

Eat Less and Exercise More – Is It Really Enough to Knock Down the Obesity Pandemia?

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Summary

Reduced physical activity and abundant energy intake are two most common factors leading to uncontrolled body weight gain. But these factors are not under entire internal consciousness control; they are also partially genetically determined and are affected by for example food marketing practices. In addition to these two widely accepted factors, there are some other factors, whose could also contribute to the recent increase of obesity prevalence. For example, non-exercise activity thermogenesis, sleeping habits, more stable inside room temperatures (using of heating and air conditioning), high prescription of medications with weight gain as side effect, psychosocial factors, unfavourable socioeconomic status and unpleasant urban environment are the background factors which should not be omitted if obesity/BMI determination should be fully understood and kept under control. In conclusion, unhealthy life style is necessary, but not sufficient for obesity development.

Key words

Obesity • NEAT • Uncommon factors • Sleeping • Psychosocial factors

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Introduction

The prevalence of obesity (defined like body mass index [BMI] > 30, calculated like kg/m²) has increased dramatically over the last five decades

worldwide, reaching around one third of the population in the most affected countries with another 30 % being overweight (BMI between 25 and 30 kg/m²).

In the last years obesity is seen as neuroendocrine and metabolic status (or disorder), which results from an interplay of obesogenic environmental factors and genetic predispositions. Simply, body fat increases in the case, when long term energy intake is greater than energy expenditure over the same period of time (Hebebrant and Hinney 2008). Despite this simple and clear fact, there are many individuals who gain or lose their body fat very easily or in opposite with large difficulties. This could be partially explained by genetic predispositions, which account for an estimated 40 - 60 % of obesity/BMI determination. But even genetic predispositions do not explain all of the obesity surrounding controversies (Hill *et al.* 2003) and there seem to be some other factors of importance which should be considered.

Eat less...

The reduction of the energy intake is perhaps the most important recommendation to obese individuals (Hainer *et al.* 2008). Indeed it is not uncommon, that the daily energy intake of some individuals can reach even more than 20 000 kJ. On the other hand, some results point on the opposite directions: for example, in England, the estimated dietary intake per person per day went down over the last twenty years, while the mean BMI has

been increasing (Prentice and Jebb 1995). The amount of calories sold in beverages decreased for 15 % through the last 8 years (Cunningham, personal communication).

The question is - is it just hunger and uncontrolled phagomania in overweight and obese people? Or are there other factors leading to the abundant energy intake?

Generally since the Second World War, the increased amount and availability of food is seen as a cause of the obesity epidemic in most countries. Simultaneously, it was confirmed more times, that low socioeconomic status is associated with high BMI. Interestingly - the number of obese individuals is growing

i/ in developed countries in low – social-classes

and

ii/ generally through the most population spectrum in developing countries, although there seems to be a variations' in the gradient by development.

But, it was not yet documented that in poor countries the mean of BMI is going down with higher population income.

While higher income leads to the higher purchasing power, the price levels are sometimes growing steeper than the income. To save money for cars and houses take a long time, and it is often inaccessible for most of the population. Thus, the “investment” into food is the easiest way how to spend money. Additionally, healthy, high quality food is usually more costly and less available. Also the unit packs in supermarkets are growing and promotions “buy one, get second free” are increasingly common. These facts could partially explain the reality, that especially individuals with low socioeconomic status consumed abundant amount of food and also why the quick shift from under- to over- nutrition in many developing countries is observed (Wang *et al.* 2009).

Dietary habits

Too many pages have been described about the correct dietary habits to maintain the optimal body weight – breakfast, snack, lunch, snack and dinner. A similar mountain of paper probably put our attention on dietary habits of our ancestors which we should follow-up in order to stay lean.

Although it is impossible to prove, it is very unlikely that our ancestors' ate regularly five times a day small portions of food. Much more likely, they experienced the so called “yo-yo” effect (Wilson 1990) in

their body weight. The weight gain through summer and autumn was absolute necessary to insure winter survive. It is likely, that we are evolutionary programmed to eat irregularly. Thus, to really follow the habits of our ancestors, periods of overfeeding need to be followed/up with periods of starvations.

Exercise more...

Physical activity is no doubt important for maintaining the body weight and for supporting the healthy status of each individual. Still, the last and the most controversial question remains to be answered - if, for example, the exercise give me no general positive psychical feeling (nearby some positive somatic effect on my health) and I still exercise two or three hours per week, what is my real benefit for the life expectancy? Make it sense to winn let say 20 minutes of the life expectancy and pay for it with 1 hour of unpleasant and unfavor activity?

Further, if it is everything really so easy, why are the people not able hold just two simple recommendations (just eat less and exercise more) and are getting more and more obese?

In fact, it is estimated, that you should exercise in the gym at least three times per week one hour to see some positive effect (Keith *et al.* 2007) and not all activities are in the same way profitable. Through spinning the first half hour, no fat is burned down. Swimming is also not an activity leading to intensive fat burning “just” help in forming of the body. Most of the individual's exercise for less than two hours per week. It accounts for mean energy expenditure of ~ 400 kJ/day. It is an equivalent of consumption or nonconsumption of ~ 200 ml of 100 % fruit juice/day or to eat or not to eat one chocolate bar in about one week. The same effect could be achieved by replacing of 30 cumulative minutes (daily) of using stair instead of elevators, walking instead of using public transportation on short distances (without “losing” the time for exercise itself). Even standing instead of sitting in public transportation (if you spend in ~ 1 hour/daily) lead to cumulative energy expenditure which is equivalent to roughly 0.5 kg of body fat per year.

It is reasonable to assume, that most people are really not able to exercise three times or more a week. With children at home, full time job one hour or more away from the home there is not much time to spare. Laziness is, of course, humans nature, but there are other

objective factors keeping the people from exercise. Several studies have confirmed that a couple of factors connected with high urbanization are significant factors reducing the physical activity and leading to weight gain. The higher density of bus and underground stops (however – using public transportation is still negatively associated with obesity, compared with using own cars [Lindström 2008]), the lower density of pleasant places to exercise, presence of garbage, poor side walk quality, high population density, feeling unsafe from crime or traffic (Boehmer *et al.* 2007, Rundle *et al.* 2007). All these factors are independently associated with low physical activity and with obesity.

The next question is - can the lack of time and lack of proper places be in some way replaced? Possibly, yes.

Nonexercise activity thermogenesis (NEAT)

There are three components of human energy expenditure. Two of them have very small interindividual variability – basal metabolic rate and thermic effect of food – and represent about 70 % of the total energy expenditure. The rest could be further divided into exercise activity thermogenesis (EAT) and non-exercise activity thermogenesis (NEAT) (Levine 2007), NEAT being much more important.

Instead to find two or more hours per week for exercise, it should be easier to change the general life style to enhance the NEAT expenditure. Here, each, even small, step (using stair instead of elevators or lifts, walking instead of using cars on short distances, avoiding the use of internet shopping and banking but visiting the shops per peddes,...) can bring large effect, if it is sustained through years.

It is not surprising, that lean individuals walk about 2.5 hours per day more than obese individuals. It is surprising, that this proportion remains more or less stable, if obese people are losing weight and lean people are gaining weight. Thus, are there predispositions, to walk more?

It is possible that walking served as an evolutionary selection force. Humans evolved as walkers and per peddes overwhelmed the whole world. To search the food, major part of our ancestors probably walked for many hours each day and were genetically programmed to NEAT-prompting clues. In contrast to second part of the individuals, to whom to minimize the moving was the way to survive and conserve the energy and these

individuals may be prone to sedentary life style (for more details about the hypothesis, see Levin 2007). The recent “progress” further diminishes the necessity of walking, using internet banking, internet shopping and partner searching through internet some people virtually lose their ability to walk sufficient time per day.

And what about...

...the global warming? Interestingly, there are so far no data. However it is known, that environmental temperature is an important regulator of energy expenditure. High increases of room temperatures (studies show about 5 °C increase in last ~ 50 years) significantly reduce energy expenditure (Keith *et al.* 2006). Animal experiments have shown that higher temperature also diminishes the appetite. Quiet recently was shown, that (through cool temperatures) activated brown adipose tissue in humans could burn in one year the equivalent amount of energy as is stored in 4 kg of white fat tissue (Farmer 2009).

Surprisingly, also air conditioning through the summer seems to have a role in gaining weight. Only if you will spend in summer 24 hours per day in air conditioned rooms, everything will be fine. But it is not the case. Through the leaving the air-conditioned spaces, quick changes of temperature have confusing effects on body temperature regulation and on energy management/regulation of food intake.

The easiest way - to sleep more!

For both children and adults (but valid particularly in younger age groups) the number of sleep hours per night is inversely associated with BMI values (Patel and Hu 2008). Sleep restriction influence many physiologic pathways, including secretions of many hormones such as leptin and ghrelin and leads to increasing hunger and appetite.

Environmental chemicals and pharmaceuticals

There is increasing evidence, that maintaining the internal endocrine balance is important for BMI regulation (Elobeid and Allison 2008). It is virtually impossible to eliminate the exposure to low levels of chemical pollutants, known as endocrine disruptors (e.g. plant estrogens, plasticisers or pesticides). This chronic exposure may

affect different pathways and lead to increase in white adipose tissue, similarly to for example postmenopausal females. In postmenopausal females, however the weight gain is reversible and can be influenced using estrogen replacement therapy (Haarbo *et al.* 1991).

Weight gain is also stimulated by many widely used drugs. Not only psychotropic medication, such as antipsychotics and antidepressants (Garland *et al.* 1988) but also for example beta blockers and oral contraceptives have weight gain as a common side effect.

The last, it is well known, that stopping of smoking leads in most of the individuals to weight gain. It was confirmed by quite recent results from Czech MONICA study. It was detected, that the prevalence of smoking decreased and BMI values increased in Czech males. In females, in contrary, BMI did not change probably also like a consequence of constant smoking rate (Adámková, personal communication). Thus even such positive change in life style as stopping of smoking could lead to weight gain.

Psychological factors

With increasing prevalence of obesity, the general acceptance of obesity is also increasing. Thus also psychological factors are probably more important, than we think. It is less common, that obese individual marry somebody, who is lean. Offspring's, understandably, are more likely to be obese.

Also some particular characteristics of personality (such as neuroticism, low conscientiousness, low order and high impulsiveness) may involve the eating behaviours and the personal ability to keep diet and weight control (Provencher *et al.* 2008, Terraciano *et al.* 2009).

Unusual 32 years study from the Framingham Heart Study Social Network (Christakis and Fowler 2007) has shown that, a person's chances of becoming obese increased if he or she had a friend who became obese (even if they are hundreds of kilometers' away). The probability of become obese significantly increase even in a three degrees of separation (to a person's friend's friend's friend) suggested some way of obesity "contagiousness" (Cohen-Cole and Fletcher 2008, Fowler and Christakis 2008).

Fat mass obesity related (FTO) gene

Genetic plays important role in all biochemical

processes, so why the obesity should be an exception? The first unequivocal data about the role of genes in obesity determination are now available.

Recently, a consistent association across the populations was described between variants within the FTO gene and body weight (Frayling *et al.* 2007, Hubáček *et al.* 2008, 2009). Presence of one negative allele adds in mean ~ 1.3 kg, homozygotes are about 2.5-3 kg heavier than noncarriers, regardless if analyzed individuals are lean or obese. Despite intensive research the mechanism of action is not well understood yet. Some studies suggested that FTO variants are associated with the amounts of food consumed and with a preference for high energy density food. Dozens of other genes are being investigated but, so far, FTO has the strongest effect.

Conclusions

Obesity is not a problem which is easy to solve.

There is no doubt about the important role of physical activity and reasonable energy intake in the obesity pandemic, although recent knowledge shows, that the improper lifestyle is most probably necessary, but not sufficient factor of obesity development. But there are however, often some factors behind (Table 1), and they have so far received much less attentions then they deserve and that could be relevant pieces in the obesity-puzzle with measurable and significant effects on obesity development.

Table 1. Summary of less common factors, associated with changes in body weight.

Factor	Leads to...
<i>Non exercise activity</i>	Decrease of body weight
<i>thermogenesis</i>	
<i>High room temperature</i>	Increase of body weight
<i>Air conditioning</i>	Increase of body weight
<i>Sleep deprivation</i>	Increase of body weight
<i>Psychosocial factors</i>	Increase or decrease of body weight
<i>Unpleasand urban environment</i>	Increase of body weight
<i>Advertisements</i>	Increase of body weight
<i>Endocrine disruptions</i>	Increase of body weight
<i>Stopping of smoking</i>	Increase of body weight

In particular, the easy enhancing of the NEAT, lowering the room temperatures, avoiding air conditioning, reasonable use of medication and construction of more pleasant urban environment will help to keep our body weight in recommended ranges.

Conflict of Interest

There is no conflict of interest.

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