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Original Research Paper

Integrative health check reveals suboptimal levels in a number of vital biomarkers

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ABSTRACT

Background: Health checks are becoming more available in the community, with the intention of disease detection and prevention in asymptomatic people. This article summarises findings in an Australian adult sample from a health check conducted at the National Institute of Integrative Medicine (NIIM). There has been controversy regarding reference ranges and what constitutes optimal and standard reference ranges. Biomarkers were compared with standard reference ranges, and with optimal health reference ranges.

Methods and results: A total of 139 participants voluntarily undertook the NIIM Health Check across a 4 year period. Participants underwent a full day of medical examinations, including liver and kidney function, thyroid, full blood count, glucose, vitamin and mineral tests. Suboptimal values were evident in a large portion of participants in vitamin D, vitamin B12, homocysteine, and iodine levels. Variables such as age, gender, body mass index (BMI) and season were important covariates.

Conclusion: The sub-optimal levels in vitamin D, vitamin B12, sub-standard levels in iodine, and excessive homocysteine, were consistent with previous population studies and are associated with a number of preventable diseases such as dementia, hypertension, cancer and thyroid disease. Our analysis highlights the importance to screen for biomarkers prone to deficiencies in Australia.

What is already known about the topic?

- Health checks are becoming more available in the community, with the intention of disease detection and prevention in asymptomatic people.
- Sub-optimal levels of vitamins and minerals can lead to long term health problems.

What this paper adds?

- Sub-optimal levels in vitamin D, vitamin B12, sub-standard levels in iodine, and excessive homocysteine, were evident in a large portion of asymptomatic participants.
- Sub-optimal levels in vital biomarkers are associated with a number of preventable diseases such as dementia, hypertension, cancer and thyroid disease.
- Our article highlights the importance to screen for biomarkers prone to deficiencies in Australia.

1. Introduction

The recent National Health Survey indicates an all-time high prevalence of chronic diseases among Australians, including cancer, diabetes, cardiovascular disease, long-term mental or behavioural conditions and asthma [1,2]. Almost all Australians (99%) aged 15 and over have at least one risk factor for poorer health such as high blood pressure or vitamin deficiency due to poor nutrition, and about 1 in 7 people have five or more risk factors [3]. Encouraged by these statistics, we have initiated a health check programme that evaluates both current and potential matters of health and offers follow-up advice.

Medical screening has a long history [4]. The World Health Organization (WHO) has encouraged a holistic view of health by defining it as 'a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity' [5]. Screening tests and examinations, including comprehensive health checks can help with detection and prevention of diseases.

Health checks have become a common part of hospitals, insurance companies, schools and workplaces. Notably, the Victorian government implemented the Work Health programme which conducted approximately 800,000 workplace health checks with the intention of promoting a healthier workforce. However,

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vitamin D, vitamin B12, homocysteine, and iodine levels are not routinely assessed in general practice, which we investigated in this study [6].

The health check data used for this analysis was acquired from the National Institute of Integrative Medicine, 'The NIIM Health Check', collected over a four year period. The analysis examined levels required for optimal health rather than minimal levels to avoid disease. For a number of biomarkers such as vitamin D, standard reference ranges are below the optimal ranges that are needed for optimal health. Many vitamin D experts advocate maintaining 25(OH) D levels at >75 nmol/L (used in the study) up to as high as 80 nmol/ml or 200 nmol/L [7–9] whereas the standard reference range is considered >50 nmol/L. Optimal vitamin D levels (>75 nmo/L) have been associated with maximum mineral bone density, increased intestinal calcium absorption, decreased risk of osteoporosis and risk of fracture, higher serum phosphorus levels, increased performance speed and proximal muscle strength, and a significant decrease in the likelihood of chronic diseases such as cancers, auto immune disease, osteoarthritis and diabetes [7–9]. The vitamin B12 standard reference range is 200–700 pg/ml whereas the proposed optimal range is 500–1300 pg/ml [10]. Higher vitamin B12 ranges have been associated with increased cognitive function, and reflexes, decreased brain atrophy, confusion, weakness and depression [10]. Additionally, many experts suggest that the optimal health range for homocysteine is <7 μmol/L and the standard reference range is 5.0–12 μmol/L, with the optimal range showing a significant association with a lower likelihood of stroke, atherosclerosis and improved overall cardiovascular function [11].

The aim of the present study was to determine whether a sample of health check participants would provide results consistent with previous population literature regarding a number of vital biomarkers.

2. Methods

The data was obtained from a de-identified cohort of asymptomatic individuals in the National Institute of Integrative Medicine's 'NIIM Health Check', between November 2010 and December 2014. The NIIM Health Check includes a broad spectrum of innovative medical testing considered one of the most comprehensive integrative health checks in Australia [12].

Participants responded to an advertisement on the NIIM website and provided consent for their de-identified data to be used in this study. The NIIM Health Check receives mainly participants with no symptoms who participate purely for a preventative purpose. Participants can choose from several Health Check packages featuring different suites of tests and costs. Therefore not all participants necessarily undertake all tests. The NIIM Health Check payments are not covered by the clinic or Medicare. Costs are typically paid directly by the patient, with some participants being sponsored by their workplace. The majority of NIIM Health Check participants come from higher socioeconomic backgrounds. However a number of participants earning an average wage participate via an instalment plan. Participants consented to allow for the collection and analysis of completely anonymous data. Only those consenting were eligible to have such anonymous data collated for research purposes. Participants were considered eligible if they were capable of attending three appointments across one-month duration, consisting of an initial 5-h screening appointment a 1.5 h medical imaging appointment, and a 2 h final reviewing consultation with a General Practitioner (GP) practicing integrative medicine (the combination of evidence-based complementary and conventional medicine).

Socio-demographic data was obtained from a standardised online health questionnaire routinely administered to participants prior to their initial appointment. The first appointment involved comprehensive pathology testing. The final appointment took place 4 weeks following the first appointment and included a consultation with an integrative GP, where all reports and test results were discussed. Following the NIIM Health Check, treatment strategies for any abnormalities were discussed, which included behavioural factors such as diet, sleep, exercise, sun exposure, as well as supplementation and/or medication. The NIIM Health Check pathology results are presented here. Pathology tests included liver and kidney function, thyroid, full blood count, glucose, vitamin and mineral tests.

2.1. Statistical analyses

Descriptive analyses were undertaken for all blood tests and were compared to population reference ranges (Melbourne Pathology) and optimal ranges [7,8,10,25,26,37]. Data was subgrouped by age, gender, BMI and season. An analysis of variance (ANOVA) was used to establish significant differences. All analyses were conducted with IBM SPSS version 22.

3. Results

A total of 139 participants undertook the NIIM Health Check. Not all biomarkers were measured for all participants, depending on patient requests (Table 1). Extremely high outlier values, due to supplementation, were excluded. Mean age of the overall study population was 48.8 years (range 28–82 years) with an even gender balance (52.5% males). The majority of participants were of a higher socio-economic status with higher education (80%), mainly non-smokers (90%), and asymptomatic.

Mean blood test results at baseline and the proportion of participants that had levels in the standard reference range are summarised in Table 1. Significant differences between genders were found in a number of blood tests, such as ferritin ($p < 0.001$), transferrin ($p = 0.001$), saturated transferrin ($p = 0.003$), haemoglobin ($p < 0.001$), red blood cell ($p < 0.001$), platelets ($p = 0.002$), erythrocyte sedimentation rate ($p = 0.009$), and creatinine ($p < 0.001$) (Table 1). A majority of participants were in the standard reference range for each biomarker, but close to half of the female sample was below the red blood cell and creatinine reference range (56.4% and 69.6% respectively). Standard reference ranges are closely linked to optimal health and minimal risk of diseases. However, for a number of biomarkers, standard reference values were below levels considered to achieve optimal health (Table 2).

In our population, mean vitamin D, vitamin B12, homocysteine, and iodine levels were below their optimal levels (Fig. 1B) even though a majority of participants were within the standard reference range for each of these biomarkers (Fig. 1A). We explored these further by BMI and age categories (Table 2). Mean vitamin D serum level was 68.64 nmol/L, below the optimal level of >75 nmol/L. A trend revealed that mean vitamin D levels were higher in males than in females (mean difference = 11 nmol/L ± 8.9, $p = 0.16$) in the youngest age category (≤39 years), compared to a mean difference of 2.59 nmol/L (40–59 years, $p = 0.68$) and 4.9 nmol/L (≥60 years, $p = 0.55$). BMI was inversely correlated to vitamin D levels in healthy weight males (80.81 nmol/L) and obese males (61 nmol/L) ($r = -0.25$, $p = 0.048$). Additionally, vitamin D levels were correlated to seasonal changes in winter months in Australia ($r = -0.24$, $p = 0.06$). There was a borderline significant difference of 11.14 nmol/L between males and females during winter months ($p = 0.056$), and a significant difference for females between winter (59.48 nmol/L) and summer (70.3 nmol/L) months ($p = 0.037$).