

# Nutritional optimization of physiological rhythms: a rising innovation

## Abstract

This article describes how nutritional and lifestyle optimization of human physiological rhythms provides opportunities to improve health and life quality. Minimizing the interruptions in the synchrony of internal and external rhythms in today's lifestyles must be a priority.

**Keywords:** nutrition, lifestyle, physiology, rhythm

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## Introduction

The objective of this perspective article is to introduce nutritional optimization of physiological rhythms of human body as a rising science in improving life quality. Almost all forms of life have evolved to exhibit physiological and behavioral patterns that are coordinated with the surrounding environment.<sup>1-3</sup> This means that almost all biological processes such as biochemical reactions demonstrate patterns recurring at particular time intervals. Many principal rhythms of life are circadian which occur within approximately a 24h period. For instance, rest and activity, body temperature, digestive enzymes, and blood concentrations of some hormones and metabolites possess circadian rhythms. Such rhythms are self-maintained and persist even in non-rhythmic environments.<sup>1,2</sup>

The circadian rhythms are endogenous and driven by the biological clocks located in the hypothalamus and in the liver. However, this should not leave the impression that external stimuli do not affect the circadian rhythms but rather mean that the circadian rhythms do not necessarily need any external cues to persist. There is an incorrect, interchangeable use of 'circadian' and 'diurnal' in the literature. The 'circadian rhythms' are by definition endogenous which recur over almost a 24-h period and do not require an external cue such as light intensity or feed delivery to be sustained. The diurnal rhythms, in contrast, are 24h rhythms which are easily altered by external factors and may not persist in the absence of an external cue. By altering the feeding time and photoperiod, it is very likely to alter the diurnal rhythms but not necessarily the circadian ones. Therefore, the potential exists to synchronize the occurrence of diurnal rhythms with that of circadian rhythms to manipulate nutrient use efficiency and partitioning, and thereby, to optimize nutrient metabolism. Daily rhythms of blood metabolites and hormones must be uncovered to enable evaluating the chronobiological significance of feeding timing in nutrient partitioning and metabolism.<sup>3-8</sup>

The portal blood carries metabolites that are drained mostly from the rumen and the small and large intestines. These organs plus pancreas, spleen, and the related adipose and muscle tissues are known as portal-drained viscera (PDV). The PDV and liver form splanchnic tissues. Despite their smaller size relative to the rest of the

body, the splanchnic tissues contribute to approximately 20-50% of total body oxygen use in mammals with gut fermentation. Therefore, the PDV as the major site of nutrient digestion can influence diurnal patterns in nutrient delivery to the portal vein. The liver will thus encounter diurnal patterns in the input of propionate, amino acids, lactate, and beta-hydroxy butyrate. Diurnal patterns of portal blood metabolites occur in response to the diurnal patterns of food intake, gut fermentation, and nutrient digestion and absorption. Except for propionate and ammonia in ruminants, the liver has limited capacity for the uptake and metabolism of other metabolites such as acetate, lactate, and beta-hydroxy butyrate. As a result, diurnal patterns in the concentrations of acetate, lactate, and beta-hydroxy butyrate in the peripheral blood will most likely reflect the diurnal patterns of their portal concentrations.<sup>9-17</sup>

Initiatives must be taken to develop feasible strategies whereby to improve human health via optimizing physiological rhythms. Photoperiod, eating timing, exercise intensity and timing, resting management, social life improvement, and the balance between physical and brain activities are amongst key measures of life to optimize. Interruption of biological clocks of the body in brain, liver and other possible tissues must be avoided by proper management of circadian rhythms of the above measures.

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## Conflict of interest

Author declares that there is no conflict of interest.

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