

Same meal, *different hour*

Circadian biology, individual responses, and what European dietary guidance is still missing

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The starting point

60%

Almost 60% of adults in the WHO European Region live with overweight or obesity

1 in 3

Nearly one in three children in the Region live with overweight or obesity

Our dietary guidelines rest on solid evidence. Yet the same advice produces very different results in different people.

What we have just heard

Responses differ

People respond very differently to identical meals.

Zeevi et al., Cell 2015; Berry et al., Nat Med 2020

Genes explain little

Genetic variants explain only a small share of that variation.

Berry et al., Nat Med 2020

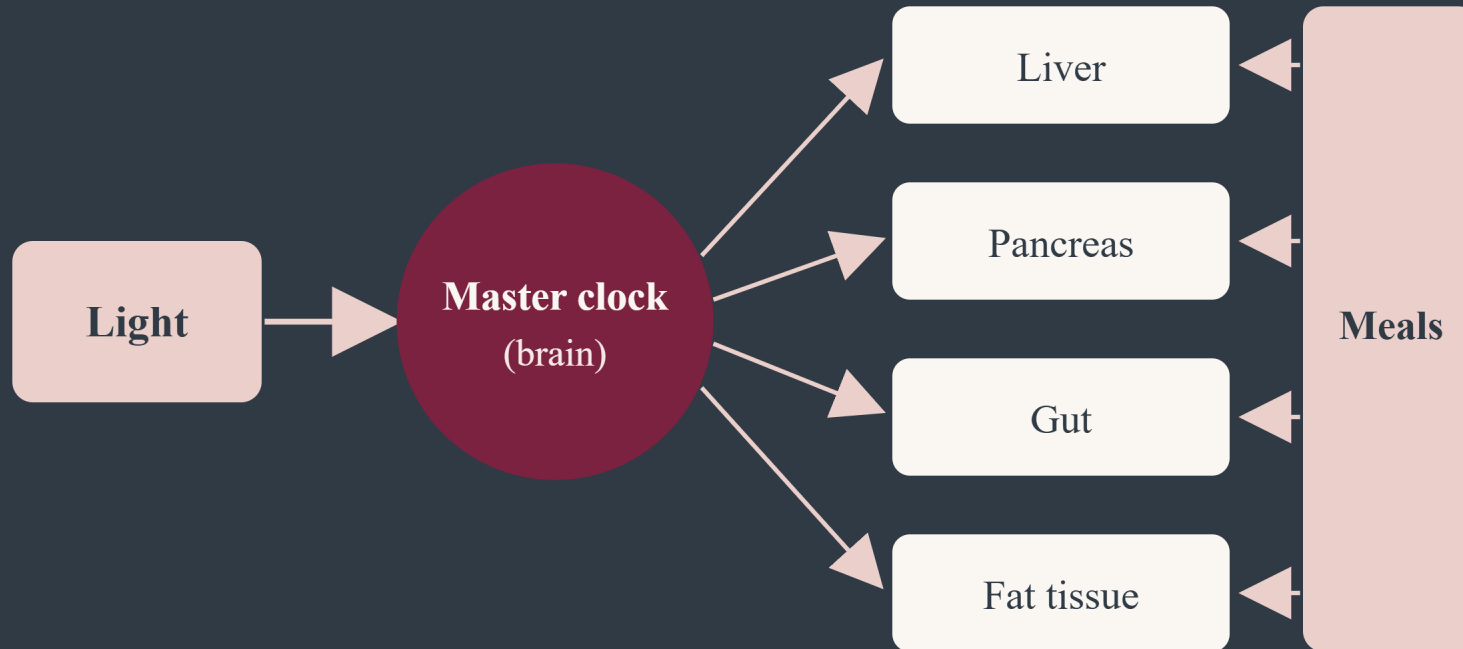
Prediction is partial

Models built on biology and lifestyle predict responses only in part.

Berry et al., Nat Med 2020

One factor appears in these models yet receives little attention in dietary guidance: *time*.

The body keeps time



A master clock in the brain is set by **light**.

Clocks in the liver, pancreas, gut and fat tissue are set largely by **when we eat**.

Light at night and late meals pull these clocks apart: **circadian misalignment**.

What my research showed

Glucose

One hour of blue light at night impaired glucose tolerance and lowered insulin in a day-active rodent.

Appetite

The same light exposure increased sugar intake, with effects that differed between males and females.

Timing and colour

In rats, effects depended on the hour of the night and the wavelength of the light.

Light is not neutral for metabolism: its timing, colour and our biology all shape the response.

The same holds in people

1 night

of sleep with moderate room light (100 lux) raised night-time heart rate and next-morning insulin resistance in healthy adults, compared with sleep in dim light.

Mason et al., PNAS 2022 (controlled laboratory study)

The effect appeared after **a single night**, in people without metabolic disease.

100 lux is **ordinary room lighting**: a lamp left on, a television, a lit street outside the window.

Daylight matters too

4.5 days

of office work by natural daylight, instead of constant artificial light, gave adults with type 2 diabetes more time in the normal glucose range.

Harmsen et al., Cell Metabolism 2026 (randomised crossover, 13 adults)

Same people, same controlled setting, **different light.**

Daylight also shifted metabolism towards **fat oxidation** and raised evening melatonin.

Most Europeans spend **80–90% of their time indoors.**

The body needs light by day as much as darkness by night.

Where night light comes from

At home

Screens, televisions and bedroom lighting in the hours before and during sleep.

In our streets

99% of people in Europe live under light-polluted skies. Sky brightness in Europe rose about 6.5% a year from 2011 to 2022.

Falchi et al., Sci Adv 2016; Kyba et al., Science 2023

At work

Night and rotating shifts place light, meals and activity in the biological night.

Light at night is now a near-universal exposure, and much of it lies beyond individual control.

Population studies point the same way

+17%

risk of gaining 5 kg or more in women sleeping with a light or TV on (43,722 women)

Park et al., JAMA Intern Med 2019

+53–67%

type 2 diabetes risk, brightest vs darkest nights, measured by wrist sensors (84,790 adults, UK Biobank)

Windred et al., Lancet Reg Health Eur 2024

+28%

diabetes prevalence where outdoor night light is brightest vs darkest (98,658 adults)

Zheng et al., Diabetologia 2023

In UK Biobank, the difference in diabetes risk between bright and dark nights was similar to the difference between low and moderate genetic risk.

Observational studies: they show associations, consistent with experimental evidence, not proof of causation.

When we eat, and when we work

Later meals

Identical meals eaten about four hours later increased hunger, lowered energy expenditure and favoured fat storage.

Vujović et al., Cell Metab 2022 (crossover trial)

Your own clock

In German twins, eating later relative to one's own internal clock was linked to lower insulin sensitivity. Meal timing was up to 60% heritable.

Vahlhaus et al., eBioMedicine 2025 (twin study)

Late lunch, less weight lost

In 420 adults in Spain, those eating their main meal after 15:00 lost less weight on the same programme.

Garaulet et al., Int J Obes 2013 (observational)

Shift work

Shift work is linked to higher odds of diabetes, highest for rotating shifts (odds ratio 1.42).

Gan et al., Occup Environ Med 2015 (meta-analysis)

Our guidelines say a great deal about what to eat, and very little about when.

Time: the missing dimension

Same meal, different hour, different light: a different metabolic response.

Unlike most personalised tools, the circadian message is affordable, universal and actionable: daylight by day, darkness at night, earlier and regular meals.

Avoiding light at night may be a simple, cost-effective recommendation, even for people at high genetic risk (Windred et al., 2024)

Do personalised programmes beat standard advice?

Trial	Personalised on	Result
Food4Me 7 EU countries, 2017	Diet, phenotype, genotype	Diets improved more than with standard advice. Adding phenotype or genotype data gave no extra benefit.
DIETFITS 609 adults, US, 2018	Genotype, insulin secretion	No genotype or insulin effect. Individual weight change ranged from –30 kg to +10 kg on the same diets.
Personal Diet Study 204 adults, US, 2022	Predicted glucose responses	No greater weight loss than a standard low-fat diet at 6 months.
ZOE METHOD 347 adults, US, 2024	Glucose, blood fats, microbiome, health history	Lower triglycerides and weight (–2.5 kg); no difference in LDL cholesterol. Company-funded.

Celis-Morales et al., Int J Epidemiol 2017; Gardner et al., JAMA 2018; Popp et al., JAMA Netw Open 2022; Bermingham et al., Nat Med 2024

Measuring individual responses: not yet reliable

0.14–0.31

Reliability of one person's glucose response to the same meal eaten twice, a week apart (1.0 would be perfect)

Hengist et al., Am J Clin Nutr 2025

0.43

Agreement between two glucose monitors worn at the same time when ranking the same person's meals (1.0 would be perfect)

Howard et al., Am J Clin Nutr 2020

Individual variation is real. Today's consumer tools do not yet capture it precisely enough to replace public guidance.

Technology must be affordable to everyone

If personalised prevention depends on a device, a subscription or high literacy, it will reach those who need it least.

More on how to make these tools affordable and accessible in my second intervention.

Four capacities personalisation must build

The field now agrees the future is multifactorial: biology, behaviour and environment. The Four Intelligences framework I have developed turns this into capacities every citizen can learn.

Nutritional

Understanding food and how one's own body responds to it, including timing and light.

Emotional

Reading hunger, fullness and emotional cues, and eating without shame.

Social

Eating within culture, family and community, and shaping healthier food environments.

Adaptive

Adjusting to changing lives: shift work, life stages, new evidence, a changing climate.

These capacities need no device, and they help people use any tool well.

A layered model for European guidance

Individual tools · validated biomarkers and devices, used where evidence shows benefit, with professional support

Context-adaptive guidance · meal timing, light and sleep, work schedules, life stage, culture, budget

Universal foundation · food-based dietary guidelines, the shared public health baseline for everyone

Beneath every layer: the four intelligences. People who understand their own hunger, rhythms and responses can personalise any guidance, with or without a device.

Five proposals for European policy

1 **Bring time and light into dietary guidance**

Meal timing, sleep, daylight and darkness in food-based dietary guidelines, and in workplace health guidance for shift and night workers (EU-OSHA).

2 **Treat light at night as an environmental health determinant**

Consider night light and daylight access in EU environmental, urban, building and public-lighting policy, alongside noise and air quality.

3 **Fund independent, long-term trials that include time**

Publicly funded studies in diverse European populations with circadian measures, via Horizon Europe (Cluster 1) and the European Partnership for Personalised Medicine.

4 **Set evidence and affordability standards**

Independent validation and algorithm transparency before health claims, and a public, low-cost route for any tool used in prevention.

5 **Make food and body literacy a public good**

Schools, primary care and parents (EU4Health), data protection under the European Health Data Space, results reported by socioeconomic group.

Dietary guidelines describe what a population needs.

People also need to understand how their own body responds to food, to time and to light.

That understanding should be a public good.

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