Biospecimen Science in The Janus Serum Bank

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Background

The potential value of a biobank depends on the quality of the samples, *i.e*. to what extent they may reflect the biological, or biochemical situation in the individual at the time of sample collection. The sample quality is essential to obtain reliable measurements of archival samples, and lack of component stability may invalidate scientific results. The Janus Serum Bank, owned by the Cancer Registry of Norway was established in 1973. The funding at that time gave room only for simple practical and logistics solutions compared with modern biobanks with respect to temperature monitoring, sample access etc. Despite these limitations and a suboptimal temperature of –25 °C (–13 °F), the bank has been used extensively in epidemiological cancer research.

Material and statistical methods

In this work we analysed proteins, hormones, amino acids, vitamins, and other biochemical compounds. We used a repeated cross-sectional design to investigate the effect of long term storage at –25 °C. Samples were randomly selected from men aged 40–49 years at blood draw, distributed in equally sized groups according to length of storage and compared to freshly collected samples. Figure 1 shows a flowchart of the sample selection. Z- score plots were used to check for normality and variance in each group. Group comparisons were done by ANOVA and Student Newman-Keuls. Evaluation of central tendency and dispersion was done by median with quartiles and mean with 95% confidence interval for each group.

Results

The work demonstrated non-significant or numerically small group differences for a number of components as shown in table 1. Most proteins were robust to long-term storage, while some enzymes seemed to be particularly fragile. The vitamins demonstrated large variability. Folate was especially vulnerable in contrast to Cobalamin, a stable vitamin. The hormones showed stable levels during long-term storage. Higher levels of testosterone in the oldest samples may indicate a change in the background population over three decades.

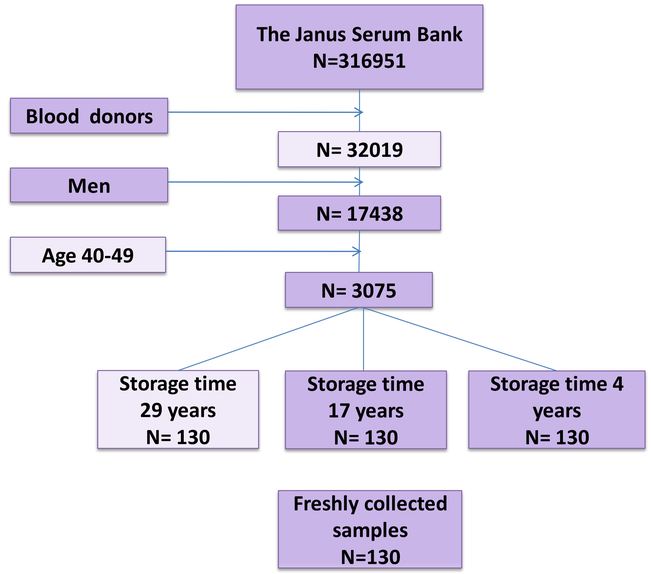

Figure 1 Sample selection

Conclusion

The findings showed great variation in stability for the selected components. In biobank based research, pilot studies are recommended when the stability of the component of interest is unknown.

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Table 1 Stability data of selected components

Component	Percent diff.†	Bias crit.‡	Comments
Sodium	+3.9	0.3	Sublimation
Potassium	+26.4	1.8	Prean. handling
Calsium	+7.4	0.8	Higher level
Bilirubin	–59.4	10.0	Instable
Creatinine	–1.2	3.4	Stable
Uric acid	–7.6	4.8	Rel. Stable
Iron	+4.0	8.8	Stable
Ferritin	–18.5	5.0	Instable
Transferrin	+8.2	1.3	Higher level
Albumin	-1.9	1.3	Stable
Sex Hormone Binding Globulin	+7.1	11.1	Stable
Alanin aminotransferase	–73.4	12.0	Instable
Aspartate aminotransferase	+2.0	5.4	Stable
Creatine Kinase	–96.1	11.5	Instable
Immunoglobulin E	+4.3	NA	Stable
Immunoglobulin G	+1.0	4.3	Stable
Cystatin C	–3.3	3.4	Stable
Insulin C- peptide	–98.7	4.1	Instable
Folate	–69.9	11.2	Instable
Cobalamin	+8.9	8.0	Stable
Methyl malonic acid	0	NA	Stable
Homocystein	+4.4	7.7	Stable
Testosterone*	+24.4	5.8	Higher level
Follicle Stimulating Hormone*	+4.6	5.1	Stable
Luteinizing Hormone*	+1.9		Stable

† Pecent difference between long-term stored (29 Years) and fresh samples

‡ Bias criterion in percent: 0.25 · total biological variance= $0.25\sqrt{CVw^2 + CVg^2}$

CV_w= biological variance within individual
CV_g= biological variance between groups

* Corrected for sublimation