



# Can Running through Chrono-Nutrition Help Prevent Diabetes?

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## Perspective

Volume 7 Issue 3

Received Date: July 18, 2022

Published Date: July 26, 2022

DOI: 10.23880/doi-16000257

## Abstract

This perspective article aimed to develop and propose a question if running through chrono-nutrition can help prevent diabetes and obesity (diabesity) by optimizing circadian rhythms of glucose metabolism. With the advancing mechanization, eating behavior (timing, sequence, and frequency) has significantly changed. People are now more willing to eat fast foods at suboptimal times of the circadian period. Growing evidence suggests that untimely eating and lack of adequate exercise can interfere with optimal physiological rhythms of glucose and insulin metabolism that can lead to diabesity. Type 2 diabetes mellitus (T2D) is a foremost metabolic disorder worldwide occurring largely due to suboptimal eating timing and lifestyle. Consuming less sugars and carbohydrates during evening and overnight may help optimize human chrono-physiology. Chrono-nutrition via optimizing the timing of meals is a growing science that needs to be well elucidated and practiced to help prevent or possibly reduce risks of T2D and obesity in today's complicated life.

**Keywords:** Chrono-nutrition; Circadian rhythm; Glucose; Diabetes; Physiology; Science

## Philosophy and Discussion

This objective of this perspective article was to develop and as much as possible to address a question if running through chrono-nutrition can help prevent diabetes by optimizing circadian rhythms of glucose metabolism. The suprachiasmatic nucleus (SCN) is a structure present in the hypothalamus and a central clock that alongside peripheral clocks in liver orchestrates circadian rhythms of glucose metabolism [1,2]. It is known that glucose tolerance decreases in the evening and night simply and philosophically because less nutrients are needed overnight [3]. As such, eating large evening meals of mainly high-sugar and starchy foods should be avoided to reduce risk of diabesity. Contemplation in the circadian rhythms of glucose metabolism suggests decreased insulin sensitivity and pancreatic  $\beta$ -cells function in the evening vs. morning [2]. Increased insulin resistance is a predisposing factor for T2D development [4]. Moreover,

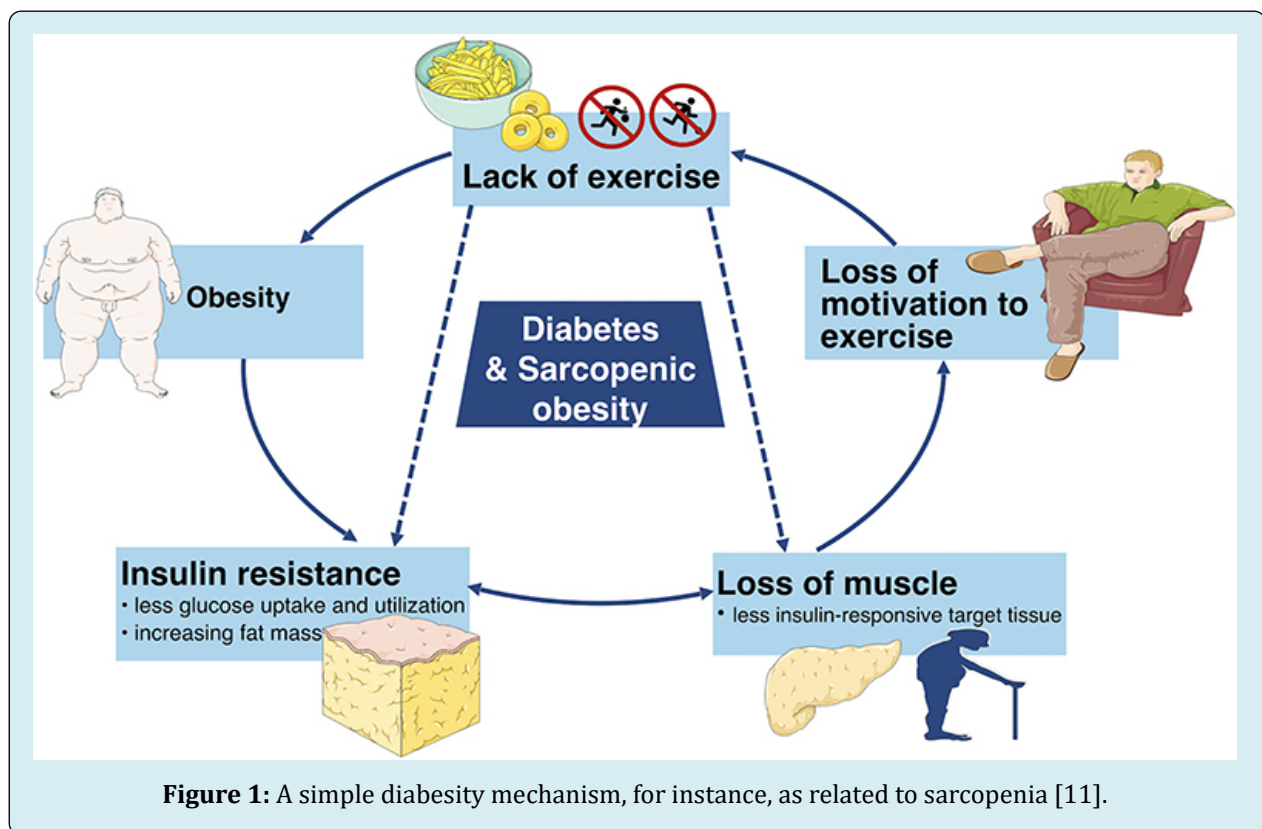
insulin resistance and energy over-intake leads to hepatic and abdominal adiposity, likely increasing hepatic insulin resistance and suboptimal hepatic and peripheral glucose metabolism [4]. Subsequently, glucose over-flux during evening and overnight increases the risk of insulin resistance that could increase T2D likelihood [5].

Glucose assimilation and metabolism are meticulously associated with circadian systems. Thus, changing the main eating time from morning to evening might cause elevated blood glucose and its related problems. The evening chronotype people tend to consume foods heavily late overnight. It has been shown that night workers have reduced glucose tolerance, and thus, are at higher risks of prediabetes and diabetes development. This suggests abnormal circadian metabolism of glucose in shift workers and nocturnal eaters [6].

Moreover, increased melatonin secretion has been reported in late eaters, suggesting impaired glucose metabolism and disturbed glucose circadian rhythms [2]. Melatonin is known for its basic role in sleep-cycle and circadian rhythms regulation. Increased melatonin secretion overnight coincided with heavy evening food intake may further impair glucose metabolism towards lower glucose tolerance [7]. Hence, the increased diabetes risk in nocturnal eaters and shift-workers might be because of the disrupted circadian rhythms of glucose metabolism. In addition, melatonin possesses an inhibitory effect on insulin secretion that further complicates the problem [7].

From a meal timing perspective, then, chrono-nutrition

implies that high-energy nutrients should be consumed rather early in the morning when physical activity and brain work increase [5]. As such, consuming breakfast is encouraged, but nocturnal eating is discouraged [8]. Besides eating timing, improved nutrient and waste metabolism will depend on well-coordinated eating and exercise that requires future research. Overall, chrono-nutrition is an emerging science that can offer a simple and feasible methodology to help optimize glucose metabolism and reduce diabetes risk. Running through chrono-nutrition should equip the postmodern man with strong tools to minimize risks of diabetes and obesity [9,10]. The Figure 1 illustrates a simple mechanism of diabetes as related to sarcopenia, for instance, which could be minimized with optimal chrono-nutrition.



## Conclusion

Glucose metabolism is orchestrated through circadian rhythms. Glucose tolerance, for instance, decreases during evening and overnight. Thus, night eaters may exhibit elevated blood glucose or hyperglycemia nocturnally. The increased hyperglycemia together with the greater insulin resistance are the predisposing factors for T2D. It is suggested that chrono-nutrition is a growing science and practice that comes to play an important role in preventing diabetes through optimizing glucose metabolism circadian

rhythmicity in today's stressful life. Running through chrono-nutrition should equip the postmodern man with reliable tools to minimize the risk of diabetes. Future studies are required to further elucidate what specific foods and fruits should be consumed at what specific times of the circadian period to minimize diabetes.

## Acknowledgement

Nature and Mountains are acknowledged for their inspirations towards scientific contemplations.

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