Is it easier to gain weight during summer or winter?

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Abstract

The incidence of obesity has been increasing year after year even in the middle and poor-income countries. Being aware of the risk factors that facilitate body weight gain is fundamental to keep body weight in the desired range and, hence, limiting the obesity-mediated complications. The human body is provided with homeostatic mechanisms that utilizes the stored fat during summer to warm the body during winter seasons keeping the body weight at baseline. So, the current mini review discusses the changes occur during cool (winter) and hot climates (summer) and the homeostatic as well as behavioral mechanisms adopted to deal with such changes with an emphasis on contribution to weight gain.

Keywords: Obesity; Weight Gain; BMI; Energy Expenditure; Thermoregulation

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Introduction

In the recent four decades, obesity has been tripled worldwide putting heavy burden for both individuals and health sector [1]. Not only in the developed nations, has nowadays even Middle East region witnessed elevating prevalence rates of obesity and overweight. About 21% and 33% of Middle East residents are obese and overweight, respectively [2]. Obesity is multifactorial but preventable disease. Being obese is accompanied by consecutive comorbidities such as type 2 diabetes, many types of cancers, fatty liver disease, hypertension, stroke, myocardial infarction, among others [1]. Overweight is diagnosed simply via body mass index (BMI) with BMI ≥ 25 kg/m² is overweight while obese people has BMI ≥ 30 kg/m² [3]. Several risk factors increases ease the obesity including physical inactivity, calorie-rich diets and unemployment [1].

Thermoregulation

The body maintains body temperature at set point (37 °C) which is ideal for biomolecules, cells and organs in the body. Temperature homeostasis is controlled by hypothalamus. Thermoregulation is cooperated by two parts: outer shell (represented by skin) and inner core (represented by viscera and nervous system). Skin exhibits fluctuating changes in temperature with environment whilst nervous system and viscera have relatively stable temperature [4]. Two main mechanisms regulate body temperature upon receiving temperature change: feedback and feedforward mechanisms [5]. Feedback regulation occurs when there is a difference in temperature (either positive or negative) between the core body temperature and the environment. During
winter, the cold environment needs to be countered by thermogenesis inside the body once thermoreceptors detect the temperature change via many mechanisms including shivering thermogenesis [6]. The body exhibits different adaptations and acclimatization patterns in summer and winter periods (Table 1).

| Table 1: Comparison of acclimatization patterns during cold and hot climates [7]. |
|-----------------------------------------------|-------------------|-------------------|
| Acclimatization pattern                      | Against cold      | Against heat      |
| Physiological                                |                   |                   |
| Skin blood flow                              | Vasoconstriction  | Vasodilation      |
| Water evaporation                            | Inhibited         | Sweating          |
| (Non)Shivering thermogenesis                 | Activated         | Inhibited         |
| Behavioral                                   |                   |                   |
| Postural change                              | Compact           | Exposed           |
| Temperature choice                           | Heat-seeking      | Cold-seeking      |

Physiological acclimatization patterns are governed by autonomic nervous system, i.e. involuntarily dissipate or generate heat. Muscular shivering and brown adipose tissue thermogenesis generate heat while vasoconstriction limits heat dissipation and vice versa [8]. Similarly, behavioral acclimatization is motivated which involve seeking to heat/cold body temperature as external source and/or changing body posture to restrict heat dissipation [9]. It is worthy noting that thermoregulation is highly depending on energy as well as fluid homeostatic mechanisms. That is, upon exposure to cold environment, body demands continuous energy and consecutive heat generation to warm body core organs. Upon placing mice at 4°C environment, cold-induced thermogenesis consumed approximately 60% of total energy expenditure [10]. To satisfy such energy need, mice exposed to cold environment doubled their daily food intake [11]. Likewise, obese people cool less rapidly in comparison with lean people when immersed in water. This indicates that obese people rise their metabolic rate less significantly than lean individuals. Therefore, obesity pose an advantage in cold conditions but, on the flip side, represents an obstacle during hot conditions as the extra fat impede heat dissipation more pronouncedly than lean individuals [12].

So, at which season body weight gain becomes easier?

There is an argument regarding whether body weight increases during cold or hot climate. It is established that body heat is associated with obesity as evidenced by CoLaus study [13]. At ambient temperatures, it is true that energy expenditure (and thus energy intake) and thermogenesis increases, but in the modern society, humans are buffered from extreme cold and at the same time spend more time in a nearly bearable state where energetic costs are minimized. This suggests that cold climate favors obesity than hot climate [14]. On the other hand, children at summertime gained more weight compared to school year time taking into consideration that the physical activity in summer is greater [15–18]. Although some weight gain was documented in female college students, the association was insignificant [19].

Conclusion

In summary, summer time contributes much greater to weight gain and thus obesity than winter time. This is because the highly demanding energy expended in winter for warming the body is absent in summer which makes the body store excessive calorie taken as fat contributing thus to weight gain. According to the conclusion of the present narrative mini review, people, particularly overweight and obese ones, should minimize high-calorie diets during summer time as they put extra weight to the body. The reverse scenario is applicable, the winter season is an opportunity for overweight and obese people to lose some weight, particularly if coupled with exercise.
References


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