Autonomic, Cardiovascular and Respiratory Responses to Hyperglycemic Stimulus in Healthy Subjects

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Although hyperglycemia is a common condition presented postprandially in healthy subjects and chronically sustained in diabetic patients, its autonomic, cardiovascular and respiratory effects have not been clearly elucidated. Our aim was to assess the effects of hyperglycemia on: cardiovascular and respiratory variables, the power and central frequency (CF) of autonomic spectral indexes, baroreflex (BRS) and respiratory sinus arrhythmia (RSAS) sensitivities.

Time series of RR intervals (RR), systolic pressure (SP), diastolic pressure (DP), and respiration (Res) were formed from ECG, arterial pressure and respiration recordings of ten healthy subjects during three 5-min stages: control, peak hyperglycemia, after ingesting 1 gr/kg of glucose, and recovery. Using the time-frequency distributions of the series, which were assumed to be non-stationary, the time course of low-frequency (LF_{RR}, LF_{SP}, LF_{DP}), and high-frequency (HF_{RR}, HF_{Res}) powers and their respective CF ($CFLF_{RR}$, $CFLF_{SP}$, $CFLF_{DP}$, $CFHF_{RR}$, $CFHF_{Res}$) were computed. Instantaneous BRS and RSAS were obtained by alpha index and time-frequency coherence. Means of 1-min epochs of the variables dynamics were used for statistical analysis.

In relation to baseline, epoch means of instantaneous response patterns in hyperglycemia (peak of 143±12 mg/100 ml, $p<0.001$) of: HF_{RR}, LF_{RR}, LF_{DP}, BRS, HF_{Res}, RR and DP decreased ($p<0.03$); $CFLF_{SP}$, $CFLF_{DP}$, $CFHF_{RR}$, RSAS and $CFHF_{Res}$ increased ($p<0.04$); and $CFLF_{RR}$, LF_{SP} and SP were similar. Most recovery epoch means were similar to control.

Our findings suggest that hyperglycemia causes inhibition of: 1. vagal activity, indicated by reduced HF_{RR}, associated to RR shortening; 2. sympathetic outflow, indicated by decreased LF_{RR} and LF_{DP} and increased $CFLF_{DP}$ and $CFLF_{SP}$, associated to reduced DP, which, via baroreflex with decreased BRS, buffers the sympathetic activity reduction; 3. respiratory centers, shown by decreased HF_{Res} (although $CFHF_{Res}$ increased slightly) associated with increased RSAS. The association between LF_{DP} reduction and $CFLF_{DP}$ increase support that both spectral features, CF and power, are sympathetic activity measures.