Why so Fat?

Franco Contaldo, Maurizio Marra*, Lidia Santarpia and Fabrizio Pasanisi

Department of Clinical Medicine and Surgery, Interuniversity Centre for Obesity and Eating Disorders (CISRO), University of Naples Federico II, Naples, Italy

*Corresponding author: Maurizio Marra, Department of Clinical Medicine and Surgery, University of Naples Federico II, Naples, Italy, Tel: +390817462333, Fax: +390815466152, E-mail: marra@unina.it

Introduction

The epidemic of severe obesity (i.e., body mass index > 40 kg/m^2), now involving > 5 percent of the adult US population [1], has almost reached, at least in this country, the prevalence of diabetes, thus becoming a real social burden [2].

When focusing on severe obesity an intriguing question is why so many people, and not only in the US, reach such a massive increase in body fat, apparently in the absence of any biological and/or cultural-behavioural compensation, as the natural phenotypic response to our ancestral genotype.

Keywords

Severe obesity, Palaeolithic diet, Obesogenic environment, Adaptation

Abstract

The epidemic of severe obesity is a worldwide social burden, involving all ages and all ethnic communities. Among the possible reasons for the severe obesity epidemic, it might be considered a biological “adaptation” of the human phenotype to its genotype programmed in the Palaeolithic age for a daily energy balance usually above 3000 kcal/day. To test the hypothesis we compared 90 control subjects (60 F, 30 M, 23.9 ± 2.5 yrs, BMI 22.2 ± 1.7 Kg/m², TEE 1913 ± 370 kcal/die) and 90 young severely obese patients (60 F, 30 M, 23.9 ± 2.4 yrs, BMI 47.5 ± 5.9 kg/m², TEE 3049 ± 579 kcal/die), all recruited from a Southern Italy population.

Data show a mean TEE in severely obese patients slightly above 3000 Kcal/day, close to the one expected to correspond to our Palaeolithic genotype.

In the present human environment, severe obesity, at least in some cases, might be interpreted, in absence of other bio-behavioural compensation, as the natural phenotypic response to our ancestral genotype.

The selection of the human genotype has been determined for a hunter-gatherer lifestyle typical of Homo Sapiens, until 10,000 years ago i.e., at the end of the Palaeolithic age, when the human population all over the planet counted – at its demographic peak – about ten million individuals [10].

If we accept as reasonable the assumptions proposed for instance by Hambrecht [11] nowadays, with a human population of seven billion people mostly living in metropolitan areas [9], individual average energy expenditure per kg body weight should be about 40 percent that of our Palaeolithic ancestors.

As to food (i.e., energy) intake, Bellisari, Eaton and others [8,12-13], have reasonably reconstructed the average diet of Palaeolithic foragers. The most reliable Palaeolithic diet – again, the one shaped for our genotype – compared with current recommendations appears to have a high calorie and protein content about 3000 Kcal per day of which 30 - 50% represented by proteins, the main protein food source being wild game. “This energy intake (i.e., about 3000 Kcal/day) would approximately correspond to the expected energy requirements/expenditure of our aborigine/Palaeolithic ancestors”. In terms of nutrient composition, this aborigine diet is low in saturated fats, simple sugars and sodium, vice versa rich in animal proteins, polyunsaturated omega 3 fatty acids, vitamins and minerals, in particular potassium and calcium. If compared to current western diets dietary thermogenesis by the Palaeolithic diet is certainly higher than contemporary diets. Furthermore in the wildness, the availability of fat (from animal source) and simple sugars (from wild honey for example) was rare and rather periodic or seasonal [14]. However, as a matter of fact, nowadays a high protein diet for the whole human population does not appear ecologically sustainable nor has indication [15-16]. In conclusion expected energy expenditure according to our ancestral genotype should be of at least 3000 Kcal/day, mostly due to the continuous and heavy daily physical exercise and, to a lesser degree, to the composition of this “hyperproteic” diet.

Nevertheless, the life of our Palaeolithic ancestors, besides the regular and intense physical activity, was also characterized, in at least some regions of the world and in the dry seasons of the year, by alternating periods of feast and famine [17-18] which may have


Received: February 05, 2015: Accepted: October 24, 2015: Published: October 28, 2015

Copyright: © 2015 Contaldo F. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.
also conditioned our genotype versus an efficient nutrient/substrate utilization.

Nowadays our genotype "survives" in a totally different environment "i.e., the so called obesogenic environment", which has heavily affected and modified our energy expenditure. Under such external pressures, besides the already referred dramatic reduction in physical exercise, the composition of our diet has also changed: more saturated fats and simple sugars, less proteins and omega 3 fatty acids, more "artificial foods [19] etc". In other words, an increase in the absolute intake of fat, a poorly thermogenic nutrient, and a shift from proteins to simple sugars, for the more thermogenic ones. These changes have facilitated a number of individual adaptive (potentially pathological) responses, such as hyperinsulinemia, insulin resistance etc. in other words the metabolic syndrome. Severe obesity, we speculate, represents, in absence of an efficient cultural control, the natural, immediate phenotypic response to the conflict between our genotype versus an efficient nutrient/substrate utilization.

"To test the hypothesis we have measured resting energy expenditure by indirect calorimetry in a group of young adult severely obese patients to verify if their daily energy expenditure corresponds, although in a totally different environment, to the one expected for our aborigine/Paleolithic ancestors".

Table 1: Individual characteristics, body composition, REE and TEE in 90 (60 females and 30 males) obese patients and in 90 (60 females and 30 males) normal weight subjects.

<table>
<thead>
<tr>
<th>Study population</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obese (n.180)</td>
<td>Obese (n.60)</td>
<td>Obese (n.120)</td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
</tr>
<tr>
<td>Age years</td>
<td>Weight kg</td>
<td>Height cm</td>
</tr>
<tr>
<td>23.9 (2.4)</td>
<td>130 (21)</td>
<td>168 (8)</td>
</tr>
<tr>
<td>23.9 (3.5)</td>
<td>61.2 (76)</td>
<td>167 (7)</td>
</tr>
<tr>
<td>0.882</td>
<td>0.000</td>
<td>0.800</td>
</tr>
<tr>
<td>FFM kg</td>
<td>FM kg</td>
<td>BMI kg/m²</td>
</tr>
<tr>
<td>65.3 (11.7)</td>
<td>76.6 (11.2)</td>
<td>47.5 (5.9)</td>
</tr>
<tr>
<td>45.0 (8.7)</td>
<td>54.7 (7.4)</td>
<td>22.2 (1.7)</td>
</tr>
<tr>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>REE kcal/die</td>
<td>REE/FFM kcal/kg</td>
<td>RQ</td>
</tr>
<tr>
<td>2345 (446)</td>
<td>36.1 (4.2)</td>
<td>0.857 (0.033)</td>
</tr>
<tr>
<td>1472 (285)</td>
<td>32.8 (3.1)</td>
<td>0.829 (0.139)</td>
</tr>
<tr>
<td>0.000</td>
<td>0.000</td>
<td>0.058</td>
</tr>
</tbody>
</table>
| TEE kcal/die     | 3049 (579) | 30.5 ± 537 kcal/day in men and 2762 ± 339 kcal/day in women, a value actually not too far from the one calculated for normal weight physically active Paleolithic foragers as well as for living aborigines.

Results are expressed as mean and standard deviation. The statistical analysis was performed using one - way ANOVA test (SPSS-PC vers.15) for differences in mean values between genders.

When compared with normal weight individuals, the obese group had markedly increased BMI (+115%), REE (+65%) and calculated TEE (+48%) values (Table 1).

When RQ was corrected for fat free mass (REE/FFM) the increase observed, compared to normal weight individuals was only 11%. This last figure represents the adaptive increase in energy demands for unit of FFM due to the overall increase in body mass in severely obese patients.

If we multiply REE of severely obese patients by 1.3, a coefficient currently used for sedentary people, the expected total daily energy expenditure (calculated TEE) in obese individuals would be 3621 ± 537 kcal/day in men and 2762 ± 339 kcal/day in women, a value actually not too far from the one calculated for normal weight physically active Paleolithic foragers as well as for living aborigines.

Obesity, in particular severe obesity, has reached an uncontrolled epidemic diffusion all over the world [22], despite intensive studies it appears still unsuccessful any intervention to reverse this trend in obesity prevalence. Failure to conservative treatments has been also interpreted as considering obesity a biological adaptation (with pathological consequences) to our obesogenic environment rather than a true disease [20,23]. On the other hand in potentially unhealthy

ISSN: 2377-3634


Page 2 of 3
adaptations like this, intervention strategies should be aimed more at prevention than strictly to treatment, by reducing exposure to obesogenic environmental factors at least since childhood [24].

In this study we have explored the hypothesis that severe obesity represents a phenotypic adaptation of our genotype, selected in a highly demanding environment as was the one during the Palaeolithic pre-agriculture period, when exposed – in particular during the last decades – to an “obesogenic environment”. This environment is characterized by a dramatic reduction in physical activity [25], continuous exposure to highly caloric meals, an huge consumption of “artificial foods” like caloric sweeteners and sugar alcohols [19], exposure to chemical pollutants with endocrine disrupting capacities [26] etc.

The calorie expenditure of severely obese individuals, evaluated in this study and in agreement with literature data [27], appears to correspond to the one expected on the basis of our ancestral genotype but the calorie balance is obtained in a totally different way represented by a huge amount of fat mass, a consequent increase in fat free mass, metabolic syndrome onset with its complications, and a final increase inREE.

Severe obesity in this environment might well be interpreted, at least in some cases, as the consequence of the phenotypic (pathological) adaptation to our ancestral genotype in the absence of any bio-behavioural compensation. This could be one reason why, with an apparently unjustifiable mechanism, many individuals become so fat and are resistant to conservative treatments.

Effective educational preventive campaigns against obesity, starting since early developmental ages, associated with a continuous struggle against urban sprawl appear in our opinion an urgent policy to counteract chronic not communicable diseases, including severe obesity, epidemic.

Conflict of Interest

All authors disclose any financial and personal relationships with other people or organisations that could inappropriately influence their work.

References


2. www.who.int/hpr/NPH/docs/gs_obesity.pdf


