Fasting plasma glucose and HbA1c measurement: a comparative analysis with A1c-Derived Average Glucose Study

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Background

A1c-Derived Average Glucose (ADAG) study:

- Multicenter observational study that used continuous glucose monitoring and seven-point daily self-monitored blood glucose (SMBG) to determine the relationship between glycated hemoglobin (HbA1c) and mean average glucose.
- The estimated average glucose (eAG) in mg/dL was calculated by the formula $28.7 \times \text{HbA1c (\%)} - 46.7$.
- Using the SMBG results from 378 ADAG study participants, it was determined the average fasting blood glucose (BG) for predefined target HbA1c groups between 5.5-8.5%.

AIM

To compare fasting plasma glucose (FPG) and HbA1c measurements (venous sample) from an outpatient population followed in our Hospital with SMBG results (capillary sample) from ADAG study.

Methods

RETROSPECTIVE STUDY

- Concomitant measurement of hemoglobin (Hb), HbA1c and FPG from outpatient adults followed in Centro Hospitalar São João (only the last sample of each patient was considered for analysis).
- Exclusion criteria: age < 18 and > 70 years old, HbA1c < 5.5% or > 8.5%, inpatient care, Day Hospital, pregnant women, Primary Health Care Centre, other specific reasons.
- **We analyzed data from adults between 18 and 70 years old and HbA1c values between 5.5–8.5% (similar to ADAG study).**

ANALYSED DATA

- Hemoglobin, Hb (g/dL): sodium-lauryl-sulphate method; Sysmex XE-5000 or Sysmex XE-2100 D.
- FPG (mg/dL): enzymatic-ultraviolet assay; Olympus AU5400 - Beckman Coulter
- HbA1c (%): ionic exchange HPLC (High-Performance Liquid Chromatography); Variant II Turbo Bio-Rad. eAG (mg/dL): $28.7 \times \text{HbA1c (\%)} - 46.7$

STATISTICAL ANALYSIS (SPSS Statistics 20.0): Frequencies, percentages, mean, standard deviation, independent-samples T test.

Results

10 520 patients

53.6% female
46.4% male

Mean age
55.97 ± 10.93 years

Mean Hb
13.70 ± 1.70 g/dL

Mean HbA1c
6.33 ± 0.80%

Mean FPG
117.21 ± 39.49 mg/dL

	OUR RESULTS		ADAG STUDY		
HbA1c levels	n (%)	Mean venous fasting glucose in mg/dL (95%CI)	n (%)	Mean capillary fasting glucose in mg/dL	Δ in fasting glucose (mg/dL) between our results and ADAG study
5.5–6.49%	6 919 (65.8)	101.77 (101.28–102.27)	119 (31.5)	122 (117–127)	– 20.23
6.5–6.99%	1 294 (12.3)	130.33 (128.40–132.26)	91 (24.1)	142 (135–150)	– 11.67
7.0–7.49%	996 (9.5)	141.65 (139.01–144.30)	74 (19.6)	152 (143–162)	– 10.35
7.5–7.99%	694 (6.6)	158.20 (154.38–162.01)	61 (16.1)	167 (157–177)	– 8.8
8.0–8.5%	617 (5.9)	177.18 (172.39–181.97)	33 (8.7)	178 (164–192)	– 0.82

In fasting state, mean venous plasma glucose from our population was always lower comparing with mean capillary glucose from ADAG study. The increased in the HbA1c group diminished the discrepancy between our results and ADAG study. The reason for the discrepant results is not completely understood, but may due to different measurement methods, different populations and interference factors.

Conclusion

- Several factors may interfere with glucose and HbA1c measurements.
- Our results compare venous measurements from a real-life population to SMBG of a reference study. We highlight the different results and the difficulty in comparing glucose levels from different measuring procedures.
- Empirical data may help patients and physicians to optimize glucose monitoring targets.

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