Agreement between estimated and measured heights and weights in hospitalised patients – a restrospective study

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Introduction

The European Society for Clinical Nutrition and Metabolism (ESPEN) estimates that about 30% of all hospital patients are undernourished and need special nutritional care. ESPEN advises that all patients be screened for nutritional risk on admission. An ideal nutritional risk screening tool should be simple and quick to use by nursing staff when admitting patients to hospital. Tools recommended by ESPEN are the NRS 2002, MUST and MNA – all of which utilise body mass index (BMI = kg/m^2) and require accurate recording of a patient's height and weight.[1]

In reality, however, patients often cannot stand up straight for accurate height measurement, or are unable to step on a scale. In such cases, height and weight values are often obtained from the patient or their relatives, who either do not know, or do not report the values accurately, particularly in the South African setting where many patients do not own a scale and language barriers complicate communication. In many institutions the height and weight recorded in the patient's file on admission, are also values "guessed" by the attending nurse.

Various indirect methods have been developed to estimate height and weight. Height may be estimated using knee height (KH), and weight using KH and mid upper-arm circumference (MUAC).[2] These methods have been tested and validated in various population groups in studies where reliability was carefully controlled. In the academic hospitals in Bloemfontein, South Africa, dietetic interns (final year students performing an internship) routinely screen newly admitted patients using the NRS2002. Since 2003, certain wards in the three academic hospitals have been identified for nutritional screening as part of an ongoing research study. Since 2005 the students have been recording both measured and estimated heights and weights (using the above-mentioned methods), where possible. The study reported here aimed to assess the level of agreement between the measured and estimated heights and weights of patients as recorded by the dietetic students, in order to determine whether including these indirect methods in a nutritional risk screening tool would deliver reliable results in cases where direct height and weight measurements were not possible.

Methods

This study was based on the screening records (recorded by dietetic interns using the NRS 2000) of patients (≥ 18 years) admitted to the medical and surgical wards in Pelonomi and Universitas Hospitals and the cancer wards of National Hospital from 2005 to 2008. The students were trained on various occasions during their studies and again just prior to starting with the screening, in standardised techniques to measure KH and MUAC. In 3732 patients height was both measured, and estimated using a standardised method based on KH. In 3774 patients weight was both measured, and estimated using a standardised method based on KH and MUAC. BMI was calculated based on measured and estimated heights (N = 3642) and weights (N = 3663) respectively. Bland-Altman analysis was used to assess the levels of agreement between the estimated and measured values.[3]

Results

The Bland-Altman plots indicated that the 95% limits of agreement between measured and estimated heights ranged from -8 cm to +33 cm, with a median of 5 cm (Figure 1a). The 95% limits of agreement between the measured and estimated weights ranged from -16 kg to 44 kg, with a median of 5 kg (Figure 1b).

The 95% level of agreement between BMI based on measured height and BMI based on estimated height ranged from -14.6 kg/m^2 to +2.5 kg/m^2, with a median of -1.5 kg/m^2 (Figure 1c). The 95% level of agreement between BMI based on measured weight and BMI based on estimated weight ranged from -5.8 kg/m^2 to +17.1 kg/m^2, with a median of 1.8 kg/m^2 (Figure 1d). Thus the methods do not consistently provide similar results.

Discussion

Most nutritional screening tools rely on BMI and require accurate weight and height measurements. In the hospital setting these measurements are sometimes difficult to perform and often need to be estimated. Standardised estimation equations are available and in this study height was estimated using KH, and weight was estimated using KH and MUAC, during nutritional risk screening performed by dietetic interns. The results show wide disagreement between the actual measured heights and weights and those estimated using the standardised estimation techniques. Using these estimations in BMI calculations predictably led to a high level of disagreement with BMI-values obtained from actual measured heights and weights. These estimation methods therefore, although validated in studies where reliability was carefully controlled, when applied in routine practice, delivered clinically important discrepancies.
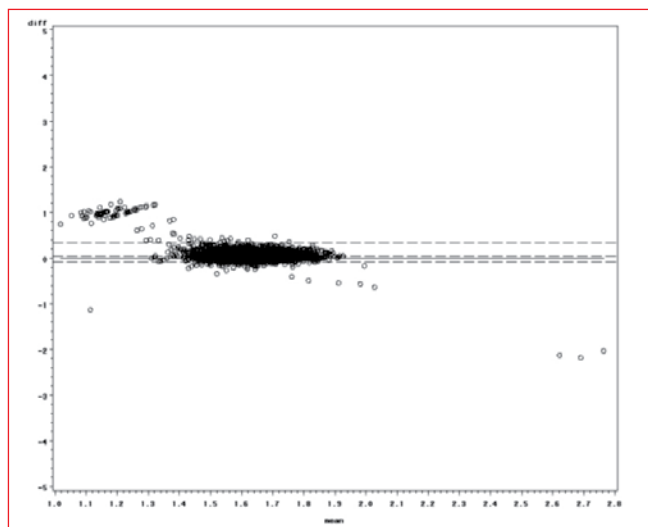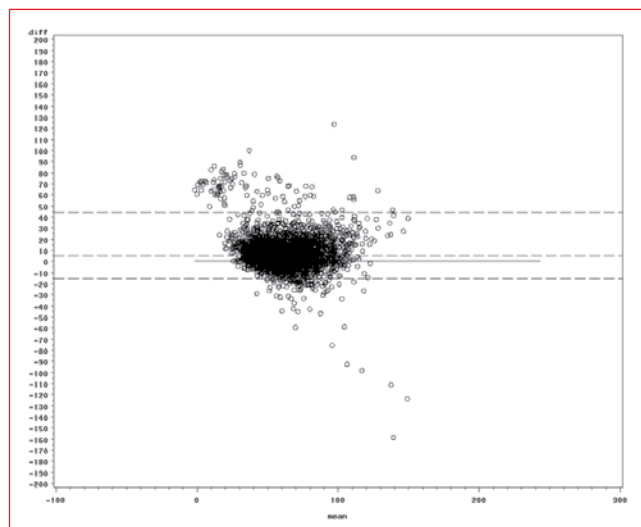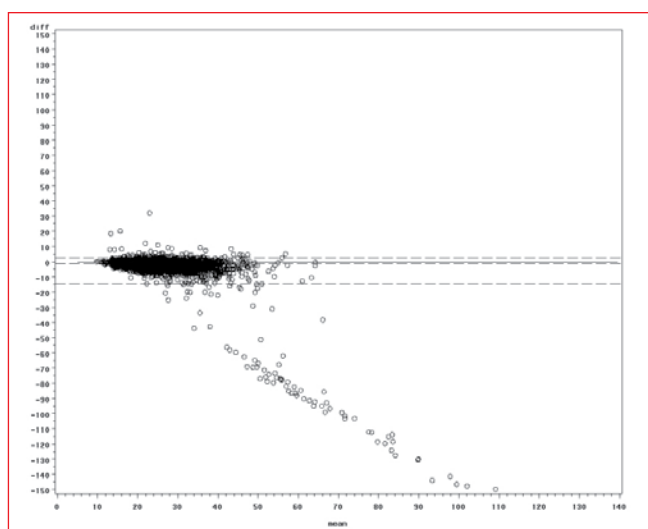
Figure 1a

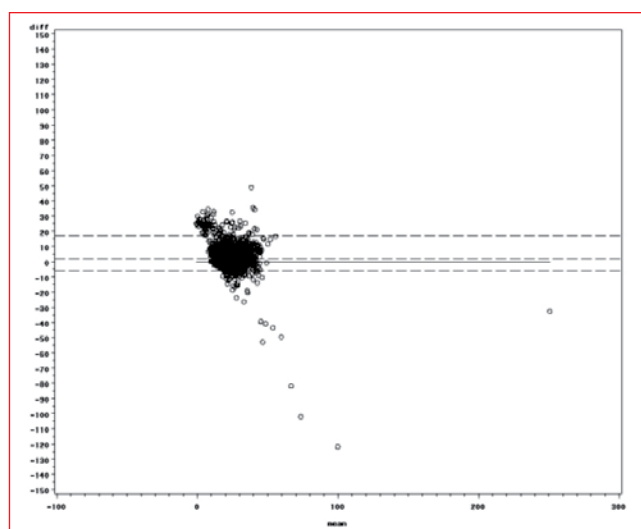**Figure 1b**

Figure 1c

Figure 1d

Figure 1: Bland-Altman plots depicting the levels of agreement between (a) measured height and height estimated with Knee Height (KH), (b) measured weight and weight estimated with KH and Mid Upper-Arm Circumference (MUAC), (c) Body Mass Index (BMI) calculated using measured height and BMI calculated using estimated height, and (d) BMI calculated using measured weight and BMI calculated using estimated weight. Bland-Altman analysis involves the plotting of the difference between measurements of the same parameter obtained with two different techniques against the mean of these measurements. Points showing perfect agreement will lie on the horizontal line drawn through the value 0. The further away the points fall from this line, the worse the level of agreement.[3]

Conclusions

A nutrition screening tool must be simple and quick to perform, but the accuracy of the assessment results will determine whether the patient will be referred for appropriate nutritional intervention or not. The results of this study emphasise that techniques making use of KH and MUAC to estimate height and weight may be too complicated to be routinely applied with acceptable reliability by students. For busy nursing staff it may only be worse. Sufficient training of staff in these techniques would be very important. Furthermore, staff would need frequent reminder of the correct way to perform the technique – for example visual aids such as posters, videos or video clips that can be run on a computer in the ward could be made available to staff. Alternatively other indirect measures such as ulnar length or demispan[4] may be used for height estimations. Whether these would give more reliable results in the routine setting, remains to be determined.

References

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