DHEA ENHANCES WORKING MEMORY AND PREVENTS DISTRACTION – BEHAVIOURAL AND ERP EVIDENCE FROM AN AUDITORY-VISUAL DISTRACTION PARADIGM

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INTRODUCTION

Is DHEA relevant for working memory and distraction?

We studied DHEA/DHEAS and cortisol relations to working memory (WM) and distraction in humans at the performance and electrophysiological level. The hypotheses to test were: 1) if higher endogenous DHEA levels would be protective from involuntary distraction and enhance cognitive performance; 2) if that effect would be translated to the electrophysiological level; and 3) if DHEA effects would be antagonistic from those of cortisol.

METHODS AND RESULTS

23 healthy female volunteers (18-26 years old) were presented a well-established auditory-visual distraction task protocol. The electroencephalogram (EEG) was recorded during the performance of one task with WM load (WM1) and one without (WM0), while ignoring task-irrelevant sounds (80% standard – st; 20% novel – nov) – figure 1. The two tasks started 120min apart, with counterbalanced order across subjects.

Performance and Event Related Potentials (ERPs) were averaged for each auditory-stimulus trial type and WM condition. Performance was evaluated by hit rate (HR), error rate (ER) and reaction time (RT). Novelty-P3 (nov-P3) was identified in the nov minus st difference waveforms (dw), P300 elicited to the visual task was compared by using both WM conditions under st auditory stimuli. Salivary DHEA, DHEAS and cortisol were measured before each task and at 30 and 60min.

**Performance, ERP and Endocrine Results**

WM load decreased the HR [F(1,21)=31.375, p<0.001, 84% in WM0 and 71% in WM1 condition] – figure 2. Distraction by novel sounds decreased the HR in WM1 condition [F(1,22)=6.897, p=0.007, 74% for st vs 65% for nov trials] and always increased the RT except when WM1 was the first task [p<0.01 in all cases].

The auditory P3 in WM0 condition was enhanced by [F(1,21)=60.894, p<0.001] and there was a trend for an additional enhancement with WM load [F(1,21)=3.439, p=0.078] – figure 3. The P300 to the visual task was enhanced in the second task [condition x task order – F(1,21)=10.184, p=0.004] – figure 4.

DHEA levels increased with the second task [F(1,40)=9.839, p<0.002], more with WM load, so that the increase after WM1 as the second task was higher than that for WM0 as the first task [F(1,10)=10.676, p=0.008]. On the contrary, cortisol decreased when WM0 was the first task [F(2,22)=9.544, p=0.007]. DHEAS levels did not change.

**Endocrine Relations to Performance and ERPs**

In trials with simultaneous WM load and distraction, overall HR (figure 5) was inversely related to basal cortisol [F(1,22)=8.173, p<0.009] and directly related to Δ DHEA30’/0’ [F(1,21)=4.383, r=0.424, p=0.049] and RT was inversely related to basal cortisol/DHEA ratio [F(1,21)=11.038, r=-0.596, p=0.003] and directly related to Δ DHEA30’/0’ [F(1,21)=8.069, r=-0.538, p=0.01]. These relations were the consequence of the relation between cortisol and DHEA reactivity and WM load costs and distraction costs on HR and RT (figure 6).

In WM1 condition, cortisol/DHEA ratio was related to WM-P3 enhancement [F(1,21)=11.989, r=+0.612, p=0.002] while visP300 [F(3,22)=11.119, r=0.798, p<0.001] was directly related to visP300 amplitude in WM condition (partial r=0.625, partial p=0.001) and higher when it was the second task, r=0.616, partial p=0.002) and baseline DHEA levels (partial r=0.516, partial p=0.01) and changed due to WM load in direct relation to DHEA reactivity [F(1,20)=9.244, r=+0.562, p=0.006] – figure 7.

**DISCUSSION**

1.DHEA was related to WM load at the performance and electrophysiological level. DHEA relations to distraction became evident under WM load.

2.In the more demanding situations (WM load and distraction), higher baseline cortisol was related to faster but less accurate answers while DHEA reactivity presented the opposite relations.

3. During WM load, baseline cortisol enhanced and DHEA prevented the processing of the distractor (nov-P3). On the other hand, DHEAS and DHEA reactivity enhanced the processing of the relevant task stimulus.

**REFERENCES**


Acknowledgements: This work received a grant from the Portuguese Calouste Gulbenkian Foundation, to SV. Subjects inclusion and material for cortisol measurement was supported by the University of Barcelona and material for DHEA measurement was supported by the Lisbon Medical School. The authors also acknowledge Merck S.A. for the donation of the material for DHEA measurements.