



## Breakfast is a key for diet



If you are feeling out of shape or having difficulty losing weight, your body clock may be disrupted. Surprisingly, breakfast has a close relationship with resetting the body clock. Reviewing your breakfast is a key for having a healthy and beautiful body.

### ◆◆ There is a clock in our bodies

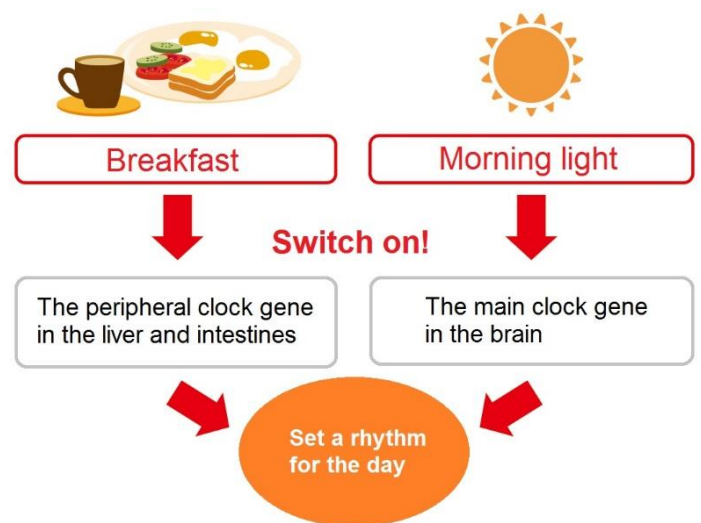
We are active during the day and rest ourselves at night. We may not pay attention to this cycle and think it is a natural mechanism of the body. Actually, it is controlled by a biological clock that is our built-in ability. The biological clock drives the body with a certain rhythm. The most basic biological rhythm is called the circadian rhythm. Humans are living with a cycle of 24 hours per day. We are active during the day and sleep at night to refresh and stay healthy. These rhythms of daily life control vital activities including body temperature, blood pressure, sleeping cycles and energy metabolism.

### ◆◆ The main clock gene in the brain and the peripheral clock gene in organs

The biological clock is regulated by the main clock genes that is located in the suprachiasmatic nucleus in the brain. The main clock gene displays an oscillation of about 25 hours. A time difference between the clock gene and our 24 hour oscillations occurs but our body adjusts the oscillation difference everyday by the morning sun. Waking up in bright natural light is important to regulate own biological clock.

Another clock genes are present in almost all body systems such as the liver and the small intestine. This is called the peripheral clock gene and controls nerves and hormones. This suggests that there is a time in a day that activates the function of our liver and intestines. Medicines refer this ideal time. For examples, the gene that synthesizes cholesterols in the liver is active at night. According to this ideal time of the liver, the medicine for the treatment of hyperlipidemia is directed to take mainly at night.

In late years, scientists started to think that there must be an ideal to have meals as well as functions of organs. Nutrition may provide different effects to the body depending on eating times. Nutrition based on eating times is called “Chrono-nutrition”.



People who are distressed about being prone to gain weight or with metabolic syndrome often believe its cause as a large calories intake. This way of thinking has triggered a diet boom with programs of meal replacement and excluding a particular nutrient or food from meals. In reality, a level of energy intake of Japanese people has been decreasing in each

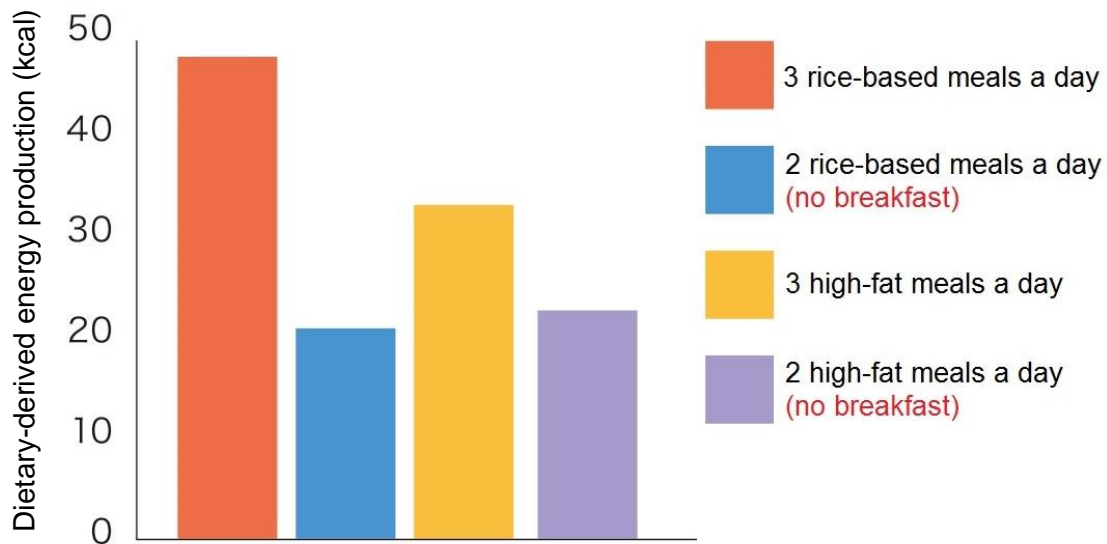
year. Perhaps surprisingly, the energy intake of Japanese people was 1874 kcal as of 2012 and this level is lower than 1946 when death from starvation occurred and their level of energy intake was 1903 kcal, according to the National Health and Nutrition Survey conducted by Ministry of Health, Labour and Welfare. Based on the results from the survey, we doubt that the increase in obesity is caused by food satiation.

### ◆◆ Having breakfast makes the body gain less weight

One cause of gaining weight easily even though the level of energy intake is low is related with a cluttered rhythm of everyday life. The most notable behavior of a cluttered life is an absence of breakfast. Many people wrongly believe that they can lose weight if they do not have breakfast because they can save a daily calories intake by skipping it.

According to a study in the USA, people who skipped having breakfast are 5 times more predisposed to weight gain than people who have breakfast. The other study in Japan has reported that the people who have breakfast tend to burn more calories than the people who skip breakfast because the amount of calories generated from food increases in the body.

### Comparison of dietary-derived energy production



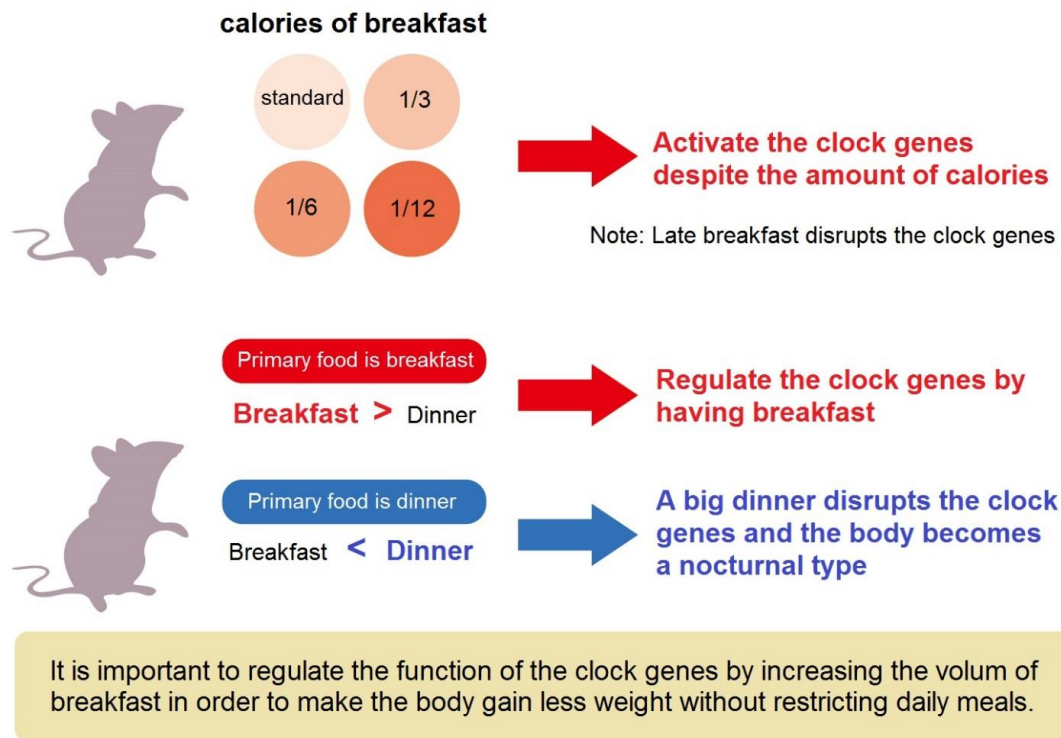
Having a robust breakfast and rice-based meal increase energy production in the body and the body burns more calories.

Reference: J.Japan Diab.Soc. 48, 761-70 (2005)

When people skip having breakfast, the brain detects a risk of starvation and minimizes mental and physical activities. By way of compensation, it promotes fat synthesis for an emergency. This is how an absence of breakfast disrupts the physical rhythm and makes people easily get fat even if the intake of calories is small.

The question is which meal is more important for us, breakfast or dinner? Actually, there is a research study to answer to this question. The researchers controlled the amount of breakfast and dinner of laboratory mice. At first, the biological clock of mice were not disrupted when the amount of breakfast was reduced from a standard volume to 1/3, 1/6 and 1/12 of the standard volume. However, the mice lost the notion of time of morning, day or night when they were given late breakfast. There was no significant effect on the biological clock of the mice when their dinner time was altered.

During the study, researchers observed the effects from a large intake of breakfast or dinner. As a result, the biological clock of the mice which eat a large breakfast and small dinner were not disrupted. On the other hand, having a large dinner disrupted the mice's biological clock and they fell into a night mode which cluttered the rhythm of everyday life. What we learned from the results is that having a good volume of breakfast at about the same time each day and a less portion of dinner is important for maintenance of the biological clock. It allows us to obtain a body that gains less weight without performing diet restrictions.



### ◆◆ Disruption of the biological clock gives adverse effects to intestines

Recent studies have unveiled the fact that gut microbiota draws influence from disruption of the biological clock. When the scientists collected feces from humans and mice at different times of the day and examined the balances of the gut microbiota present in those feces, they could observe some cadenced changes in the amount of microbiota and the subjects' activities depending on the collection time. The number of gut microbiota and its types were disrupted when the researchers changed the feeding time on mice. The mice with disrupted biological clock showed an abnormal metabolic process which drove them to gain weight and develop diabetes. There are 2 types of gut bacteria: one makes us prone to gain weight whereas the other makes us less prone to gain weight. The disruption of the biological clock inclines the balance of gut microbiota of mice making them susceptible to weight gain.

The scattered biological clock is associated with disruption in the sleep pattern. Many study data suggested that a lack of sleep increases a chance of developing a viral infection and disruption of appetite. We should check not only what we eat but also when we have meals in order to adjust our body rhythm.

References:

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Cell. 159. 469-70 (2014)

*Chrononutrition* (published by Kagawa Nutrition University)