

**COMPARATIVE STUDY OF VITAMIN B12 AND
HOLOTRANSCOBALAMIN OR ACTIVE B12 AS A
MARKER FOR VITAMIN B12 DEFICIENCY AT DR
GEORGE MUKHARI HOSPITAL**

By

Dr Louise M Murray

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Supervisor: Prof HF Joubert

Co-supervisor: Dr M de Jongh

Department of Chemical Pathology

University of Limpopo (Medunsa Campus)

DECLARATION

I, **Dr LM Murray**, hereby declare that this work, unless where acknowledged, is my own. It is being submitted in partial fulfillment of MMed in Chemical Pathology, in the Department of Chemical Pathology, School of Pathology, Faculty of Health Sciences at the University of Limpopo, Medunsa campus.

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Signature of candidate

.....

Date

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Abstract

Aim: This study was undertaken to compare the diagnostic sensitivity and specificity of total vitamin B12 analyses to active B12 (holoTC) analyses in a population of patients attending the Dr George Mukhari Hospital in Pretoria.

Methods: Routine serum folate, full blood count (FBC), thyroid function test, homocysteine, serum total vitamin B12 and active B12 analyses were performed on 30 samples.

Results: Serum folate was determined in all patients and 96% of the patients had a normal folate value. When looking at the FBC results it is important to note that three times as many males as females presented with anemia (36% versus 16%). Thyroid function tests were normal in 90% of patients. When the total vitamin B12 test was performed only 10% of patients tested positive for vitamin B12 deficiency, in contrast to the active B12 analyses where 16% of patients tested positive for vitamin B12 deficiency. Both tests had a diagnostic sensitivity of 50%. The diagnostic specificity for total vitamin B12 was 93% in comparison with the 86% obtained by the active B12 analyses; when homocysteine was used as the true marker for vitamin B12 deficiency.

Conclusion: Diagnostic sensitivity was the same and the total vitamin B12 test's specificity was better in comparison to the active B12 analyses. Thus the active B12 assay cannot be recommended for routine use, since it has no benefit.

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List of abbreviations

| | |
|------|--|
| CoA | Coenzyme A |
| CLIA | Clinical Laboratory Improvement Amendments |
| CV | Coefficient of variation |
| Da | Dalton |
| DGM | Dr George Mukhari |
| DNA | Deoxyribonucleic acid |
| dTMP | Deoxythymidine monophosphate |
| dUMP | Deoxyuridine monophosphate |

| | |
|---------------------------------------|---|
| DxI | Beckman Coulter UniCel DxI 800 Immunoassay System |
| e.g. | exempli gratia (for example) |
| FBC | Full blood count |
| FN | False negative |
| FP | False positive |
| FT3 | Free triiodothyronine |
| FT4 | Free thyroxine |
| g/dl | gram per deciliter |
| GC-MS | Gas chromatography mass spectrometry |
| GUM | Guide to the Expression of Uncertainty in Measurement |
| Hb | Hemoglobin |
| HC | Haptocobalamin |
| Hct | Hematocrit |
| H ⁺ /K ⁺ ATPase | Hydrogen potassium adenosine triphosphate enzyme(ase) |
| HIV | Human immunodeficiency virus |
| holoTC | Holo transcobalamin |
| IF | Intrinsic factor |
| IQC | Internal quality control |
| LC-MS/MS | Liquid chromatography tandem mass spectrometry |
| LDH | Lactate dehydrogenase |
| MCV | Mean cell volume |
| MEIA | Microparticle enzyme immunoassay |
| mg | milligram |

| | |
|--------|--|
| mIU/l | milli International Units per litre |
| MU | Measurement of uncertainty |
| ng/l | nanogram per litre |
| NHANES | National Health and Nutritional Examination Survey |
| NHLS | National Health Laboratory Services |
| NIST | National Institute of Standards and Technology |
| nmol/l | nanomol per litre |
| pmol/l | picomol per litre |
| RBC | Red blood cell |
| RDA | Recommended daily amount |
| RE | Random error |
| SD | Standard deviation |
| SE | Systematic error |
| SRM | Standard Reference Material |
| TC | Transcobalamin |
| TC-II | Transcobalamin II |
| TE | Total error |
| TFT | Tyroid function test |
| THF | Tetrahydrofolate |
| TN | True negative |
| TP | True positive |
| TSH | Thyroid stimulating hormone |
| µg | microgram |

| | |
|---------------------------|---------------------------|
| $\mu\text{g}/100\text{g}$ | microgram per 100 gram |
| $\mu\text{g}/\text{day}$ | microgram per day |
| $\mu\text{mol}/\text{l}$ | micromol per litre |
| USA | United States of America |
| WHO | World Health Organization |