The Promise of Low Carb Diets
"the metabolic effects of carbohydrate [to increase insulin] cause the adipocyte to take in, store, and trap too many calories. Subsequently, energy expenditure declines and hunger increases"
Fat Loss Requires Carbohydrate Reduction?

“Any diet that succeeds does so because the dieter restricts fattening carbohydrates…Those who lose fat on a diet do so because of what they are not eating – the fattening carbohydrates”

Gary Taubes, Why we get fat and what to do about it (2011).
Isocaloric 30% Calorie Restricted Diets

Only RC Diet Decreased Insulin Secretion

Mean ± 95% CI

p = 0.001

* p<0.01 vs baseline

N=19 men & women with obesity

Only RC Diet Increased Fat Oxidation

Burning Carbs

Burning Fat

N=19 men & women with obesity


Mean ± 95% CI

** p<0.001
More Cumulative Body Fat Loss with RF

** N=19 men & women with obesity

Mean ± 95% CI
** p<0.001

Only RC *Decreases* Energy Expenditure

<table>
<thead>
<tr>
<th>Δ Energy Expenditure (kcal/d)</th>
<th>Sleep</th>
<th>24 hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>RC data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RF data</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **p = 0.0024**
- **p = 0.099**

NS

* * p<0.005 vs baseline

Recently, a study in *Cell Metabolism* by Kevin Hall from the National Institutes of Health attracted a lot of buzz in the news and online…[but] **there were some real problems with the study**

- The **low-carb diet wasn’t low at all**, actually, with 29 percent of calories coming from carbs, including refined carbs. A true low-carb diet would have less than 10 percent of calories from carbs.
- It was a **very short-duration study (only six days)** conducted on only nineteen people who were contained in a metabolic ward where all the food was provided…It showed what happened in a vacuum but not in real life.

  Mark Hyman, MD  
  *Eat Fat, Get Thin* (2016)
Hypothetical Extended Duration Study

Fat Adaptation?
2 Month Isocaloric Ketogenic Diet Study

Day -28  Day -15  Day 0  Day 15  Day 28

4 weeks inpatient Baseline Diet  4 weeks inpatient Low Carb Ketogenic Diet

Energy Intake Adjustment  Energy Intake Clamped

2 days residing in metabolic chamber

DLW dose  DXA

No Diet Effect on 24hr Energy Expenditure

N=17 men with overweight and class I obesity

Mean ± 95% CI

P = 0.21

Baseline

Ketogenic

KD Hall et al. AJCN 104:1488-90 (2016).
Small & Transient Increase in Expenditure

N=17 men with overweight and class I obesity

Δ EEchamber (kcal/d)

Mean ± 95% CI

*p<0.0045

Increased N Excretion post Ketogenic Diet

N=17 men with overweight and class I obesity

Loss of Body Fat **Slows** post Ketogenic Diet

N=17 men with overweight and class I obesity

Rapid & Persistent Shift to Fat Oxidation

N=17 men with overweight and class I obesity

Burning Carbs

Δ 24hr RQ

Burning Fat

Mean ± 95% CI

*p<0.0045

**

Fat Adaptation?


p<0.0045
Energy Expenditure: Isocaloric Carb vs. Fat

Pooled weighted mean difference

P < 0.0001

Body Fat: Isocaloric Carb vs. Fat

Pooled weighted mean difference

P < 0.0001


Weighted Mean Difference in Body Fat (g/d)
How a Low-Carb Diet Might Help You Maintain a Healthy Weight

Adults who cut carbohydrates from their diets and replaced them with fat sharply increased their metabolisms.
“The pre-weight-loss value…, rather than [post-weight-loss], was originally specified in the registry as the anchor for calculating change scores, but this error was corrected…”

Two potential points of comparison:
Pre Weight Loss vs Post Weight Loss
Ebbeling et al. BMJ 2018 Reanalysis

![Bar chart showing Δ Energy Expenditure vs. High Carb (kcal/d)]

- Mod Carb: P = 0.35
- Low Carb: P = 0.0002 vs. Post-weight loss
- Low Carb: P = 0.38 vs. Pre-weight loss

Mean ± SE

[https://www.biorxiv.org/content/early/2019/01/02/476655](https://www.biorxiv.org/content/early/2019/01/02/476655)
Dr. David Ludwig @davidludwigmd · 22h
Our recent study on metabolic advantage of low-carbohydrate diets has provoked a rapidly evolving series of attacks from a few critics. Our latest response is online @bmj_latest.
➡️ Bottom line: Do a weaker analysis, get a weaker result.
➡️ No big surprise.
bmj.com/content/363/bm...

Samuele Marcora @SamueleMarcora

Replying to @davidludwigmd and @bmj_latest
Why did you originally plan a weaker analysis then?
11/29/18, 5:00 PM
No Significant Diet Effect on CO₂ Production

![Graph showing the comparison of CO₂ production rates between Mod Carb and Low Carb diets versus pre- and post-weight loss conditions. The graph includes error bars and p-values for each comparison.]

https://www.biorxiv.org/content/early/2019/01/02/476655
TEE Diet Effect Depends on Assumed $\Delta RQ$
Unaccounted Calories ⇒ Uncertain RQ

What About Energy Intake? DIETFITS Trial


Low Carb (N=209)

Low Fat (N=205)

* p<0.05
The Key to Weight Loss Is Diet Quality, Not Quantity, a New Study Finds

A O’Connor New York Times
February 20, 2018
Can We Transcend the Diet Wars?

Low Carb  Low Fat
Common Theme: Avoid Ultra-processed Food

Unprocessed or minimally processed foods include fresh, dried, or frozen vegetables, grains, legumes, fruits, meats, fish, eggs, and milk. They are the basis of healthy dishes and meals.

Ultra-processed foods include fast food, sugary drinks, snacks, chips, candies, cookies, sweetened milk products, sweetened cereals, and sauce and dressings. They are nutritionally poor.
Ultra-processed vs Unprocessed Diets

The meals had the same amount of:
Calories, Carbs, Fat, Protein, Sugar, Sodium, Fiber

20 Adults were instructed to eat as much or as little as desired

Primary Outcome: Energy Intake Differences

https://osf.io/preprints/nutrixiv/w3zh2
Ultra-processed vs Unprocessed Diet Study

https://osf.io/preprints/nutrixiv/w3zh2
Ultra-processed Diets Cause Increased Intake

https://osf.io/preprints/nutrixiv/w3zh2
More Carbs & Fat with Ultra-processed Diets

 https://osf.io/preprints/nutrixiv/w3zh2
Ultra-processed Diets Cause Weight Gain

https://osf.io/preprints/nutrixiv/w3zh2
Ultra-processed Diets Cause Fat Gain

https://osf.io/preprints/nutrixiv/w3zh2

https://osf.io/preprints/nutrixiv/w3zh2
Highly Correlated Weight & Intake Changes

https://osf.io/preprints/nutrixiv/w3zh2
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many people
infinite possibilities

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