비만치료를 위한 식사

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비만치료를 위한 식사

Diet protocol

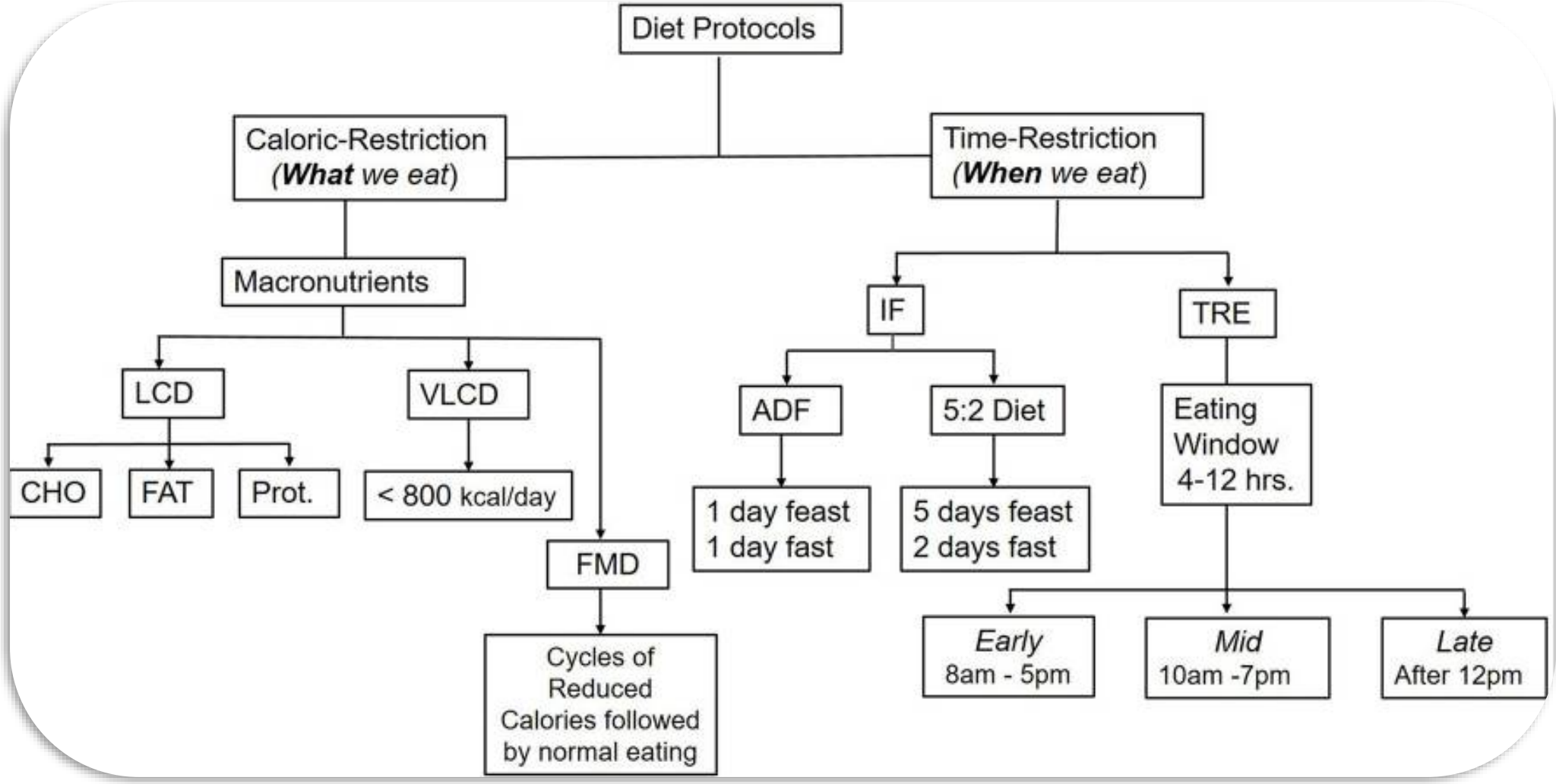
- What we eat?
- When we eat?

→

Weight loss/risk factors changes

Variability between individuals
Food quality
Guidelines

Caloric-restriction and time-restriction diet protocols



Low-calorie diet (LCD); Very low-calorie diet (VLCD); Intermittent fasting (IF); Time-restricted eating (TRE); Fasting-mimicking diets (FMD); Alternate day fasting (ADF)

Front Public Health. 2022;10:1017254

강의 내용

- Diet therapy models
  - Energy balance/Carbohydrate-insulin
  - Time restriction
- Calorie-focused diets
- Macronutrients-focused diets
- Energy density
- Time restriction-focused diets

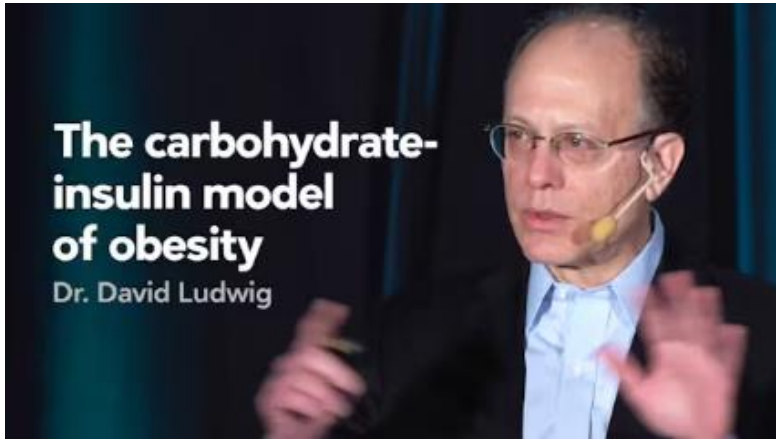
- Variability in weight loss
- Food quality
- Diet guidelines

에너지균형 vs 탄수화물-인슐린

- Energy balance model
  - Body weight is regulated by the brain in response to external signals from the food environment that are integrated with internal signals to control food intake below our conscious awareness.
- Carbohydrate-insulin model
  - Increases in the consumption of processed, high-glycemic-load carbohydrates produce hormonal changes that promote calorie deposition in adipose tissue, exacerbate hunger, and lower energy expenditure

"Our data clearly don't support the carbohydrate-insulin model [or really] the passive-overconsumption model."

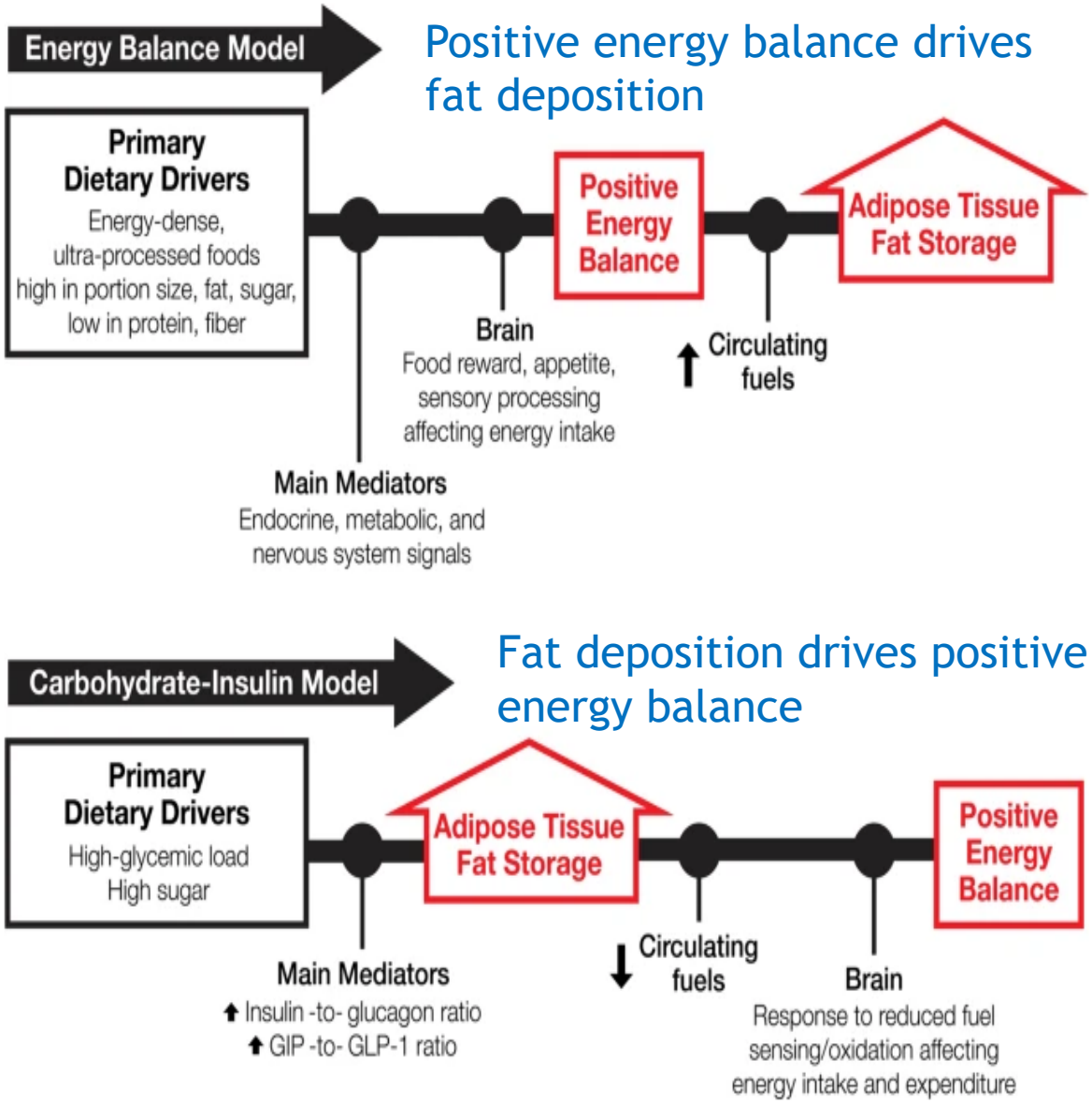
Kevin D. Hall, PhD



JAMA Intern Med 2018;178:1098

Am J Clin Nutr. 2022; 115: 1243

Fig. 1: Contrasting causal pathways in obesity models.



Eur J Clin Nutr 2022;76:1209

- **Energy balance model**
  - **Calorie restriction**
    - Low in food energy density, ultra-processed foods, portion size, fat, and sugar, high in protein and fiber

- **Carbohydrate-Insulin Model**
  - **Replace carbohydrates**
    - dietary fat, which does not stimulate postprandial insulin secretion: low-carb, high-fat or “ketogenic” diet

Science 2021;372:577

Competing paradigms of obesity pathogenesis: energy balance versus carbohydrate-insulin models

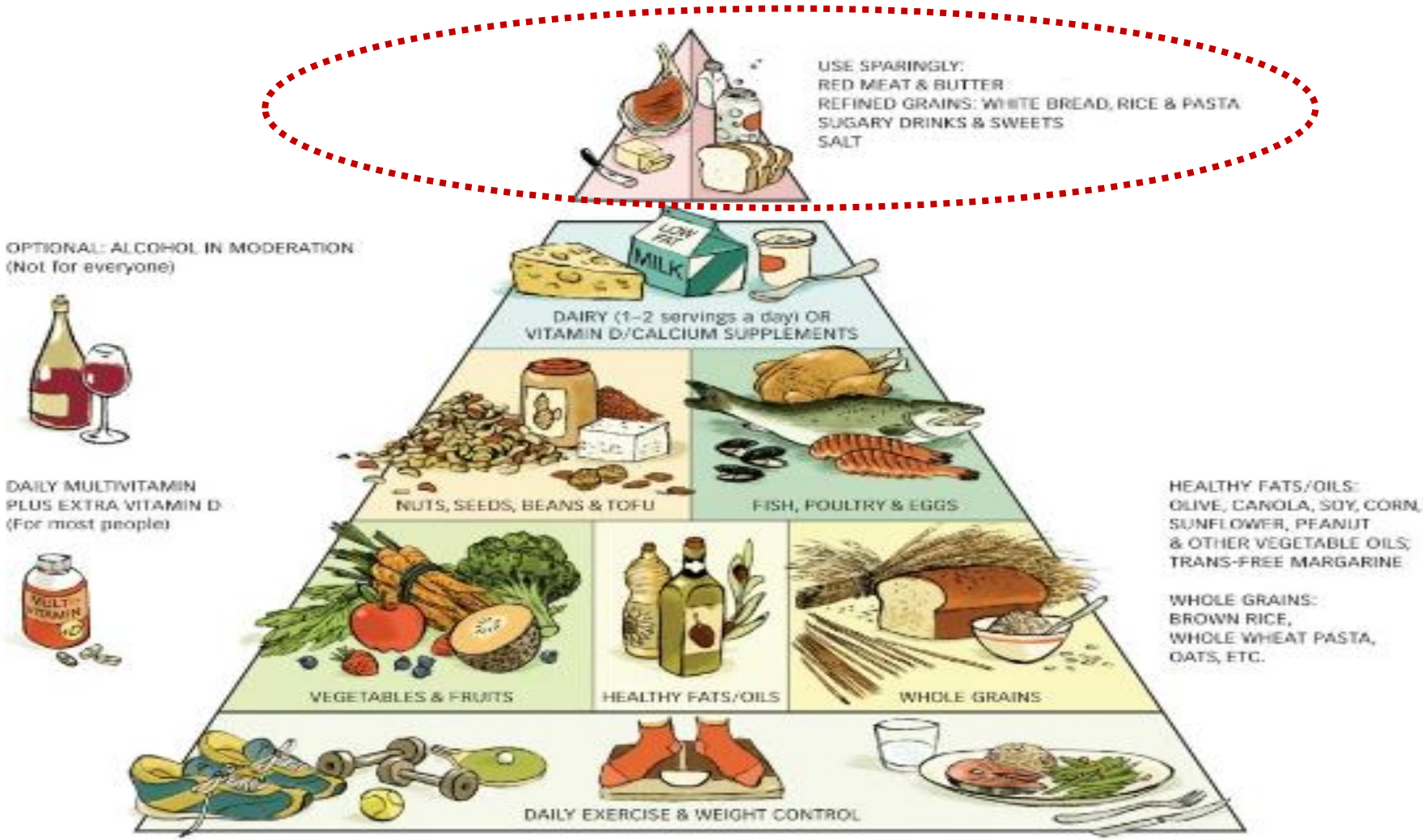
A constructive paradigm clash may be facilitated with the recognition that obesity pathogenesis in humans may entail elements of both.

Finally, we would emphasize that this paradigm clash should not delay public health action. Refined grains and added sugars comprise about one-third of energy intake in the US and Europe. Both models target these **highly processed carbohydrates—albeit for different reasons—as major drivers of weight gain**.

Regardless of how this debate may evolve, common ground now exists on the need to replace these products with **minimally processed carbohydrates or healthful fats** in the prevention and treatment of obesity.

Eur J Clin Nutr 2022;76:1209

Healthy eating pyramid



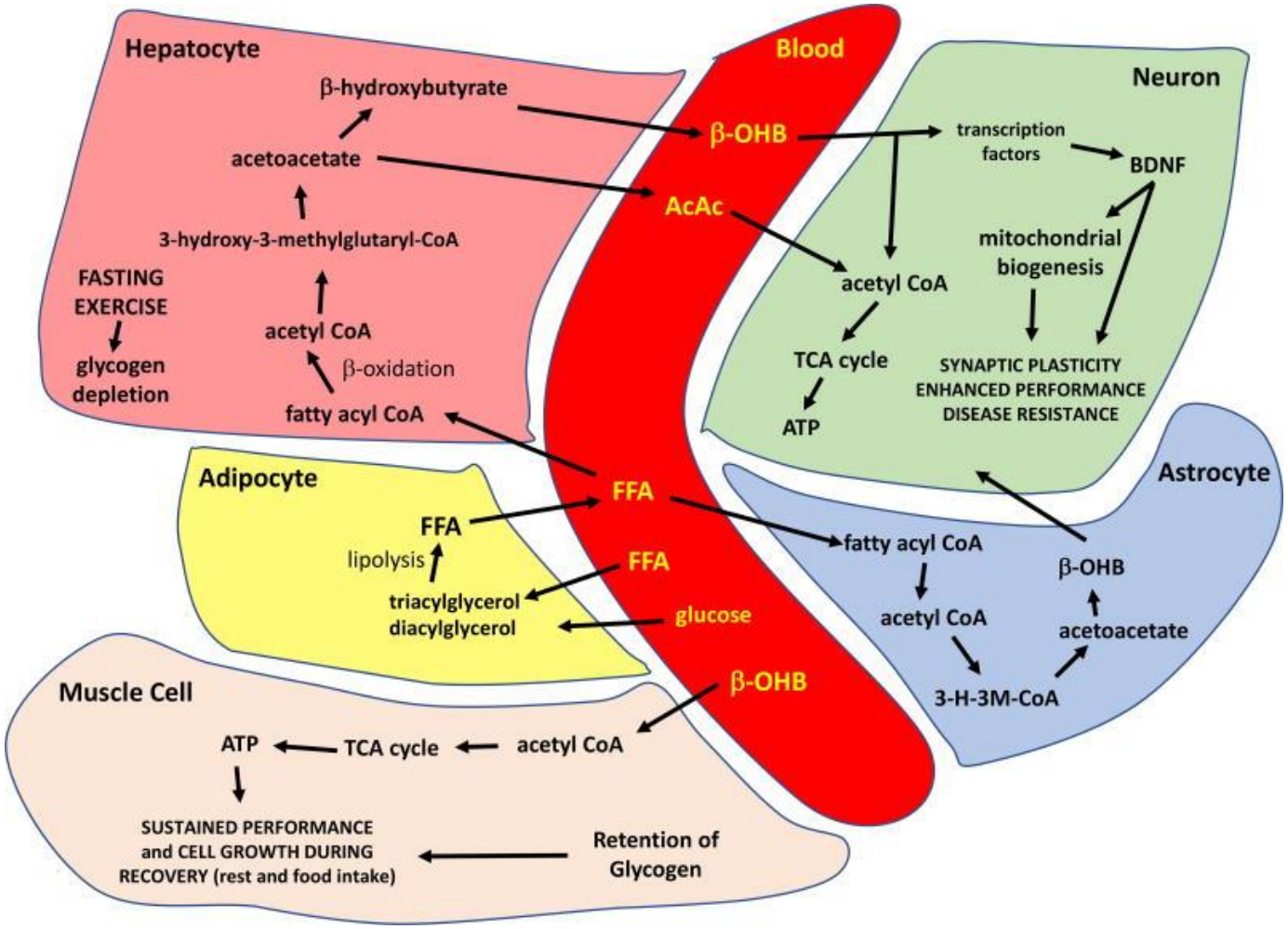
https://www.hsph.harvard.edu/nutritionsource/healthy-eating-pyramid/

식사시간 제한

- **Intermittent fasting**
  - Fasting for varying periods of time, typically for 12 hours or longer
- **Time restricted eating**
  - Restricting food intake to specific time periods of the day, typically between an 8 – 12 hours each day
  - Focuses on the timing of meals and their relation to circadian rhythm, hormonal, and metabolite profile within 24 h period
- **Alternate day fasting**
  - Consuming no calories on fasting days and alternating fasting days with a day of unrestricted food intake or “feast” day
- **Alternate day modified fasting**
  - Consuming less than 25% of baseline energy needs on “fasting” days, alternated with a day of unrestricted food intake or “feast” day

Obesity 2018;26:254

Flipping of metabolic switch



3rd phase of fasting status
(섭취후 12-36시간 경과)

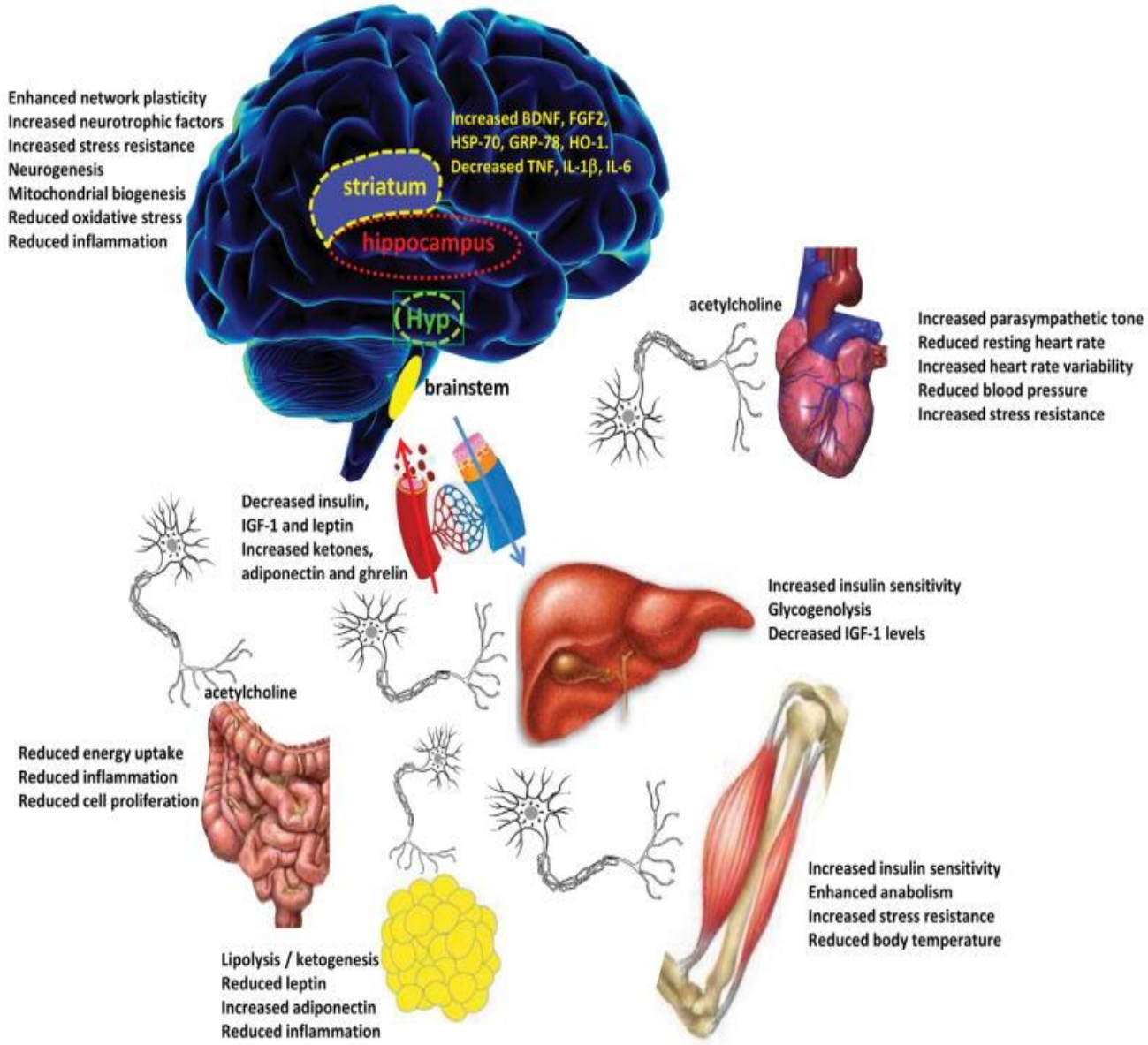
- Body's preferential shift from utilization of glucose from glycogenolysis to fatty acids and fatty acid-derived ketones
- Altered liver metabolism: periodically switches from liver-derived glucose to adipose cell-derived ketones

Obesity 2018;26:254

식사시간 제한 건강이득

Fasting stimulates adaptive cellular responses

- Improved glucose regulation
- Increased stress resistance
- Suppressed inflammation
- Upregulation of autophagy to defend against oxidative and metabolic stress



JAMA Netw Open. 2021; 4: e2139558

Cell Metab 2014;19:181

Calorie-focused diets

- Low calorie diet
- Very low calorie diet

Macronutrients-focused diets

- Low fat diet
- Low carbohydrate diet
- High protein diet

Energy density

Time restriction-focused diets

Calorie-focused diets

Balanced Low calorie diet

- Energy intake targets of 800–1800 kcal/d or energy deficit of 500–750 kcal/d based on energy expenditure estimations
- 45%–65% carbohydrate, 20%–35% fat [≤10% from saturated fat], and 10%–35% protein
- When combined with lifestyle modification, weight losses of 5–8 kg in 6 months, which were maintained at 1 year with continued lifestyle counseling.

Very low-calorie diet

- < 800 kcal/d while aiming to provide essential nutrients
- meal-replacement shakes or protein-sparing modified fasts with a multivitamin and 2–3 g/d of potassium
- 70–100 g/d of protein, designed to spare the loss of lean body mass
- Should be used as part of a comprehensive lifestyle intervention with appropriate medical supervision (potential side effects: cholelithiasis, dehydration)
- Calorie intake should be gradually increased to a level consistent with their new, lower body weight (e.g., increasing calories by 100 kcal/wk until weight stabilizes)

J Clin Invest 2021;131:e140065

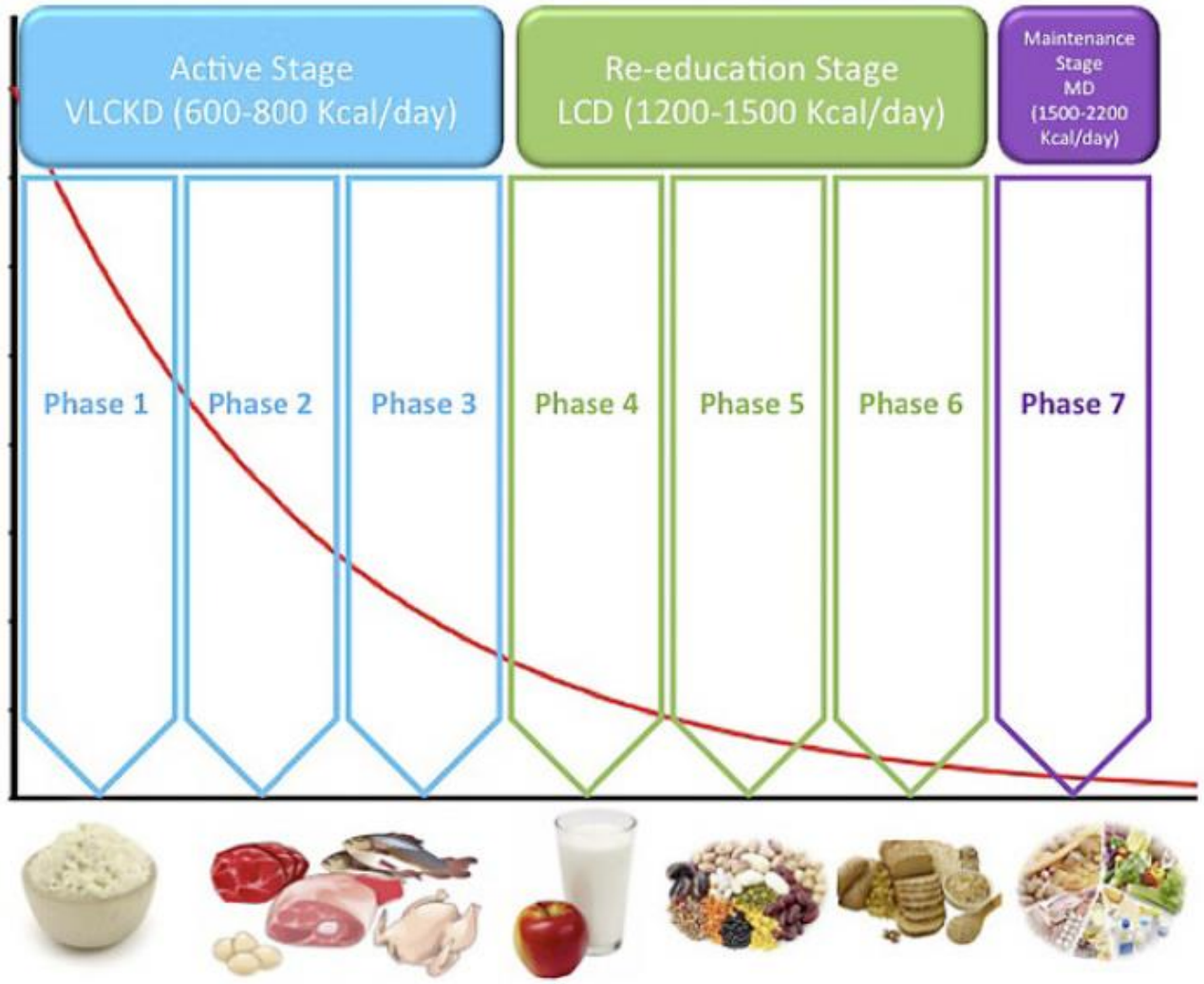
European Guidelines for Obesity Management in Adults with a Very Low-Calorie Ketogenic Diet

Active stage

- CHO (<50 g/day, ≃13% of the total energy intake from vegetables), 0.8–1.2 g of protein/kg of IBW (high biological-value protein), 15–30 g of fat/day (olive oil 10g), 500–800 kcal/day
- Supplements (vitamins, minerals, omega-3)
- Amino acid supplements

Re-education stage

- Carbohydrates are gradually reintroduced: the lowest glycemic index foods (fruit and dairy products – phase 4), followed by foods with moderate (legumes – phase 5), and a high glycemic index (bread, pasta, and cereals – phase 6)

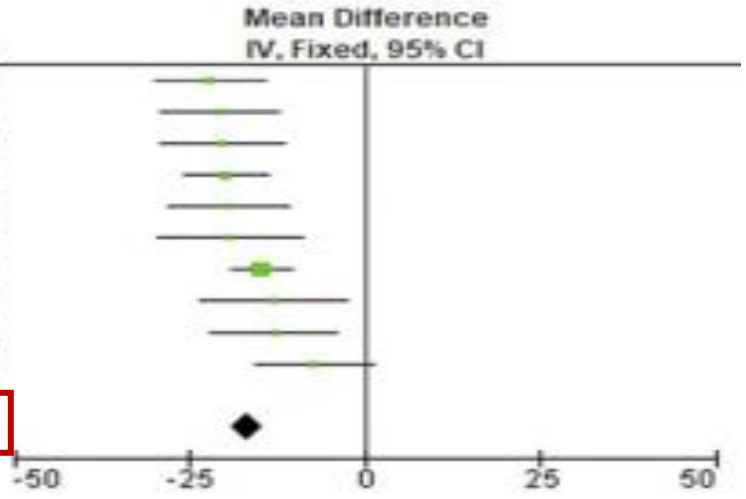


Obes Facts 2021;14:222

Weight loss (kg) after 4-6 month of VLCKD

Study or Subgroup	T1 Mean	T1 SD	T1 Total	T0 Mean	T0 SD	T0 Total	Weight	Mean Difference IV, Fixed, 95% CI
Moreno 2014 [32]	75.8	9.1	27	97.9	18.9	27	8.6%	-22.10 [-30.01, -14.19]
Gomez-Arbelaez 2017 [29]	75.1	11.8	20	95.9	16.3	23	7.6%	-20.80 [-29.23, -12.37]
De Luis 2016 [27]	71.8	11.4	15	92.2	13.1	15	7.0%	-20.40 [-29.19, -11.61]
De Luis 2016 DHA [27]	72.3	7.1	14	92.05	8.7	14	15.6%	-19.75 [-25.63, -13.87]
Sajoux 2019 [35]	76.6	11.1	20	96	16.3	20	7.2%	-19.40 [-28.04, -10.76]
Gutierrez-Repiso _2 [30]	76.63	12.83	9	95.71	9.46	9	5.0%	-19.08 [-29.49, -8.67]
Goday 2016 [28]	76.8	9.1	45	91.47	11.43	45	29.6%	-14.67 [-18.94, -10.40]
Gutierrez-Repiso 2019_1 [30]	79.78	13.92	15	92.74	15.86	15	4.7%	-12.96 [-23.64, -2.28]
Gutierrez-Repiso 2019_3 [30]	77.62	8.22	9	90.58	10.83	9	6.8%	-12.96 [-21.84, -4.08]
Rubini 2015 [34]	74.8	11.7	16	82	12.4	16	7.7%	-7.20 [-15.55, 1.15]
Total (95% CI)			190			193	100.0%	-16.76 [-19.08, -14.43]

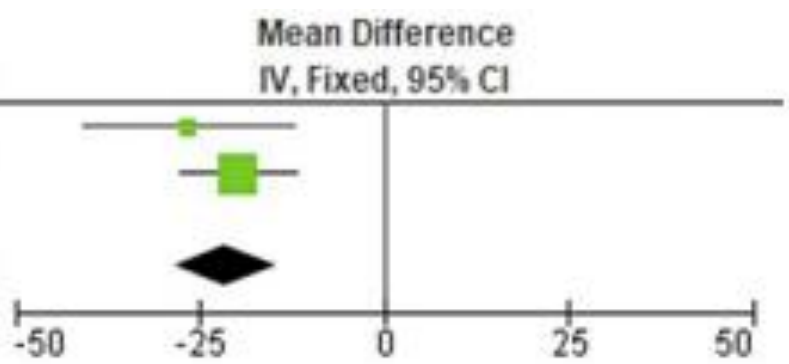
Heterogeneity: Chi² = 11.97, df = 9 (P = 0.21); I² = 25%
Test for overall effect: Z = 14.13 (P < 0.00001)



Weight loss after 12 month of VLCKD

Study or Subgroup	T1 Mean	T1 SD	T1 Total	T0 Mean	T0 SD	T0 Total	Weight	Mean Difference IV, Fixed, 95% CI
Perticone 2019 [33]	87.3	22.8	28	113.9	31	28	23.6%	-26.60 [-40.85, -12.35]
Moreno 2014 [32]	78	9.1	27	97.9	18.9	27	76.4%	-19.90 [-27.81, -11.99]
Total (95% CI)			55			55	100.0%	-21.48 [-28.40, -14.56]

Heterogeneity: Chi² = 0.65, df = 1 (P = 0.42); I² = 0%
Test for overall effect: Z = 6.09 (P < 0.00001)



Obes Facts 2021;14:222

Macronutrients-focused diets

Low-fat diet

- < 30% of calories from fat

Low-carbohydrate diet

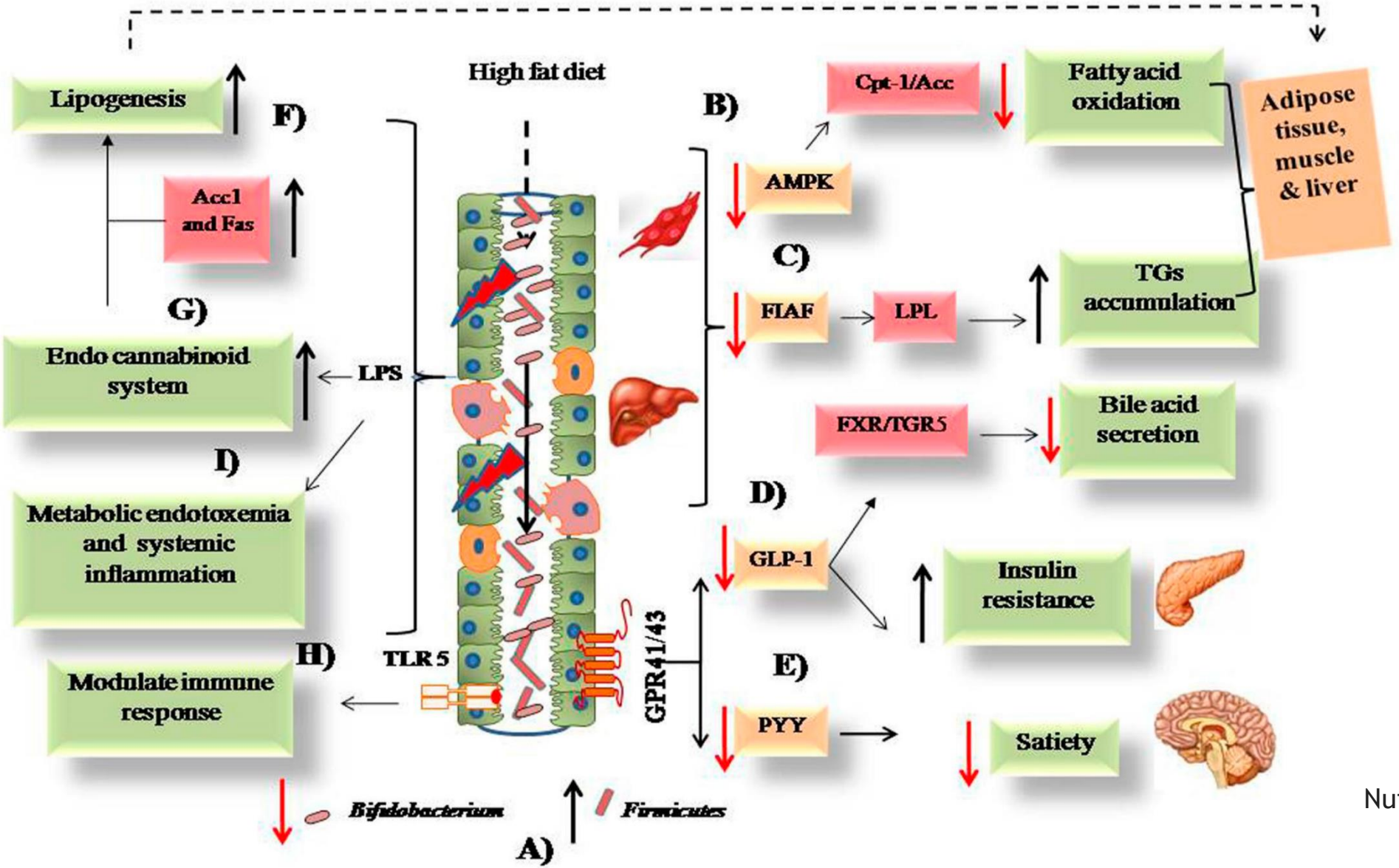
- 60–130 g of carbohydrate per day (≤20%–45% of daily energy intake)
- Very-low-carbohydrate diet:< 60 g of carbohydrate per day

High-protein diet

- ≥25% of calories from protein or ≥1.6 g of protein/BW(kg)
- Higher protein content is a feature of many lower-fat and lower-carbohydrate diets

J Clin Invest 2021;131:e140065

Mechanisms associated with the intake of high fat diet and obesity



Nutrients **2019**;11:2749

Adenosine monophosphate kinase (AMPK); Fasting induce adipose factor (FIAF); lipoprotein lipase (LPL); peptide YY (PYY); Acetyl-CoA carboxylase (Acc1); Fatty acid synthase (Fas) enzymes; Lipopolysaccharide (LPS); Toll-like receptor 5 (TLR-5); Carnitine palmitoyltransferase(Cpt-1); G-protein coupled receptors (GPR); Farnesoid X Receptor (FXR)

Effect of **Low-Fat vs. Other Diet Interventions** on Long-Term Weight Change in Adults: A Systematic Review and Meta Analysis

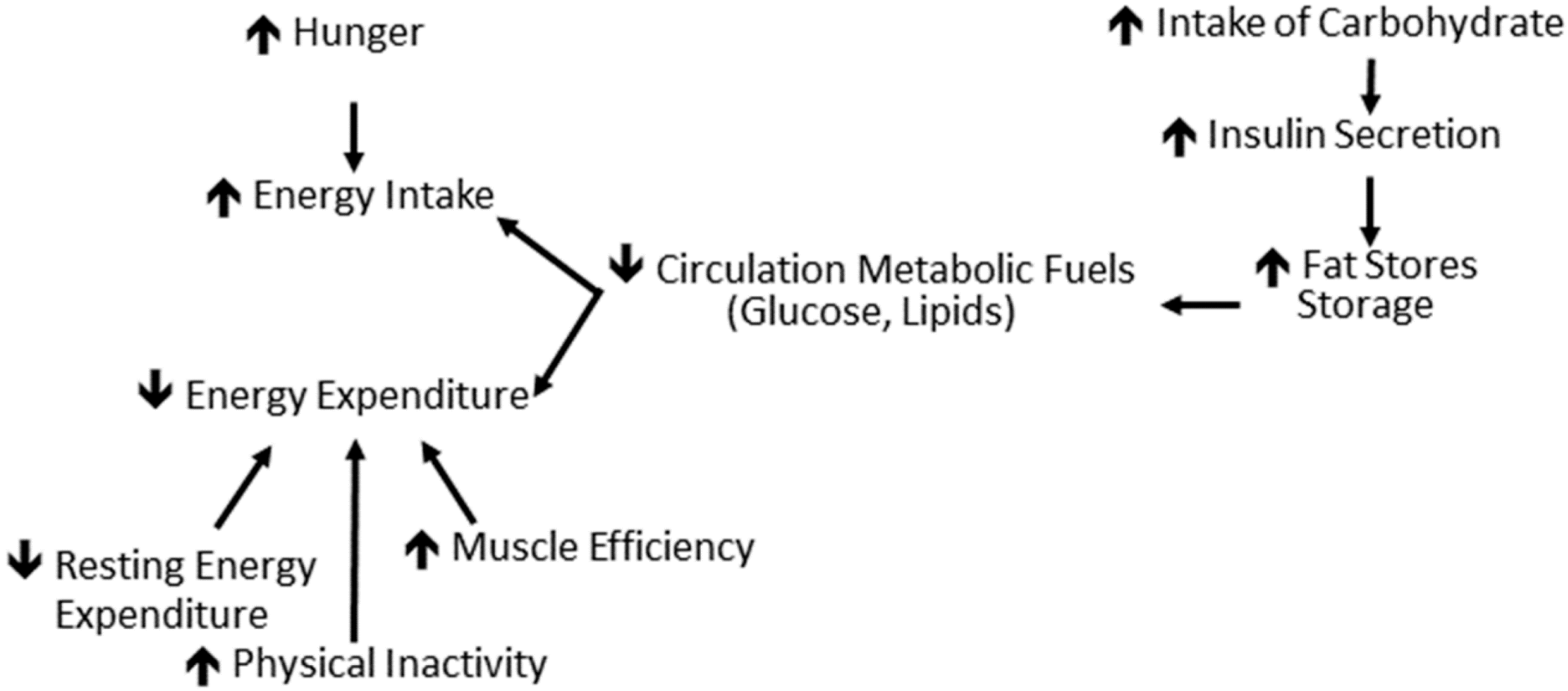
Systematic review and random effects meta-analysis of RCTs comparing the long-term effect (≥1 year)

In the setting of weight loss trials

- low-carbohydrate interventions led to significantly greater weight loss than low-fat interventions (weighted mean difference [WMD]=1.15 kg, 95% CI=0.52 to 1.79; I^2=10%).
- Low-fat did not lead to differences in weight change compared with other moderate fat weight loss interventions (WMD=0.36, 95% CI=-0.66 to 1.37; I^2=82%)
- Superior only when compared with "usual diet" (WMD=-5.41, 95% CI=-7.29 to −3.54; I^2=68%)

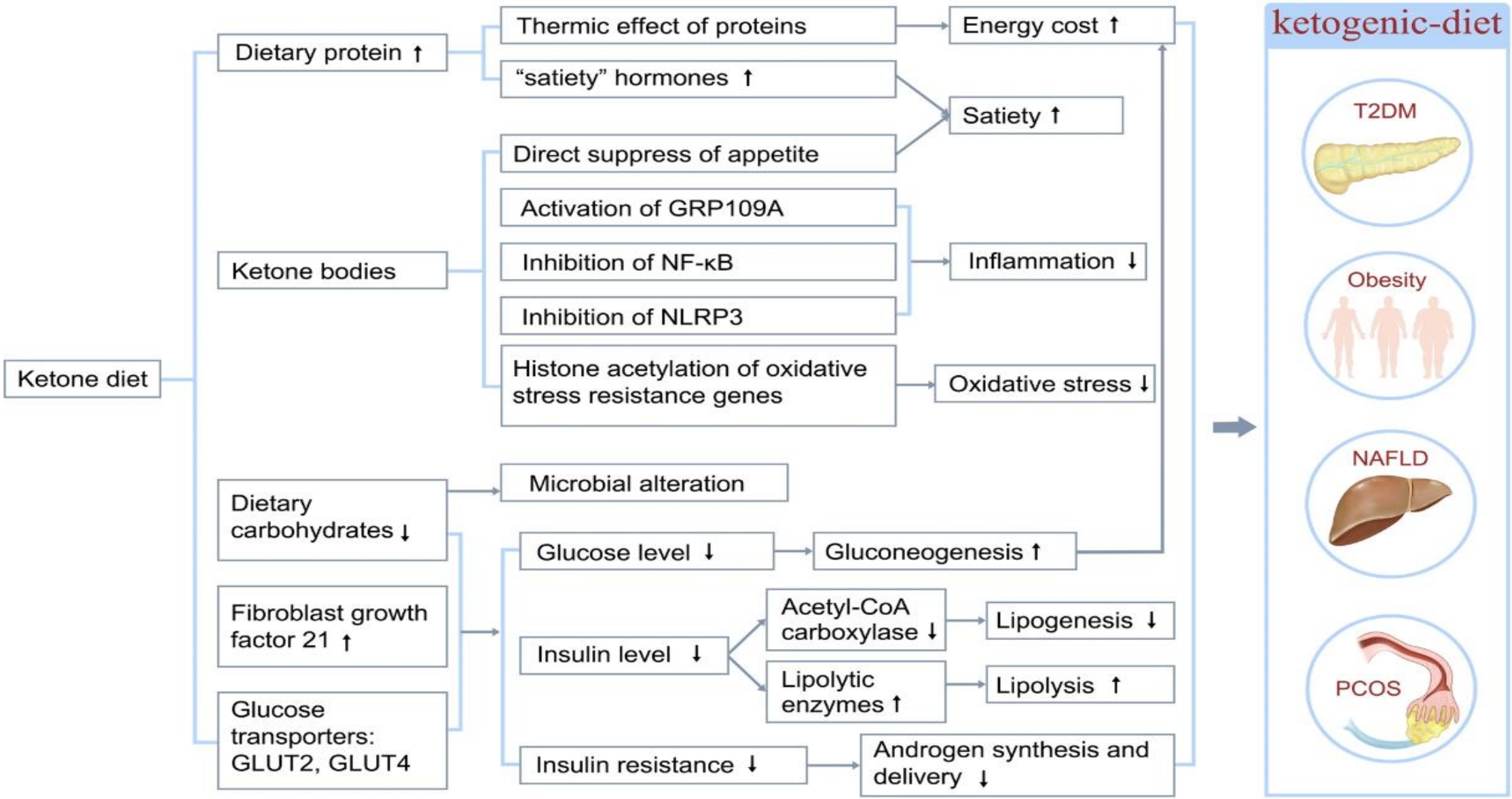
Lancet Diabetes Endocrinol 2015;3:968

Mechanisms associated with the intake of high carbohydrate diet and obesity (Carbohydrate-insulin model)



Nutrients **2019;**11:2749

Mechanisms of Ketogenic diet



Sig Transduct Target Ther **7**, 11 (2022)

Low-carbohydrate vs balanced-carbohydrate diets for weight and CV risk

Summary of findings 1. Summary of findings table - Low-carbohydrate weight-reducing diets compared to balanced-carbohydrate weight-reducing diets in overweight and obese participants without T2DM (weight-reducing phase only)

Low-carbohydrate weight-reducing diets compared to balanced-carbohydrate weight-reducing diets in overweight and obese participants without T2DM (weight-reducing phase only)

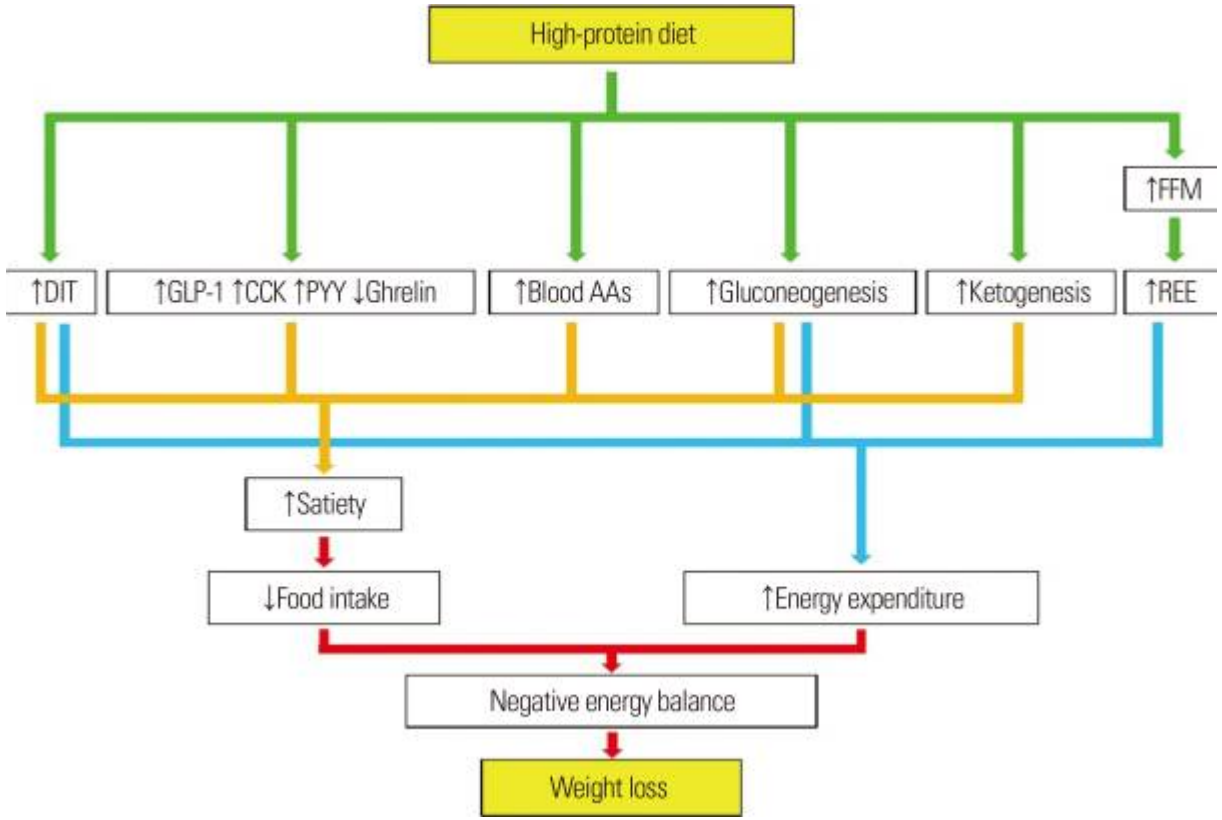
Patient or population: overweight and obese participants without T2DM (weight-reducing phase only)
Setting: outpatient clinics, medical/research centres in high-income countries
Intervention: low-carbohydrate weight-reducing diets
Comparison: balanced-carbohydrate weight-reducing diets

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	Nº of participants (studies)	Certainty of the evidence (GRADE)	Comments
	Risk with balanced-carbohydrate weight-reducing diets	Risk with low-carbohydrate weight-reducing diets				
Change in body weight (kg) at 3 to < 12 months	The mean change in body weight (kg) at 3 to < 12 months ranged from **-11.34 to -2.3** kg	MD **1.07 kg lower** (1.55 lower to 0.59 lower)	-	3286 (37 RCTs)	⊕⊕⊕⊖ Moderate[a]	Low-carbohydrate weight-reducing diets probably result in little to no difference in change in weight at 3 to 8.5 months.
Change in body weight (kg) at ≥ 12 months	The mean change in body weight (kg) at ≥ 12 months ranged from **-11.6 to -1.7** kg	MD **0.93 kg lower** (1.81 lower to 0.04 lower)	-	1805 (14 RCTs)	⊕⊕⊕⊖ Moderate[a]	Low-carbohydrate weight-reducing diets probably result in little to no difference in change in weight (kg) at 1 to 2 years.

- Low-carbohydrate weight-reducing diets probably result in little to no difference in change in DBP at 1 to 2 y.
- Low-carbohydrate weight-reducing diets probably result in little to no difference in change in LDL cholesterol at 1 to 2 y.

Cochrane Database Syst Rev 2022;1:CD013334

High protein diet and weight loss

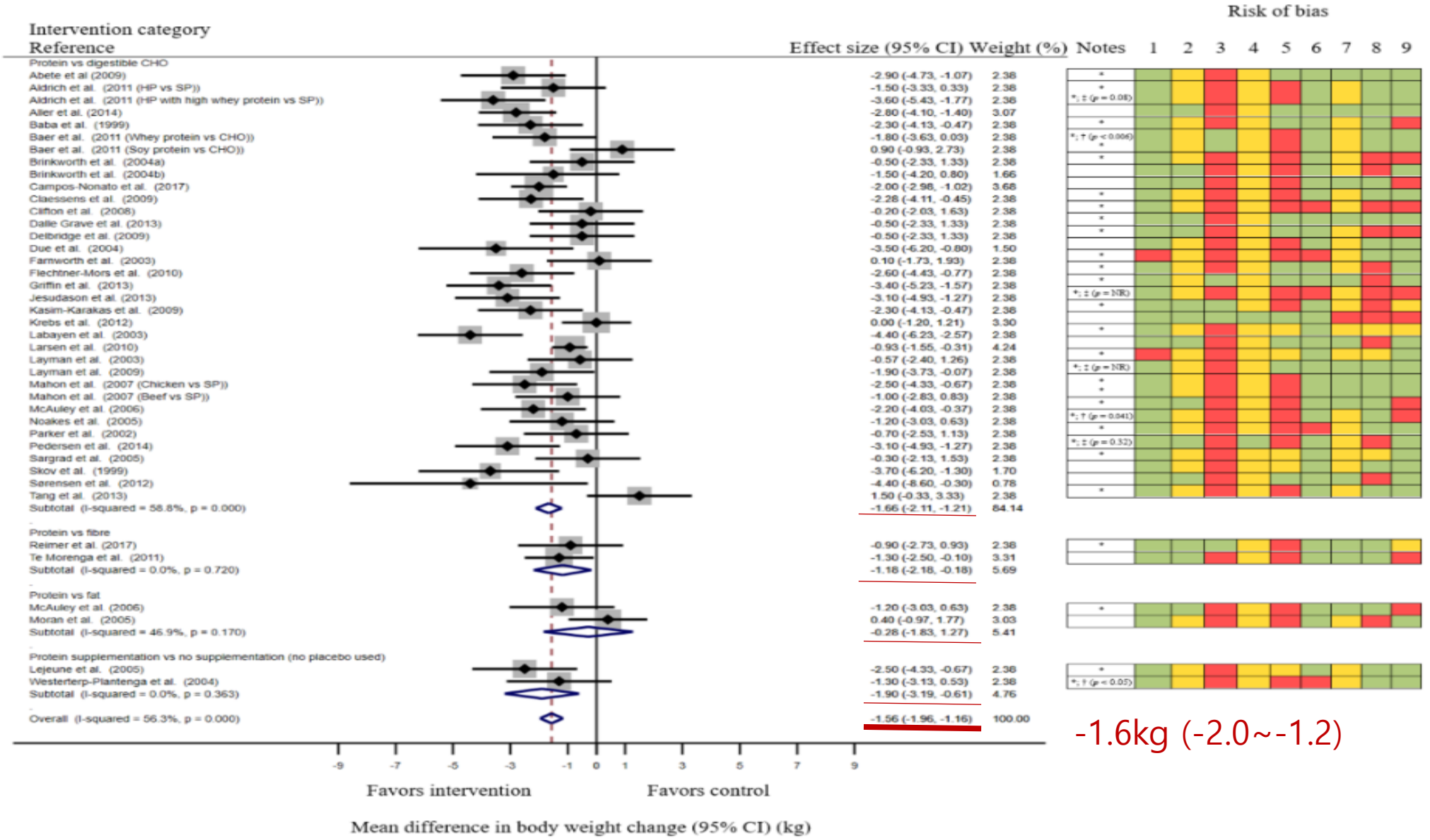


Aminostatic theory suggests that there is a nutrient-specific hierarchy of satiating power, with protein having a more satiating power than carbohydrate, which is in turn more satiating than fat

diet-induced thermogenesis (DIT)

J Obes Metab Syndr 2020;29:166

High protein diet and weight loss



-1.6kg (-2.0~-1.2)

Nutrients 2021;13:3193

Difference in Weight Loss at 6- & 12-Month FU Across All Diet Classes using network meta-analysis of 48 RCTs

6-mo Weight Loss, kg \ 12-mo Weight Loss, kg				
	No diet (6 mo: 0; 12 mo: 0)[a]	5.16 (2.68 to 7.63)	5.70 (4.14 to 7.35)	7.25 (5.33 to 9.25)	7.27 (5.26 to 9.34)
6.07 (4.23 to 7.84)		LEARN (6 mo: 0; 12 mo: 0.02)[a]	0.55 (−1.71 to 2.87)	2.10 (−0.20 to 4.47)	2.12 (−0.33 to 4.59)
6.78 (5.50 to 8.05)	0.71 (−0.97 to 2.44)		Moderate macronutrients (6 mo: 0; 12 mo: 0)[a]	1.55 (0.13 to 2.95)	1.56 (−0.17 to 3.30)
8.73 (7.27 to 10.20)	2.66 (0.93 to 4.44)	1.95 (1.13 to 2.79)		Low carbohydrate (6 mo: 0.83; 12 mo: 0.48)[a]	0.02 (−1.78 to 1.79)
7.99 (6.01 to 9.92)	1.92 (−0.19 to 4.06)	1.20 (−0.42 to 2.79)	−0.74 (−2.31 to 0.78)		Low fat (6 mo: 0.17; 12 mo: 0.50)[a]

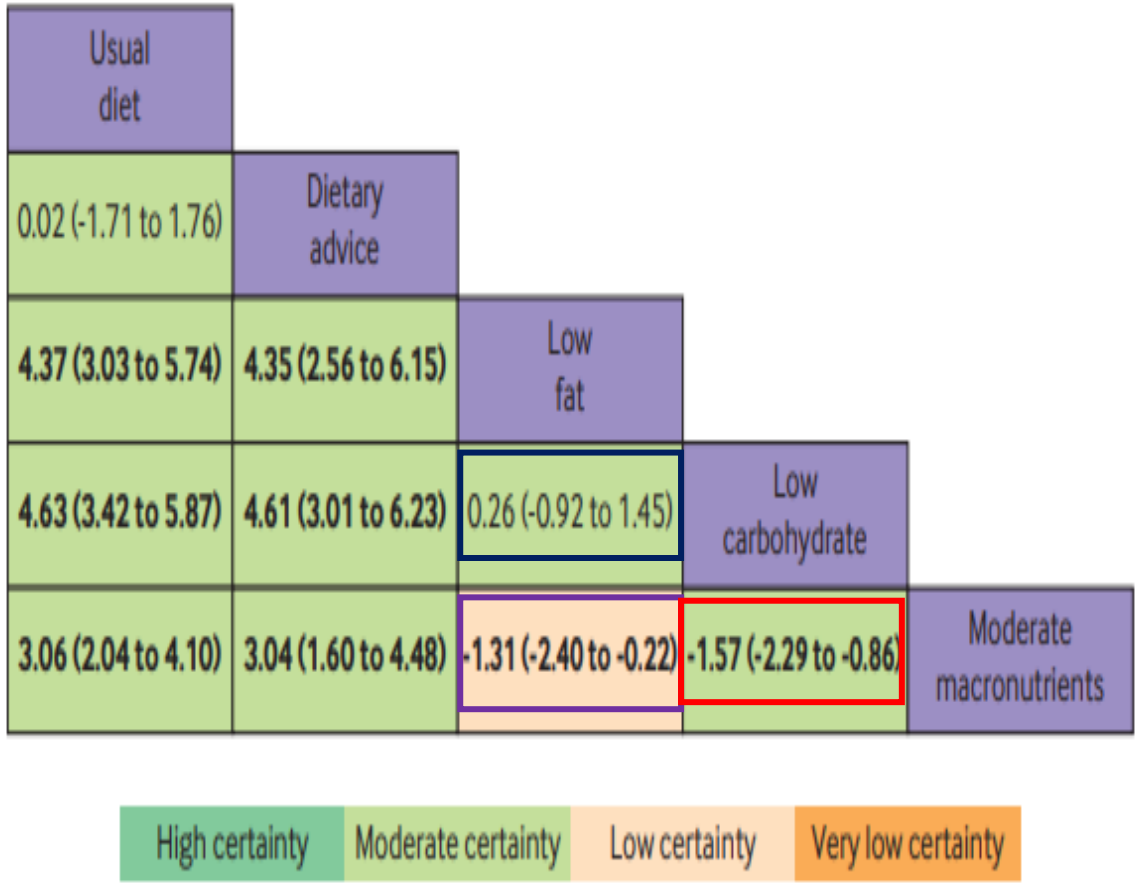
Type of Diet	Branded Diets[a]	Carbohydrates, % kcal	Protein, % kcal	Fat, % kcal
Low carbohydrate	Atkins, South Beach, Zone	≤40	Approximately 30	30-55
Moderate macronutrients	Biggest Loser, Jenny Craig, Nutrisystem, Volumetrics, Weight Watchers	Approximately 55-60	Approximately 15	21-≤30
Low fat	Ornish, Rosemary Conley	Approximately 60	Approximately 10-15	≤20

[a] The Lifestyle, Exercise, Attitudes, Relationships, and Nutrition (LEARN) diet was applied as both a low-fat diet (2 trials) and a moderate macronutrient diet (5 trials) among the 7 included trials having used the LEARN diet (Table 2).

Slimming World was excluded from the diet class analyses because it does not fit any of the definitions above.

JAMA 2014;312:924

Macronutrient pattern/popular diets network meta-analysis results for 6 m weight loss



Diet *v* usual diet	Weight loss (kilograms)	Systolic blood pressure reduction (mm Hg)	Diastolic blood pressure reduction (mm Hg)	Low density lipoprotein reduction (mg/dL)	High density lipoprotein reduction (mg/dL)	C-reactive protein reduction (mg/dL)
Atkins	5.46	5.14	3.30	-2.75	3.41	0.64
Zone	4.07	3.46	2.33	-2.89	-0.33	0.27
DASH	3.63	4.68	2.84	3.93	-1.90	NA
Mediterranean	2.87	2.94	1.03	4.59	-0.61	0.25
Paleolithic	5.31	14.56	3.85	7.27	-2.52	0.52
Low fat	4.87	3.95	2.22	1.92	-2.13	0.33
Jenny Craig	7.77	7.86	7.81	0.21	-2.85	0.19
Volumetrics	5.95	2.93	1.95	7.13	-0.13	NA
Weight Watchers	3.90	2.80	1.03	7.13	-0.88	0.87
Rosemary Conley	3.76	2.39	1.44	7.15	-2.04	NA
Ornish	3.64	0.69	0.20	4.71	-4.87	1.11
Portfolio	3.64	5.97	3.98	21.29	-3.26	-0.37
Biggest Loser	2.88	3.17	2.20	3.90	-0.01	NA
Slimming World	2.15	NA	NA	NA	NA	NA
South Beach	9.86	NA	NA	-0.64	0.36	NA
Dietary advice	0.31	0.58	0.40	-2.01	-1.71	-1.15

"Among the most effective" with moderate to high certainty
"Inferior to the most effective/superior to the least effective" with moderate to high certainty
"Among the least effective" with moderate to high certainty
"Maybe among the most effective" with very low to low certainty
"Inferior to the most effective/superior to the least effective" with very low to low certainty
"Maybe among the least effective" with very low to low certainty
"Maybe worse than usual diet"

BMJ 2020;369:m696

Macronutrient pattern/popular diets network meta-analysis for weight loss

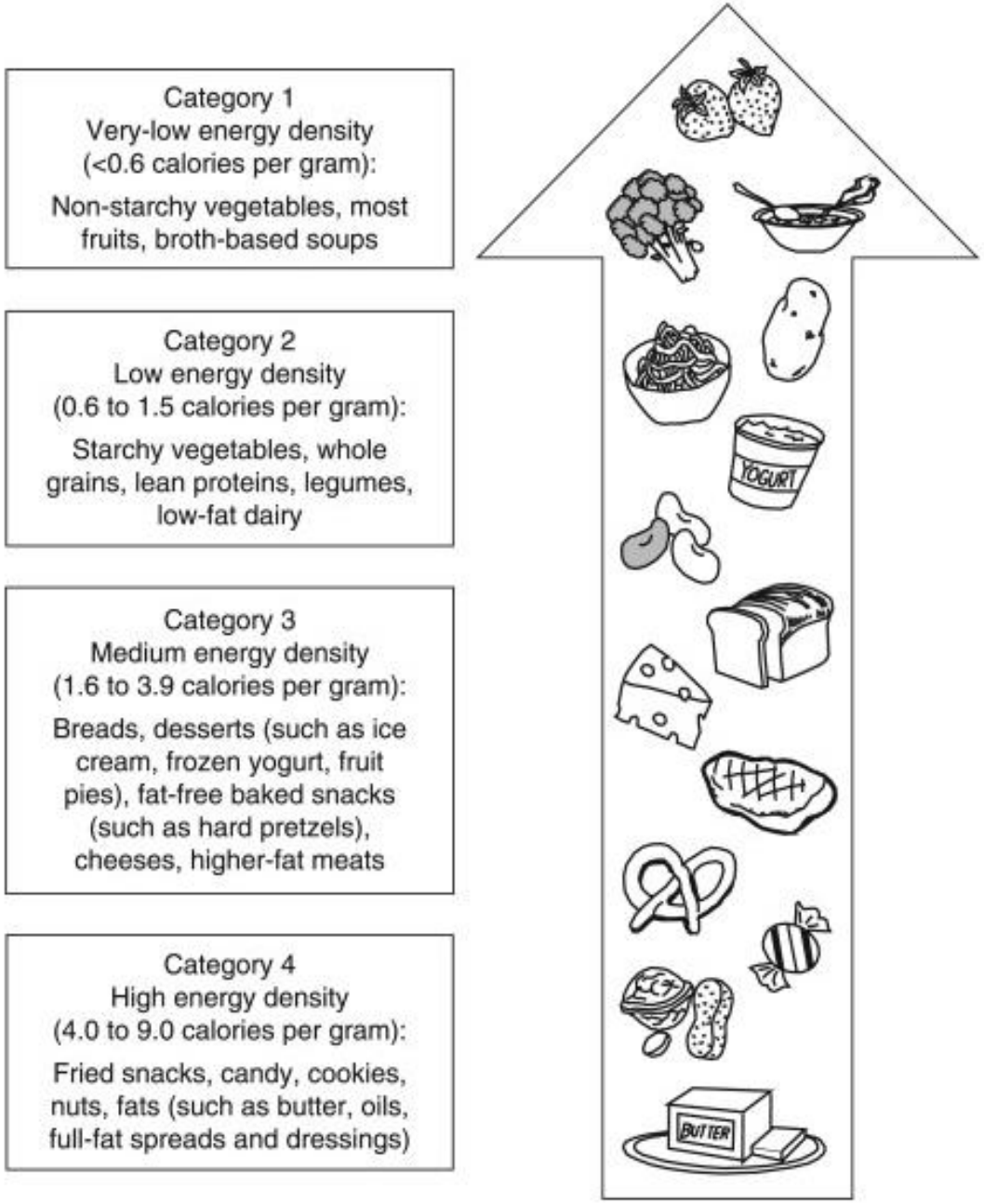
- **At 6 months**, dietary macronutrient patterns (low carbohydrate, low fat, and moderate macronutrient) were associated with larger reductions in body weight and BP than a usual diet. Reductions with moderate macronutrient diets were slightly smaller than with the other two macronutrient patterns.
- **At 12 months**, effects on weight were less than at six months (about **3 kg** at 12 months). macronutrient diet related improvements in BP and blood lipids disappeared almost completely.

- Differences between diets are trivial to small, implying that **people can choose the diet they prefer** from among many of the available diets without concern about the magnitude of benefits.

BMJ 2020;369:m696

Dietary Energy Density (ED) =Calories/gram

Med Clin North Am 2018;102:107



Managing and Preventing Obesity 2015

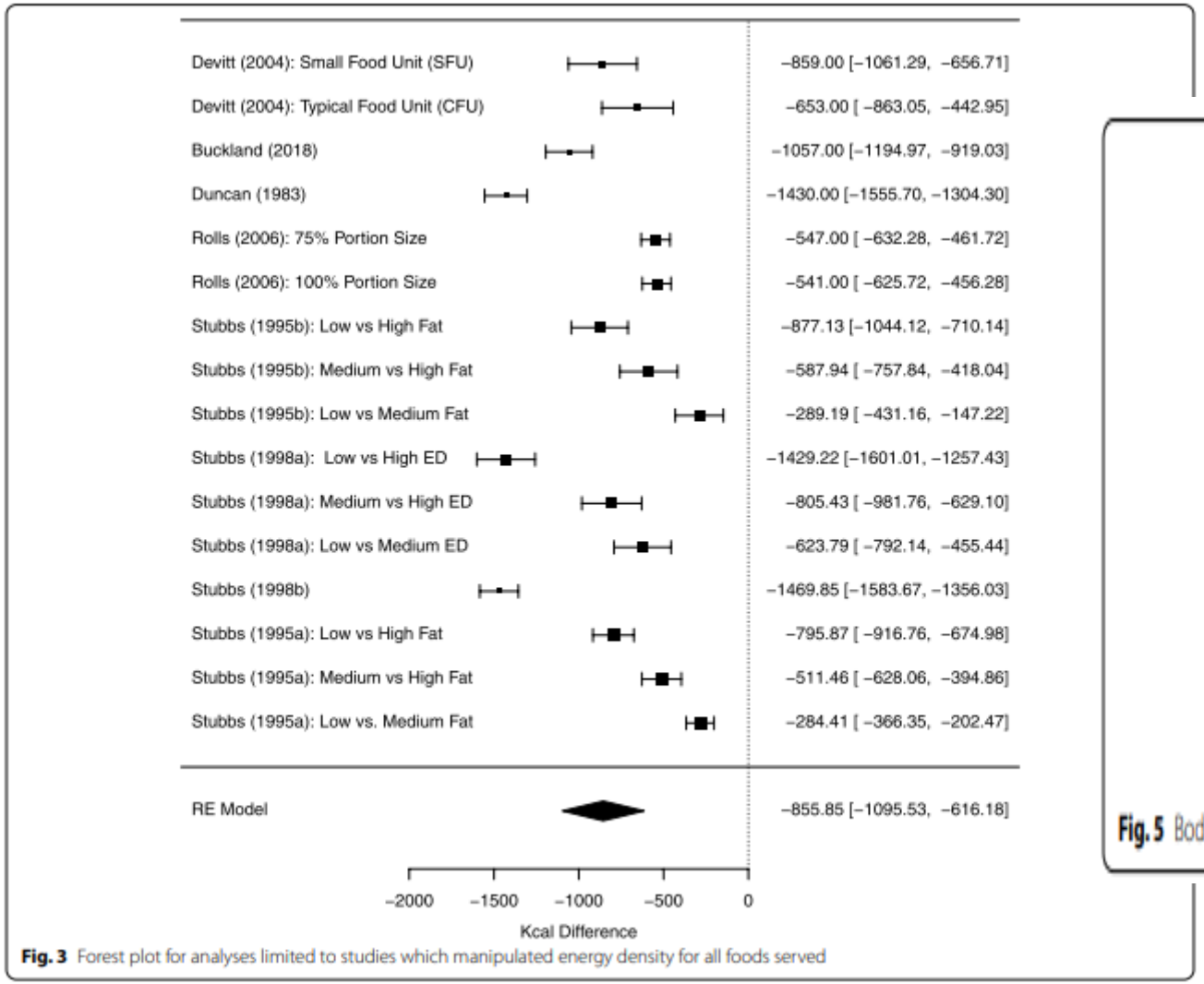


Fig. 3 Forest plot for analyses limited to studies which manipulated energy density for all foods served

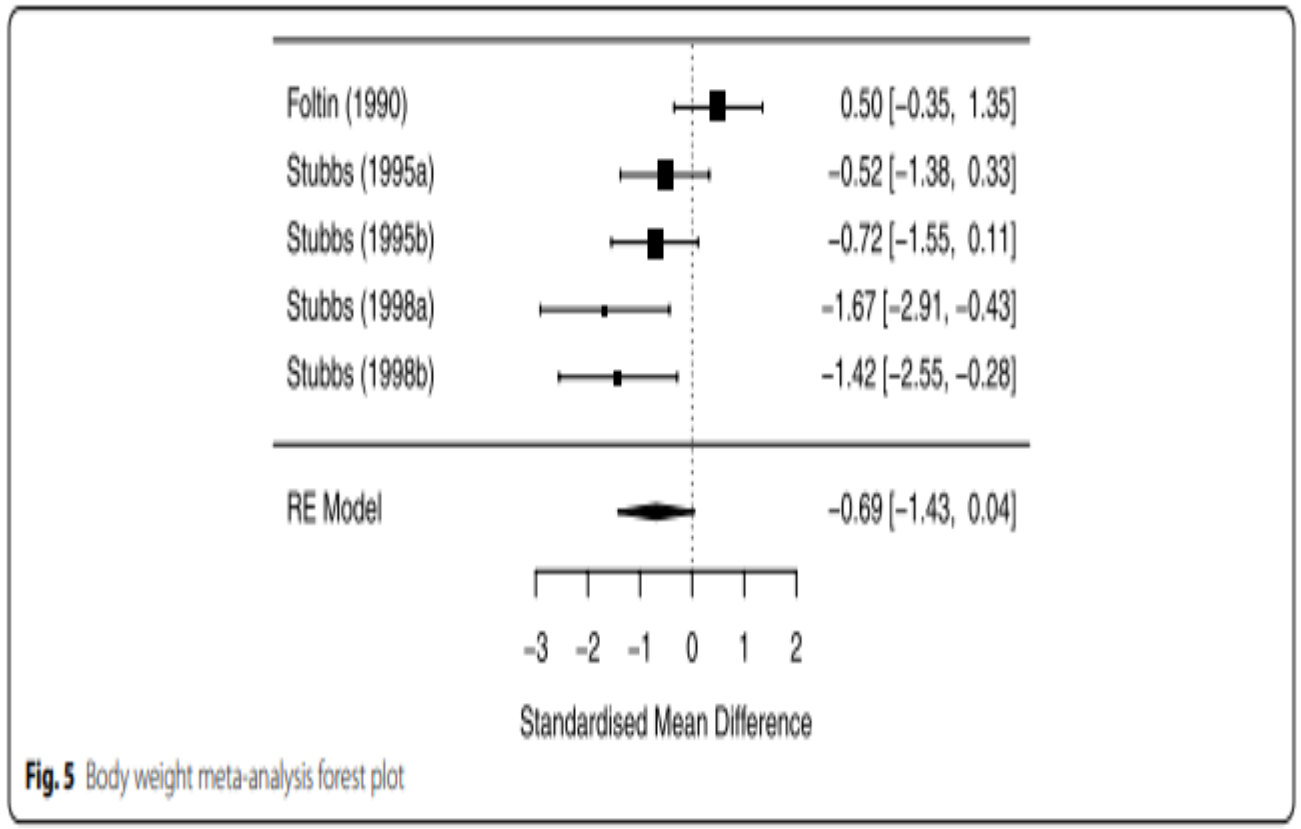


Fig. 5 Body weight meta-analysis forest plot

- Lower ED was associated with a large decrease in daily energy intake.
- Serving lower ED food tended to be associated with greater weight loss than serving higher ED food, but this difference was not significant (−0.7 kg)

Int J Behav Nutr Phys Act 2022;19:48

Intermittent Fasting (IF) and Obesity-Related Health Outcomes: Umbrella Review of Meta-analyses of Randomized Clinical Trials

- 4 types of IF
  - zero-calorie alternate-day fasting (zero-calorie ADF): alternating days of fasting with zero caloric intake and days of ad libitum eating
  - modified alternate-day fasting (MADF): alternated between days of ad libitum eating and days of fasting with total caloric intake ranging from 0% to 40% or 0 to 600 kcal/day for 3 to 5 days per week
  - 5:2 diet: fasted for 1-2 days/week (either consecutively and nonconsecutively) with total caloric intake ranging 0-40% (0-600kcal)/day and 5 days of ad libitum eating
  - time-restricted eating (TRE):fasting for 12-24 hours/day

JAMA Netw Open. 2021; 4: e2139558

MADF vs. regular diet or continuous energy restriction

- for 1~2 m: reduced BMI in healthy adults and adults with overweight, obesity, or NAFLD (MD, −1.20, 95% CI[−1.44 to −0.96]).
- for 2~3 m: reduced body weight in adults with overweight or obesity (MD, −1.65 kg 95% CI [−2.73 to −0.58])
- for 2~6 m: reduced body weight in adults with obesity (MD, −1.42 kg, 95% CI [−2.44 to −0.41])
- for 2~6 m: reduced fat-free mass in adults with obesity compared with continuous energy restriction (MD, −0.70 kg; 95% CI, −1.38 to −0.02)

zero-calorie ADF vs. regular diet or continuous energy restriction

- for 1~2 m: reduced fat mass in adults with overweight or obesity (MD: −1.99 kg [−2.59 to −1.38])

5:2 diet vs. continuous energy restriction

- for 3 to 6 m: reduced fasting insulin in women with overweight or obesity (MD, −1.00 mIU/mL; 95% CI, −1.77 to −0.39)

Beneficial associations of IF with anthropometric and cardiometabolic outcomes supported by moderate to high quality of evidence, which supports the role of IF, especially modified alternate-day fasting, as a weight loss approach for adults with overweight or obesity.

JAMA Netw Open. 2021; 4: e2139558

Variability in weight loss
Food quality
Diet guidelines

Interindividual Variability in weight loss

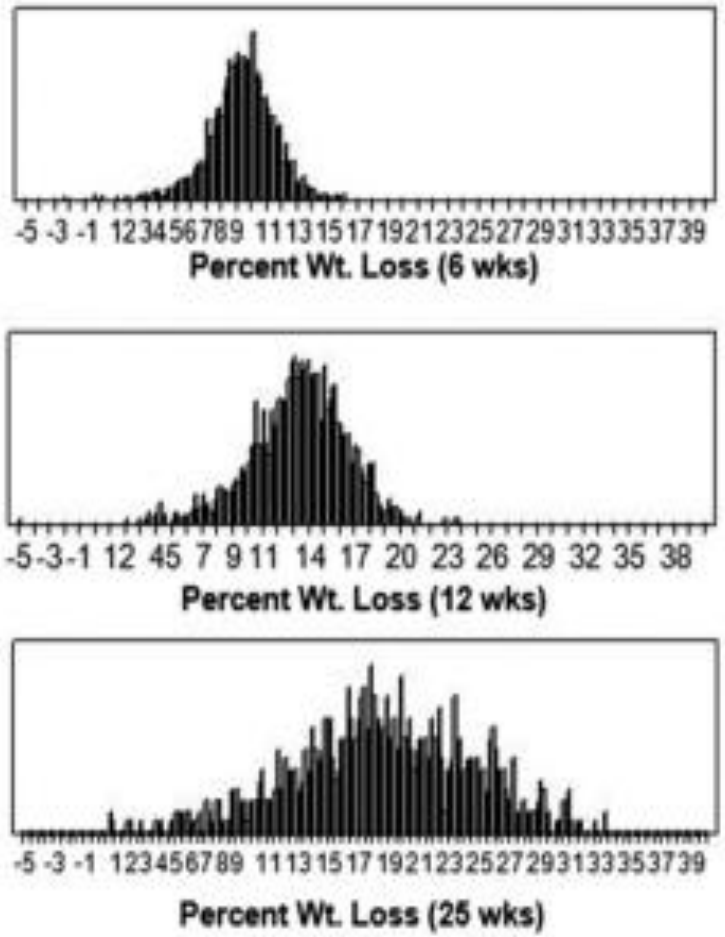


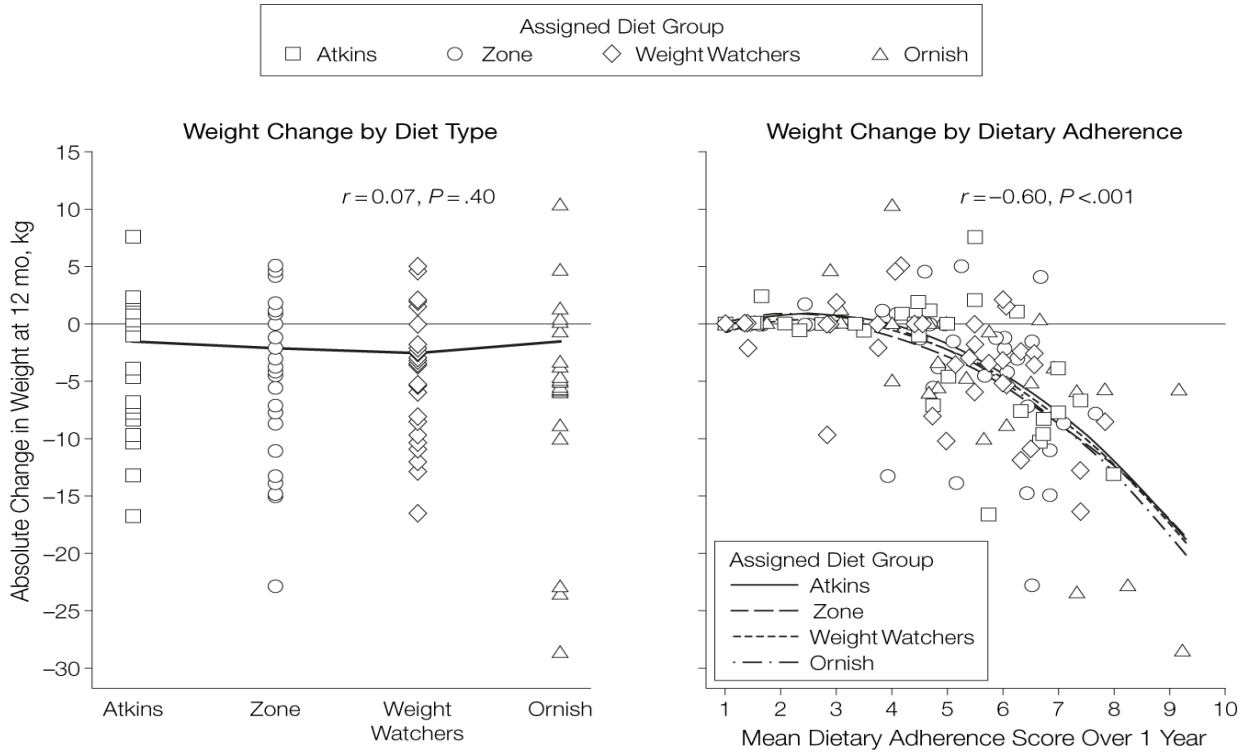
Table 1
Variability in weight loss in response to named dietary programs. (Adapted from [40]).

Diet	Mean weight loss at 6 months[a] (kg)	Variability in weight loss (95% CI)
LEARN	6.0	4.2 to 7.8
Moderate Macronutrient	7.7	5.8 to 9.6
Low Fat	8.3	5.9 to 10.7
Atkins	10.1	8.2 to 12.1
Zone	8.4	6.4 to 10.4
Weight Watchers	7.3	5.3 to 9.3
Ornish	9.0	6.4 to 11.7
Jenny Craig	5.8	3.3 to 8.3
Volumetrics	9.9	5.5 to 14.2
Rosemary Conley	6.6	2.8 to 10.3
Biggest Loser	5.4	1.5 to 9.3
Nutrisystem	7.4	4.6 to 10.2

[a] Compared to no diet. Findings were reported based on a meta-analysis of 48 unique randomized trials.

Metabolism 2020;113:154388

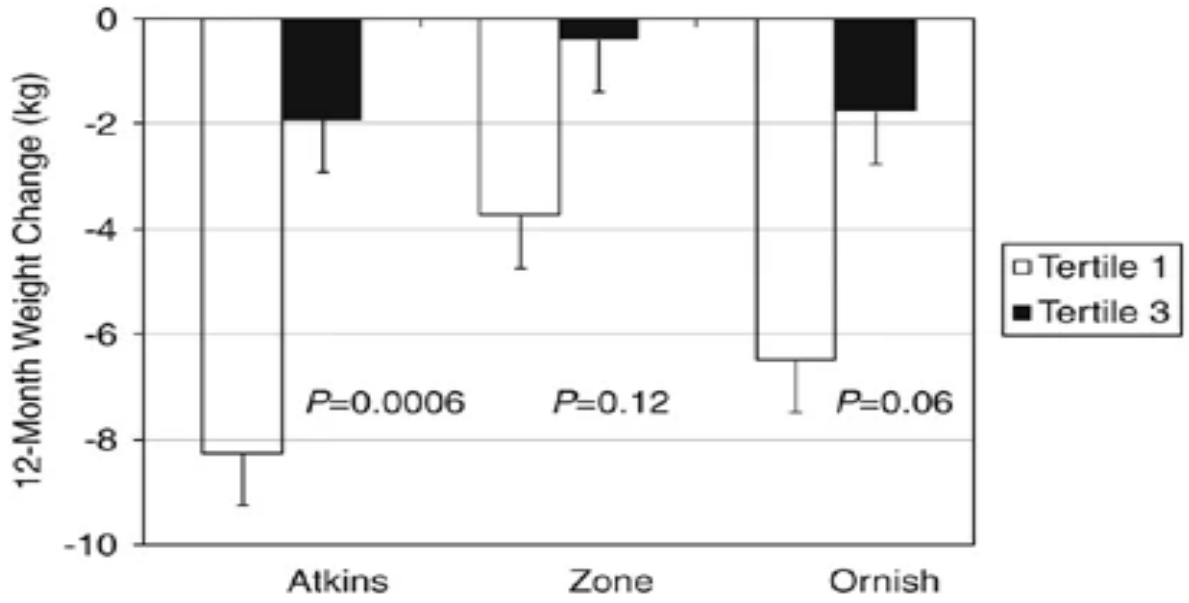
Comparison of the Atkins, Ornish, Weight Watchers, and Zone Diets for Weight Loss and Heart Disease Risk Reduction A Randomized Trial



JAMA. 2005;293(1):43

Conclusions Each popular diet modestly reduced body weight and several cardiac risk factors at 1 year. Overall dietary adherence rates were low, although increased adherence was associated with greater weight loss and cardiac risk factor reductions for each diet group.

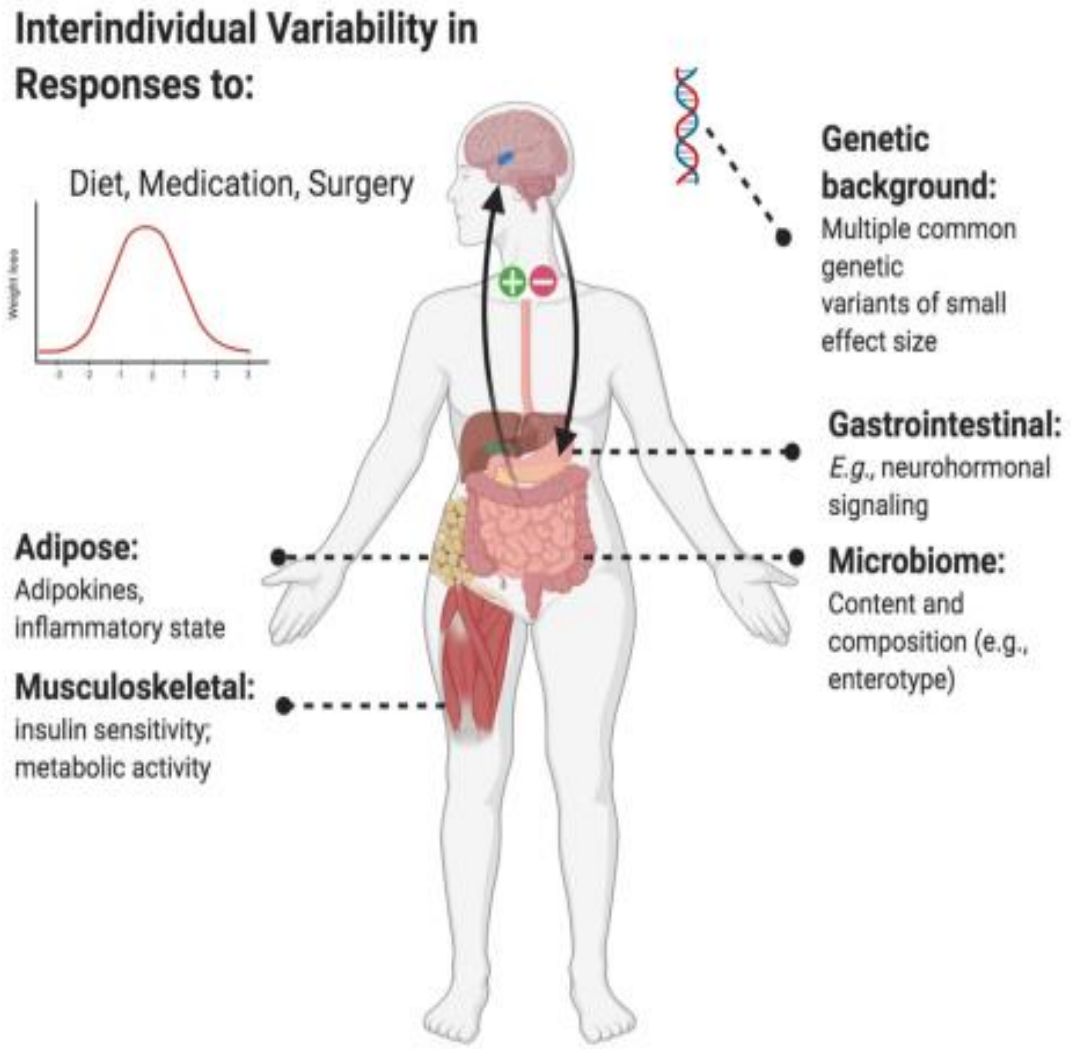
Dietary adherence and weight loss success among overweight women: results from the A TO Z weight loss study



12-month weight change was greater in the most adherent compared to the least adherent tertiles.

- These results suggest that strategies to increase adherence may deserve more emphasis than the specific macronutrient composition of the weight loss diet itself.

Int J Obes **32**, 985–991 (2008)



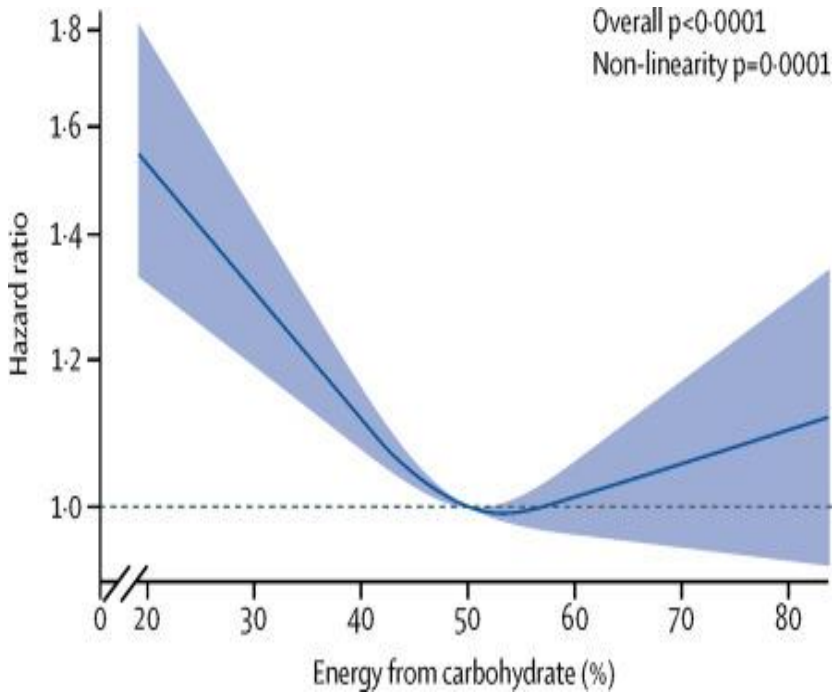
"Adherence to diet"

- Weight loss
- Severity of diet methods
- Adverse effects
- Age/gender/education
- Physician–patient relationship
- Social support
- Food prices
- Available food resources
- Duration of the marriage
- Reason for referring to the clinic
- Initial BMI
- Weight satisfaction
- lunch and dinner times
- Sleep time…

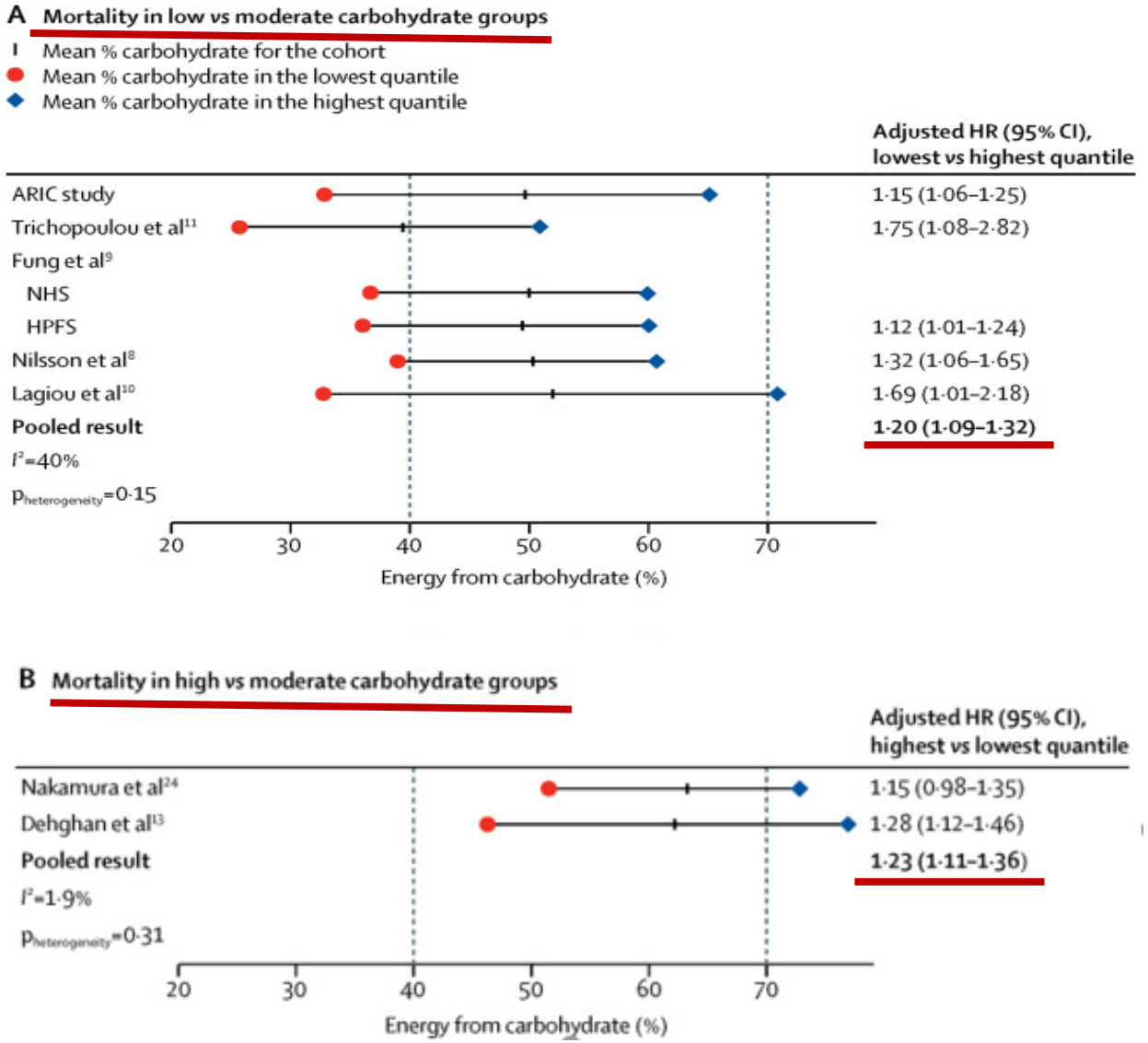
Metabolism 2020;113:154388
Sci Rep 2022;12:12340

Carbohydrate intake and mortality

ARIC cohort



Meta analysis of prospective cohort studies



Lancet Public Health 2018;3:e419

Carbohydrate intake and mortality

Meta analysis of prospective cohort studies

	Study	HR (95% CI)	HR (95% CI)
		Substitution of carbohydrate for animal protein and fat	Substitution of carbohydrate for plant protein and fat
Low-to-moderate carbohydrate consumption	Fung et al (HPFS)	1·31 (1·19–1·44)	0·81 (0·74–0·89)
Low-to-moderate carbohydrate consumption	Fung et al (NHS)	1·17 (1·08–1·26)	0·79 (0·73–0·85)
Low-to-moderate carbohydrate consumption	ARIC	1·20 (1·09–1·32)	0·86 (0·75–0·99)
Low-to-moderate carbohydrate consumption	Combined low-to-moderate cohorts	1·22 (1·14–1·31)	0·81 (0·76–0·85)
Moderate-to-high carbohydrate consumption	Nakamura et al	1·00 (0·87–1·19)	0·92 (0·80–1·09)
Meta-analysis (pooled result)		1·18 (1·08–1·29) p<0·0001	0·82 (0·78–0·87) p<0·0001

Lancet Public Health 2018;3:e419

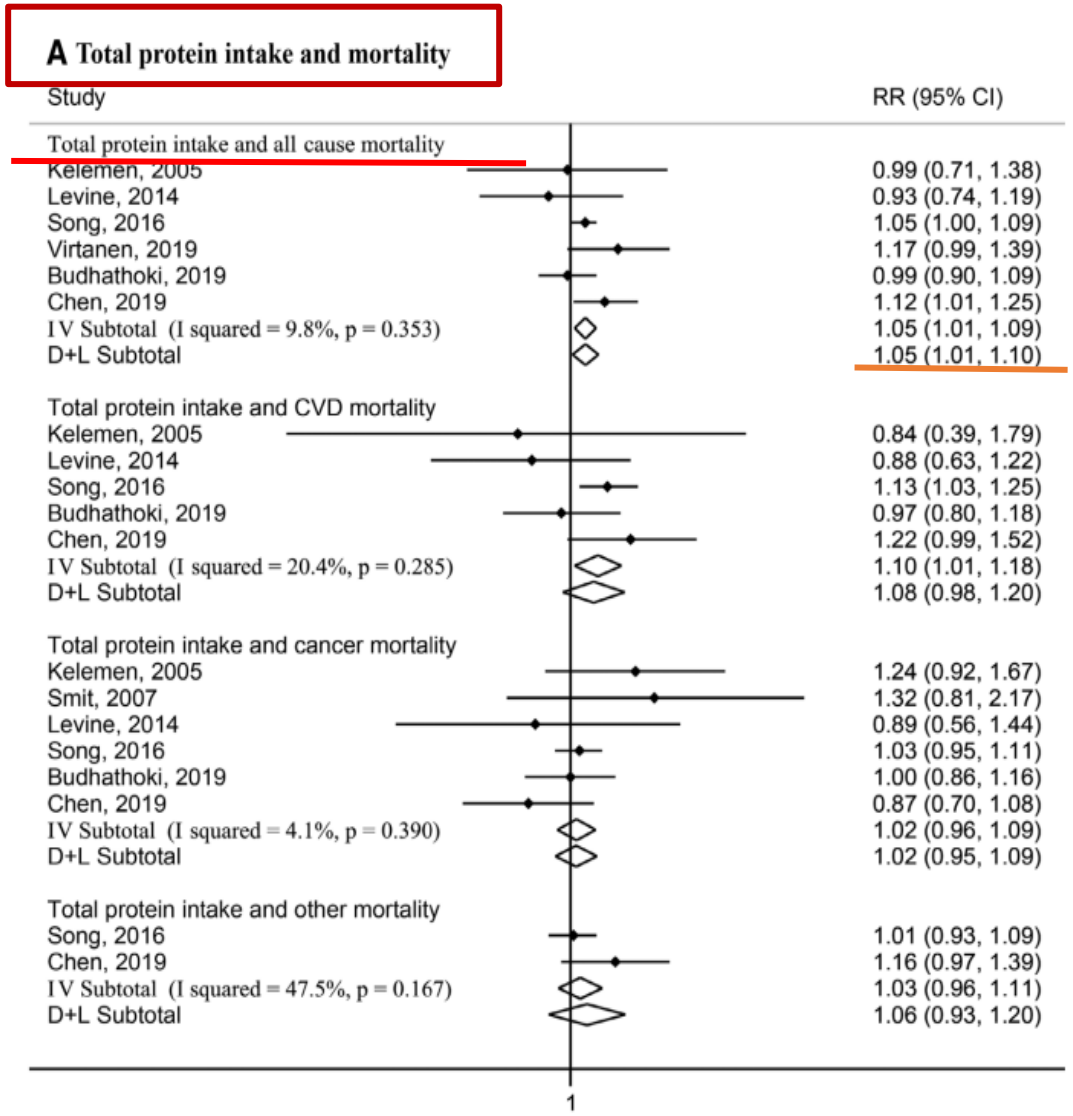
Carbohydrate intake and mortality

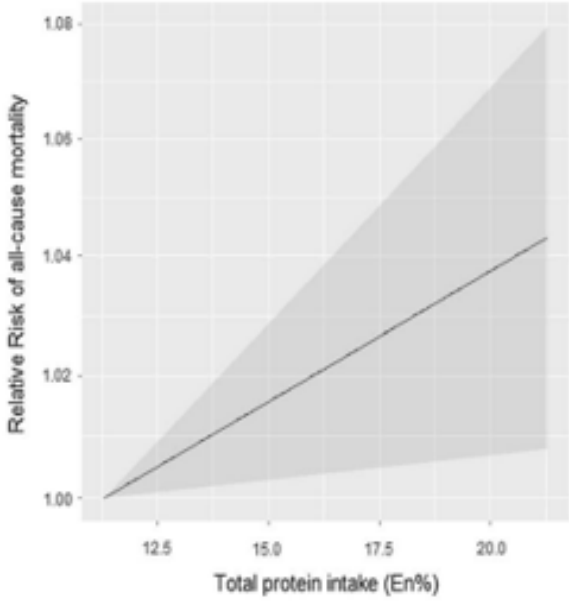
- Both high and low percentages of carbohydrate diets were associated with increased mortality, with minimal risk observed at 50–55% carbohydrate intake.
- Low carbohydrate dietary patterns favouring animal-derived protein and fat sources(lamb, beef, pork, and chicken) were associated with higher mortality, whereas those that favoured plant-derived protein and fat intake(vegetables, nuts, peanut butter, and whole-grain breads) were associated with lower mortality
- Long-term effects of a low carbohydrate diet with typically low plant and increased animal protein and fat consumption have been hypothesised to **stimulate inflammatory pathways, biological ageing, and oxidative stress.**
- High carbohydrate diets tend to be **high in refined carbohydrates**, such as white rice; these types of diets might reflect poor food quality and confer a **chronically high glycemic load** that can lead to negative metabolic consequences.

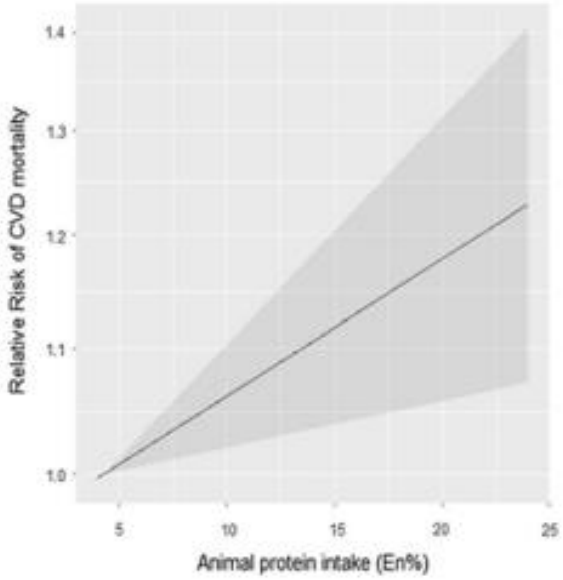
Lancet Public Health 2018;3:e419

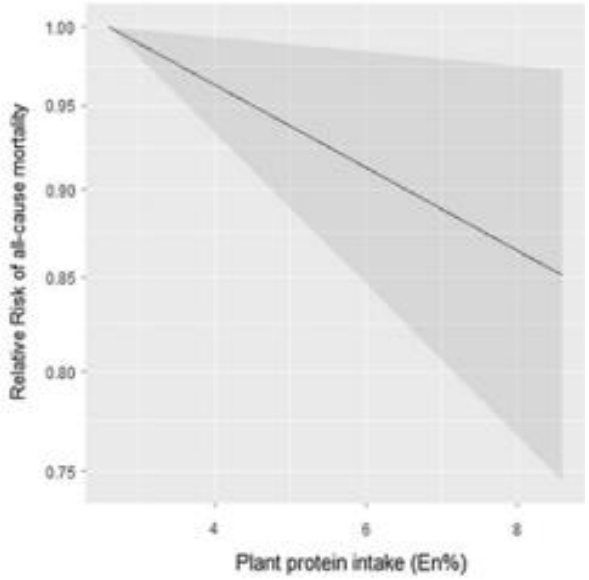
Protein intake and mortality

Meta analysis of prospective cohort studies





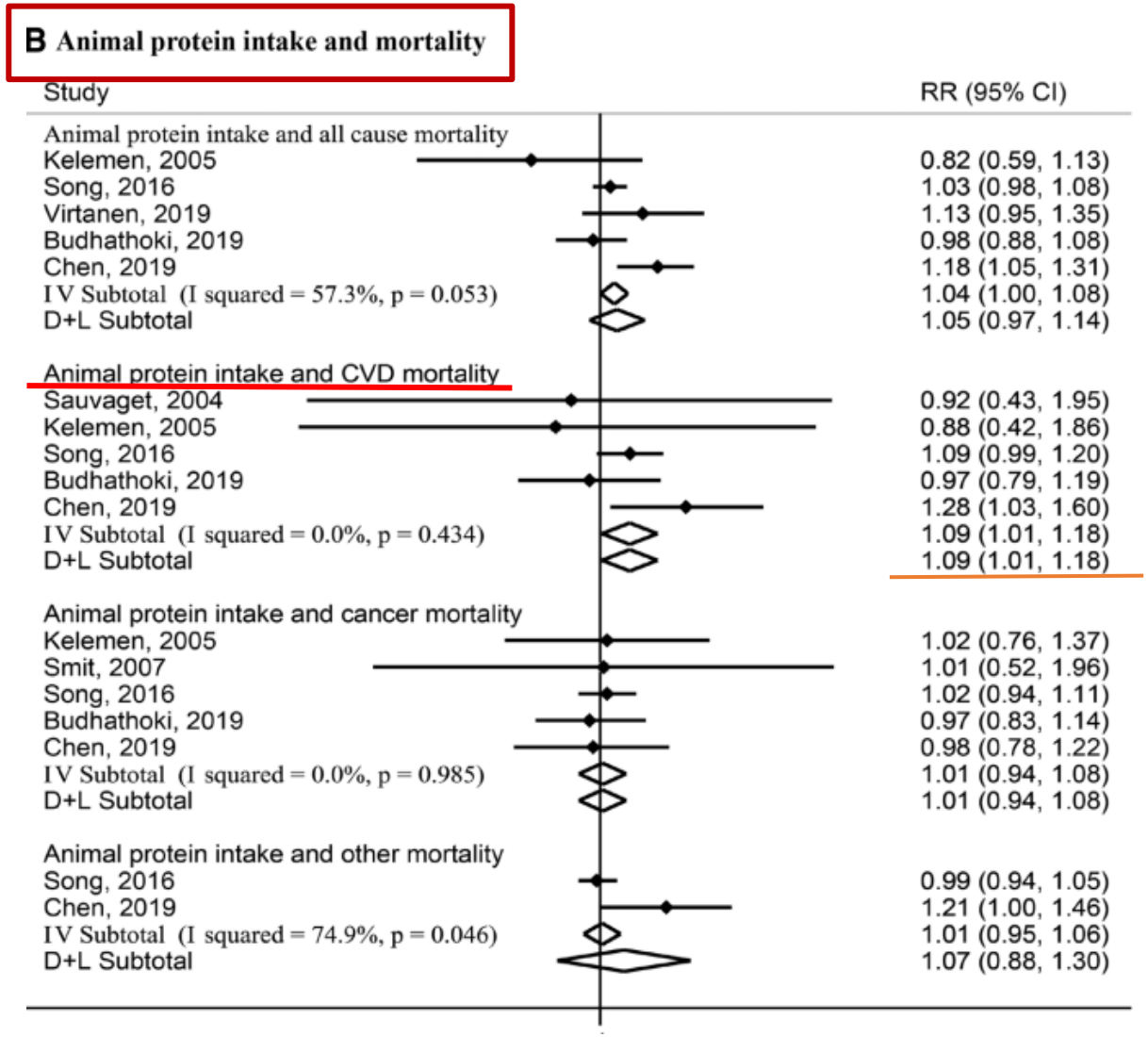


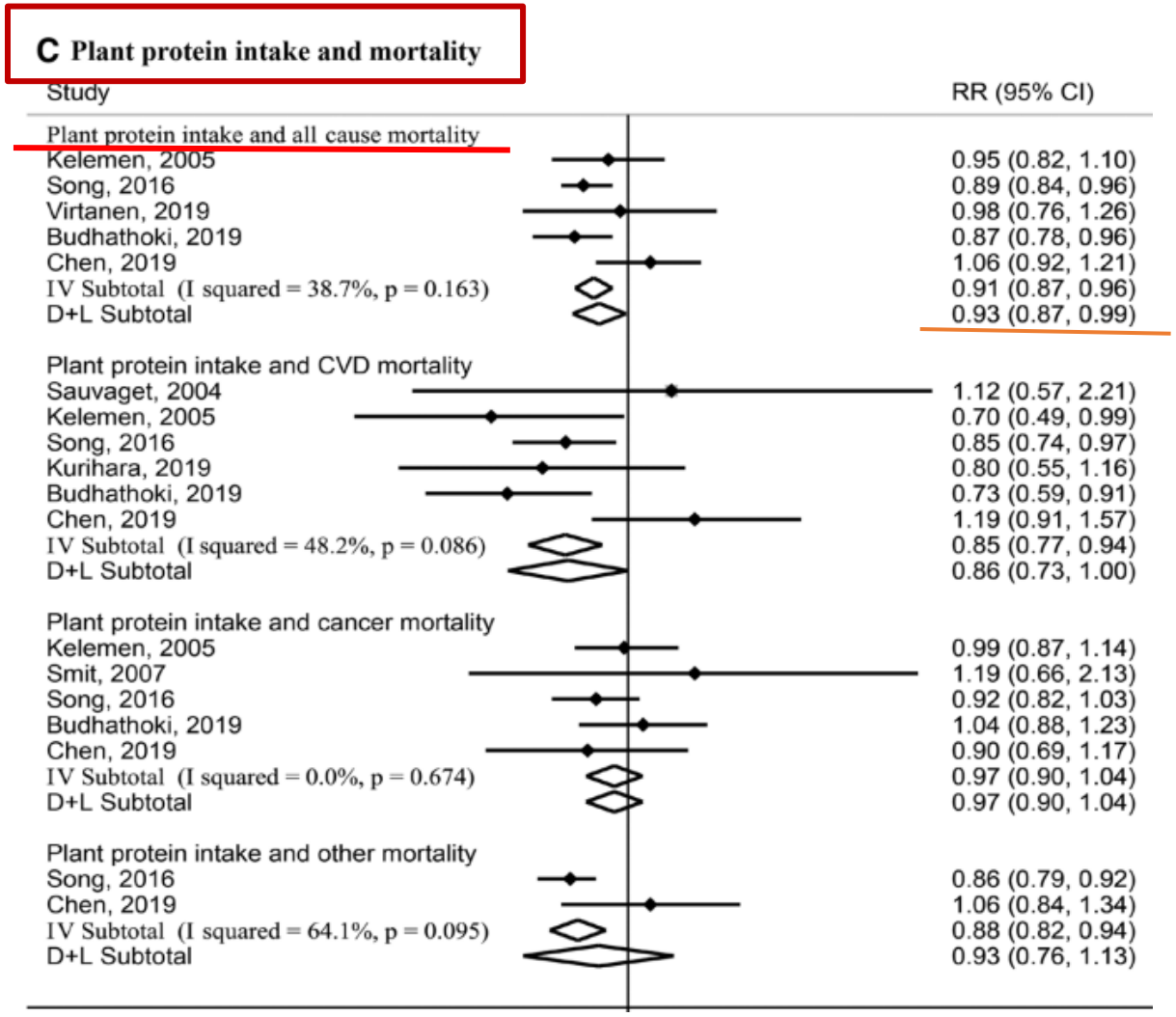


Eur J Epidemiol 2020;35:411

Protein intake and mortality

Meta analysis of prospective cohort studies





Eur J Epidemiol 2020;35:411

Protein intake and mortality

- In contrast to reported beneficial short-term effects of dietary protein intake on weight management, and cardiovascular risk factors, higher total protein intake was associated with higher all-cause mortality, which was mainly driven by a positive association between animal protein intake and CVD mortality.

- Possible mechanisms and pathways for animal protein and CVD mortality may involve the amino acids of animal protein (e.g. branched-chain and aromatic amino acids) and accompanying components of animal protein from animal food sources (e.g. SFA from red and processed meat).

- Evidence from prospective cohort studies to date suggests that total protein intake is positively associated with all-cause mortality, mainly driven by a harmful association of animal protein with CVD mortality. Plant protein intake is inversely associated with all-cause and CVD mortality.

Eur J Epidemiol 2020;35:411

Fat intake and mortality

Meta analysis of prospective cohort studies

Table 2
Summary of pooled relative risks (RR) of mortality from all-causes, CVD, and cancer for total and specific types of fat intake.

	Highest *versus* lowest				% of energy increment from fat				
	No. of studies	RR (95% CI)	I^2 (%)	*P* value	% of energy	No. of studies	RR (95% CI)	I^2 (%)	*P* value
All-cause mortality									
Total fat	8	0.89 (0.81–0.99)	82.3	<0.001	5	6	0.99 (0.98–1.00)	67.5	0.002
Saturated fat	11	1.03 (0.94–1.13)	90.4	<0.001	5	10	1.02 (1.00–1.05)	83.1	<0.001
Monounsaturated fat	10	0.94 (0.89–0.99)	61.2	0.003	5	8	0.98 (0.97–0.99)	36.8	0.11
Polyunsaturated fat	11	0.88 (0.81–0.94)	84.7	<0.001	5	9	0.93 (0.89–0.97)	83.7	<0.001
Trans-fat	5	1.11 (1.02–1.21)	80.8	0.001	1	6	1.06 (1.01–1.10)	89.5	<0.001
CVD mortality									
Total fat	9	0.95 (0.85–1.07)	51.3	0.02	5	7	1.00 (0.99–1.01)	48.3	0.04
Saturated fat	11	1.02 (0.92–1.12)	78.2	<0.001	5	10	1.03 (1.00–1.07)	76.1	<0.001
Monounsaturated fat	11	0.94 (0.88–1.01)	47.1	0.03	5	9	0.99 (0.96–1.01)	53.1	0.01
Polyunsaturated fat	11	0.95 (0.89–1.02)	64.2	0.001	5	9	0.95 (0.91–0.98)	59.1	0.004
Trans-fat	6	1.14 (1.02–1.26)	46.6	0.1	1	7	1.06 (1.02–1.11)	50.8	0.05
Cancer mortality									
Total fat	5	1.00 (0.88–1.14)	69.2	0.003	5	4	1.00 (0.99–1.01)	50.9	0.07
Saturated fat	7	1.09 (1.00–1.18)	73.2	<0.001	5	6	1.04 (1.02–1.06)	58.8	0.02
Monounsaturated fat	7	0.98 (0.93–1.03)	35.8	0.13	5	6	0.99 (0.98–1.00)	11.8	0.34
Polyunsaturated fat	7	0.92 (0.89–0.95)	13.0	0.33	5	6	0.96 (0.94–0.99)	41.9	0.10
Trans-fat	3	0.97 (0.91–1.03)	46.1	0.17	1	3	0.99 (0.98–1.00)	0.0	0.37

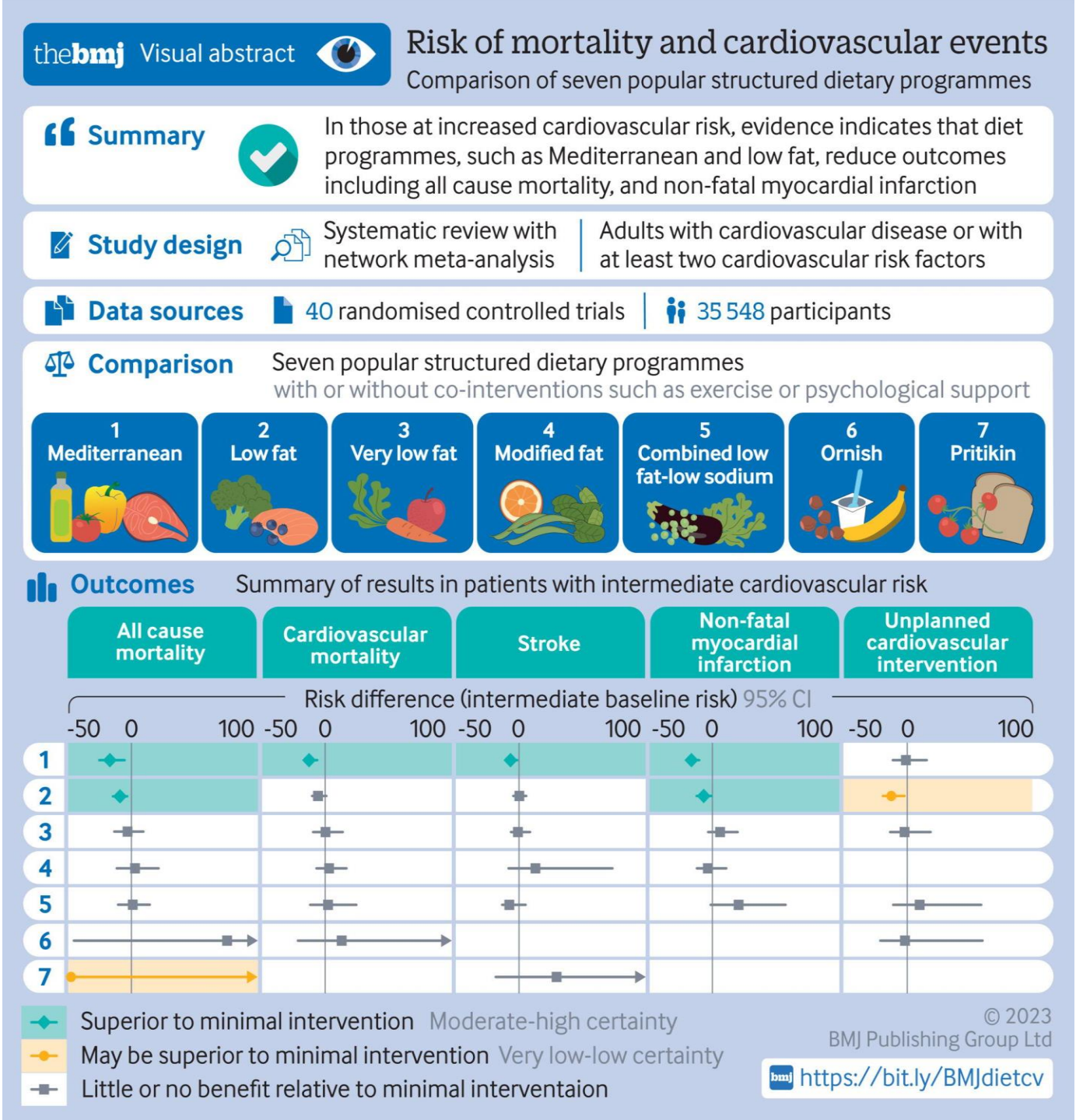
CVD, cardiovascular disease.

Clin Nutr 2021;40:1060

Fat intake and mortality

- Diets high in **saturated** fat were associated with higher mortality from all-causes, CVD, and cancer.
- Diets high in **polyunsaturated fat** were associated with lower mortality from all-causes, CVD, and cancer.
- Diets high in **trans-fat** were associated with higher mortality from all-causes and CVD.
- Diets high in **monounsaturated fat** were associated with lower all-cause mortality.

Clin Nutr 2021;40:1060



Conclusions

- Moderate certainty evidence shows that programmes promoting Mediterranean and low fat diets, with or without physical activity or other interventions, reduce all cause mortality and non-fatal myocardial infarction in patients with increased cardiovascular risk.

- Mediterranean programmes are also likely to reduce stroke risk.

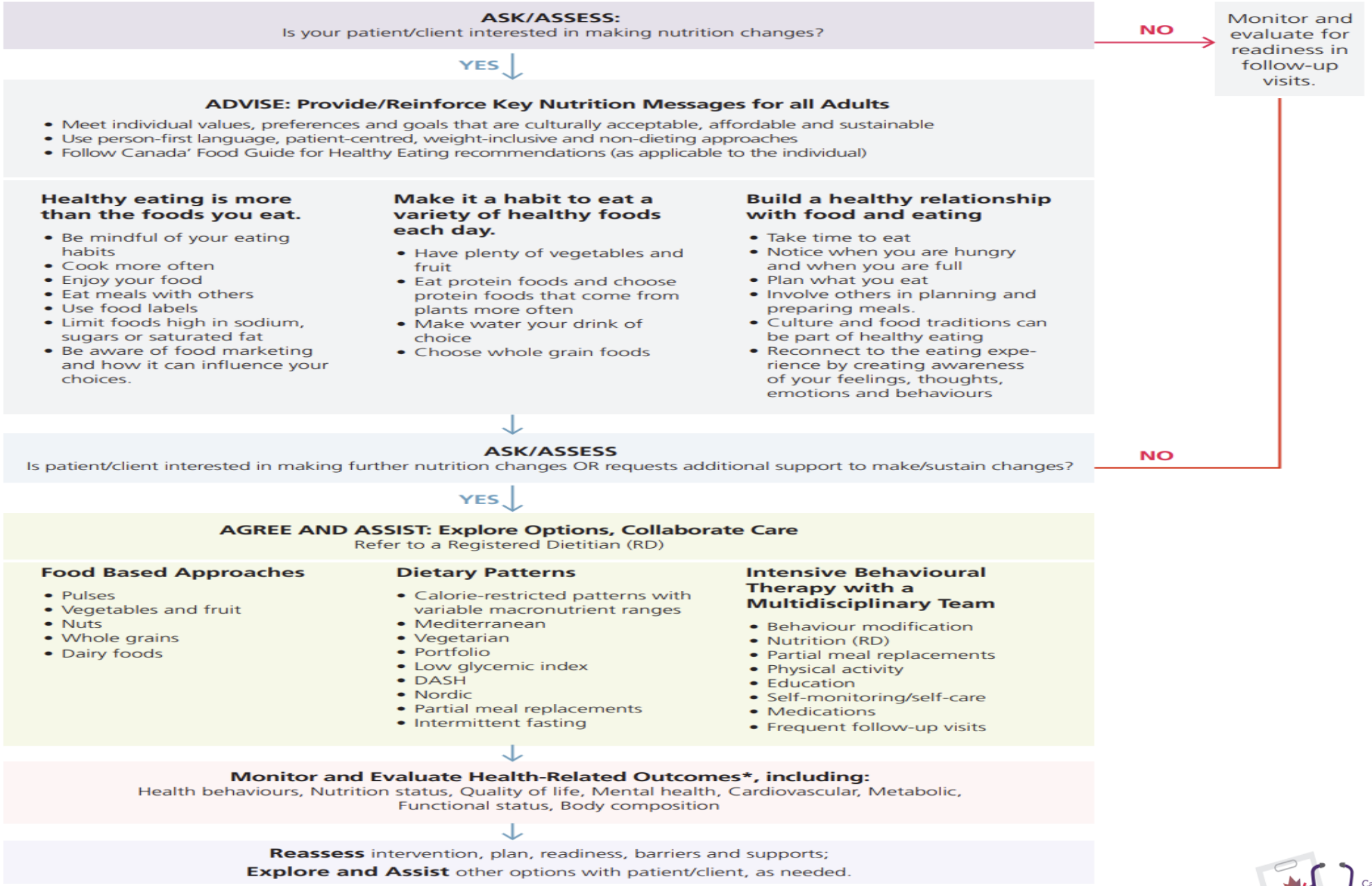
BMJ 2023;380:e072003

- Incorporate the diet quality of what we eat with insights from the timing of when we eat it.
  - Consider the best timing window and diet composition and quality of diet, including the intakes of whole grain, plant-based diet, limiting ultra-processed food, and portion control.
- Individualized and tailored diet protocols may be adopted for personalized nutrition that increases compliance, tolerability, and sustainability to achieve optimal health outcomes.

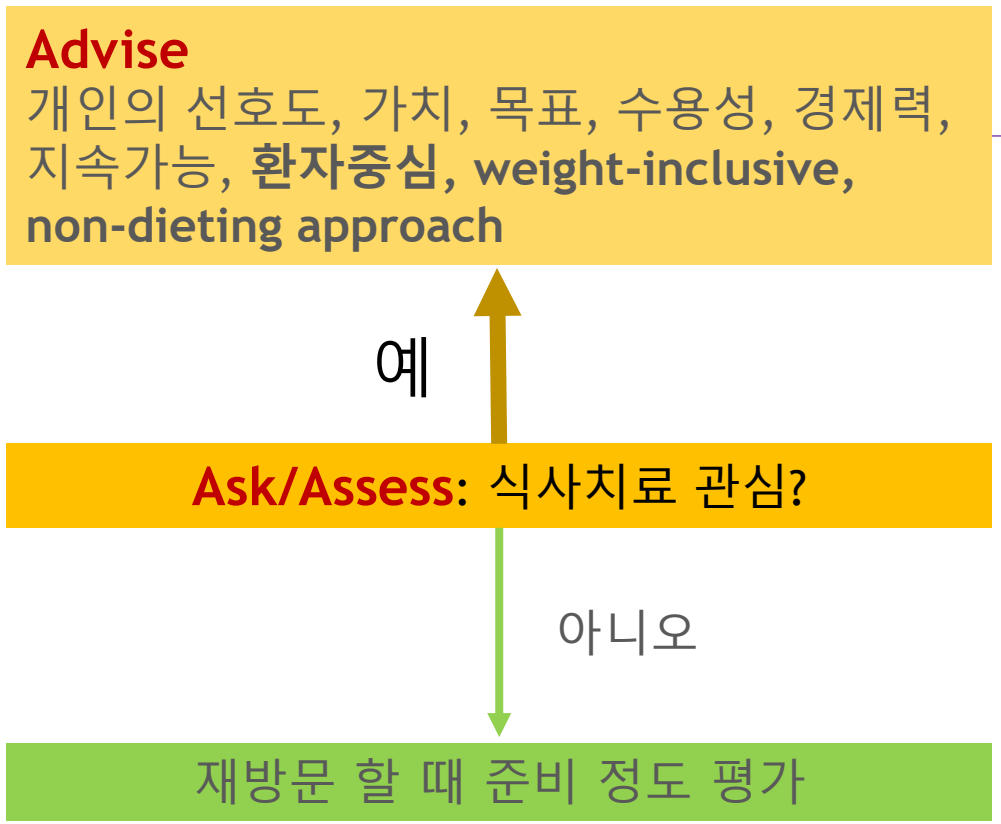
Front Public Health. 2022;10:1017254

- 대한비만학회 식사치료지침
- 영국 NICE 비만관리 식사권고 (Obesity: identification, assessment and management Clinical guideline)
- 미국 AACE/ACE 비만치료 식사 권고 (**AACE/ACE Comprehensive Clinical Practice Guidelines for Medical Care of Patients with Obesity)**
- 캐나다 의학적 영양치료지침

대한비만학회	**개별화**된 열량제한 식사/다량영양소 구성도 개별화/**건강**한 식생활 VLCD 제한적 허용
NICE	선호도 고려한 유연하고 **개별화**된 열량제한식사 (성인에서 600 kcal 제한 또는 800-1600 kcal, 저지방식)/영양불균형 주의/체중감량이 안되더라도 **건강** 개선 강조/VLCD 주의/long-term multicomponent strategy/**sustainable** change
AACE/ACE	열량제한식사/환자의 **선호도, 체중감소**효과, **건강개선** 효과, **순응도** 등 고려한 다량영양소 조성 변화, 식사 패턴
CANADA	유연하고 **환자 중심** 식사/체중감소 외 **만성질환** 위험과 QoL 개선할 수 있는 영양치료/개인의 식사 패턴, 음식의 질, 식사와 건강의 관련성에 초점/열량제한 식사의 한계 고려/미량영양소 결핍 고려



Canadian Adult Obesity Clinical Practice GUIDELINES



- **건강한 식사**
  - 더 자주 요리
  - 음식 즐기기
  - 다른 사람과 함께 식사
  - 식품 영양성분 읽기
  - 염분, 설탕, 포화지방 많은 음식 제한
  - 식품 마켓팅 유의
- **다양한 음식섭취와 건강한 식사 습관**
  - 충분한 채소/과일
  - 식물성 단백질 위주 식품
  - 충분한 물
  - 가공 안된 곡류
- **음식/식사와 건강한 관계**
  - 식사를 위한 시간 내기
  - 허기감과 포만감 인지
  - 식사 계획하기
  - 식사준비에 다른 사람 참여
  - 건강한 식생활 문화
  - 식사와 감정, 생각, 행동 간 관련성 인식

Assess: 더 집중적 영양치료를 원하는지

AGREE AND ASSIST: Explore Options, Collaborate Care

Refer to a Registered Dietitian (RD)

Food Based Approaches

- Pulses
- Vegetables and fruit
- Nuts
- Whole grains
- Dairy foods

Dietary Patterns

- Calorie-restricted patterns with variable macronutrient ranges
- Mediterranean
- Vegetarian
- Portfolio
- Low glycemic index
- DASH
- Nordic
- Partial meal replacements
- Intermittent fasting

Intensive Behavioural Therapy with a Multidisciplinary Team

- Behaviour modification
- Nutrition (RD)
- Partial meal replacements
- Physical activity
- Education
- Self-monitoring/self-care
- Medications
- Frequent follow-up visits

Monitor and Evaluate Health-Related Outcomes*, including:

Health behaviours, Nutrition status, Quality of life, Mental health, Cardiovascular, Metabolic, Functional status, Body composition

Canadian Adult Obesity Clinical Practice Guidelines

	Hunger, satiety	Blood pressure	Blood lipids	Weight	Waist circumference	Body composition	CVD, CHD morbidity, mortality	Risk CVD	Glycemic control	Risk T2DM	Metabolic Syndrome	Quality of life	Depression
Medical Nutritional Therapy (RD)	■	■	■	■	■				■				
Intensive behavioural therapy	NR	■	■	■			■		■		■		
Calorie restriction		■	■	■		■			■	■			
Lower carbohydrate				■									
Dietary fibre (25–29 mg)		■	■	■		■	■		■				
Low-calories sweeteners				■			■						
Higher protein (25–40%)	■		■	■		■							
Increased protein + calorie restriction			■	■		■							
Whey protein supplement		■	■	■		■			■				
Replace fat or carb with protein					■								
Lower fat				■									
Mediterranean			■				■		■	■	■		
Vegetarian			■	■			■		■	■			
Portfolio		■	■				■						
Low glycemic index			■	■			■			■			
DASH			■	■	■		■		■	■			
Meal replacements		■		■					■			■	
Intermittent fasting				■									
Pulses		■	■					■	■				
Vegetables and fruits		■					■		■	■			
Nuts			■				■		■				
Whole grains			■										
Dairy				■	■	■				■			
HAES®	■		■									■	■
Mindfullness-based approaches				■					■				

존중, 공감
- 체중 편견 최소화
- 환자 중심 단어
- 긍정적, 지지적 대화

개별화된 접근
- 사회적/환경적/심리적 요인 고려
- 조정자 역할
- 유연한 케어

지속 가능한 방법
- 적절한 정보와 방법 활용
- 환자와 치료자의 기대 차이 존중
- 환자의 능력, 장점, 회복력을 기반으로 환자와 파트너십 형성

비만치료를 위한 식사 =사람중심 케어

비만영양치료

저당질 식사 1500 칼로리 식단

There is not a one-size-fits-all diet for obesity treatment.

감사합니다