LIFE Science Hub
JOURNAL OF SCIENCE
EXPANDING KNOWLEDGE ABOUT NUTRITION AND HEALTH

ORIGINAL RESEARCH
ISSN 2845-7501

Effects of dexamethasone on insulin action in isolated rat adipocytes

M. Moscati[1]

1 Italy

1. ABSTRACT

The analyzed study evaluated whether dexamethasone, a synthetic glucocorticoid, modified the way isolated rat adipocytes bind insulin, take up glucose, and use it to produce energy. Under the reported experimental conditions, the treatment reduced both glucose transport and oxidation by 30-40% at rest and with low insulin concentrations, with no differences in insulin binding to the cell.In paragraph 4.14 of “The Choice to Live in Health or Illness” by Dr. A. Colonnese and R. Panzironi, the publication contributes to the narrative that glucocorticoids can reduce glucose uptake and utilization in adipose tissue. Independent evidence confirms that dexamethasone can decrease glucose entry into adipose cells and, in some models, reduce components of insulin signaling. However, results vary based on the adipose depot and the cellular model. Confirmation is therefore primarily mechanistic and does not equate to a direct clinical demonstration in humans.

ONLINE ARTICLE

ARTICLE INFORMATION

Published: November 22, 2026
Updated: November 22, 2026

DOI 10.5281/zenodo.24447244

MISSION

LIFE Science Hub – Journal of Science was founded with the aim of making scientific knowledge accessible without giving up methodological rigour, quality of sources and authoritativeness of content. The journal promotes the dissemination of knowledge in the health, nutrition, medical and longevity sciences, building a bridge between the world of research and society.

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 dexamethasone could reduce glucose utilization in adipocytes, i.e., in adipose tissue cells, by acting on insulin binding to the cell or at a subsequent step. The authors' hypothesis was that the drug directly interferes with the system that allows glucose to enter the cell.The research is relevant to section 4.14 of "The Choice to Live in Health or Illness" by Dr. A. Colonnese and R. Panzironi because it documents a specific segment of the narrative: after exposure to dexamethasone, rat adipocytes showed lower glucose uptake and lower glucose oxidation. Oxidation is the process by which the cell uses glucose to obtain energy.The study did not measure IRS-1, IRS-2, PI3K, or AKT. IRS-1 and IRS-2 are proteins that transmit the signal initiated by insulin inside the cell; they are not glucose transporters. Consequently, the publication can support the reduction of glucose transport and utilization in adipocytes, but it does not directly demonstrate that this reduction depends on IRS-1, IRS-2, or the PI3K/AKT pathway.

3. MATERIALS AND METHODS OF THE ORIGINAL STUDY

The study was conducted *in vitro*, meaning on adipocytes isolated from rats and studied outside the organism. The cells were exposed to dexamethasone at concentrations described by the authors as therapeutically achievable in humans. The exact concentration, duration of incubation, number of animals, and number of cell preparations are not reported in the available material, which consists only of the abstract.The authors evaluated three aspects: insulin binding to adipocytes; glucose transport, measured through the uptake of carbon-14 labeled 2-deoxy-glucose; and glucose oxidation. 2-deoxy-glucose is a glucose analog used to estimate how much sugar enters the cell, because it is taken up but does not normally follow all subsequent metabolic transformations.Measurements were performed without insulin, with low insulin concentrations below 25 microU/mL, and with maximal concentrations above 100 microU/mL. The control group consisted of adipocytes not treated with dexamethasone. Statistical procedures, P-values, confidence intervals, and inclusion or exclusion criteria are not reported in the available material.

4. RESULTS

The main result was a reduction in the ability of fat cells to use glucose when insulin was absent or present at low concentrations. In adipocytes treated with dexamethasone, glucose oxidation decreased by 30-40% compared to controls, both in the basal state and with insulin levels below 25 microU/mL. However, at maximal insulin concentrations exceeding 100 microU/mL, the authors observed no differences in glucose oxidation between treated cells and control cells.To clarify whether the lower energy utilization of glucose depended on reduced entry into the cell, the authors measured 2-deoxy-glucose uptake. This parameter also decreased by 30-40% in adipocytes exposed to dexamethasone, both without insulin and at all insulin concentrations examined. Simply put, less glucose entered the treated cells.Insulin binding to adipocytes showed no differences between treated cells and controls. This finding suggests that, under the *in vitro* conditions of the study, the reduced glucose uptake was not explained by a lower capacity of insulin to bind to the cell surface. The absolute values of the measurements, the experimental sample size, and the statistical values are not reported in the available material.

5. INTERPRETATION

For an adipose cell, reducing glucose entry means having less substrate to use or transform. The analyzed study indicates that dexamethasone can hinder this process in rat adipose cells and that, under these conditions, the lower glucose oxidation seems to result primarily from its reduced transport into the cell.The segment of the chain directly supported by the publication is therefore: exposure to dexamethasone reduction of glucose transport in adipocytes reduction of glucose oxidation. The data on insulin binding is important because it did not show a decrease in the binding of the hormonal signal to the cellular receptor.The book's paragraph expands on this narrative by including IRS-1, IRS-2, and the PI3K/AKT pathway. This extension is biologically plausible in light of subsequent studies, but it does not derive directly from the analyzed research. Furthermore, the result concerns isolated rat adipocytes and does not prove on its own that the

effect occurs with identical intensity in human adipose tissue or that it directly causes systemic insulin resistance.

6. INDEPENDENT SUPPORTING EVIDENCE

Confirmation closely aligned with the narrative of this paragraph comes from rat adipocytes cultured for 24 hours with dexamethasone. In this model, the drug reduced both basal and insulin-stimulated uptake by approximately 40-50%. It also reduced IRS-1 expression by about 75%, PI3K content by about 20%, and PKB/AKT content by about 45%; insulin-induced PKB phosphorylation decreased by approximately 40%. Phosphorylation is a chemical modification that often activates or regulates a protein. This study therefore confirms both the reduction in glucose uptake and, in an independent model, a possible involvement of intracellular insulin signaling [1].A previous experiment on cultured primary adipocytes had already shown that dexamethasone reduced basal transport and transport maximally stimulated by insulin. After acute exposure, the drug reduced the number of glucose transporters present in the membrane; after 24 hours, it also decreased the total number of cellular transporters. This finding supports the idea that the defect may involve the availability or translocation of transporters to the membrane, rather than just insulin binding [2].Evidence in human adipose cells has added an element of biological relevance, as well as tissue specificity. In omental—that is, visceral—adipocytes taken from 18 non-diabetic subjects, dexamethasone reduced basal and insulin-stimulated uptake by approximately 50% and decreased IRS-1 by about 40% and PKB by about 20%. In subcutaneous adipocytes from the same study, no consistent effect on uptake emerged. Therefore, the mechanism appears possible in humans, but not uniform throughout all adipose tissue [3].

7. CONFLICTING EVIDENCE

A result directly relevant to, yet not overlapping with, the linear narrative that glucocorticoids always reduce insulin signaling in adipocytes was observed in a differentiated human subcutaneous adipocyte cell line. In these cells, treatment with dexamethasone for 24 hours or 7 days increased insulin-stimulated phosphorylation of IRS-1 and AKT/PKB, a result consistent with an increase in intracellular insulin signaling [4].This study does not prove that dexamethasone improves whole-body insulin sensitivity. The authors themselves studied a subcutaneous cell model and not visceral adipose tissue, muscle, or the human organism as a whole. However, it shows that the effects of glucocorticoids can depend on the type of adipocyte, the duration of exposure, and the metabolic context. This discrepancy limits the possibility of describing dexamethasone as a uniform inhibitor of the IRS-1/PI3K/AKT pathway in every adipose depot.

8. QUADRO COMPARATIVO E SINTESI DELLE EVIDENZE

The table distinguishes the publication covered in the review from independent research that confirms or defines the biological pathway discussed in the book's paragraph.

Quadro comparativo

Reference	Study type	Population or model	Main result	Direction of evidence	Strength of evidence
Original study	In vitro cellular	Isolated rat adipocytes	Dexamethasone reduced glucose transport and oxidation by 30-40%, with no differences in insulin binding.	direct confirmation	moderate
[1]	In vitro cellular	Cultured primary rat adipocytes	Reduction in glucose uptake and decrease in IRS-1, PI3K, and PKB/AKT after dexamethasone.	direct confirmation	moderate
[2]	In vitro cellular	Cultured primary adipocytes	Reduction in glucose transport and lower availability of transporters in the membrane and cell.	direct confirmation	moderate
[3]	Ex vivo cellular	Omental and subcutaneous adipocytes from 18 non-diabetic subjects	Dexamethasone reduced glucose uptake in omental adipocytes, but not consistently in subcutaneous ones.	direct confirmation	moderate
[4]	In vitro cellular	Differentiated human subcutaneous adipocyte line	Il desametasone ha aumentato la fosforilazione di IRS-1 e AKT/PKB indotta dall'insulina.	discordant evidence	preliminary

9. SINTESI EDITORIALE E CONCLUSIONI

CONCLUSIONS

The analyzed study directly supports the finding that dexamethasone can reduce glucose transport in isolated rat adipocytes and that this reduction is accompanied by lower glucose oxidation. Independent evidence confirms a decrease in glucose uptake in various adipose models, and at times, alterations in proteins involved in insulin signaling.The link to IRS-1, IRS-2, and PI3K/AKT, however, requires a cautious formulation. IRS-1 and IRS-2 are not glucose transporters, and the original study did not evaluate them. Overall, the narrative of the paragraph is supported at a mechanistic level, with variability dependent on the adipose depot and the experimental model. Further confirmation in humans is necessary to define the clinical relevance of the complete chain.

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.

11. RIFERIMENTI BIBLIOGRAFICI

[1] **Dexamethasone impairs insulin signalling and glucose transport by depletion of insulin receptor substrate-1, phosphatidylinositol 3-kinase and protein kinase B in primary cultured rat adipocytes**
Buren et al., 2002
European Journal of Endocrinology
DOI: https://doi.org/10.1530/eje.0.1460419

[2] **Dexamethasone Regulates the Glucose Transport System in Primary Cultured Adipocytes: Different Mechanisms of Insulin Resistance After Acute and Chronic Exposure***
GARVEY et al., 1989
Endocrinology
DOI: https://doi.org/10.1210/endo-124-5-2063

[3] **Short- and long-term glucocorticoid treatment enhances insulin signalling in human subcutaneous adipose tissue**
Gathercole et al., 2011
Nutrition & Diabetes
DOI: https://doi.org/10.1038/nutd.2010.3

[4] **Glucocorticoids Down-Regulate Glucose Uptake Capacity and Insulin-Signaling Proteins in Omental But Not Subcutaneous Human Adipocytes**
Lundgren et al., 2004
The Journal of Clinical Endocrinology & Metabolism
DOI: https://doi.org/10.1210/jc.2003-031157