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monotonous driving task

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## SESSION 1

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José González-Alonso, PhD. Professor of Exercise and Cardiovascular Physiology. Brunel University London. Uxbridge. United Kingdom.

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### Hydration and the human brain circulation and metabolism

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Dehydration accrued during exercise in the heat challenges systemic and locomotor muscle blood flow, but its impact on brain blood flow and metabolism remains poorly understood. In this talk I will present the findings of two recent studies assessing brain haemodynamics and metabolism during maximal incremental and prolonged sub-maximal exercise in the heat, with and without dehydration. Measurements of cerebral blood flow using Doppler ultrasonography, in addition to arterial and internal jugular venous blood samples for the assessment of cerebral metabolism, were obtained. The pertinent mechanisms regulating brain blood flow in the present studies will be explored. The importance of these disturbances on the metabolism of the brain and the implications for exercise will be discussed.

*Key words:* Cerebral blood flow, dehydration, exhaustive exercise.

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### Mild hypohydration increases the frequency of driver errors during a prolonged, monotonous driving task

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*Purpose:* Driver error is the largest cause of road traffic accidents, accounting for around 68 % of all vehicle crashes in the UK. During long and monotonous driving, most individuals display progressive signs of visual fatigue and a loss of vigilance. Since deficits in total body water (TBW) are associated with altered mood and decrements in aspects of cognitive function, it is possible that dehydrated drivers may be more susceptible to errors in judgement and car handling. With this in mind, the aim of the present study was to examine the effects of fluid restriction, on performance during a prolonged, monotonous driving task.

*Methods:* Eleven healthy males (age  $22 \pm 4$  y) completed a familiarisation trial, before two experimental trials were undertaken in a randomised manner. Each experimental trial took place over two days. On day 1 volunteers were instructed to consume a volume of fluid in line with published guidelines (HYD trial) or 25 % of this intake (FR trial). Participants came to the laboratory the following morning after an overnight fast (day 2). One hour following a standard breakfast, a 120 min driving simulation task began. During the HYD trial volunteers were provided with 200 mL of fluid every hour, and on the FR trial only 25 mL was made available each hour. Body mass, serum and urine osmolality, and subjective feelings were recorded during trials. Driver errors, including instances of lane drifting or late breaking, brain activity (EEG) and heart rate were recorded throughout the driving task.

**Results:** Pre-trial body mass ( $P=0.692$ ), urine osmolality ( $P=0.838$ ) and serum osmolality ( $P=0.574$ ) were the same on both trials. FR resulted in a  $1.1\pm0.7\%$  reduction in body mass, compared to  $-0.1\pm0.6\%$  in the HYD trial ( $P=0.002$ ). Urine and serum osmolality were both increased following FR ( $P<0.05$ ). EEG alpha and theta activity increased throughout both HYD and FR trials ( $P=0.038$ ), indicative of reduced vigilance, but no clear difference was apparent between the trials ( $P=0.062$ ). There was a progressive increase in the total number of driver errors observed during both the HYD and FR trials, but significantly more incidents were recorded throughout the FR trial (HYD  $47\pm44$ , FR  $101\pm84$ ; ES = 0.81;  $P=0.006$ ).

**Conclusions:** The results of the present study suggest that mild hypohydration, resulted in an increase in errors during a prolonged, monotonous drive, compared to that observed while performing the same task in a hydrated condition. The magnitude of decrement reported was similar to that observed following the ingestion of alcohol resulting in a blood alcohol content of approximately 0.08 % (the current UK legal driving limit), or while sleep deprived. There is no question that both drink-driving and driving while tired increases the risk of road traffic accidents, and many countries have instigated national campaigns to educate drivers of the associated risks. Given the present findings, perhaps some attention should also be directed to encouraging appropriate hydration practices among drivers.

**Key words:** *Dehydration, Cognitive function, Road traffic accident*

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