

Breakfast Science

Timing, composition and metabolic health

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What counts as breakfast?

The first eating occasion after the overnight fast

THE SCIENTIFIC QUESTION

**We often hear that breakfast is the “most important meal of the day.”
Does the evidence support this for everyone?**

Its effect depends on three questions:

WHEN Timing

WHAT Composition

WHO Target individual

BREAKFAST EATING VERSUS BREAKFAST SKIPPING

- **Children who consume breakfast have significantly higher daily intakes of energy and protein.**
- **Conversely, breakfast skippers often exhibit:**
 - **Lower intakes of cereals, milk, fruits, vegetables - protein, vitamins, and minerals (e.g., calcium, iron, vitamin A, and vitamin C).**
 - **Higher intakes of fat and miscellaneous foods high in sodium, sugar and saturated fat.**

Uma Chitra and C Radha Reddy, "The role of breakfast in nutrient intake of urban schoolchildren," **Public Health Nutrition**, 2007. DOI: [10.1017/S1368980007219640](<https://doi.org/10.1017/S1368980007219640>)

The overnight fast changes the metabolic setting

OVERNIGHT

The body maintains blood glucose using stored glycogen and glucose production by gluconeogenesis.

Insulin levels fall between meals, fat tissue releases more fatty acids. Tissues use these fatty acids and glycerol.

Around waking, cortisol rises as part of the body's daily rhythm. This hormonal setting helps make fuel available for the start of the active period.

FIRST MEAL

Breakfast ends the fast and produces a glucose and insulin response shaped by meal composition.

Liver glucose output falls, fat release slows, and the liver and muscles take up or store glucose.

The size and duration of the resulting glucose rise depend on the meal's carbohydrate amount and composition, and the individual's insulin response and metabolic health.

Fasting duration and prior evening intake also affect the morning response.

Breakfast and the “Second-Meal Effect”

The composition of breakfast can influence the body’s glucose, insulin and appetite responses to the next meal, usually lunch.

WHY IT MAY HAPPEN

Breakfast pattern	Likely subsequent response
Refined cereal, added sugar, little protein or fibre	Rapid glucose rise, shorter satiety and earlier hunger
Whole grain or millet + protein + fibre	More sustained satiety and potentially better glucose control at lunch
Breakfast skipped	Longer fasting interval; some individuals may experience greater hunger and a higher glucose response after lunch

Check portions, added sugar, excess sodium and fat quality in packaged breakfast choices.

Effects vary by population and meal. Examples: PMID 19366973 and PMID 39948032.

Meal timing influences glucose response

Equivalent meals can produce different responses at different times of day.

Human crossover studies generally find higher post-meal glucose responses in the evening than in the morning.

Regular sleep and meal schedules help place this finding in context.

For someone who sleeps at night, breakfast usually occurs near the beginning of their biological day. For a shift worker, a meal eaten at 8 a.m. may occur near bedtime instead.

Evidence: systematic review of randomized crossover studies, PMID 35512764; meta-analysis, PMID 31782659.

Breakfast quality matters

Build the meal around food groups, metabolic needs and the day's activities.

01 Protein source

Pulses, eggs, milk, curd or tofu

Supports satiety and muscle protein synthesis

02 Carbohydrate quality

Whole grains, millets or minimally processed cereals

Provides slower and more sustained energy

03 Fibre and micronutrients

Vegetables and whole fruit

Adds fibre, vitamins, minerals and food volume

04 Healthy fats

Nuts, seeds or unsweetened nut pastes

Improves nutrient density and may extend satiety

Also consider portion size, added sugars, sodium and degree of processing.

An Indian breakfast: what would you improve?

Compare poha, idli–sambar, upma, aloo paratha, sandwich, poori and the ready to eat breakfast cereals

Breakfast cereal	Approximate GI
Steel-cut oats	50–55
Rolled oats	55–60
Unsweetened muesli	40–55
Quick/instant oats	~65–75
Cornflakes	77–93

For each meal, ask:

Where is the protein? How much fibre and produce? What do the portion and added sugar contribute?

Example: add sprouts or peanuts and vegetables to poha; pair with curd if suitable.

The 5 Ts of breakfast

Timing When is the meal eaten?

Type What foods make up the meal?

Total energy Does the portion suit the day?

Texture and processing How refined or sweetened is it?

Target individual Who is eating it?

The best breakfast recommendation fits the person and the full dietary pattern.

Selected references

Sievert K et al. Effect of breakfast on weight and energy intake. BMJ. 2019;364:l42. doi:10.1136/bmj.l42

Leung GKW et al. Time of day difference in postprandial glucose and insulin responses. Chronobiol Int. 2020. PMID: 31782659.

Is evening carbohydrate intake associated with higher glycaemia than morning intake? Systematic review of randomized crossover studies. PMID: 35512764.

Jovanovic A et al. The second-meal phenomenon in type 2 diabetes. Diabetes Care. 2009. PMID: 19366973.

Thank You

Questions and discussion

**Breakfast science asks more than whether we eat.
It asks when, what, how much and for whom.**

THE 5 Ts OF BREAKFAST

Timing • Type • Total energy • Texture and processing • Target individual