Abstract: High-fat diets induce whole-body insulin resistance. The aim of this study was to compare the effect of two interventions: 3-day food restriction (66% of ad libitum fed) and 3-day exercise training (voluntary running wheels), on decreased insulin-mediated whole body glucose uptake in high-fat fed rats (5 mo old) using the hyperinsulinemic euglycemic clamp procedure. The control group was maintained on rat chow alone. After high-fat feeding for 2 wk, insulin-stimulated whole body glucose utilization was significantly decreased by 26%. The exercise training was more effective than food restriction in lowering plasma concentrations of insulin and triacylglycerol and tissue concentrations of triacylglycerol in soleus muscles. Diminished whole-body glucose uptake resulting from high-fat feeding was reversed completely by exercise training, but only partially by food restriction.

The time course of starvation on insulin-stimulated glucose uptake was also observed in high-fat fed rats. Although the extension of starvation time to 48h resulted in decreased plasma glucose, insulin and triacylglycerol concentrations, whole body glucose uptake did not increase further.

These findings suggest that short-term exercise has a higher restorative effect on insulin sensitivity in high-fat fed rats than food restriction, in spite of the same loss in body weight, presumably due in part to improved local lipid availability.


Keywords: hyperinsulinemic euglycemic clamp, insulin resistance, dietary fat, training, food restriction
in vivo

In vivo studies were performed as described previously for the determination of glucose disposal rates. The aim was to study the effect of different interventions on glucose metabolism in vivo. This was done by measuring glucose disposal rates during euglycemic clamp studies.

Animal and experimental design

Animal and experimental design were performed as described previously. The aim was to study the effect of different interventions on glucose metabolism in vivo. This was done by measuring glucose disposal rates during euglycemic clamp studies.

Measurement of in vivo glucose disposal by euglycemic clamp studies

In vivo studies were performed as described previously for the determination of glucose disposal rates. The aim was to study the effect of different interventions on glucose metabolism in vivo. This was done by measuring glucose disposal rates during euglycemic clamp studies.

Plasma, liver and muscle lipid assay

Plasma, liver and muscle lipid assay were performed as described previously for the determination of glucose disposal rates. The aim was to study the effect of different interventions on glucose metabolism in vivo. This was done by measuring glucose disposal rates during euglycemic clamp studies.
Statistical analysis

Body weight and food intake

Plasma glucose, insulin, and lipids levels

Liver and muscle triacylglycerol levels and abdominal fat accumulation

In vivo glucose disposal

<table>
<thead>
<tr>
<th></th>
<th>( )</th>
<th>( )</th>
<th>( )</th>
<th>( )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statistical analysis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Body weight and food intake</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plasma glucose, insulin, and lipids levels</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liver and muscle triacylglycerol levels and abdominal fat accumulation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In vivo glucose disposal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Reversal of diet-induced insulin resistance

S. Sakamoto et al.
et al. investigated the in vitro and in vivo effects of

In vitro investigations were performed on human

The Journal of Medical Investigation Vol. 47 2000
S. Sakamoto et al.
Reversal of diet-induced insulin resistance