Which Waist Girth? An Analysis Using 3D Scanning.

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Abstract

Introduction

Waist girth (WG) is often used as a predictor of the risk of cardio-metabolic disease in adults. This is because WG is highly correlated with levels of subcutaneous and visceral abdominal fat which itself is strongly linked to cardio-metabolic disease, morbidity and mortality [1,2]. Additionally, WG is strongly correlated to cardiovascular risk factors such cholesterol levels [3]. Currently there are many different protocols commonly used for WG measurement. There are also multiple cut-off values recommended to identify people at increased risk of various health problems. This has lead to confusion as to which protocol and cut-off values to use.

Aim

The primary aim of this study was to determine the magnitude of the differences when taking WG measurements using seven different protocols on the same set of subjects. The seven protocols compared were; Umbilicus, Iliac Crest, Minimum, Mid-point, Visual Narrowing, 10th Rib and Berlei. Additional aims were to; determine the accuracy with which girths at one site can be predicted from girths at other sites, and; determine the extent to which the same individuals are identified as being at *increased* or *high* risk of health problems (e.g. metabolic syndrome) using the seven different protocols when applying Western cut-off values.

Method

The Vitus-XXL three-dimensional scanner was used to measure seven different waist girths on 348 Australian adults (176 M, 172 F) covering a range of BMI categories, aged 18-30 years. The absolute (metric) and relative (percentage) differences were calculated between WG measurements using the seven different protocols. Paired t-tests were completed to determine significant differences. Deming regression was used to develop equations which could predict one WG from another with each equation tested against a holdback sample. Lastly, Cohen's Kappa was used to determine the extent to which the same individuals were identified as being at *increased* or *high* risk when using different protocols and applying Western cut-off values.

Results

This study determined that there are significant differences in measurements dervied from the seven protocols assessed. Differences were found for both sexes and across all BMI categories. The maximum average difference between two protocols was for the Umbilicus and Minimum protocols with the male sample group recording an average difference of 4.0 cm (4.6%) while females had an average difference of 10.4 cm (11.9%). Overall, the correlations between the different protocols were quite high, with underweight females showing the largest error when testing the predictive equations against the holdback sample. One of the major findings resulting from the Cohen's Kappa analysis was the substantial differences in classifying someone at *increased* or *high* risk using the Umbilicus and Iliac protocols compared to the remaining five protocols. This was especially notable for the female sample groups.

Discussion

The two main issues associated with WG are (a) the number of current protocols available and (b) the various cut-offs associated with predicting health problems like metabolic syndrome. The fact that different protocols are producing substantially different results for classifying subjects as *increased* or *high* risk could have significant ramifications given that six of the seven protocols are commonly used for health based assessments. It is recommended that either the Minimum or Visual narrowing protocol is used to minimise error and assist in comparisons with other datasets. However, further work needs to be completed to determine which WG protocols and cut-off values are best suited for each situation.

References

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