

## Human Chronophysiology and Chrono-Nutrition: Emerging Sciences

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### Abstract

Human chronophysiology and chrono-nutrition were underlined as emerging sciences that require more research to set guidelines for specialized nutritional regimens for people of varying ages and chrono-work metabolic status. Timing, frequency and regularity of eating matter towards optimal human health and longevity. These aspects need to be enlightened through future research and education.

**Keywords:** Chronophysiology; Chrono-Nutrition; Human Health; Metabolism

This article delineates human chronophysiology and chrono-nutrition as emerging sciences. Chronophysiology is concerned with timing of cell, tissue and body functions. This timing could be within a 24-h period or longer. If it is within an almost 24-h period, it is called a circadian rhythm. If such a biological process occurs over a period of approximately one year, it is called a circannual rhythm. The most notable external cues that regulate body function over a circadian period are eating and exercise time and photoperiod. This means that it biologically and health-wise matters when within the 24-h period, food is taken and exercise is conducted [1-5].

Timing of eating and exercise has been proposed to affect human health and life quality [7-12]. For instance, glucose tolerance decreases as day ends and night begins. This is basically because human has evolved to be active during day and rest overnight. As a result, little metabolism occurs overnight and thus limited nutrients would be required overnight. As such, eating large and nutritionally heavy meals must be avoided during night to reduce the likelihood of obesity and diabetes and related metabolic complexities [13]. In other words, to minimize the risk of insulin resistance, major meals should be taken during morning and day time. Instead, exercise could be performed late afternoon or in the evening [10].

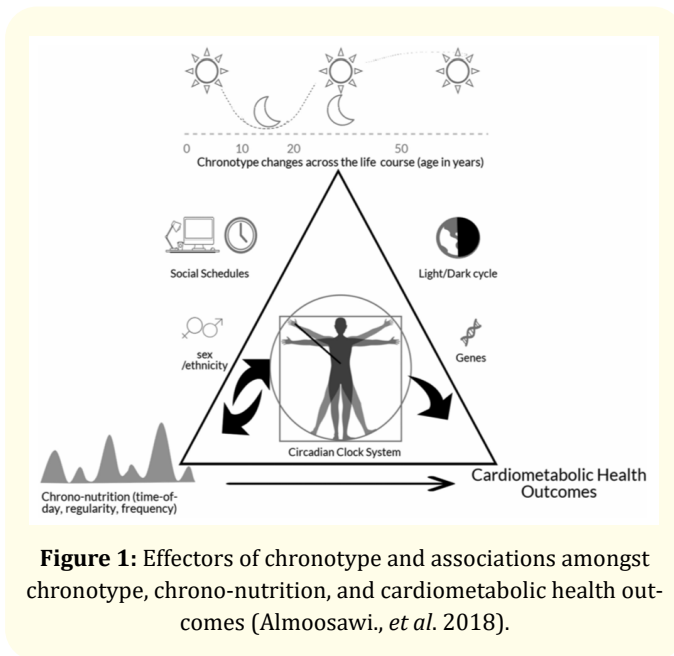
It has been suggested that chronotype, chrono-nutrition and cardiometabolic health could be interrelated [14,15]. Chrono-

nutrition is concerned with timing, frequency and regularity of eating [15]. Although research findings are limited, people with evening chronotype would be prone to increased health disorders because they have lower intake of fruits and vegetables and higher intake of energy drinks, alcoholic, sugary, and caffeinated beverages, and higher fat and energy intake. In addition, they are more likely to have irregular meals and skip breakfast.

Chrono-nutrition and chronophysiology are emerging sciences in ruminants as well. Recent research demonstrated that time of feeding (evening vs. morning) alters postprandial patterns of feed intake, rumen fermentation, circulating blood metabolites, as well as milk fat and energy yields [16,17]. Lactating dairy cows fed once daily at 2100 h instead of 0900 h consumed greater feed within 3-h after feeding and exhibited higher concentrations of volatile fatty acids in rumen fluid shortly after feeding. As a result, the evening-fed cows had higher blood concentrations of milk precursor metabolites (e.g., BHBA and lactate) than did the morning-fed cows [16,17]. Consequently, daily milk fat and energy yields were greater in the evening-fed cows than in the morning-fed cows. These results proved that time of feeding and time of eating are important in how nutrients are metabolized by lactating dairy cows.

This article serves to globally call for more metabolic and pathological research to further elucidate the different aspects of

chronophysiology and chrono-nutrition in preventing and managing metabolic and health disorders such as obesity, diabetes and cardiovascular complexities.



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