.073) and having decided whom to vote for

Table 1 Ballot sample representativeness compared to phone survey and town's population.

	Ballot sample (n=113)	Phone survey (n=77)	Town's election results (n=4149)
Party			
Kadima	31.9	41.07	36.05
Labor	33.6	26.78	22.41
Likud	7.1	8.92	20.29
Israel Beiteinu	4.4	5.35	6.45
Meretz	16.8	12.5	7.91
Other	6.2	5.35	6.89
			Township (n=5469)
Mean household income (NIS)	13,500	12,000	13,634
Median age (+18)	48	55	45

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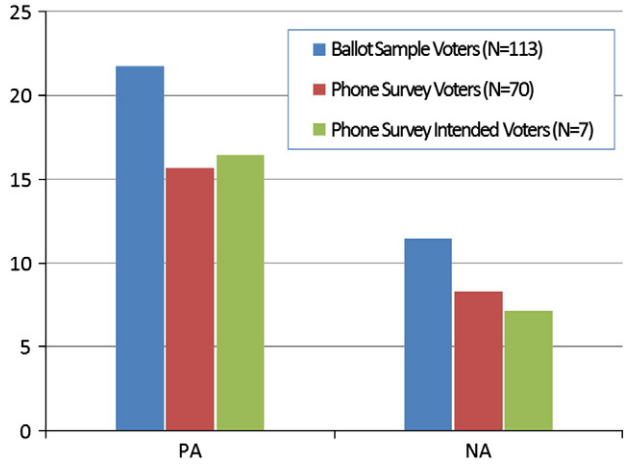

Figure 2 PANAS values for ballot voters, telephone survey voters and intended voters.

ahead of time (β = 1.16; SD = .29; t = 4.09; p = .000). In other words, a voter with a strong sense of efficacy (10) had, on average, a PA score that was 2.295 higher than his or her low efficacy (1) counterpart. Similarly, a voter who had decided whom to vote for a month or more before the election had a PA score that on average was 4.64 higher than someone who made that decision on Election Day.

The best fit model for negative affect ($R^2 = .16$) included five predictors, but only four predictors had a significant effect size: gender (β = 2.25; SD = .89; t = −2.51; p = .014), age (β = −.066; SD = .031; t = −2.16; p = .033), efficacy (β = −.383; SD = .19; t = −2.00; p = .048) and income (β = −.671.181; SD = .395; t = −1.69; p = .094). This finding indicates that on average a female voter had a NA score 2.25 higher than a male voter, a 30-year-old voter had a NA score 1.32 higher than a 50-year-old voter, a voter with a low sense of efficacy (1) had, on average, a NA score that was 3.447 higher than his or her high efficacy (10) counterpart and an individual with a very low income (1) had a NA score 2.676 higher than an individual who had a very high income (5).

Diurnal cortisol values peak at awakening and decrease rapidly throughout the day. However, in our study of voters the trend is reversed, with cortisol values increasing as the day progresses (Fig. 3). Overall, our voters show extremely high levels of cortisol (β = 19.06, SD = 9.29; $p < .001$; n = 113). When comparing those who voted between 1100 and 1300 h to a control group sampled a day after the election during these same hours, we found that our voters' cortisol levels are almost three times higher (β = 18.96, SD = 9.33; n = 77) than the control group (β = 6.69, SD = 1.99; n = 6; p = .002). When we compared Election Day cortisol levels to those of these very same individuals in our second wave 21 months after the elections, we found that the Election Day levels (β = 16.23, SD = 9.80; n = 23) were significantly higher than these levels in our second wave (β = 9.65, SD = 5.72; n = 23; p = .012), Conversely, our control group's cortisol values gathered the day after the election did not change significantly after 21 months (β = 7.92, SD = 2.02; n = 5).

The best fit model for cortisol levels ($R^2 = .15$) included four predictors, but only three predictors had a significant effect size: time of vote (β = .73; SD = .271; t = 2.69; p = .008), efficacy (β = −1.083; SD = .367; t = −2.95; p = .004) and negative affect (β = .400; SD = .194; t = 2.06; p = .042). This finding indicates that on average, an individual who voted at 1400 h has a cortisol measure that was 8.03 higher than an individual who voted at 0830 h, and a voter with a low sense of efficacy (1) had, on average, a cortisol level that was 9.72 higher than his or her high efficacy (10) counterpart. At the same time, on average, a voter with the highest NA score (30) had a cortisol level that was 9.2 higher than an individual with the lowest NA (7) score.

Voters whose parties were part of the coalition (Kadima and Labor), which polls predicted would lose four to five seats in the

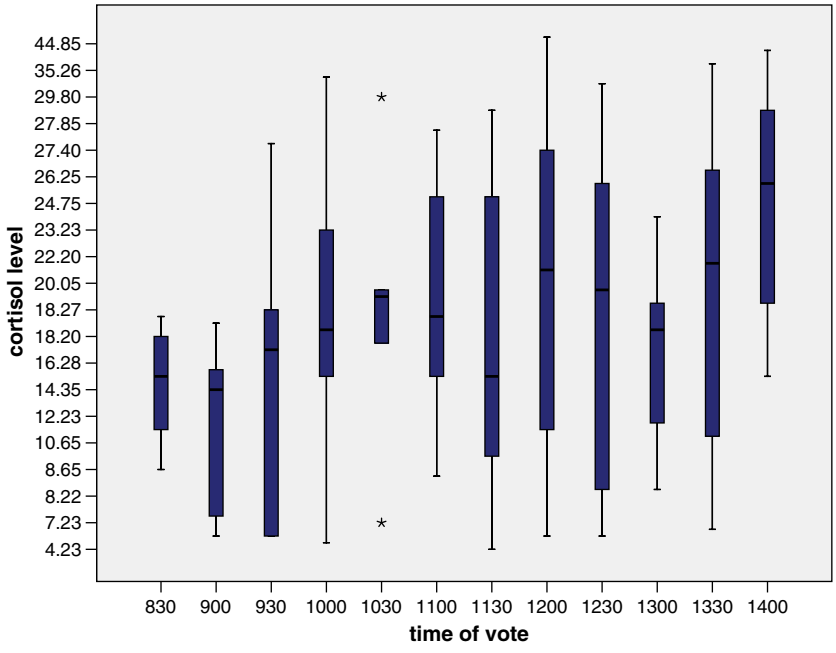

Figure 3 Diurnal cortisol levels (nmol/L) among election-day voters.

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Israeli parliament and perhaps their leadership in the government, had significantly higher cortisol levels (20.06, SD 9.90; n=50) than voters who cast their ballots for the opposition parties, which polls predicted to gain seats (Likud and Israel Beiteinu) (14.44, SD 6.97; n=10; p=.090).

Finally, wave two respondents (n=46) were asked to recall their vote choice. The best fit logistic model for correct memory recollection (R^2=.32) included two predictors: when the individual had decided whom to vote for (β=.123; SD=.059; Wald=4.30; p=.038; exp(β)=2.672) and cortisol level (β=.983; SD=.337; Wald=8.49; p=.004; exp(β)=1.131). In other words, holding the cortisol level at a fixed value, we saw a 167% increase in the odds of answering the question, "Who did you vote for in the last elections?" correctly for each unit increase in the response to the question, "When did you decide whom to vote for?" Alternatively, holding the response to the question, "When did you decide whom to vote for?" at a fixed value, we saw a 13% increase in the odds of answering the question "Who did you vote for in the last elections?" correctly for each cortisol unit increase.

4. Discussion

This is the first study to explore the psychological wellbeing of actual voters through an endocrinal measure at the ballot. Our subjects exhibited extremely high levels of cortisol, more than five times higher than expected from healthy individuals on a regular day (matching each voter to an expected normal cortisol value on a regular day) (β=3.52, SD=.55, Yehuda et al., 2003) and almost two times higher than these same individuals on a regular day. Our data show that for the vast majority of our sample, Election Day is psychologically anything but ordinary. The elevated PANAS scores, both positive and negative, indicate that voting is indeed an exciting and stressful event.

Since negative affect has been found to elevate cortisol levels (Buchanan et al., 1999), one might suggest that Israelis as a whole are under stress and it is this stress that drives the elevated cortisol found among participants. However, the lower cortisol levels found among our second wave participants, together with the lack of change observed among participants sampled the day after the elections and 21 months later, all indicate that voting, rather than national stress, is the trigger behind the high cortisol levels. The rise in diurnal levels of cortisol most probably comes from mid-day meals (Follenius et al., 1982).

As expected, those voting for parties that polls predicted were going to lose seats in parliament (Kadima and Labor) had higher cortisol levels than those voting for the opposition parties (Likud and Israel Beiteinu). It is likely that in non-proportional representation elections, such as single member districts, where polls can more accurately predict expected loss of office, the magnitude of the effect would be larger.

Shifting to memory consolidation, human experiments indicate that when cortisol was administered to participants prior to viewing arousing pictures (independent of their valance) and neutral ones, the former were remembered better than the latter (Kuhlmann and Wolf, 2006). Similarly, in studies of stress, the memory of neutral items was impaired, but the memory of non-neutral ones was not (Payne et al., 2006; Smeets et al., 2006). Our data suggest that those with high cortisol levels were better able to recall who they had voted for. Indeed, these high levels of cortisol may help explain why in follow up surveys voters in low key elections cannot recall who they voted for, or if they voted at all (Wright, 1993; Belli et al., 1999).

What may be the additional consequences of these findings for electoral participation? Cortisol influences memory retrieval in an inverted, U-shaped manner (Lupien and McEwen, 1997). In midrange doses, cortisol enhances memory, but may impair memory when its levels are high. Research shows that elevated cortisol leads to reduced hippocampal activation during memory retrieval (Wolf et al., 2001) and to reduced blood flow in the posterior right medial temporal lobe, leading to impaired memory retrieval (de Quervain et al., 2003). Pharmacologically-induced cortisol impedes memory retrieval (Wolf et al., 2001), impairing not just episodic memories, but even autobiographic ones (Buss et al., 2004). Similarly, psychological stress elevates cortisol levels, which also block episodic memory retrieval (Wolf, 2009) and impair subjects' ability to recall declarative memories, such as words learned a day earlier (Kuhlmann et al., 2005b). The effect is even more pronounced when participants have to perform in front of an audience (Tollenaar et al., 2008). High levels of cortisol have a strong impact on the recall of emotionally arousing material, but also have an effect on the recall of neutral material (Kuhlmann et al., 2005a), and even long-term memory retrieval (Tollenaar et al., 2008). Such a clash between high levels of cortisol and memory may be problematic not only when taking an exam or giving testimony in a court (Wolf, 2009), but also at the ballot box.

Cortisol administration also increases reward-seeking and risk-taking behavior, likely due to the increase in dopaminergic activity (Marinelli et al., 1998; Putman et al., 2010). Similarly, stress-induced cortisol has significant effects on cognition. Acute stress disrupts decision-making (Keinan et al., 1987; Preston et al., 2007; Porcelli and Delgado, 2009), making those with higher levels of cortisol more sensitive to immediate rewards than those with lower levels (Piazza et al., 1993; Adam and Epel, 2007; Newman et al., 2007). The former are also more prone to making snap decisions, indicative of a loss of top-down control (Keinan et al., 1987; Porcelli and Delgado, 2009). Cortisol administered individuals are much more risk seeking when the probability of losing and winning is high, a pattern that reflects the combined effect of reduced sensitivity to cues of punishment and increased sensitivity to reward (Putman et al., 2010). Finally, van den Bos et al. (2009) have shown that men with cortisol levels that had been elevated by stress make poorer decisions, as do women with acute cortisol levels.

In an ideal democracy, we would like citizens to make reasoned choices, and vote based on the ideas and quality of the parties and candidates in a given election. We do not argue that emotions have no role to play in elections; feeling anxious about a candidate is a good enough reason not to vote for him or her (Marcus and Mackuen, 1993). However, we must understand that emotions are not merely feelings; often they carry with them a physio-endocrinal component which itself has the potential to biologically affect decision-making at the ballot box.

We suspect that both the electoral and public components of voting elevate cortisol. In other words, civic duty, the fate

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of the nation and the prospect of electoral loss all generate emotions that may elevate cortisol, but so does the requirement to vote in a public location, exposed to and even scrutinized by strangers. Given that Israel generally does not have absentee voting, we could not compare regular and absentee voters. If those who vote from home score lower on PANAS and have lower cortisol levels than those who come to the polls, it may shift the debate over absentee ballots from being able to vote and the effort to increase the electorate to a broader discussion that also encompasses the quality of the electorate's decisions, assuming that future research does find that cortisol affects decision-making.

This exploratory field study is not free of limitations. First, despite our efforts we were unable to gather samples from non-voters. Hence, we cannot ascertain whether voters are different from non-voters in any way. Is it possible that some of them exhibit such high stress levels that inhibit participation altogether? It also may be the case that non-voters are the ones with the lowest PA levels, and this lack of excitement makes them stay home on Election Day. Second, is the size of this effect large enough to alter the outcome of elections? In other words, it remains to be seen whether acute cortisol levels can alter a voter's choice at the last minute and the percentage of the electorate affected by these levels. Finally, the study was conducted during a very emotional election. Perhaps we would have found lower cortisol levels in less hotly contested elections. Nevertheless, it is often the emotional elections that determine the fate of a nation. Hence, we believe these elections are the ones on which future studies should focus.

Our study demonstrates that voting is psychologically and physiologically an exciting and stressful event. Only additional research will determine if that stress is capable of altering voting decisions. Despite its limitations, we believe that the results are of immense importance for scholars in the field of political science. Recently, scholars have called for an increasing dialog between political science and neuroscience (Fowler and Schreiber, 2008; McDermott, 2009). This study is a small step towards such a synergy.

Role of the funding source

The study was funded by the first author's departmental research fund.

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Conflict of interest

The authors declare no conflicting interests.

Acknowledgment

The authors would like to thank Ms. Einav Jerochim for her much appreciated assistance.

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Please cite this article as: Waismel-Manor, I., et al., When endocrinology and democracy collide: Emotions, cortisol and voting at national elections, Eur. Neuropsychopharmacol. (2011), doi:10.1016/j.euroneuro.2011.03.003