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## Obesity and the Biological Clock: A New Paradigm?

Brahim Selmaoui<sup>1,2</sup><sup>1</sup>Department of Experimental Toxicology, INERIS, Parc ALATA, BP2, Verneuil-en-Halatte, France<sup>2</sup>PériTox, Perinatal & Risks Toxic, UMR - I 01 INERIS, UFR of Medicine, University of Picardie Jules Verne, Amiens, France**Corresponding author:** Selmaoui B, Department of Experimental Toxicology, INERIS, Parc ALATA, BP2, 60550, Verneuil-en-Halatte, France,**Tel:**+330344618268; **E-mail:** brahim.selmaoui@ineris.fr**Rec date:** April 28, 2016, **Acc date:** April 30, 2016, **Pub date:** May 2, 2016**Copyright:** © 2016 Selmaoui B. 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.**Citation:** Selmaoui B (2016) Obesity and the Biological Clock: A New Paradigm. *J Clin & Mol Endocrinology* 1

### Introduction

Obesity, among adults and children, is becoming a worldwide health problem reaching epidemic proportions, and is associated with major adverse consequences for human health such as heart disease, type 2 diabetes mellitus, hypertension and some forms of cancer. So far, the problem of obesity and other related metabolic disorders has led researchers to explore the physiology of energy homeostasis, the process whereby energy intake is matched to energy expenditure over time. Findings have revealed that neuronal systems play a role in the control of body fat content and glucose metabolism by regulating energy intake, energy expenditure, and endogenous glucose production [1].

Another factor that seems to be involved in obesity is now emerging; it concerns our inner biological clock that is located in the suprachiasmatic nuclei (SCN) of the hypothalamus. The SCN controls the temporal organization of several aspects of human and animal physiology. For example, food is ingested in a circadian manner in nature and in laboratory animals kept in constant conditions [2]. This circadian rhythmicity in food ingestion is driven by a biological clock [3,4].

It is reported that disruption in the feeding rhythm may play a role in the development of obesity. In humans, irregular timing of eating is observed in shift workers who seem to gain weight more often than those who work usually during the day [5]. In parallel, studies in animals showed that circadian rhythmicity of food intake was found to be altered in genetically obese animals showing an increase of food intake during the light period. This finding shed light on the circadian rhythmicity of food intake and its impact on the development of obesity.

The discovery of clock genes has led to rapid progress in exploring their role in obesity. Both the master clock in the hypothalamus and the peripheral clocks seem to also be involved in the regulation of body weight and obesity. This is strongly supported by some several reports which have demonstrated that mutations in the clock genes disrupt metabolic functions and/or induce obesity [6-8].

Taken together, these data and others suggest a possible role of the biological clock in metabolism and obesity.

Recent studies have highlighted the importance of chronobiology when researching the mechanisms related to the development of obesity. For a long time, physiological processes in humans or animals were thought to be maintained in a homeostatic fashion, with any deviation restored by a feedback mechanism.

But several studies have now shown that the concept of biological rhythmicity as being complementary to homeostasis. For example, studies of human sleep indicate that the sleep-wake cycle is regulated by both homeostatic and circadian processes [9,10].

Certainly, factors implicated in the pathogenesis of obesity are diverse and may act synergistically. It is possible that the biological clock may play a crucial role in this process. Hence, it is clear that obesity reflects not only the homeostatic concept but also the circadian component. If we consider these factors together, research will certainly bring new insights into the development of new therapeutic strategies to control and prevent obesity.

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