
Diagnostic performance of body mass index to identify obesity as defined by body adiposity: a systematic review and meta-analysis

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CRD summary

This review found that body mass index cutoff values commonly used to diagnose obesity had high specificity and low sensitivity to identify adiposity; they failed to identify half the people with excess body fat. These conclusions were based on summary estimates produced by extremely heterogeneous data and are unlikely to be reliable.

Authors' objectives

To determine the performance of body mass index (BMI) to detect obesity (body adiposity).

Searching

MEDLINE, EMBASE, Cochrane Database of Systematic Reviews, Cochrane Central Register of Controlled Trials (CENTRAL), Web of Science and Scopus were searched (date range 1950 to June 2008). Some details of the search strategy were reported and included a diagnostic filter. References of retrieved articles were screened and experts in the area were contacted to identify additional studies. The review was restricted to studies reported in English.

Study selection

Studies that assessed the performance of BMI to measure body adiposity (index test) compared to a body composition technique (reference standard) and that reported standard measures of diagnostic performance (sensitivity, specificity, positive predictive value, negative predictive value) were eligible for inclusion.

Included studies were conducted in USA, Switzerland, New Zealand, Australia, Portugal, India, China, Japan, Italy, Singapore, Thailand and Brazil. Mean age ranged from 20 to 66 years. The proportion of men ranged from zero to 100%. Reference standards used to determine body fat were hydrostatic weighing, dual energy X-ray absorptiometry, isotope dilution, skin fold, bioelectrical impedance analysis and air-displacement plethysmography. Thresholds to define both an abnormal BMI and excess body fat varied across studies.

One reviewer assessed studies for inclusion. A subset of 10 full-text studies included at the title and abstract stage were reviewed by two independent reviewers.

Assessment of study quality

Studies were assessed for methodological quality using criteria developed by the authors: standardisation and accuracy of height measurement; standardisation and accuracy of weight measurement; reference standard; time between index test and reference standard; blinding of index test interpreted to reference standard; and instructions given to participants on diet and exercise before body composition measurement. Studies were assigned a score from 6 to 16 based on items fulfilled and were classified as low, fair, good or excellent quality based on summary scores.

The authors did not state how many reviewers performed the quality assessment.

Data extraction

One reviewer extracted data to calculate sensitivity, specificity and positive and negative likelihood ratios.

Methods of synthesis

Summary sensitivity, specificity, positive and negative likelihood ratios and diagnostic odds ratios (DOR) were estimated using DerSimonian and Laird random-effects models. Heterogeneity was assessed using forest plots and the I^2 statistic. Subgroup analysis was conducted based on BMI threshold to define obesity, reference standard threshold to define obesity, reference standard used, regional origin of studies and quality score.

Results of the review

Twenty-five studies that reported data on 32 samples (n= 31,968) were included.

Sensitivity ranged from 9% to 100%. Summary sensitivity was 50% (95% CI 43% to 57%). Specificity ranged from 10% to 100%. Summary specificity was 90% (95% CI 86% to 94%). There was substantial heterogeneity in both sensitivity and specificity ($I^2 > 98\%$).

Substantial heterogeneity remained for all subgroup analyses.

Authors' conclusions

Commonly used BMI cutoff values to diagnose obesity had high specificity but low sensitivity to identify adiposity as they failed to identify half of the people with excess body fat.

CRD commentary

The review addressed a clear question supported by defined inclusion criteria. The literature search included some relevant databases. Use of a diagnostic filter meant that relevant studies may have been missed. Some attempts were made to identify unpublished studies. The review was restricted to English-language studies and nine studies were excluded as they were written in other languages. Most of the review process was conducted by one reviewer and so there was potential for bias and error. Study quality was assessed using some relevant criteria, but results were summarised as a grading based on summary scores which were impossible to interpret and the quality of the included studies remained unclear. Very limited details of the included studies were reported, which made it difficult to determine the generalisability of the review findings. The synthesis of results used adequate methods, but heterogeneity was not investigated appropriately.

The authors' conclusions were based on summary estimates produced by extremely heterogeneous data. The conclusions are unlikely to be reliable.

Implications of the review for practice and research

Practice: The authors stated that the definition of obesity at the individual level needed to be reassessed.

Research: The authors did not state any implications for research.

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This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.