Long- and Short-Term Cardiometabolic Health Effects of Low Carb Diets

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Obesity increasing in epidemic proportions

Predisposes to type 2 diabetes

**FIGURE 1.** Age-adjusted relative risk (RR) of type 2 diabetes by baseline waist circumference (WC), waist-to-hip ratio (WHR), and BMI deciles. $n = 27,270$.

Mainstream lifestyle recommendations for maintaining a healthy body weight based on:

- healthy balanced diet (moderate-high carbohydrate)
- sufficient physical activity
While mainstream lifestyle recommendations are effective for weight management, many people have difficulty complying.

People are looking for “easier options”
“unconventional” diets emerging which promise greater benefits for less effort
Low-carb diets one of the most popular

Dr Atkins Diet Books

2nd edition (2002) sold >50,000 copies in Australia (APA Bestseller Survey)

Hollywood celebrities

Brad Pitt reported using a low-carb diet when preparing for Troy
Increasing range of low-carbohydrate products entering the market-place.

From: www.atkins.com
More people asking health professionals about potential benefits of low-carb diet

“You’re very low in carbohydrates, Humpty. I’m surprised you’re not a lot thinner!”

From: www.glasbergen.com
What is a low-carbohydrate diet?
No standard definition

Low carbohydrate diet generally considered to be 30 – 130 g CHO/day (~6 – 30% energy intake)\(^1\)

Atkins diet

20g CHO/day (~4-5% energy intake) for weight loss

40g CHO/day (~8-10% energy intake) for weight maintenance

\(^1\) Hite et al. Nutr Clin Pract 26:300, 2011
Is there any evidence to support benefits of low-carbohydrate diets?
Low-carb *ad libitum* diet vs energy-restricted low-fat diet resulted in greater weight loss over 6 months \(^1,^2,^3\)

Conflicting findings over 12 months\(^1,^4\)

Meta-analysis of RCT’s with *ad libitum* intake concluded greater weight loss over 6 months but not 12 months\(^5\)

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Ad libitum approach makes it difficult to interpret mechanism underlying greater initial weight loss

May be due to:

- voluntary energy-restriction
- "metabolic benefit" of low-carb intake
We sought to examine the effect of a low-carbohydrate diet without potential confounding by differences in energy intake.
• 118 overweight/obese adults
• 12 month intervention
• Low-carbohydrate, high-saturated-fat diet (Atkin’s Diet)
  - 4% carbohydrate
  - 35% protein
  - 61% fat (20% saturated fat)
• Low-fat moderate-carbohydrate diet
  - 46% carbohydrate
  - 24% protein
  - 30% fat (<8% saturated fat)
• Diets were isocaloric (6-7 MJ/d, 30% energy-deficit)

Greater weight loss (8.1 vs 6.7 kg) over 8 weeks\(^1\) but not over 6 months\(^2\) or 12 months\(^3\)

Adapted from: Brinkworth et al. Obesity 17:1916-1923, 2009

Summary of weight loss effects

Low-carbohydrate diets (ad libitum or isocaloric) promote greater weight-loss than conventional diets over the short-term.

Does not appear to be due to differences in energy-intake.

Most evidence favours no greater weight-loss over the longer-term.

But continue to lose as much weight as with conventional diet.
Are there other health benefits of a low-carbohydrate diet?
We showed short-term effects (2 mo) of low-carbohydrate diet on traditional CVD risk factors similar to low-fat diet \(^1\) except:

- **greater improvements** in:
  - HDL
  - triglycerides

- **lesser improvements** in:
  - Total cholesterol
  - LDL

\(^1\) Keogh et al. Am J Clin Nutr 2008;87:567-576
Long-term effects similar to low-fat diet except\(^1\):

- **greater improvements** in
  - HDL
  - triglycerides

- **increased**:
  - Total cholesterol
  - LDL

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\(^1\) Brinkworth et al. Am J Clin Nutr 2009;90:23-32
Increase in LDL raised concern of longer-term adverse effect on CVD risk.
Recent meta-analysis showed increase in LDL over 6 months, but decrease over longer term.\(^1\)

Meta-analysis allayed some fears in relation to long term adverse effects of low-CHO diets on CVD risk

Summary of cardiometabolic effects

Similar benefits for traditional CVD risk factors as other diets, except for:

- short term increases in LDL
- greater increases in HDL
- greater decreases in triglycerides
OTHER benefits?

HOWEVER!
12 months of low-carbohydrate diet impaired brachial artery flow-mediated dilatation\textsuperscript{1}.

Other benefits?

Prognostic marker for future cardiac events\textsuperscript{2,3}

Impairment of FMD associated with increase in depression scores

Improvements in anxiety, depression and mood attenuated on a low-carb diet \(^1\)

Impaired FMD also prognostic marker for future cardiac events$^{1,2}$

From: www.whatisaheartattack.net
Despite adverse effect on FMD, recent meta-analysis of observational studies indicated low-carb intake not associated with increased incidence of CVD or risk of CVD mortality\textsuperscript{1}

\begin{figure}
\centering
\includegraphics[width=\textwidth]{figure1.png}
\caption{(A) Low-carbohydrate score}
\end{figure}

\begin{table}
\centering
\begin{tabular}{|l|c|c|}
\hline
Study & Weight & Risk Ratio IV, Random, 95\% CI \\
\hline
Lagiou, 2007 & 1.0\% & 2.36 [0.69, 8.02] \\
Fung, 2010 & 91.0\% & 1.08 [0.95, 1.22] \\
Nilsson, 2012 & 8.0\% & 1.22 [0.80, 1.86] \\
Total (95\% CI) & 100.0\% & 1.10 [0.98, 1.24] \\
\hline
\end{tabular}
\end{table}

Heterogeneity: $\tau^2 = 0.00$; $\chi^2 = 1.81$, df = 2 ($P = 0.41$); $I^2 = 0\%$

Test for overall effect: $Z = 1.55$ ($P = 0.12$)

\textsuperscript{1} Noto et al. PlosOne 8:e55030, 2013
Summary

Weight loss with low-carb diet
- slightly better than conventional diet over short-term
- similar over the longer-term

Traditional CVD risk factors improved
- greater improvements in HDL
- greater improvements in triglycerides

Some evidence of adverse effects on FMD and mood, but no increase in CVD incidence or mortality
Summary

Jury still out on some aspects of low carbohydrate dietary pattern
Likely to remain popular
due to food choices available
Collaborators

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University of South Australia

Professor Peter Clifton
Associate Professor Jennifer Keoghs

Funding agencies:

National Health and Medical Research Council of Australia
National Heart Foundation of Australia
Diabetes Australia Research Trust