Energy balance, a new paradigm and methodological issues: The ANIBES study in Spain
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Energy balance is a necessary framework that can be used to understand the interplay between energy intake, energy expenditure and energy storage that determines body weight. A better understanding of energy balance can help develop more effective strategies for reducing obesity rates in individuals and populations.

The ANIBES scientific study (Anthropometry, Intake and Energy Balance in Spain) approaches for the first time in Spain the energy balance concept through a new design, protocol and methodology, which are some of the main strengths:

- Representative national sample targeted
- The broad age range included (9-75 years)
- The geographical distribution: both inland and islands
- 128 sampling points
- New technologies (tablet devices and accelerometer devices) used to measure dietary intake and physical activity level, which allow to record data in real time

This study was carried out by a group of scientists from the Spanish Nutrition Foundation (FEN) in collaboration with a scientific Panel of Experts. It aims to evaluate, for the first time in a study, the intake and energy expenditure and the intake of macronutrients, as well as anthropometric data and dietary habits of the population.

The ANIBES scientific study’s protocol has been carefully designed based on scientific evidence available and it will provide with valuable useful data for the food policy planning and also with guidelines on this topic.

Moreover, the final protocol of the ANIBES scientific study was previously approved by the Clinical Research Ethics Committee of the Autonomous Region of Madrid (Spain).
A dynamic and complex process

The energy balance is a dynamic, interactive and complex process where a change in one component can affect the rest of the components. Some of the main gaps on the energy balance knowledge have been considered in the ANIBES scientific study, where all previous evidences and experiences are also included:

1. Great experience in short-term studies about the major components of energy balance, but our knowledge is still deficient regarding their interaction over the long term. For this reason, longitudinal studies to learn the details of these correlations and changes in body weight among children and adults are needed.

2. Need of an integrative approach: biological and psychological factors affect the components of energy balance and cannot be analyzed separately.

3. The importance to understand the effects of different doses in physical activity, both in the total daily energy expenditure, the energy intake, and body composition and body weight in children and adults.

4. Better understanding of the underlying mechanisms that enable differences in energy intake, food preferences and body weight.

5. Development of new accurate methods to measure energy balance over the long term so that the current inaccuracies with the calculation of energy intake and energy expenditure are reduced.
Design and sampling procedure

The design of the ANIBES scientific study aimed a sample size which should be representative of all individuals living in Spain (excluding the autonomous cities of Melilla and Ceuta) aged 9-75 years-old (divided at the same time by age ranges) and living in municipalities over 2,000 inhabitants.

<table>
<thead>
<tr>
<th>SAMPLE (n)</th>
<th>Initial targeted sample</th>
<th>Final sample</th>
<th>Final + Boost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base</td>
<td>2,634</td>
<td>2,009</td>
<td>2,285</td>
</tr>
<tr>
<td>SEX</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>1,309</td>
<td>1,013</td>
<td>1,160</td>
</tr>
<tr>
<td>Women</td>
<td>1,325</td>
<td>996</td>
<td>1,125</td>
</tr>
<tr>
<td>AGE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Children (9-12 years-old)</td>
<td>240</td>
<td>100</td>
<td>213</td>
</tr>
<tr>
<td>Adolescents (13-17 years-old)</td>
<td>246</td>
<td>124</td>
<td>211</td>
</tr>
<tr>
<td>Adults (18-64 years-old)</td>
<td>1,911</td>
<td>1,588</td>
<td>1,655</td>
</tr>
<tr>
<td>Elderly (65-75 years-old)</td>
<td>237</td>
<td>197</td>
<td>209</td>
</tr>
</tbody>
</table>

In order to cover more representativeness, the study was conducted through a stratified multistage 128 sampling points. Moreover, 90 interviewers participated in this study, who were allocated in 11 different geographical areas, all previously trained by the Spanish Nutrition Foundation (FEN).
Fieldwork

The participants of the study have been randomly selected, with the exception of the municipalities over 100,000 inhabitants, where a postcode proportional criterion was considered.

Stratified multistage sampling - 2,634 individuals
September 19th, 2013 – November 16th, 2013
Divided into 15 cycles

Each cycle includes:

FIRST VISIT
- Face-to-face interview fulfilling recruitment quotas
- Anthropometric data
- 24h-dietary recall
- Participants training (how to use tablet and software)
- 3-day dietary record (autofilled on tablet by each participant)
- 10 % of the total sample used an accelerometer

DIETARY RECALL
- Individuals used the tablet for 3 days
- Thursday, Friday and Saturday / Sunday, Monday and Tuesday
- Photographs and descriptions

SECOND VISIT
- Face-to-face interview on physical activity habits
- Interview on perceptions of health and eating habits
- Collection of the tablet and, if appropriate, the accelerometer

79 % used a tablet
12 % used a photo camera
9 % used telephone interviews
Protocol for data collection, processing and coding

The use of new technologies has enabled to collect, verify and code all the information in real time.
Each participant had a tablet device to record everything eaten or drunk over three consecutive days:

- What and how much was eaten
- Where they were during each intake
- What they were doing while they were eating

Furthermore, the software also contained several questions about usual eating habits in order to facilitate coding.

**ANIBES scientific study** >> Anthropometric data, macronutrients and micronutrients intake, practice of physical activity, socioeconomic data and lifestyles of the population
Intakes of energy and nutrients were calculated from the energy consumption records included in the software for the ANIBES study, for which a special adapted Dietary Evaluation Program from the Spanish Nutrition Foundation was used. Database was stratified as follows:

- Level 1 – 16 food and beverage groups
- Level 2 – 29 food and beverage subgroups
- Level 3 – 761 food and beverages entries
- Brand
- Culinary treatment
- Portion sizes
Data cleaning

As soon as the data from the tablet devices are coded and transferred into the ANIBES database, a data cleaning process is implemented, which is divided into three stages:

1\textsuperscript{st} stage
- The only valid data are those in which participants recorded the intake details for at least three consecutive days (registers that comprised just one or two days were eliminated).
- If a participant registered more than three days, the only valid data were those under the initial scheme: 2 working days and 1 weekend day.

2\textsuperscript{nd} stage
Participants that include energy intake data of less than 500 kcal/day or unexplained behavior in energy intake variations between the 3-day food dietary record when compared to the 24-h dietary recall were eliminated.

3\textsuperscript{rd} stage
Participants were considered eligible if they had fulfilled the previous stages and if they had completed successfully both visits during the fieldwork.
References

Scientific Committee

- **Prof. Javier Aranceta, MD, PhD**
  Chairman of the Scientific Committee of the Spanish Society of Community Nutrition (SENC), Clinic Director of the Spanish Foundation for Nutritional Research (FIN), and Associate Professor at the University of Navarra

- **Prof. Ángel Gil, PhD**
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- **Prof. Rosa Mª. Ortega, PhD**
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- **Prof. Dr. Gregorio Varela-Moreiras**
  President of the Spanish Nutrition Foundation (FEN), Director of Nutrition and Food Sciences Research Group (CEUNUT) and Professor of Nutrition and Food Sciences at CEU San Pablo University of Madrid

The final protocol of the ANIBES scientific study was previously approved by the Clinical Research Ethics Committee of the Community of Madrid (Spain).
ANIBES scientific study
>> Anthropometric data, macronutrients and micronutrients intake, practice of physical activity, socioeconomic data and lifestyles of the population

With the collaboration of:
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