ORIGINAL ARTICLE

Weight, Height and Body Mass Index: Effectiveness of the "Clinical Insight" in the Correct Interpretation of Anthropometric Parameters

Peso, altura, índice de masa corporal: efectividad del "ojo clínico" en la correcta interpretación de parámetros antropométricos

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ABSTRACT

Background: Excess weight, defined as body mass index (BMI) ≥25 kg/m², is associated with increased cardiovascular risk. While BMI is easy to obtain, medical professionals often rely on their own clinical perception.
Objectives: The aim of the present study was to 1) evaluate the concordance between subjective estimates and actual measurements, 2) analyze if there is agreement between BMI categories as determined by objective measurements and as perceived by physicians, and 3) assess if there is inter-observer variability in subjective perceptions of weight, height and BMI category.
Methods: We conducted a prospective and observational study. Cohen's kappa index was used to analyze the degree of agreement between observers. A value greater than 0.6 was considered "good correlation." The Bland-Altman test was used to evaluate the differences between actual and estimated measurements. A difference greater than 5 kg in weight and greater than 5 cm in height between the actual and estimated measurements was considered clinically significant.
Results: A total of 87 patients were evaluated; 54% were men. More than 58% of the subjective perceptions of weight and 44% of height were significantly different from the objective measurements. The concordance between objective measurements of BMI and subjective impressions was not good.
Conclusion: In more than half of the cases, subjective perceptions of physicians when calculating weight, height, and BMI are inappropriate. There is significant variability in clinical perceptions. It is essential to measure objectively in order to properly categorize patients.

Keywords: Obesity - Excess weight - Anthropometric indices - Correlation

RESUMEN

Introducción: El exceso de peso, definido como un índice de masa corporal (IMC) ≥25 kg/m2 implica un aumento del riesgo cardiovascular. Si bien es una medida sencilla de obtener, los médicos utilizamos muchas veces nuestra propia impresión clínica.
Objetivos: 1) Evaluar si existe correlación entre el peso y la altura obtenidos por estimación subjetiva y las medidas reales; 2) analizar si hay concordancia entre las categorizaciones del IMC por medidas objetivas y por impresiones subjetivas; 3) analizar si hay variabilidad inter observador en las impresiones subjetivas de peso, altura y categorías del IMC.
Material y métodos: estudio prospectivo, observacional. Se utilizó la prueba Kappa de Cohen para analizar el grado de concordancia entre los observadores, estableciendo como "buena correlación" un valor mayor a 0,6, y el test de Bland Altman para evaluar las diferencias entre las medidas reales y las estimadas. Se consideró clínicamente significativas una diferencia de peso mayor de 5 Kg y de altura mayor de 5 cm entre las medidas reales y las estimadas.
Resultados: Fueron evaluados 87 pacientes, 54% varones. Más del 58% de las impresiones subjetivas de peso y del 44% de las de altura fueron significativamente distintas a las objetivas. No hubo buena correlación entre las categorías objetivas y subjetivas del IMC.
Conclusión: Las impresiones subjetivas de los médicos en el cálculo del peso, altura e IMC son inapropiadas en más de la mitad de los casos y hay gran variabilidad entre las impresiones clínicas. Es imprescindible medir objetivamente para catalogar adecuadamente a los pacientes.

Palabras Clave: Obesidad - Exceso de peso - Índices antropométricos - Correlación

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INTRODUCTION

Excess weight, defined as a body mass index (BMI) ≥ 25, affects more than 50% of the Western population and 62.5% of the population of the World Health Organization Region of the Americas. (1) This issue has emerged as a major public health concern in the 21st century, underscoring its global health priority due to its increasing prevalence and its association with various complications such as type 2 diabetes, hypertension, heart failure, dyslipidemia, osteoarthritis, obstructive sleep apnea, depression and several types of cancer. (2) Since 1975, obesity rates have almost tripled, affecting people of all ages and social groups worldwide and have increased by almost five times in children and adolescents. (3) In Argentina, there has been a clear upward trend in the prevalence of overweight and obesity across all age and social groups over the years, particularly among the most socially vulnerable groups (4) and has increased from the third edition of the National Survey of Risk Factors (ENFR), where it was 57.9%, to the fourth edition, where it reached 61.6%. Clearly, the trend continues to rise compared to the previous three editions. (5)

While other anthropometric measures are also currently used to better stratify the risk of excess body fat and fat distribution is also considered, BMI is the most validated and widely used tool worldwide. (6) Although BMI can be easily calculated, it requires the availability of a scale and an altimeter which may not be present in all medical offices. Additionally, the measurement process can be time-consuming. Therefore, the trend is to rely on weight and height self-reported by the patient or a family member. Alternatively, a BMI category is assigned according to the subjective perception of the physician. The aim of the present study was to 1) evaluate the concordance between subjective estimates of weight and height and the actual measurements, 2) analyze if there is agreement between BMI categories as determined by objective measurements and as perceived by physicians, and 3) assess if there is inter-observer variability in subjective perceptions of weight, height and BMI category.

METHODS

We conducted an observational and cross-sectional study. Hospitalized patients in the Cardiology Service who were able to ambulate and could be weighed and measured were included in the study. Pregnant patients and those with cachexia, edema, ascites or heart failure were excluded.

Each patient was evaluated by three different physicians. One physician performed the objective measurement of weight and height and calculated the BMI according to the formula. (7) The remaining two physicians examined the patient at different times on the same day, each documenting their subjective assessment of the patient's weight and height and BMI category on the record sheet.

The categories were established according to objective criteria in underweight (UW) if BMI was < 18 kg/m², normal weight (NW) if BMI was between 18.1 and 24.9 kg/m², overweight (OW) if BMI was between 25 and 29.9 kg/m², and obesity (O) if BMI was > 30 kg/m². All overweight or obese patients were grouped together as "excess weight."

Statistical analysis

Qualitative variables are presented as percentages and were compared with the chi-square test or Fisher's test. Quantitative variables are presented as mean and standard deviation (SD) or median and interquartile range (IQR). Cohen's Kappa index was used to assess the agreement between the diagnoses of the different BMI categories, considering the following cut-off points < 0: poor, 0 - 0.20: slight, 0.21 - 0.40: fair, 0.41 - 0.60: moderate, 0.61 - 0.80: substantial and 0.81 - 1.0: excellent. The Bland-Altman plot method was used to estimate the differences in the measurements of the variables. This analysis permitted the evaluation of both systematic bias and the dispersion between the two methods evaluated. A p value < 0.05 was considered statistically significant.

A difference greater than 5 kg in weight and greater than 5 cm in height between the actual and estimated measurements, as well as between those estimated by different operators was considered clinically significant. All the statistical calculations were performed using Stata 22 software package.

Ethical considerations

Informed consent was not required since the information was anonymized and obtained noninvasively.

RESULTS

A total of 87 patients were included; median age was 59 years (IQR 37-72) and 54% were men.

Table 1 shows the percentage of measurements with significant variations (> 5 or 10 kg) in weight or > 5 cm in height.

The Bland Altman plots (Figure 1) illustrate the distribution of the subjective measurements compared with the actual one and the distribution between subjective perception 1 and 2.

In the objective calculation of BMI, 8 patients (9%) were UW, 26 (30%) had normal weight NW, 35 (40%) OW and 18 (21%) were obese. Table 2 shows the categories according to objective measurements of the patients and how many of them are assigned to other categories according to the subjective perception of the operators. The coincidence between the objective determination and the subjective estimation is remarked green. The underestimation of OW stands out, in one third of the patients for observer 1 and almost 50% for observer 2. When the objective determinations of NW and OW were compared with the subjective determinations of observer 1, the subjective determinations of observer 2 and the two subjective determinations with each other, Cohen's kappa indices ranged from 0.3 to 0.5, so the agreement was low. Agreement was somewhat better in the extreme categories: underweight and obesity (Table 3).

DISCUSSION

Excess weight is an epidemic in the Western world associated with increased risk of diabetes and cardiovascular disease. A BMI ≥ 25 kg/m² is the most common tool used to define excess weight. While it is a simple

Table 1. Percentage of significant differences between subjective perceptions of operators 1 and 2 versus actual measurements and those of operator 1 versus operator 2

Measurements	DIF > 5 KG (%)	DIF > 10 KG (%)	DIF > 5 cm (%)
Subjective 1 vs. objective	60.92	29.1	44.8
Subjective 2 vs. objective	58.62	28.8	44.8
Subjective 1 vs. subjective 2	63.22	43.7	59.7

DIF: difference

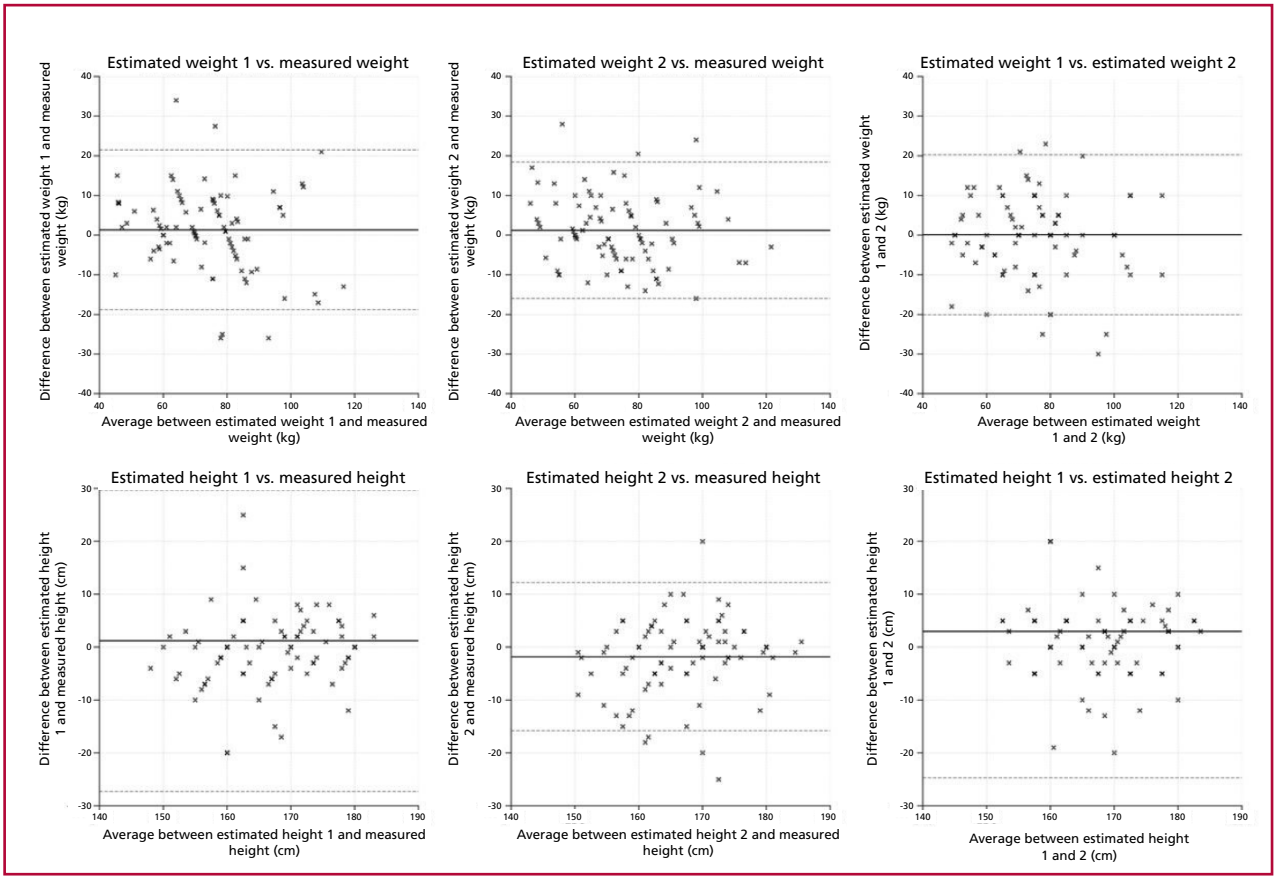

Fig. 1. Bland Altman plots for the analysis of differences in weight (top, in kg) and height (bottom, in cm) between the values estimated by the different operators and measured values.

Table 2. Assignment to different BMI categories according to the subjective perceptions of operators 1 and 2

	N:87	Subjective measurement 1				Subjective measurement 2			
Objective measurement	n	UW	NW	OW	O	UW	NW	OW	O
n		6 (6.89)	37 (42.53)	25 (28.74)	19 (21.84)	6 (6.8)	42 (48.2)	21 (24.1)	17 (19.5)
UW	8 (9)	5	2	1	0	4	4	0	0
NW	26 (30)	1	22	2	1	2	20	2	2
OW	35 (40)	0	12	18	5	0	17	11	7
O	18 (21)	0	1	4	13	0	1	8	9

BMI: body mass index; NW: normal weight; O: obesity; OW: overweight; UW: underweight

Table 3. Cohen's kappa indices for the different comparisons. An index >0.6 implies good concordance

	Low weight	Normal weight	Overweight	Obesity
Subjective 1 vs. objective	0.69	0.53	0.39	0.62
Subjective 2 vs. objective	0.53	0.37	0.13	0.39
Subjective 1 vs. subjective 2	0.64	0.53	0.17	0.44

measure to obtain, it is not typically collected during physical examination because physicians generally categorize patients based on the patient's self-reported information or on their own clinical assessment. While some reports indicate that self-reported weight is generally consistent with measured weight, (8,9) discrepancies have been observed in studies ranging from 20 to 84%. (10-14) These inconsistencies have been observed in self-reported BMI and in reports from family members. This lack of association is influenced (among other factors) by sex, age and socioeconomic level. (15-17) Women tend to underestimate their weight while men tend to overestimate their height. It has also been demonstrated that, irrespective of other sociodemographic factors, there are differences in the self-reported incidence of overweight and obesity among the ethnic groups analyzed. (18)

As medical professionals, we recognize the importance of knowing our patients' weight to ensure proper dosing of medications and their weight and height to calculate BMI. We are trained to see many patients and probably have the perception that our "clinical insight" allows us to accurately "calculate" instead of measuring. In addition, there is often a lack of time and equipment for the correct measurement at the time of consultation. As a result, most physicians who are not specialized in nutrition or diabetes calculate BMI instead of measuring it.

Our study revealed significant and clinically relevant differences in both weight and height measurements, with these subjective measurements being erroneous in more than half of the patients. Additionally, there is significant variability in the subjective perception of physicians. Strikingly, the estimated differences in weight and height between physicians' impressions and the actual ones are significantly greater than those observed in self-reported weight and height. (19-21)

The assignment to a given BMI category based on self-reported data compared to objective measurement is also subject to bias and may lead to errors in categorization (22,23). In this sense, physicians tend to overestimate normal weight and underestimate overweight. There is a higher probability of a correlation between subjective perception and objective measurement, as well as interoperator agreement, in the extreme categories of underweight and obesity.

There are no similar studies in the literature, so we cannot compare our results. However, due to the high margin of error in subjective clinical assessments, the low cost of necessary equipment, and the ease of obtaining objective measurements, we believe it is crucial to share our findings. This will help us correctly classify our patients and perform the necessary interventions without avoidable biases.

CONCLUSIONS

In more than half of the cases, subjective perceptions of physicians when calculating weight, height, and BMI are inappropriate. There is significant variability in clinical impressions between physicians, except for obesity assessments, where there is greater agreement between subjective and objective measurements. However, the lack of correlation between normal weight and overweight ranges underscores the importance of objective measurements for accurate patient categorization.

Conflicts of interest

None declared.

(See authors' conflict of interests forms on the web).

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