

Chrono Nutrition: Eating at the Right Time for Better Health

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Chrono nutrition is an emerging field of nutritional science that examines how the timing of food intake interacts with the body's internal biological clock, or circadian rhythm, and influences metabolic health (Garaulet & Gómez-Abellán, 2014). The human body is organized around an approximately 24-hour biological rhythm that regulates sleep, digestion, hormone secretion, body temperature, and energy metabolism. When meal timing is appropriately aligned with this natural rhythm, the body may utilize nutrients more efficiently, contributing to better metabolic health and potentially reducing the risk of chronic diseases.

Contemporary lifestyles have significantly altered traditional dietary patterns (Arble et al., 2009; Wehrens et al., 2017). Long working hours, irregular meal schedules, shift work, prolonged screen exposure, and late-night eating can disturb the body's internal clock.

Such lifestyle patterns have been associated with obesity, impaired glucose regulation, hypertension, cardiovascular problems, poor sleep, and gastrointestinal disturbances.

Therefore, chrono nutrition offers a simple, practical, and potentially cost-effective approach to improving dietary habits without necessarily requiring major changes in the



types of foods consumed.

Different organs and tissues in the human body exhibit daily biological rhythms. The liver, pancreas, stomach, skeletal muscles, and adipose tissue perform metabolic functions that vary throughout the day. Hormones involved in hunger, insulin secretion, digestion, and energy metabolism also fluctuate according to circadian timing.

For example:

- Insulin sensitivity is generally higher earlier in the day (Sutton et al., 2018).

- The body's ability to process and utilize nutrients changes across the day.
- Metabolic activity tends to decline during the evening and night.
- During nighttime, the body shifts its physiological emphasis toward rest, repair, and restoration.

Thus, consuming meals at appropriate times may support metabolic efficiency, whereas eating large or energy-dense meals at biologically inappropriate times may place additional metabolic stress on the body.

The Biological Clock of the Body

The body's central biological clock is located in the suprachiasmatic nucleus (SCN) of the hypothalamus. It receives information about the light–dark cycle, primarily through signals originating from the eyes, and coordinates numerous physiological processes throughout the body.

The circadian system influences:

- Sleep–wake patterns
- Appetite and food cravings
- Hormone secretion
- Blood glucose regulation
- Body temperature
- Digestion and gastrointestinal activity
- Lipid metabolism
- Energy expenditure
- Immune-system functions

Importantly, food intake itself also acts as a timing signal for peripheral clocks present in organs such as the liver, pancreas, and gastrointestinal tract. Therefore, both what we eat and when we eat can influence metabolic health.

Major Principles of Chrono Nutrition

1. Start the Day with a Healthy Breakfast

Breakfast follows an overnight fasting period and can provide energy and nutrients needed to begin daily activities. Some studies suggest that consuming more calories earlier in the day may support better weight management and metabolic control (Jakubowicz et al., 2013).

However, the emphasis should be on a balanced and nutritious breakfast rather than simply increasing calorie intake. A healthy breakfast may include whole grains, pulses, milk or curd, fruits, vegetables, nuts, or other locally available nutritious foods.

2. Consume More Energy Earlier in the Day

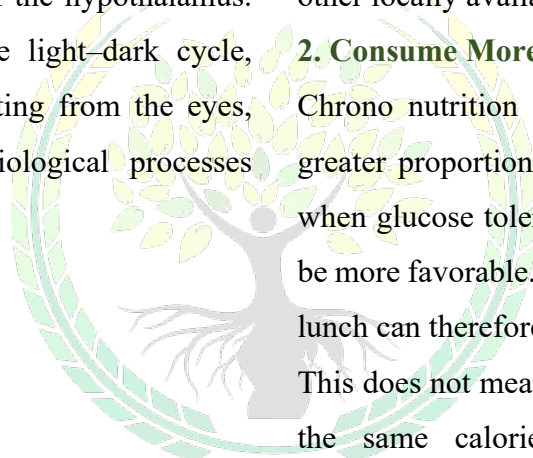
Chrono nutrition generally encourages consuming a greater proportion of daily energy earlier in the day, when glucose tolerance and insulin sensitivity tend to be more favorable. A nutritious breakfast and adequate lunch can therefore form the major meals of the day.

This does not mean that everyone must follow exactly the same calorie distribution. Individual energy requirements, occupation, age, health status, and lifestyle should also be considered.

3. Eat Dinner Early and Keep It Light

Dinner is preferably consumed 2–3 hours before bedtime, allowing sufficient time for digestion before sleep. Heavy, fried, highly processed, and sugar-rich foods should preferably be avoided close to bedtime.

A light dinner containing vegetables, whole grains, pulses, or other nutrient-dense foods can be a better choice than a large, energy-dense meal late at night.



4. Maintain Regular Meal Timing

The human body functions more efficiently when daily routines are reasonably consistent. Eating meals at approximately similar times each day may help maintain regular patterns of hunger, digestion, and glucose regulation.

Irregular meal timing can interfere with normal metabolic rhythms. Therefore, consistency is more important than perfection.

5. Avoid Unnecessary Late-Night Snacking

Television viewing, smartphone use, prolonged working hours, and stress have contributed to the increasing habit of late-night snacking. Chips, sweets, fast foods, sugary beverages, and other energy-dense snacks are commonly consumed at night but may provide relatively few essential nutrients.

Replacing late-night snacking with healthier daytime eating patterns can support better metabolic health and may also improve sleep quality.

Health Benefits of Chrono Nutrition

1. Weight Management

Appropriate meal timing, particularly consuming meals earlier in the day, may support energy metabolism and reduce the tendency toward excessive late-day energy intake. Early time-restricted feeding has been shown to improve certain metabolic parameters, including insulin sensitivity (Sutton et al., 2018).

2. Better Blood Glucose Regulation

Meal timing can influence glucose tolerance and insulin sensitivity. Consuming a greater proportion of food earlier in the day may support better blood glucose regulation and may contribute to reducing

metabolic risk when combined with an overall healthy diet and lifestyle.

3. Improved Heart Health

Maintaining regular eating patterns and avoiding excessive late-night energy intake may contribute to better cardiometabolic health. Healthy meal timing should, however, be considered alongside other important factors such as physical activity, healthy food choices, adequate sleep, and maintaining a healthy body weight.

4. Better Digestion

The digestive system follows circadian patterns, and eating primarily during the active phase of the day may support normal digestive function. Avoiding heavy meals immediately before bedtime may help reduce problems such as discomfort, reflux, and indigestion in susceptible individuals.

5. Better Sleep

Late-night heavy meals and frequent nighttime snacking may interfere with comfortable sleep. Eating dinner earlier and allowing adequate time between dinner and bedtime may support better sleep quality as part of a healthy daily routine.

6. Improved Mental Performance

A balanced diet and regular meal schedule can help provide a steady supply of energy and essential nutrients required for normal brain function. A nutritious breakfast may be particularly useful for individuals who have demanding academic or occupational schedules.

7. Healthy Ageing

Maintaining regular eating patterns along with a balanced diet, physical activity, and adequate sleep

may support healthy ageing. Appropriate synchronization between eating patterns and circadian rhythms may contribute to better metabolic regulation and overall well-being.

Practical Tips for Following Chrono Nutrition

Chrono nutrition does not require expensive foods, complicated diets, or specialized products. Some simple practices include:

- Start the day with a nutritious breakfast.
- Prefer nutrient-dense foods over highly processed foods.
- Consume the major proportion of daily food intake during the active part of the day.
- Keep lunch nutritious and adequately balanced.
- Eat dinner approximately 2–3 hours before bedtime.
- Avoid frequent late-night snacking.
- Limit sugary drinks and highly processed foods, particularly at night.
- Maintain relatively consistent meal timings.
- Drink adequate water throughout the day.
- Combine healthy meal timing with regular physical activity and adequate sleep.

These practices can be adapted according to age, occupation, culture, food availability, and individual nutritional requirements.

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Conclusion

Good nutrition is not only about what we eat but also, to some extent, when we eat. The human body follows circadian rhythms that influence digestion, hormone secretion, glucose regulation, energy metabolism, and other physiological functions. Aligning meal timing with these natural rhythms may support metabolic health, digestion, healthy body weight, sleep, and overall well-being.

Chrono nutrition does not require expensive foods or complicated dietary plans. Simple practices such as having a nutritious breakfast, consuming adequate food during the active part of the day, maintaining regular meal timings, avoiding unnecessary late-night snacking, and having an early and relatively light dinner can contribute to healthier eating patterns.

As lifestyle-related diseases become increasingly common, paying attention to meal timing along with food quality, portion size, physical activity, and sleep provides a practical approach to promoting healthier living. These practices can be adapted for individuals of different age groups and living conditions, including rural communities, while taking individual nutritional needs into consideration.

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