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Insufficient sleep and reduced insulin sensitivity in women

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1. ABSTRACT

The original study evaluated whether a moderate but prolonged reduction in sleep could alter glucose metabolism in healthy women. In a randomized crossover design, 38 women followed a condition of adequate sleep for six weeks and a restriction of approximately 1.5 hours per night for another six weeks. During the restriction, total sleep decreased by 1.34 hours per night, and fasting insulin and the HOMA-IR index—an estimate of insulin resistance based on fasting glycemia and insulin—increased. The increase in HOMA-IR was more evident in postmenopausal participants and was not explained by changes in adiposity.The publication contributes to the passage from “The Choice to Live in Health or Illness” by Dr. A. Colonnese and R. Panzironi, which states that chronic sleep restriction can reduce insulin sensitivity even without significant changes in body composition. Independent experimental studies in women, cellular analyses, and a meta-analysis of randomized trials support the same direction of effect. However, a small study suggests that the metabolic alteration also depends on the concomitant circadian disruption. Overall, the narrative is moderately confirmed, especially on an experimental level.

ONLINE ARTICLE

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MISSION

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Through articles, reviews, in-depth analyses and expert contributions, the Journal champions evidence-based medicine and science, fostering a correct interpretation of scientific data and countering misinformation. Every piece of content is developed with the aim of translating the complexity of research into understandable, useful and applicable information, while keeping intact the principles of accuracy, transparency and scientific independence.

Free from political, industrial and commercial influence, the journal stands as an authoritative and independent editorial space, dedicated to promoting scientific culture, professional development and the growth of health awareness among the public.

2. ANALYZED STUDY

The research question was whether a mild but prolonged reduction in sleep duration, similar to what many people experience in daily life, could worsen the way the body responds to insulin in women without known cardiometabolic diseases. The hypothesis was that sleeping less for several weeks would increase insulin resistance, which is the condition in which muscles, the liver, and adipose tissue respond less effectively to insulin, thus requiring a greater amount of the hormone to keep glucose under control.The relevance to paragraph 4.15 is specific: the research documents the final segment of the narrative, namely chronic sleep restriction increase in fasting insulin and HOMA-IR reduced insulin sensitivity, without the effect being mediated by changes in adiposity. In "The Choice to Live in Health or Illness" by Dr. A. Colonnese and R. Panzironi, this evidence is used to argue that insufficient sleep can contribute to metabolic dysfunction even in healthy women.As a randomized crossover study, in which participants underwent both sleep conditions, the design is suitable for evaluating a short-term causal effect of sleep restriction on the measured metabolic indicators. However, it cannot prove that every person who sleeps little will develop diabetes, nor can it establish the role of cortisol in the chain described in the book: no cortisol measurements are reported in the available material.

3. MATERIALS AND METHODS OF THE ORIGINAL STUDY

The available material is only the abstract. The study was randomized and crossover: each participant completed two six-week phases, one with adequate sleep and one with sleep restriction of 1.5 hours per night. Women aged between 20 and 75 were recruited, free of cardiometabolic diseases, with habitual sleep duration verified by actigraphy, a technique based on a wearable motion sensor. To enter the study, they had to habitually sleep between seven and nine hours per night.The final sample included 38 women, 11 of whom were postmenopausal. Fasting plasma glucose and insulin, HOMA-IR, the area under the glucose and insulin curve, the Matsuda index, and the disposition index were measured after an oral glucose tolerance test. The Matsuda index estimates insulin sensitivity during the test; the disposition index assesses whether pancreatic beta cells adequately compensate for reduced insulin sensitivity.The researchers applied linear models adjusted for baseline outcome values. They also evaluated whether changes in adiposity mediated the effects of sleep restriction. The precise method of randomization, the order of the two phases, the washout period between phases, the detailed exclusion criteria, and the complete values of the anthropometric measurements are not reported in the available material.

4. RESULTS

Sleep restriction resulted in an effective and significant reduction in total sleep time: compared to the adequate sleep condition, participants slept an average of 1.34 ± 0.04 hours less per night, with $P < 0.0001$. In practical terms, the average sleep duration during restriction was approximately 6.2 hours per night.With less sleep, fasting insulin increased. The estimated coefficient for the comparison between restriction and adequate sleep was 6.8 ± 2.8 pmol/L, with $P = 0.016$. HOMA-IR also increased by 0.30 ± 0.12 units, with $P = 0.016$. This result indicates greater insulin resistance in the sleep-restricted condition: given the same fasting glycemia, higher insulin suggests that the body must produce more of the hormone to achieve similar glucose control.The increase in HOMA-IR was more pronounced in the 11 postmenopausal women compared to the premenopausal women: 0.45 ± 0.25 versus 0.27 ± 0.13, respectively; the interaction test yielded $P = 0.042$. This indicates that, in this sample, menopausal status was associated with a more unfavorable response to sleep restriction. The result must be interpreted with caution because the postmenopausal subgroup was small.Changes in adiposity did not mediate the effect of sleep restriction on glucose metabolism outcomes. Furthermore, including adiposity as an adjustment variable did not change the results in the overall sample. The abstract does not report the full values for the area under the curve for glucose and insulin, the Matsuda index, and the disposition index; for such data, it must therefore be stated that they are not reported in the available material.

5. INTERPRETATION

The simplest interpretation of the results is that sleeping about an hour and a half less each night for six weeks made the insulin response less efficient in the women studied. The body showed an increase in fasting insulin and HOMA-IR, without this increase being explained by a change in adiposity. The result is consistent with the idea that sleep directly participates in metabolic regulation.The point supported by the study in the book's paragraph is therefore limited: chronic sleep restriction can increase indicators of insulin resistance in healthy women even without measurable changes in adiposity. The work does not, however, demonstrate the entire chain proposed in paragraph 4.15, which includes chronic stress, increased cortisol, alterations of the hypothalamic-pituitary-adrenal axis, and reduced peripheral glucose uptake. The available material does not report measurements of cortisol, the hypothalamic-pituitary-adrenal axis, or glucose uptake in individual tissues.A further limitation concerns the main indicator. HOMA-IR is useful in clinical studies and is derived from fasting values, but it does not directly measure how much glucose enters muscles and other tissues during controlled insulin stimulation. For this reason, the result reinforces the existence of a metabolic effect of prolonged sleep restriction, but it does not by itself identify all the responsible cellular mechanisms.

6. INDEPENDENT SUPPORTING EVIDENCE

The closest confirmation to the study's original population comes from a randomized crossover trial in postmenopausal women. After four nights of sleep restriction, nine analyzed participants spent approximately 5.0 hours in bed per night compared to 8.4 hours during habitual sleep. Insulin sensitivity, measured using the hyperinsulinemic-euglycemic clamp, decreased by 20% at a low insulin dose and by 12% at a high dose. The clamp is a procedure that directly measures how much glucose the body can utilize in response to a controlled amount of insulin. This study directly confirms that, in postmenopausal women, a reduction in sleep decreases insulin sensitivity; the main limitation is the small number of participants analyzed [1].A second crossover trial clarified a possible biological pathway at the level of human adipose tissue. Seven young adults, including one woman, spent four days with 4.5 or 8.5 hours in bed, with controlled diet and physical activity. After sleep restriction, fat cells required nearly triple the insulin concentration to achieve half the phosphorylation response of AKT, a protein that transmits the insulin signal inside the cell. The overall area of the cellular response was reduced by 30%, and whole-body insulin sensitivity also decreased. The study therefore supports a mechanism consistent with a reduced peripheral response to insulin, but it is not specific to women nor to chronic six-week restriction [2].A systematic review with meta-analysis synthesized 41 randomized trials of sleep restriction in healthy adults. Across the studies, sleep restriction significantly reduced insulin sensitivity, with a standardized mean difference of –0.70 and $P < 0.01$. This result reinforces the general direction of the effect observed in the analyzed study. The meta-analysis integrates different protocols, sleep durations, and measurement methods; therefore, it consolidates the overall picture but does not replace specific evidence for women of different ages and menopausal status [3].

7. CONFLICTING EVIDENCE

A three-week controlled experiment indicated that the relationship between insufficient sleep and glucose metabolism may also depend on the circadian context. In nine healthy adults subjected to chronic sleep restriction while keeping the duration of light exposure constant and minimizing disruption to the biological clock, no adverse effects on glycemia were observed after a standardized meal. In a previous group of 21 participants, however, chronic restriction accompanied by recurrent circadian misalignment was associated with a significant increase in postprandial glycemia, with $P < 0.0001$ [4].This evidence does not invalidate the result of the analyzed study, because the sample was very small, the comparisons involved different study groups, and the primary outcome was glucose tolerance after a meal, not HOMA-IR. However, it indicates that nighttime light, sleep schedule, circadian rhythm, diet, and duration of exposure can modify the magnitude of the metabolic effect. No directly conflicting evidence sufficiently relevant has been identified that demonstrates, in women with a comparable six-week

protocol, an improvement in insulin sensitivity caused by sleep restriction.

8. QUADRO COMPARATIVO E SINTESI DELLE EVIDENZE

The table distinguishes the study under review from the independent publications used to confirm or define the specific passage of the book.

Quadro comparativo

Reference	Study type	Population or model	Main result	Direction of evidence	Strength of evidence
Original study	Randomized crossover trial	38 healthy women; 11 postmenopausal; two six-week phases	Restriction of 1.34 hours of sleep per night increased fasting insulin and HOMA-IR, regardless of adiposity	direct confirmation	moderate
[1]	Crossover RCT	9 postmenopausal women analyzed	Four nights of restriction reduced insulin sensitivity measured by clamp by 20% and 12%	direct confirmation	moderate
[2]	Crossover RCT with cellular analysis	7 young adults; adipocytes from subcutaneous adipose tissue	Restriction reduced the AKT response to insulin in adipocytes and total insulin sensitivity	biologically consistent evidence	moderate
[3]	Systematic review and meta-analysis of RCTs	41 randomized trials in healthy adults	Sleep restriction significantly reduced insulin sensitivity	indirect confirmation	moderate
[4]	Controlled experimental study	9 healthy adults with chronic restriction and reduced circadian disruption; comparison with 21 adults from a previous study	With a protected circadian rhythm, no adverse effects on postprandial glycemia emerged after three weeks	discordant evidence	preliminary

9. SINTESI EDITORIALE E CONCLUSIONI

CONCLUSIONS

The study analyzed directly supports the finding that six weeks of reduced sleep can increase fasting insulin and HOMA-IR in healthy women, without the effect being explained by changes in adiposity. The signal appeared more pronounced after menopause, but this finding requires validation in larger samples. Independent evidence confirms quite consistently that sleep restriction reduces insulin sensitivity; the precise mechanism and the relative roles of cortisol, nighttime light, and circadian misalignment remain to be clarified.

Aggiornato al 24/11/2026. Questo contenuto riflette una sintesi divulgativa delle evidenze scientifiche al momento della pubblicazione e non sostituisce il parere medico.

10. TRANSPARENCY AND SCIENTIFIC RESPONSIBILITY

Artificial Intelligence was used solely as a tool for editorial and documentary support. All content, interpretations, bibliographic citations and conclusions have been verified, reviewed and approved by the author, who assumes full scientific responsibility for them.

The manuscript was also subjected to independent peer review prior to publication.

To ensure the greatest transparency, the complete history of the article, including the dates of submission, revision, acceptance and publication, as well as information on the peer review process, is available on the dedicated Article History page.

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