

Anbefaling av prøverør til forsendelse ved glukosebelastning



Lutz Schwettmann
Gruppe for årets tema - diabetes

Nasjonale og internasjonale retningslinjer

Recommendation 3



The diagnosis of gestational diabetes mellitus at any time during pregnancy should be based on any one of the following values:

- Fasting plasma glucose = 5.1-6.9 mmol/l (92 -125 mg/dl)
- 1-h post 75g oral glucose load ≥ 10.0 mmol/l (180 mg/dl)*
- 2-h post 75g oral glucose load 8.5 – 11.0 mmol/l (153-199 mg/dl)

Clinical Chemistry 57:6
e1-e47 (2011)

Special Report

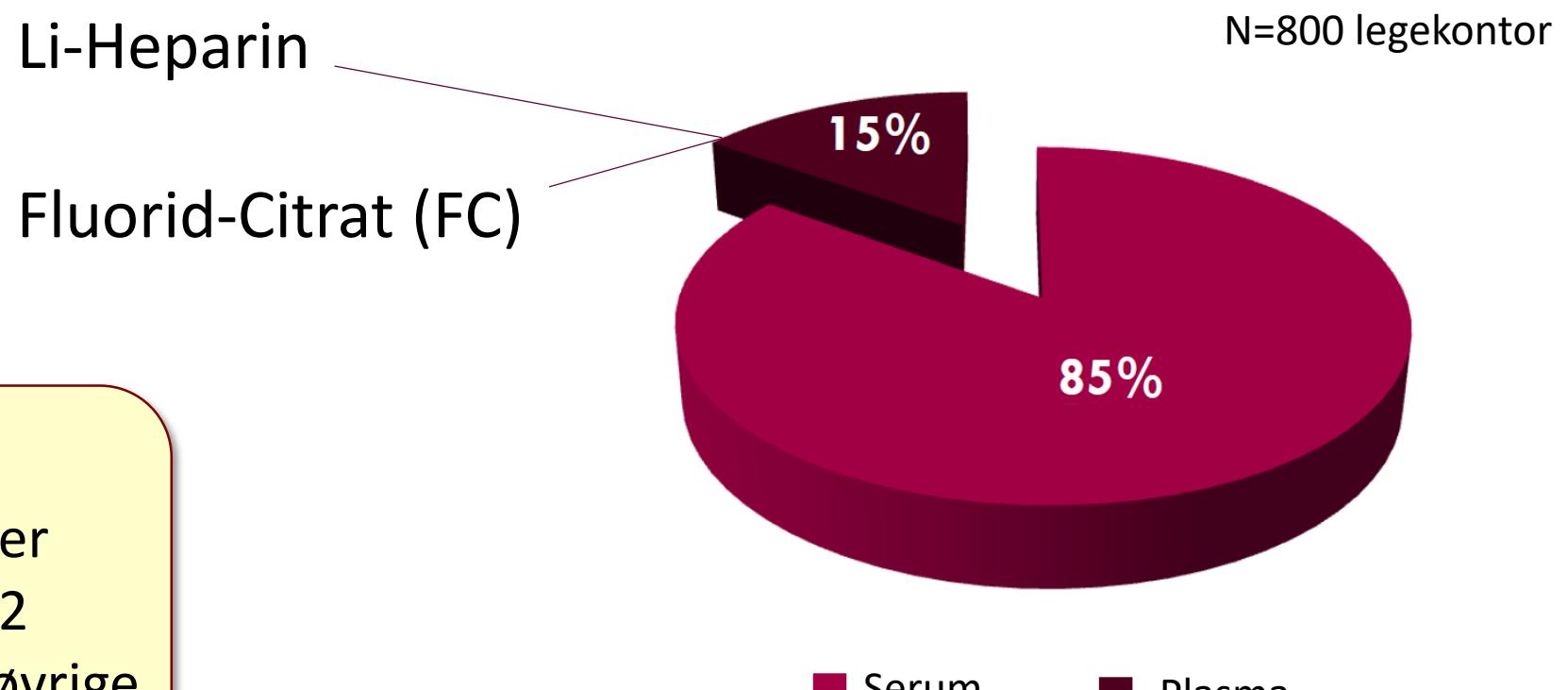
Guidelines and Recommendations for Laboratory Analysis in the Diagnosis and Management of Diabetes Mellitus

David B. Sacks,^{1*} Mark Arnold,² George L. Bakris,³ David E. Bruns,⁴ Andrea Rita Horvath,⁵ M. Sue Kirkman,⁶ Ake Lernmark,⁷ Boyd E. Metzger,⁸ and David M. Nathan⁹

RECOMMENDATION: WHEN GLUCOSE IS USED TO ESTABLISH THE DIAGNOSIS OF DIABETES, IT SHOULD BE MEASURED IN VENOUS PLASMA
A (high).

Definisjoner			
Hyperglykemi i 1. trimester (ikke diabetes)	Diabetes i svangerskapet	Diabetes oppdaget i svangerskapet	Svangerskapsdiabetes
<ul style="list-style-type: none">• HbA1c 5,9-6,4% (41 - 46 mmol/mol) i første trimester• Henvis kvinnan til spesialisthelsetjenesten	<ul style="list-style-type: none">• Kjent pregestasjonell diabetes• Henvis kvinnan til spesialisthelsetjenesten	<ul style="list-style-type: none">• HbA1c $\geq 6,5\%$ (48 mmol/mol) eller fastende plasmaglukose $\geq 7,0$ mmol/l, eller 2-timers verdi etter glukosbelastning: $\geq 9,0$-11,0 mmol/l• Henvis kvinnan til spesialisthelsetjenesten	<ul style="list-style-type: none">• Fastende plasmaglukose: $\geq 5,3$-6,9 mmol/l, eller 2-timers verdi etter glukosbelastning: $\geq 9,0$-11,0 mmol/l• Oppfølging av fastlege, jordmor eller annet helsepersonell med egnet kompetanse

Prøvemateriale til forsendelse ved oGTT



45% av legekontor
sentrifugerer ofte eller
alltid prøvene innen 2
timer sammen med øvrige
rør

Endring i plasmaglukose over tid i fullblodprøve

Glykolyse:

5-7% per time

ca. 0,6 mmol/L per time

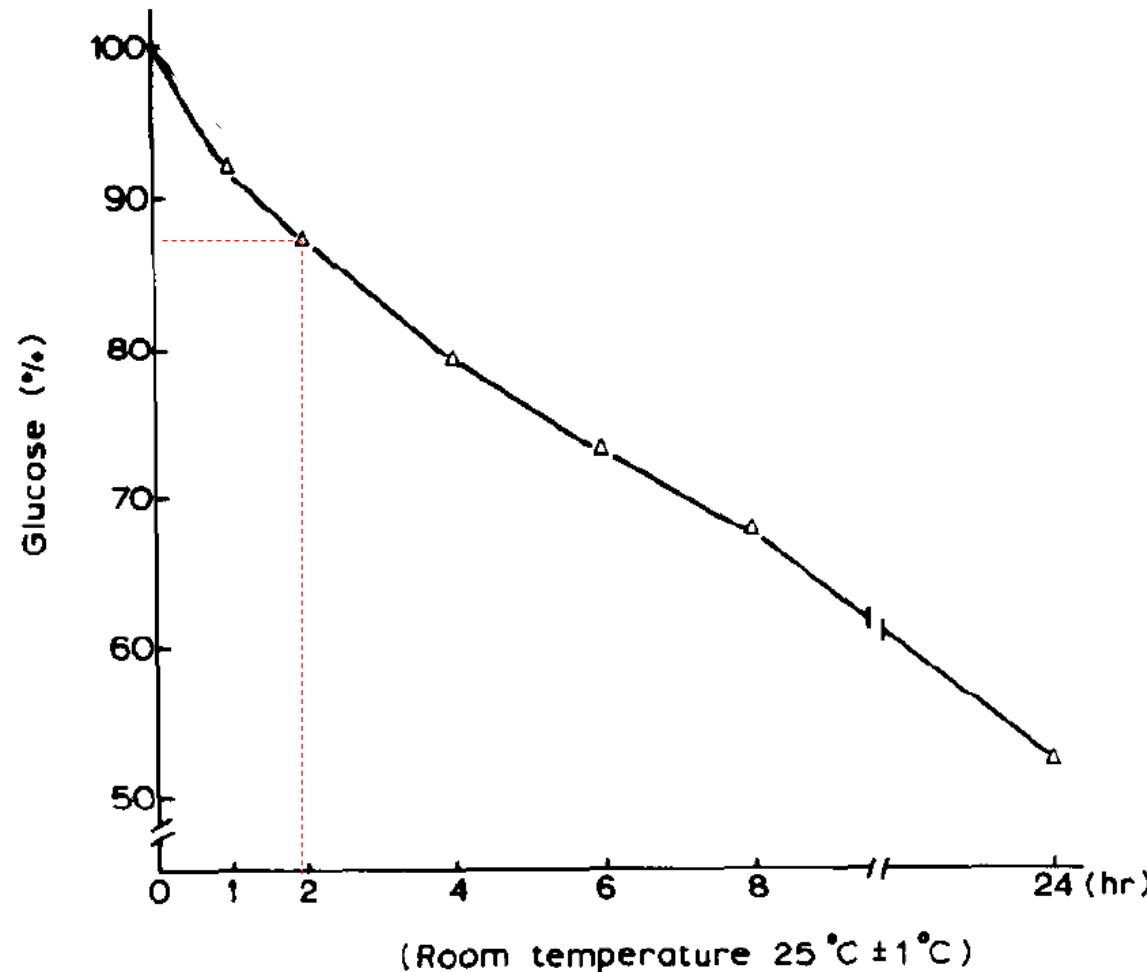
Avhengig av:

Glukosekonsentrasjon

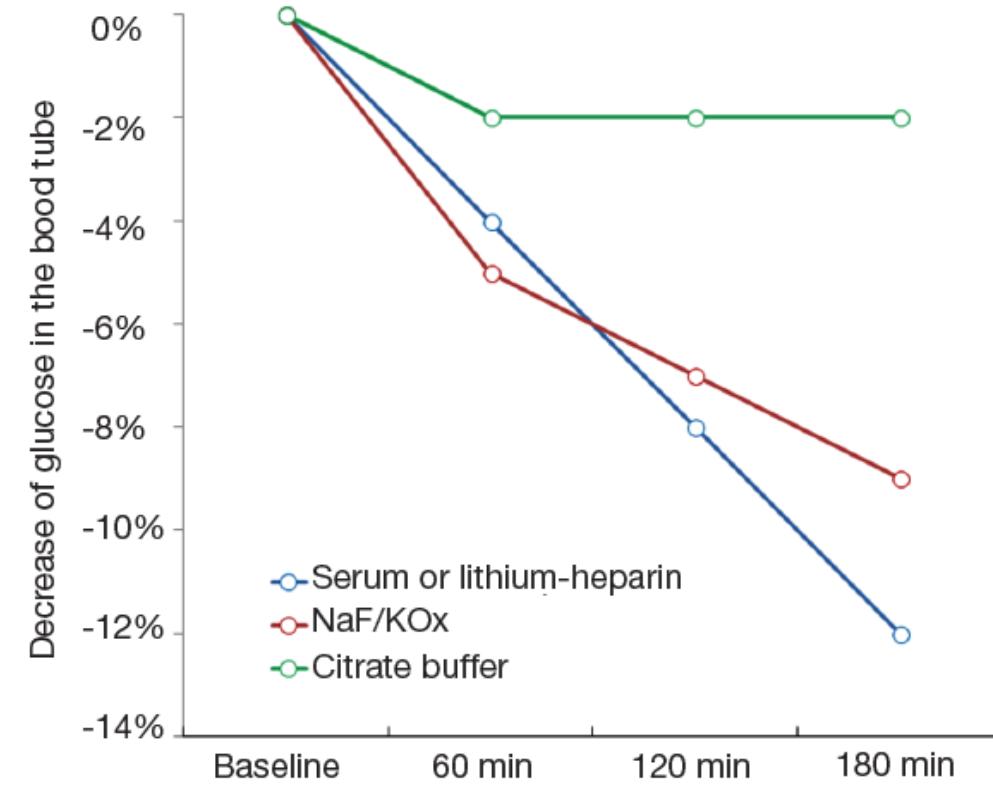
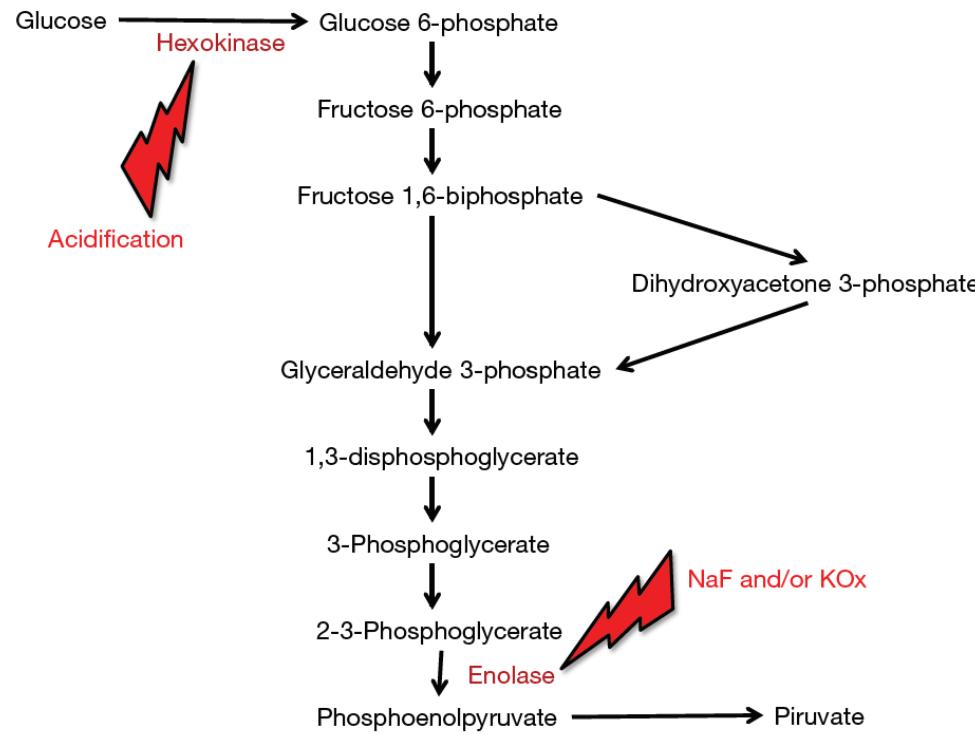
Temperatur

Antall leukocytter

etc.



Virkmekanisme fluorid-citrat



Anbefalinger i andre land



Plasmarør settes på is

ADA og NACB

RECOMMENDATION: TO MINIMIZE GLYCOLYSIS, ONE SHOULD PLACE THE SAMPLE TUBE IMMEDIATELY IN AN ICE-WATER SLURRY, AND THE PLASMA SHOULD BE SEPARATED FROM THE CELLS WITHIN 30 MIN. IF THAT CANNOT BE ACHIEVED, A TUBE CONTAINING A RAPIDLY EFFECTIVE GLYCOLYSIS INHIBITOR, SUCH AS CITRATE BUFFER, SHOULD BE USED FOR COLLECTING THE SAMPLE. TUBES WITH ONLY ENOLASE INHIBITORS, SUCH AS SODIUM FLUORIDE, SHOULD NOT BE RELIED ON TO PREVENT GLYCOLYSIS
B (moderate).

EQUALIS

Rekommendation

1 (2)

Expertgrupperna för allmän klinisk kemi och patientnära analyser

2016-04-20

Rekommendation för provtagningsrör med surt citrat vid glukosanalyser

Sammanfattning

För analys av glukos i venöst taget prov rekommenderar vi provtagning i rör med surt citrat (FC-blandning) som torrsubstans.

Finland: Fluorid-Citrat rør

Danmark: Fluorid-Citrat rør

Tyskland: Fluorid-Citrat rør

Holdbarhet av glukose i Fluorid-Citrat-rør

Your **Power** for Health



20 December 2017

Product handling: Updated Instruction For Use of FC Mix Tubes

Dear valued customer,

Based on further internal studies to evaluate the glucose stabilization of our FC Mix Tubes,

454510 | VACUETTE® FC Mix TUBE 2 ml, 13x75, pink cap-white ring

454511 | VACUETTE® FC Mix TUBE 2 ml, 13x75, grey cap-white ring

454513 | VACUETTE® FC Mix TUBE 3 ml, 13x75, pink cap-black ring

454514 | VACUETTE® FC Mix TUBE 3 ml, 13x75, grey cap-black ring

we would like to inform you of an updated handling instruction of our FC Mix Tubes. Our internal studies have reconfirmed that the mixing of the FC Mix Powder is critical for the long-term stabilization (up to 48 hours) of glucose in these tubes. Since we cannot guarantee that the inversion of the tubes (10x) is strictly followed by all of our customers and hence to ensure the integrity of the correct glucose stabilization in the samples, we have decided to revise our current Instruction For Use for the FC Mix tubes. This revision is also based on the fact, that the correct mixing of the FC Mix tubes is essential for the stabilization of glucose for 48 hours.

Revised handling protocol of FC Mix Tubes:

- FC Mix Tubes (Primary Tubes) can be stored after correct inversion for up to 24 hours at room temperature without centrifugation.



Holdbar i 48 timer ved RT etter sentrifugering

Holdbarhet av glukose i Li-Heparinrør med gel

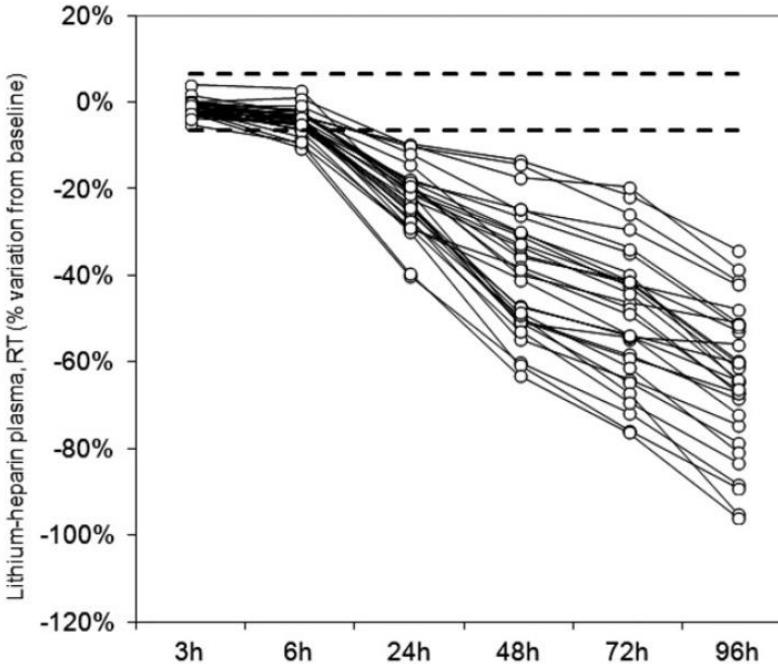


Table 2. Variation of glucose concentration (median and interquartile range) in centrifuged serum or lithium-heparin tubes ($n=30$) stored for up to 96 h at room temperature (RT) or at 4 °C.

Sample matrix; temperature	T0	3 h	6 h	24 h	48 h	72 h	96 h
Serum (mmol/L); RT	5.9 (0.9)	5.9 (1.0) <i>p = .447</i>	5.9 (1.0) <i>p < .001</i>	5.8 (1.0) <i>p < .001</i>	5.8 (1.0) <i>p < .001</i>	5.8 (1.0) <i>p < .001</i>	5.7 (1.0) <i>p < .001</i>
– Median % bias (and IQR) vs. T0	– (2.0%)	0.0% (0.0%)	0.0% (1.8%)	-3.0% (2.1%)	-3.0% (3.9%)	-2.8% (2.3%)	-3.4% (2.6%)
Lithium-heparin plasma (mmol/L); RT	5.7 (1.0)	5.6 (0.9) <i>p < .001</i>	5.6 (0.9) <i>p < .001</i>	4.5 (0.8) <i>p < .001</i>	(1.2)	2.9 (1.3) <i>p < .001</i>	2.0 (1.4) <i>p < .001</i>
– Median % bias (and IQR) vs. T0	– (2.2%)	-1.3% (2.8%)	-4.1% (2.8%)	-21.9% (9.0%)	-39.3% (20.0%)	-48.3% (19.3%)	-64.1% (21.8%)
Serum (mmol/L); 4 °C	5.8 (0.5)	5.8 (0.6) <i>p = .368</i>	5.8 (0.7) <i>p < .001</i>	5.7 (0.6) <i>p < .001</i>	5.7 (0.7) <i>p < .001</i>	5.7 (0.6) <i>p < .001</i>	5.7 (0.7) <i>p = .002</i>
– Median % bias (and IQR) vs. T0	– (0.1%)	-0.2% (0.0%)	0.0% (2.0%)	-1.6% (1.9%)	-1.4% (2.6%)	-1.6% (2.2%)	-1.5% (2.7%)
Lithium-heparin plasma (mmol/L); 4 °C	5.7 (0.6)	5.6 (0.5) <i>p < .001</i>	5.6 (0.7) <i>p < .001</i>	5.3 (0.6) <i>p < .001</i>	5.1 (0.8) <i>p < .001</i>	4.9 (0.8) <i>p < .001</i>	4.7 (0.9) <i>p < .001</i>
– Median % bias (and IQR) vs. T0	– (2.6%)	-2.1% (2.1%)	-2.0% (3.2%)	-7.1% (4.8%)	-10.0% (5.2%)	-14.5% (5.2%)	-17.8% (6.8%)

IQR: interquartile range; T0: Baseline; RT: room temperature.

Balboni et al. SJCLI 2018;7-8:546-550

- Glukose har begrenset holdbarhet i Li-Heparinplasma tatt på gelrør
- Ellers ingen studier som har bekreftet holdbarhet i Li-Heparinplasma ved RT

Holdbarhet av glukose i serum med gel

Table 2: Median glucose concentrations (1st–3rd quartile) according to tube type, storage time and storage temperature.

Storage	Number of subjects	Number of measurements	Time, h						Glucose, mmol/L	p-Value
				BD FX	BD serum	Greiner	Terumo EU	Terumo JP		
4 °C	31	152 ^a	0	4.60 (4.20–4.90) ^{e,f,g}	4.50 (4.30–5.10) ^{e,f,g}	4.80 (4.60–5.40) ^{c,d}	4.80 (4.60–5.40) ^{c,d}	4.90 (4.70–5.30) ^{c,d}	<0.001	
		154 ^a	24	4.40 (4.00–4.80)	4.60 (4.10–5.00)	4.70 (4.50–5.30)	4.90 (4.60–5.40)	4.80 (4.60–5.20)	<0.001	
		153 ^a	48	4.50 (4.10–4.90)	4.60 (4.00–5.00)	4.70 (4.50–5.60)	4.90 (4.50–5.40)	4.70 (4.40–5.10)	<0.001	
		154 ^a	72	4.30 (4.00–4.80)	4.50 (4.10–5.00)	4.90 (4.40–5.40)	5.00 (4.60–5.50)	4.80 (4.50–5.30)	<0.001	
		154 ^b	96	4.10 (3.50–4.40)	4.50 (4.10–5.00)	4.90 (4.60–5.50)	4.90 (4.70–5.30)	4.75 (4.50–5.20)	<0.001	
Room temperature	30	150	0	4.85 (4.60–5.20)	4.80 (4.50–5.10)	5.30 (4.80–5.60)	5.25 (4.80–5.50)	5.20 (4.90–5.50)	<0.001	
		150	24	4.60 (4.40–4.80)	4.70 (4.30–5.10)	5.10 (4.70–5.40)	5.10 (4.90–5.50)	4.90 (4.60–5.20)	<0.001	
		149 ^a	48	4.60 (4.30–4.90)	4.65 (4.50–5.10)	5.10 (4.70–5.40)	5.20 (4.70–5.40)	4.80 (4.30–5.00)	<0.001	
		150	72	4.15 (3.70–4.60)	4.90 (4.60–5.20)	5.10 (4.70–5.50)	5.10 (4.50–5.30)	4.80 (4.50–5.40)	<0.001	
		145 ^b	96	3.40 (3.10–3.80)	4.80 (4.60–5.30)	5.20 (4.80–5.50)	4.90 (4.40–5.30)	4.75 (4.10–5.10)	<0.001	



Winter T et al. CCLM 2018;56(8):1251-1258

Table 2. Variation of glucose concentration (median and interquartile range) in centrifuged serum or lithium-heparin tubes ($n=30$) stored for up to 96 h at room temperature (RT) or at 4 °C.

Sample matrix; temperature	T0	3 h	6 h	24 h	48 h	72 h	96 h
Serum (mmol/L); RT	5.9 (0.9)	5.9 (1.0)	5.9 (1.0)	5.8 (1.0)	5.8 (1.0)	5.8 (1.0)	5.7 (1.0)
– Median % bias (and IQR) vs. T0	– (2.0%)	0.0% (1.8%)	0.0% (2.1%)	$p < .001$ –3.0% (3.9%)	$p < .001$ –3.0% (3.9%)	$p < .001$ –2.8% (2.3%)	$p < .001$ –3.4% (2.6%)
Lithium-heparin plasma (mmol/L); RT	5.7 (1.0)	5.6 (0.9)	5.6 (0.9)	4.5 (0.8)	(1.2)	2.9 (1.3)	2.0 (1.4)
– Median % bias (and IQR) vs. T0	– $p < .001$ (2.2%)	–1.3% (–4.1%)	–4.1% (–21.9%)	$p < .001$ –39.3% (–21.9%)	$p < .001$ –48.3% (–39.3%)	$p < .001$ –64.1% (–48.3%)	$p < .001$ (–64.1%)
Serum (mmol/L); 4 °C	5.8 (0.5)	5.8 (0.6)	5.8 (0.7)	5.7 (0.6)	5.7 (0.7)	5.7 (0.6)	5.7 (0.7)
– Median % bias (and IQR) vs. T0	– $p = .368$ (0.1%)	–0.2% (0.0%)	0.0% (–1.6%)	$p < .001$ –1.6% (–1.4%)	$p < .001$ –1.4% (–2.6%)	$p < .001$ –1.6% (–2.2%)	$p = .002$ –1.5% (–2.7%)
Lithium-heparin plasma (mmol/L); 4 °C	5.7 (0.6)	5.6 (0.5)	5.6 (0.7)	5.3 (0.6)	5.1 (0.8)	4.9 (0.8)	4.7 (0.9)
– Median % bias (and IQR) vs. T0	– $p < .001$ (2.6%)	–2.1% (–2.0%)	–2.0% (–7.1%)	$p < .001$ –7.1% (–10.0%)	$p < .001$ –10.0% (–14.5%)	$p < .001$ –14.5% (–17.8%)	$p < .001$ –17.8% (–14.5%)



Balboni et al. SJCLI 2018;7-8:546-550

IQR: interquartile range; T0: Baseline; RT: room temperature.

Systematisk forskjell mellom serum og plasma

Systematisk forskjell ca. 0,2 mmol/L

The image displays a journal abstract from the Scandinavian Journal of Clinical and Laboratory Investigation, Volume 78, Number 7-8, pages 546-550, published in 2018. The article is an original research paper titled "Glucose variance for up to 96% serum and lithium-heparin gel tubes stored". It is authored by Goce Dimeski, Kong S Yow, and Niels Jørgensen. The study found a systematic difference of approximately 0.2 mmol/L between serum and plasma glucose levels after storage at room temperature for up to 96 hours. The article is associated with The Association for Clinical Biochemistry & Laboratory Medicine and is published by Taylor & Francis Group.

SCANDINAVIAN JOURNAL OF CLINICAL AND LABORATORY INVESTIGATION
2018, VOL. 78, NO. 7-8, 546-550
<https://doi.org/10.1080/00365513.2018.1517221>

Original Article

Glucose variance for up to 96% serum and lithium-heparin gel tubes stored

TECHNICAL NOTE

Fiamma Balboni^a

The Association for Clinical Biochemistry & Laboratory Medicine
Better Science, Better Testing, Better Care

Taylor & Francis Group

Check for updates

Annals of Clinical Biochemistry
2015, Vol. 52(2) 270-275
© The Author(s) 2014
Reprints and permissions:
sagepub.co.uk/journalsPermissions.nav
DOI: 10.1177/004563214544708
acb.sagepub.com

SAGE

What is the most suitable collection tube for glucose estimation?

Scand J Clin Lab Invest 2004; 64: 271-284

The Nordic Reference Interval Project 2000: recommended reference intervals for 25 common biochemical properties of plasma glucose. 1. Impact of WHO and ADA recommendations on the analysis of plasma glucose. M. Stahl, L. G. M. Jørgensen, P. Hyltoft Petersen, A. Mårtensson, H. Steensland, P. Rustad, P. Felding, L. Franzson, V. Kairisto, A. Lahti, A. Uldall, P. Hyltoft Petersen, P. Simonsson, I. Brändslund, N. De Fine Olivarius, K. Borch-Johnsen

M. STAHL,* L. G. M. JØRGENSEN,* P. HYLTOFT PETERSEN,†
I. BRANDSLUND,* N. DE FINE OLIVARIUS[§] & K. BORCH-JOHNSEN[§]

Trombinrør

Systematisk forskjell mellom serum og plasma?



Sentrifugert etter 5 min

Table 2: Data for each analyte with non-normal distribution from the three different tubes by Wilcoxon Matched-Pairs Ranks test.

Analyte	Units	n	GBLiHep median (IR)	BD RST median (IR)	GBBCAFC median (IR)	% Difference (GBLiHep – BD RST)	p-Value (GBLiHep vs. BD RST)	% Difference (LiHep – GBBCAFC)	p-Value (GBLiHep vs. GBBCAFC)
Gluc	mmol/L	40	5.6 (1.3)	5.5 (1.4)	5.6 (1.5)	-0.8±2.3	0.0271	0.8±2.3	0.0389

Dimeski et al. 2017

Ingen publiserte studier for holdbarhet ved romtemperatur!

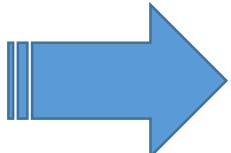
BD attesterer holdbarhet i 24 timer ved romtemperatur.



Forslag til anbefaling ved forsendelse

Trombinrør eller serum bør anbefales for glukosemålinger ved oGTT

- Riktighet
- Praktikabilitet
- Holdbarhet
- Kostnader



Endelig anbefaling forventes før sommeren