

## **Protocol**

### **Systematic review and meta-analysis on the correlation of Body Mass Index or Waist-to-height ratio with body composition measured by DEXA in children.**

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## 1. Objective

The aim of this systematic review was to assess the the validity of BMI and WtHr to assess body composition in children.

## 2. Introduction

Body composition can be assessed by different measurement techniques such as air displacement plethysmography, dual-energy X-ray absorptiometry (DXA), or bioelectrical impedance analysis. DEXA is being used as the reference standard to assess body composition in children [1] and it is suggested as the gold standard [2]. However, because these techniques are complex and expensive, they are not very feasible neither in clinical practice nor for epidemiological research. Anthropometric measures, on the other hand, are easily-obtained and they represent inexpensive tools to measure body composition [3].

Body Mass Index (BMI) has been largely used for the definition of obesity in children because it correlates well with body fat [5] and cardiovascular risk factors [4]. An important limitation of the BMI is that it does not differentiate between fat mass and fat-free mass [6], which may be the reason why a worse correlation between BMI and body fat in lean children has been described [7]. Another important limitation of the BMI is that it does not take into account fat distribution.

Visceral abdominal fat (VAT) has been suggested to be the most dyslipidemic and most atherogenic [8], but it is difficult to measure. Different anthropometric techniques have been suggested as a clinical proxy to measure VAT. Several studies have shown that both Waist Circumference (WC) and Waist to Height ratio (WtHr) may be used to assess obesity because they correlate better with VAT [9] and with metabolic risk factors in children [10,11].

## 3. Search strategy and study selection

References will be searched for in PubMed/Medline and Embase according to the following search strategy:

Dataset	Query
Embase	"bmi' and ('waist to height ratio'/exp or 'waist to height ratio') or 'waist-to-height-ratio'/exp or 'waist-to-height-ratio' and 'english' and ([newborn]/lim or [infant]/lim or [child]/lim or [preschool]/lim or [school]/lim or [adolescent]/lim) and [humans]/lim and [<1966-2016]/py"
PubMed	"bmi"[All Fields] AND ("waist to height ratio"[All Fields] OR "waist-to-height-ratio"[All Fields]) AND (("0001/01/01"[PDAT] : "2016/02/17"[PDAT]) AND English[lang] AND ("infant"[MeSH Terms] OR "child"[MeSH Terms] OR "adolescent"[MeSH Terms]))

The parameters of search will include the following filters:

- Language: English.
- Age: up to 18 years old.
- Human studies.

No time period limit will be established. Originals published up until January 2016 will be included in this search.

#### **4. Inclusion and exclusion criteria**

##### *a. Inclusion Criteria:*

- The article included the measurement of both BMI and WtHr in the same population.
- The reference standard to assess body composition was DEXA.
- The body composition was reported as total body fat (included body fat percentage).

##### *b. Exclusion Criteria:*

- Reviews, editorials, comments or letters.
- Abstracts of meeting presentations.
- Studies including only one of the anthropometric measurements of interest, but not both.
- Studies using a reference gold standard different of DEXA.
- Studies reporting an outcome different of total body fat (such as visceral fat, trunk fat...).

#### **5. Data extraction**

Two reviewers will independently screen Titles and Abstracts and decide upon the eligibility of each study based on the features of interest. Next, one of these reviewers will assess in detail the selected full-text articles for eligibility, will make the final selection according to the inclusion and exclusion criteria, and will extract the data of interest for the meta-analysis. Discrepancies will be solved by consensus and asking to a third reviewer.

The methodological quality and risk of bias will be assessed by using the QUADAS tool, a tool for the quality assessment of studies of diagnostic accuracy included in systematic reviews [12].

*a. Study details*

- Authors.
- Study design.
- Sample size.
- Sample characteristics (age, sex and ethnicity-race).
- Reported anthropometric measurements.
- Reported statistical analyses.
- Other findings of interest.

*b. Analysis plan*

The coefficient of determination ( $R^2$ ) will be calculated as the square of the coefficient of correlation when it is not reported in the original paper. The 95% confidence interval for each  $R^2$  will be calculated using the Fisher's  $z'$  transformation of the correlation coefficient ( $z' = .5[\ln(1+r) - \ln(1-r)]$ ).

We will also conduct a quantitative meta-analysis to obtain a pooled estimate (pooled  $R^2$ ) for the coefficient of determination of both BMI and WtHr with DEXA. Finally, we will compare the pooled estimates for each anthropometric measurement (using as standard error for the comparison of both  $z'$ , the standard error for the comparison of two  $z$  according to the Fisher's transformation). This procedure will allow us to assess if the difference between both estimates was statistically significant.

## **6. Conflicts of interest**

Reviewers have no conflicts of interest to declare.

## **7. References**

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