Original/Otros

Effects of food and drink ingestion on body composition variables of abdominal bioelectrical impedance

Rosalía Fernández Vázquez1, Javier Martínez Blanco2, María del Mar García Vega3, Miguel Ángel Barbancho1,4 and José Ramón Alvero Cruz1,4


Abstract

Objective: to know the changes in trunk fat and visceral fat level determined by abdominal bioelectrical impedance (BIA) as well as other anthropometric measures related to the central or abdominal fat after the ingestion of a lunch.

Methods: the experimental study was conducted to assess a longitudinal intervention descriptive study. Participants: 21 subjects (10 male and 11 female), volunteers who have access to a medical assessment, with an age of 74±13.43 years. Measurements: Maximal waist circumference in standing position, waist circumference at navel level in supine position and sagittal abdominal diameter (SAD). In the same position trunk fat and visceral fat level by abdominal bioelectrical impedance analysis with Tanita AB-140 (ViScan) were obtained before and after meal.

Results: anthropometric measures as waist circumference in supine position and SAD did not show significant differences (P>0.05), after food ingestion, except for a significant increase of the maximal waist circumference in standing position (P<0.05). In addition trunk fat and visceral fat ratio did not change (P>0.05). The percentage changes of the measures were less than 2% for waist circumference in standing position, waist circumference by Viscan, sagittal abdominal diameter and trunk fat and 5.9% for visceral fat ratio.

Conclusions: the effects on trunk fat and visceral fat ratio by abdominal bioelectrical impedance are minimal.
after the ingestion of a portion of food and drink, although it is always recommended to do it in fasting conditions.

(Nutr Hosp. 2015;32:2269-2273)
DOI:10.3305/nh.2015.32.5.9618

Key words: Abdominal bioelectrical impedance. Trunk fat. Visceral fat. Waist circumference. Sagittal abdominal diameter. Food effects.

Abreviations

BIA: Bioelectrical impedance analysis.
FFM: Fat-free mass.
FM: Fat mass.
ISAK: International Society for Advancement in Kinanthropometry.
Khz: kilohertz.
Kj: Kilojoules.
Kcal: kilocalorías.
R: Resistance (Ω).
SAD: Sagittal abdominal diameter.

Introduction

The definition of bioelectrical impedance (BIA) has been introduced in the 1950s, Thomasset, was the first to relate the total body water with the whole body impedance. Estimates of body composition, through the BIA, are based on different dielectric and conductive properties of body tissues, at different frequencies.

The single BIA uses the frequency of 50 kHz, to measure the impedance and estimate body composition. The multi-frequency BIA was developed by the need to know the distribution of extra and intracellular fluids (intracellular and extracellular water).

The BIA method of easy application and use in several settings, for body composition assessment, however the BIA measurements are standardized under several conditions, and this method is sensitive to the influence of different factors, e.g. temperature, food and drink ingestion, physical exercise and sweating among others, body position changes, or combinations of fasting conditions and rest.

These physiological situations are important to take into account when comparing studies of different authors and especially when we analyze repeated comparisons and for body composition assessments.

There are studies showing the effects of food and drink ingestion on the whole body impedance. Within 4 hours after food ingestion, this has an effect of decrease of impedance, representing a relatively small error of up to 3%. This same percentage of change can also be 3% after being supine position for 60 minutes.

It has been recently approved device of abdominal bioimpedance, which are able to estimate trunk fat and visceral fat levels, but are unknown, the effects of food and/or drink, on outcomes that offers this instrument of abdominal bioimpedance. Measures of fat located regionally in the trunk and in particular in intra-abdominal location is visceral fat and are related to metabolic syndrome and therefore highlights the importance of quantification in high risk groups.

These circumstances forced us to test possible changes in the variables of abdominal bioelectrical impedance, that some patients and residents who had to impose a schedule required of these people having to go out to eat, which, in some cases there was some disparity in the measurement conditions, therefore, the objective of the present study was to check, the magnitude of changes in trunk fat and visceral fat level determined by BIA as well as other anthropometric measures related to abdominal fat, due to ingestion of a lunch.

Methods

Subjects

Twenty-one (10 male and 11 female) volunteered subjects of 74.0 ± 13.43 years old participate in the study. All of them are older people living in a nursing home, subjected to strict timetables of the center. All of them, received detailed information from the study to be carried out within a medical examination by the Unidad de Residencias del Distrito Sanitario Costa del Sol (Consejería de Salud de la Junta de Andalucía-Málaga) and signed by the medical officer, the subsequent informed consent was given. Prior to the BIA outlined the need to urinate. The study was approved by our Ethics Committee of the University of Málaga and respected the principles of Helsinki for research in humans.

Study design

Participants were measured by anthropometric techniques and abdominal BIA, before and after lunch and similar accessed to the dining room and the second body composition measurement. The mean time between measurements was 46.2 ± 3.4 min. All abdominal BIA and anthropometric measures were measured in duplicate, computing the average value.
Anthropometric measurements

Maximal waist circumference at the level of the iliac crests was measured with a Cescorf tape measured to the nearest 0.1 cm (Cescorf, Brazil). In supine position was measured the sagittal abdominal diameter (SAD) with an anthropometer with straight branches (Holtain, Crymich, Great Britain) to the nearest 0.1 cm. The intraclass correlation coefficient was greater than 0.97 for all measures. Technical error of measurement for anthropometric variables was <1%. Anthropometric measurements were obtained according to the recommendations of the International Society for Advancement in Kinanthropometry (ISAK).

Abdominal bioelectrical impedance

An abdominal BIA with Tanita AB-140, ViScan® (Tanita, Japan) were performed for measuring trunk fat and visceral fat ratio. With the subject in supine position, on a non-metallic table, was initially measured the waist circumference in the coronal plane and a central point on the omphalion, according to the manufacturer’s instructions, by projecting a light. Trunk fat and visceral fat level ratio were obtained after having a belt with four electrodes, focused and willing at the level of the navel. Body composition values were derived by extrapolation of (6.25 to 50 Khz) impedance measures resulting values of trunk fat, expressed in percentage value (range 0-75%) and a level of visceral fat, expressed as visceral fat ratio (in arbitrary numerical units, from 1 to 59).

Diet

The meal of the participants consisted of a bowl of lentils with rice, hake with salad and a pear. The energy content of the meal was 3495 Kj or 840 Kcal. The average volume of water ingested by subject was 300 ± 247 mL.

Table I

<table>
<thead>
<tr>
<th>Variable</th>
<th>Before</th>
<th>After</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waist circumference cm</td>
<td>101.71±15.80</td>
<td>102.8±14.96</td>
<td>0.007</td>
</tr>
<tr>
<td>Waist circumf. Viscan cm</td>
<td>100.55±11.84</td>
<td>101.7±12.14</td>
<td>0.170</td>
</tr>
<tr>
<td>SAD cm</td>
<td>23.29±4.73</td>
<td>23.55±5.08</td>
<td>0.258</td>
</tr>
<tr>
<td>Trunk fat %</td>
<td>38.05±8.70</td>
<td>37.3±9.24</td>
<td>0.464</td>
</tr>
<tr>
<td>Visceral fat ratio</td>
<td>13.50±5.05</td>
<td>14.35±5.10</td>
<td>0.068</td>
</tr>
</tbody>
</table>

Table I: Anthropometric and abdominal bioelectrical impedance changes after food ingestion

Statistical methods

All results are expressed as means±standard deviation. The homogeneity of the variances of the dependent variables was assessed by means of the Shapiro-Wilk Normality Test show a normal distribution. The difference between before and after was tested by Student t-test, for paired data. Also, found the size effect, calculated from data and is a descriptive statistic that conveys the magnitude of changes. The Cohen coefficient is the index that shows us the ability to show any change (Cohen’s d15,16. Values of the Cohen’s coefficient of 0.2 to 0.3 were considered low, 0.2 to 0.5 medium and a value >0.8 was a large value16. Statistical analyses was performed by using the MedCalc software for Windows version 14.12.0 (Mariakerke, Belgium) and the significance level was previously set at P<0.05.

Results

Table I described the variables studied, which did not show significant differences, after ingestion of the food (P>0.05), except for a significant increase of the maximum waist circumference in standing position (P<0.05). The percentage changes of the measures were less than 2% for waist circumference in standing position, waist circumference by Viscan, sagittal abdominal diameter and trunk fat and 5.9% for visceral fat ratio.

Moreover, the analysis of the effect size, shows that the coefficients d are very low in all tested variables (<0.20) (Table II).

Discussion

The results of this research show that a food and drink ingestion, do not produce significant changes in anthropometric variables and body composition variables by abdominal bioelectrical impedance. Both, the anthropometric measures and abdominal bioimpedance changes are very small and not significant. There are no works that examined these variations of the ab-
dominal BIA after solid meal and beverage ingestion. This study is very important in the context of nursing homes, because the timetables can produce variations in research methodology.

Universally standardized protocols of BIA measurements have to be developed and implemented. The standard recommendations for the use of the BIA are well known and are related to the use of the equipment and the use of electrodes, as well as care available in which to avoid the contact with metals and magnetic fields, the previous measurement of height and weight, as well as compliance with the instructions of the manufacturer\textsuperscript{2,20}. These described recommendations, are for the whole body impedance and it is not necessary to enter the weight or height of the individuals in the abdominal BIA.

There are described, variations of the whole body impedance, with supine position\textsuperscript{6,9}. The small variation of the abdominal BIA not may have been due to supine position, because the BIA carried out, obtaining the results, not requires hardly more than 100-120 seconds.

An increase in the whole-body resistance (R), produces a decrease of the fat-free mass (FFM) and an increase of fat mass (FM). The decrease R by food and fluids ingestion produces the opposite effect, for greater easily pass of alternating current through the water component\textsuperscript{11,21}.

The effects of food intake on R, may take several hours, even until there is the night fasting\textsuperscript{21}. Changes of bioelectrical impedance with food and beverages may decrease whole body resistance and it is related to changes of different fluids and electrolytes, as well as its distribution, which follow the absorption and digestion of food\textsuperscript{11} and in addition the decrease of impedance are greater, in relation to amount of food and beverage intake\textsuperscript{21}.

The result of food on the BIA, after an hour, shows decreases of trunk fat and this circumstance, would be in line with the decrease in body resistance. Greater measurement of liquids, a greater assumption of water and fat-free mass and therefore there is a decrease in fat\textsuperscript{11,21,22}. Normally, less than 3% fat, changes which would be consistent with the present study\textsuperscript{22}. Percentage of anthropometric measures and variations of BIA, in this study, are less than 2%. These changes are considered very low, because the variations between days under the same conditions as the fast, or in the morning and after emptying the bladder, are checked a few minor variations of 3\%\textsuperscript{10}.

It should take into account that the supine or the resting position produces a decrease in the BIA, with an increase in the fat percent. The differences in the fat percentage may reach 10\%. Changes in visceral fat level have been 6.3\%, albeit with a proven, small size effect and without statistical significance.

The abdominal bioelectrical impedance can measure fat trunk, which is closely related to the total intra-abdominal fat and subcutaneous fat, however the level of visceral fat is related to intra-abdominal fat\textsuperscript{19}. The values of abdominal fat measured by BIA have a good concordance with DXA as reference method\textsuperscript{23}. Studies of BIA should respect the standardized methodology to optimize the measures. Once again, it seems that the most influential factor in the variation of the values of the BIA is the intake of food and drink and not to the redistribution of liquids determined by orthostatic changes.

**Study limitations**

The results should be interpreted with caution given the small sample size and it must be studied over one period longer than 2-3 hours after food and drink ingestion.

**Conclusions**

This study shows that measures of abdominal bioimpedance, does not produce variations in the variables of trunk fat and visceral fat level, so it can be used under the conditions referred to in the study without variations in the outcome variables in the first hour after lunch.

**Acknowledgements**

This study was supported by grants of Escuela de Medicina de la Educación Física y del Deporte of
Universidad de Málaga and Centro Internacional de Posgrado y Doctorado de Universidad de Málaga. The authors also thank to occupational therapist, Celia Sánchez Galán from Residencia Sarquavitae Isdabe for your great collaboration.

Referencias


