Effect of resting time prior to blood sampling on common biochemical parameters – results from thyreotropin and albumin

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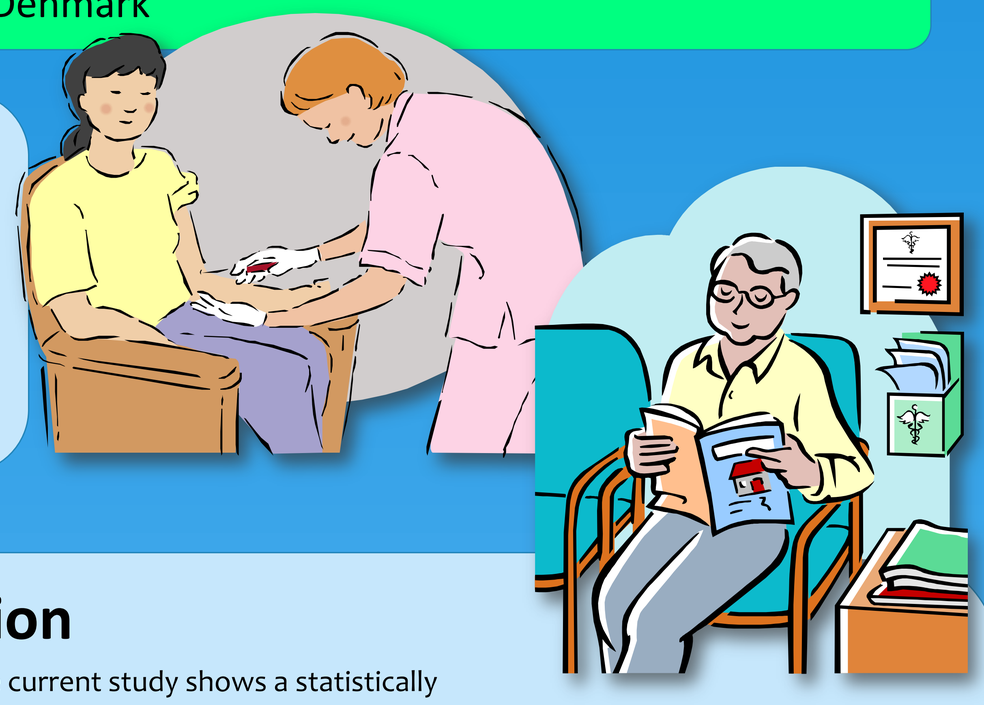
Introduction

A variety of preanalytical parameters may have a crucial impact on the quality of laboratory results. Earlier studies have shown both exercise and positional changes prior to blood sampling affects various biochemical analyses. Having to rest before blood sampling in an outpatient laboratory blood sampling setting would be an inconvenience both to patients as well as hospital. It is therefore important to ensure evidence whether a standardized period of rest before collection of blood samples is needed.



Objectives

To investigate the effect of rest time prior to blood sampling in a routine outpatient setting on common biochemical parameters and to investigate the circadian change during the opening hours of the outpatient clinic on the concentration of thyreotropin and albumin.

Table 1	Reference interval		Demand < 1/3 × 1SD
TSH	20+ years	0.30 – 4.0 × 10^{-3} IU/L	0.31
Albumin	15 – 40 years	36 - 50 g/L	1.17*
	40 – 70 years	36 - 48 g/L	
	70+ years	34 - 45 g/L	

*Reference interval set to 35-49 (if we choose the strict demands <1/4 × 1SD and reference interval 36-45 => 0.56)

Conclusion

Resting time: The current study shows a statistically significant effect of resting time prior to blood sampling on both thyreotropin and albumin values. The latter only true for the first 6 min. However, the change is not large enough to have clinical importance (<1/3*standard deviation).

Diurnal changes: Again we see a significant change for both albumin and TSH, but for albumin there it is of no clinical importance. Testing for the misclassification in respect to the reference interval showed this. For TSH we see, as has been reported in literature before, that there is a decrease from 7-9 am. Therefore it is worth considering whether the procedure of TSH blood sampling should be to start from 9 pm instead of 7 pm as it is in our clinic today.

Fig. 1

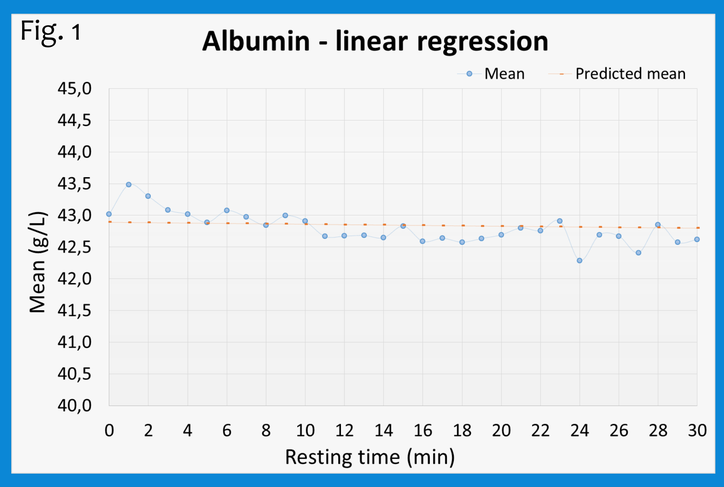


Fig. 2

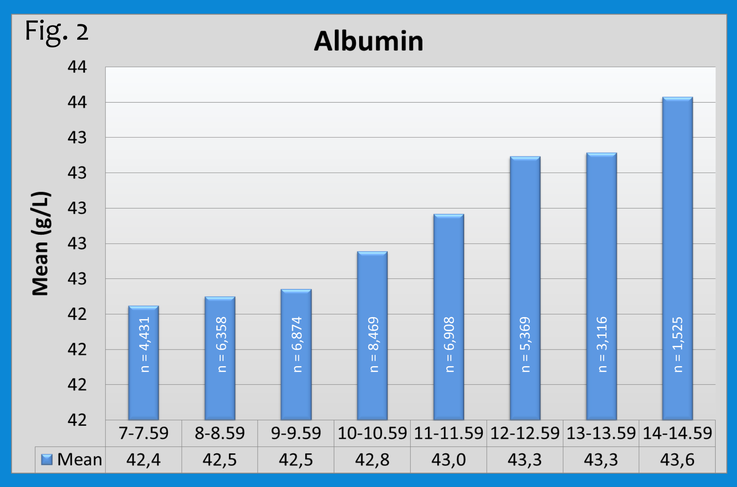
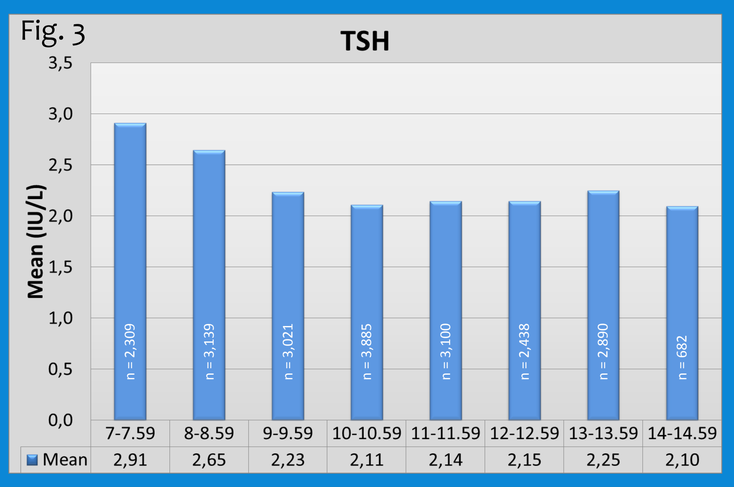


Fig. 3



Results

We show that both albumin (figur 2) and TSH (figur 3) change during the day and as shown in figur 1 albumin change during rest (change only significant in the first 6 min), which could influence the interpretation of the results when compared to reference intervals.

If the change in mean is less than 1/3*SD the same reference interval can be used during the day and for any amount of rest. Comparing the changes we see that they are relatively small. They are therefore not clinically important unless they lead to a misclassification which we therefore also investigated (table 2).

The comparison of measured and calculated values showed that 4.8 % of all measured TSH samples are *lower* in concentration than the calculated. For albumin 1.4 % of the measured samples are *higher* than the calculated ones.

Table 2	**Rest time**	**Diurnal variation**	No. of patients	Misclassification
	Max change in 60 min (p-value)	Max change in 60 min (p-value)		
TSH 0-60 min	-0.0103 (0.0029)	-0.0045 ($<2\times10^{-16}$)	19,246	4.8 %*
Albumin 0-60 min	-0.5049 (8.7×10^{-10})	0.1580 ($<2\times10^{-16}$)	42,494	1.4 %

*No of patients: 20.087

Method

All patients referred to an outpatient clinic for blood sampling were included during Nov. 2011 to Jun. 2014 (opening hours for the clinic: 7 am – 3 pm). For each patient arrival time and time of blood sampling were registered electronically using Q-MATIC Suite. Only patients above the age of 20 (TSH) or 15 (albumin) who have been resting between 0-60 min were included. The data were analysed using the "R" version 3.1.1. The underlying assumptions on normality and variance homogeneity were assessed by qq-plots and residual plots, and indicated deviation from the normality for TSH but not albumin. Albumin was estimated using linear regression, taking into account age and time of day.

A Box-Cox analysis suggested power transformation $TSH^{1/9,9}$ to normalize the data. The linear regression was therefore estimated on the transformed scale. The new model for TSH was once again checked for goodness of fit by residual plot and gave no cause for concern.

Using the algorithms, calculated values for 7 am and no resting time were compared with the measured values in respect to the reference intervals. This was done to evaluate the degree of misclassifications e.g. when the measured value would place the patient inside the reference interval as the calculated value would place the patient outside the interval and vice versa.

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