DNA damage and oxidative stress biomarkers in healthy male volunteers after a repeated bolus and continuous glucose infusion

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Introduction

Glucose variability (GV) is a phenomenon that describes fluctuations in blood glucose levels over the course of a day. As part of the investigation of risk factors for coronary heart disease, GV is increasingly becoming the focus of scientific attention. Scattering GV can contribute to the development of metabolic syndrome and type 2 diabetes. Hyperglycemia can lead to oxidative stress, which results in molecular damage due to an accumulation of reactive oxygen species (ROS).

Methods

To obtain more information on the immediate effects of GV, 10 healthy men aged 21-30 years were administered intravenous glucose continuously or as a repeated bolus over a 48-hour period in a crossover study design. Whole blood was analyzed for DNA damage using the Comet assay using three different incubation solutions (lysis buffer, H2O2 and the lesion-specific enzyme formamidopyrimidine DNA glycosylase (FPG)) and plasma for various markers of oxidative stress (protein carbonyls (PC), unconjugated bilirubin (UCB) and total antioxidant potential (FRAP)).

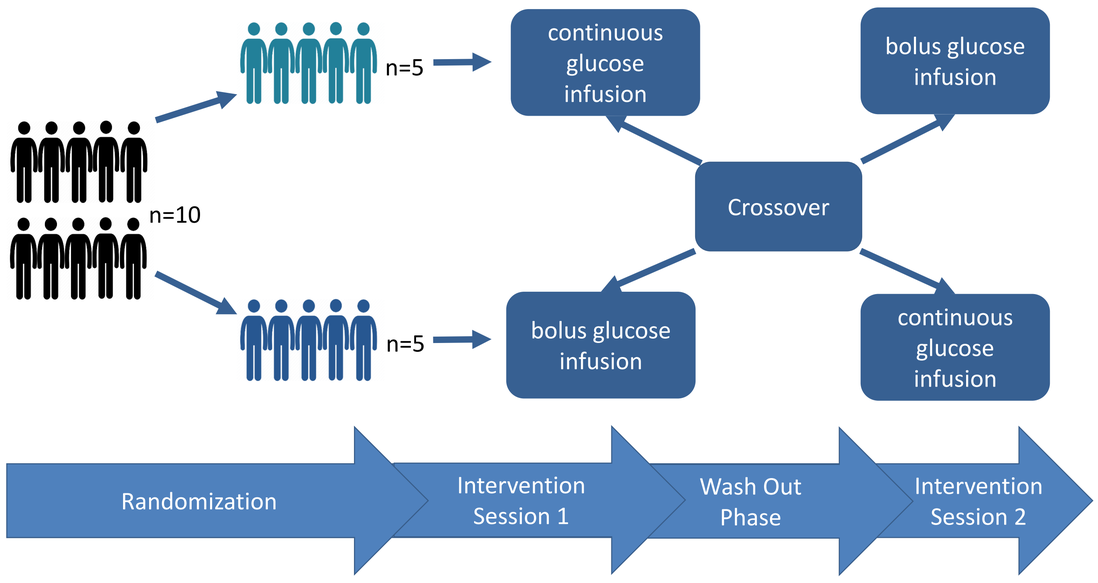

Figure 1: Illustration of the course of study

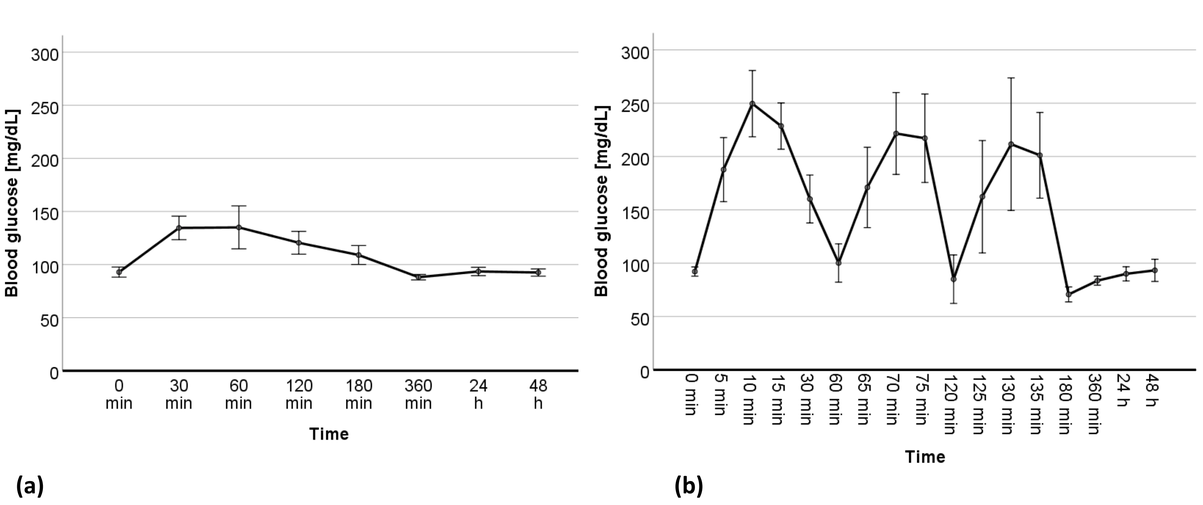

Figure 2: Progression of the blood glucose levels (mg/dL) over all measured time points with (a) continuous and (b) bolus glucose administration

Results

A significant time effect was found for the three incubation solutions for DNA damage, PC and UCB. This can potentially be attributed to circadian changes. However, no differences were observed for any of the markers between the two intervention groups.

Table 1: p-values of DNA damage and oxidative stress markers (time, time x group and group effect)

Marker	time effect (p-value)	group effect (p-value)	time × group (p-value)
Lysis [% tail intensity]	<0.001 *	0.301	0.829
H_2O_2 [% tail intensity]	0.001 *	0.377	0.059
FPG (netto) [% tail intensity]	0.015 *	0.341	0.728
PC [nmol/mg]	0.004 *	0.679	0.904
UCB [µmol/L]	<0.001 *	0.222	0.598
FRAP [µmol/L]	0.082	0.700	0.448

* …. Significant effect

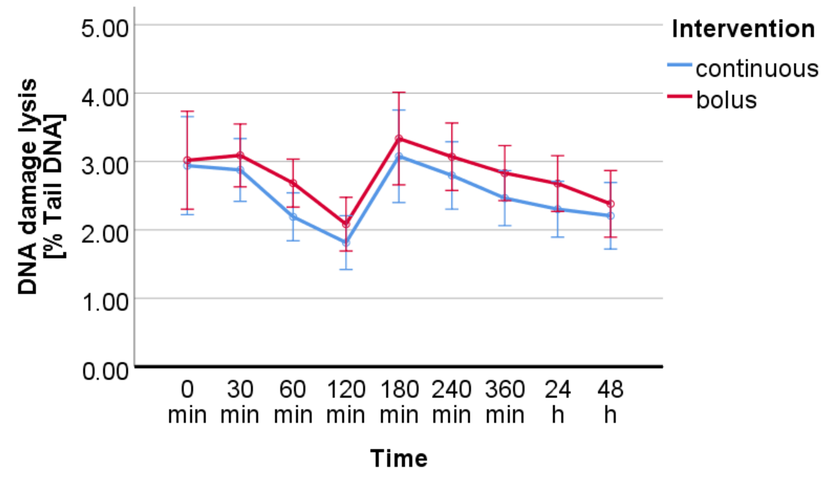

Figure 3: Progression of DNA damage (lysis) during the intervention period

Conclusion

In conclusion, it was shown that bolus glucose administration had no significant acute effect on DNA damage and oxidative stress markers in healthy men compared to continuous administration.

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References:
Bragagna L, Polak C, Schütz L, Maqboul L, Klammer C, Feldbauer R, Draxler A, Clodi M, Wagner KH. Effect of Repeated Bolus and Continuous Glucose Infusion on DNA Damage and Oxidative Stress Biomarkers in Healthy Male Volunteers. Int J Mol Sci. 2023 Sep 2;24(17):13608. doi: 10.3390/ijms241713608. PMID: 37686414; PMCID: PMC10487933.