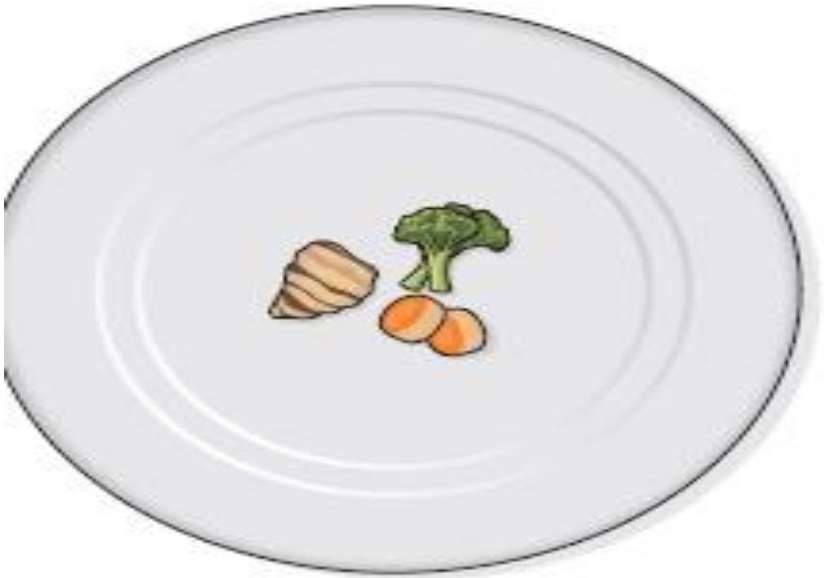
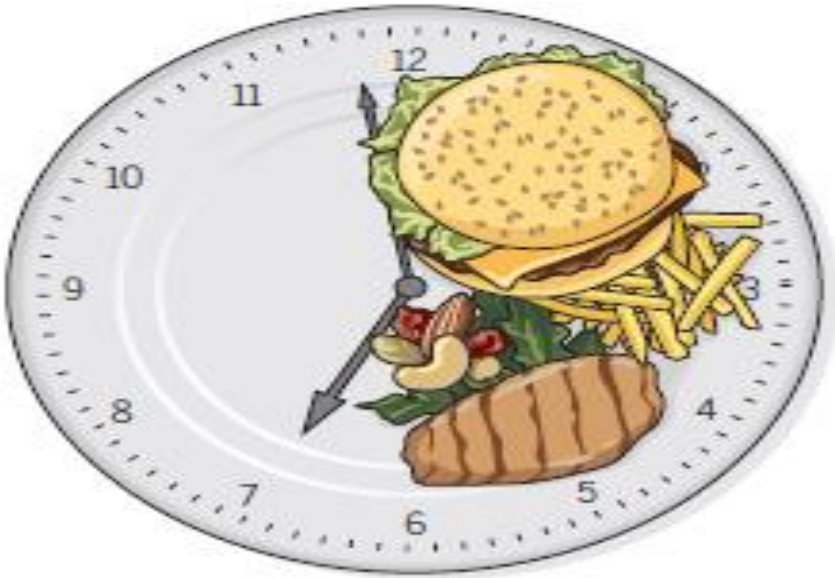
식욕 조절을 위한 비약물적 치료
- Searching for evidences

분당서울대학교 병원
김주영

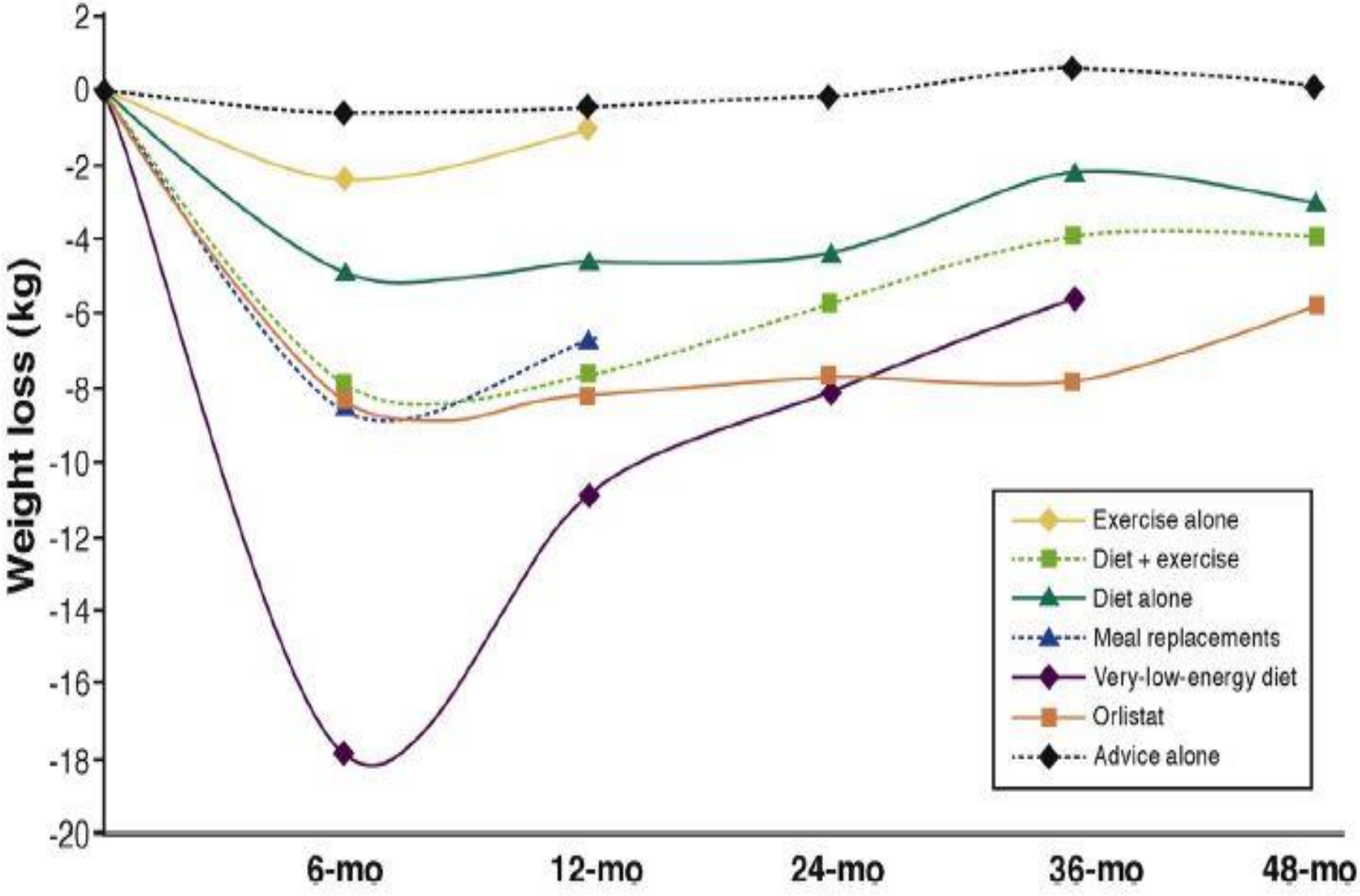
There is no such UNIVERSAL DIET because

적게 ? 시간제한 다이어트? 저탄고지? 단백질 제한 ?



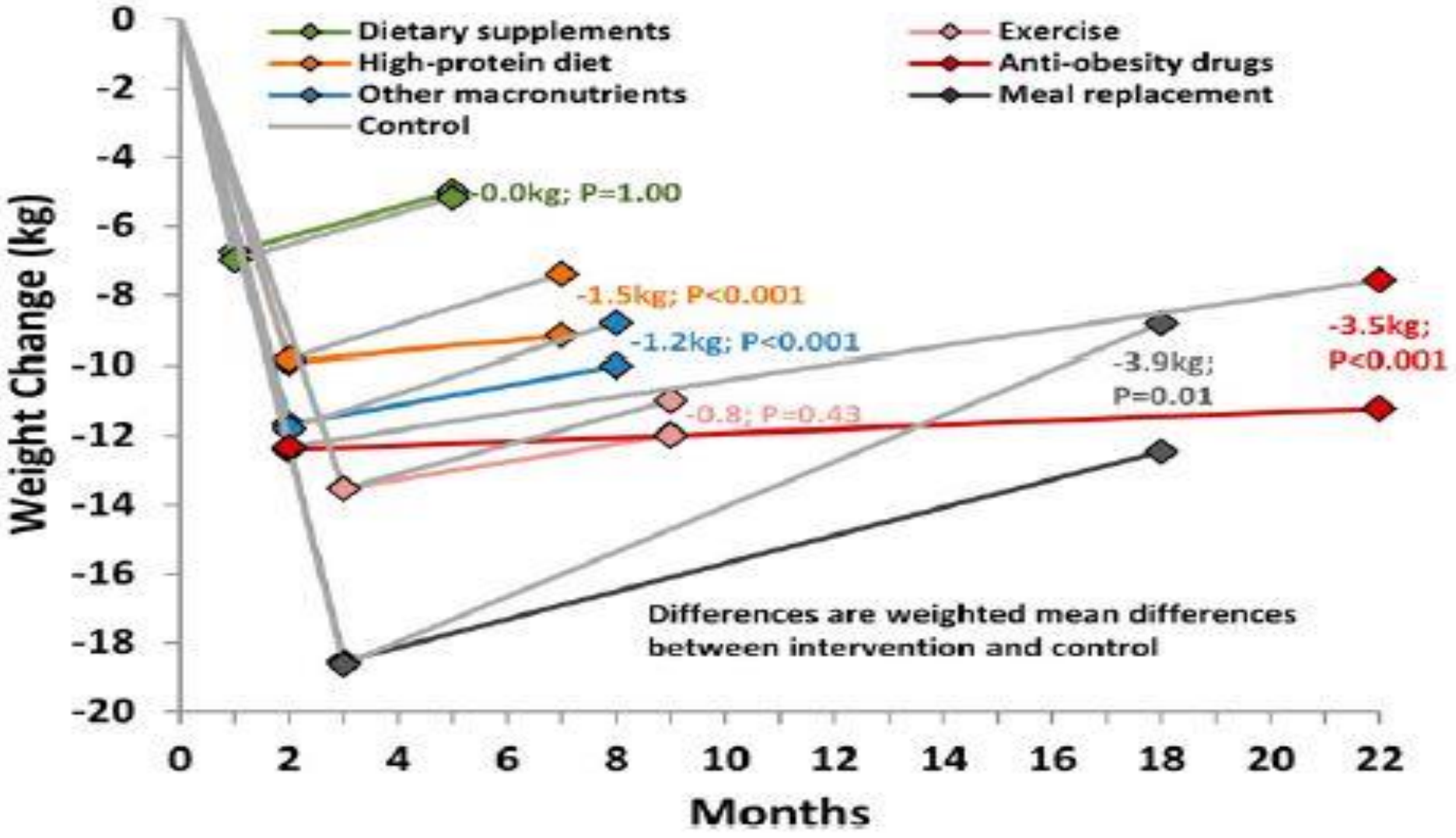


Tools for weight loss



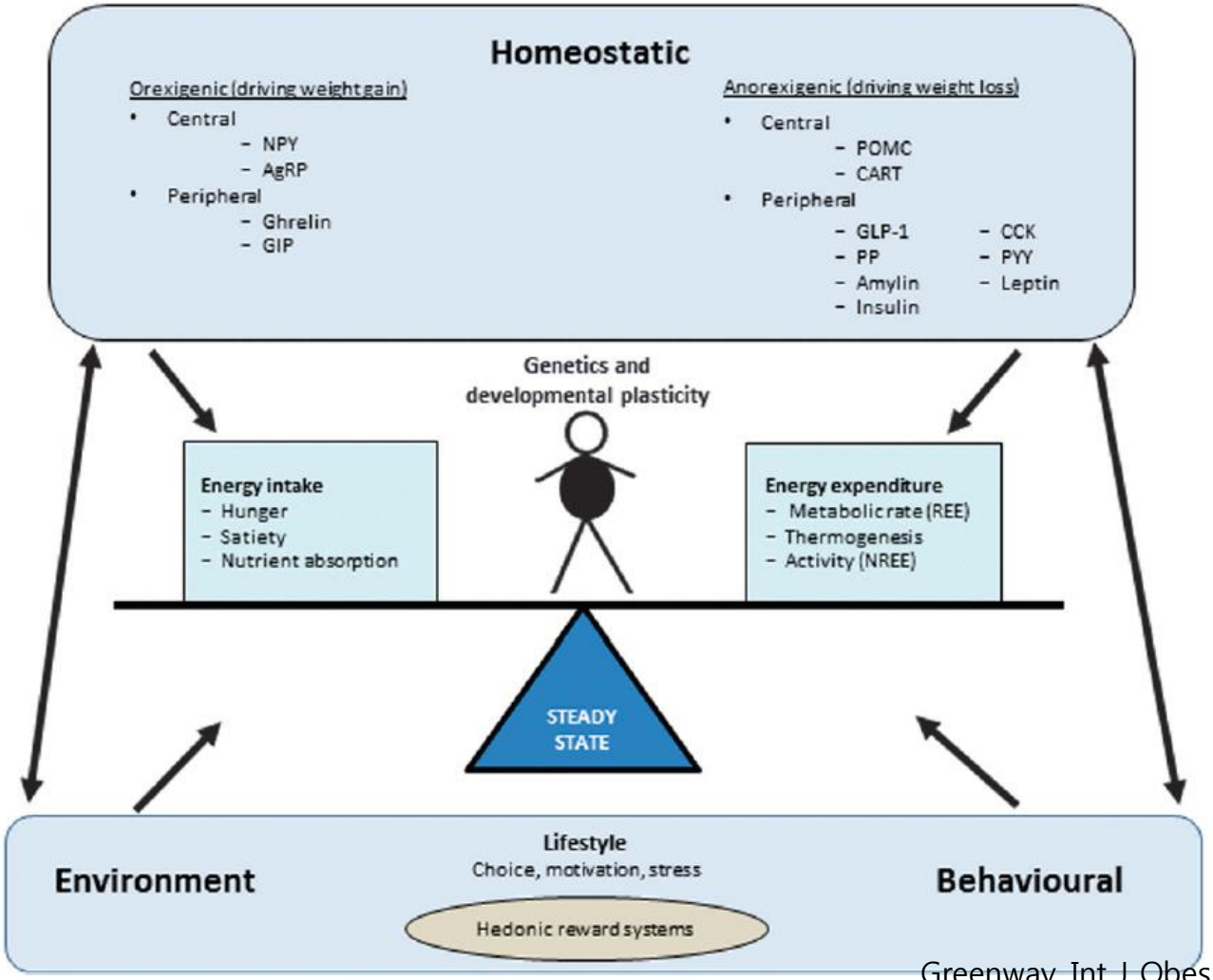
Thom et al. Gastroenterology 2017;152:1739-51

Tools for Weight Loss Maintenance



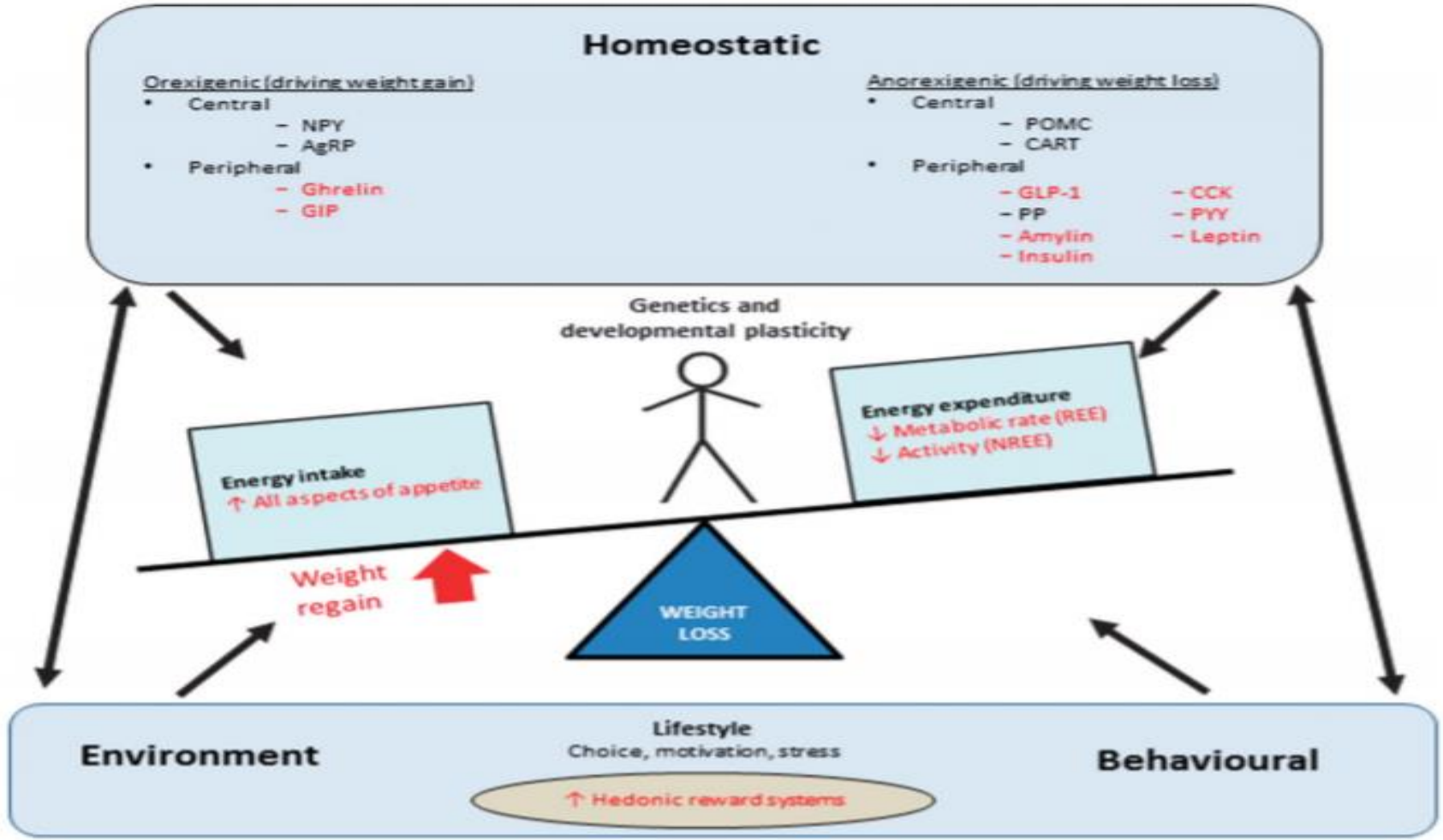
Am J Clin Nutr 2014;99:14-23

Feedback Control of Energy Intake



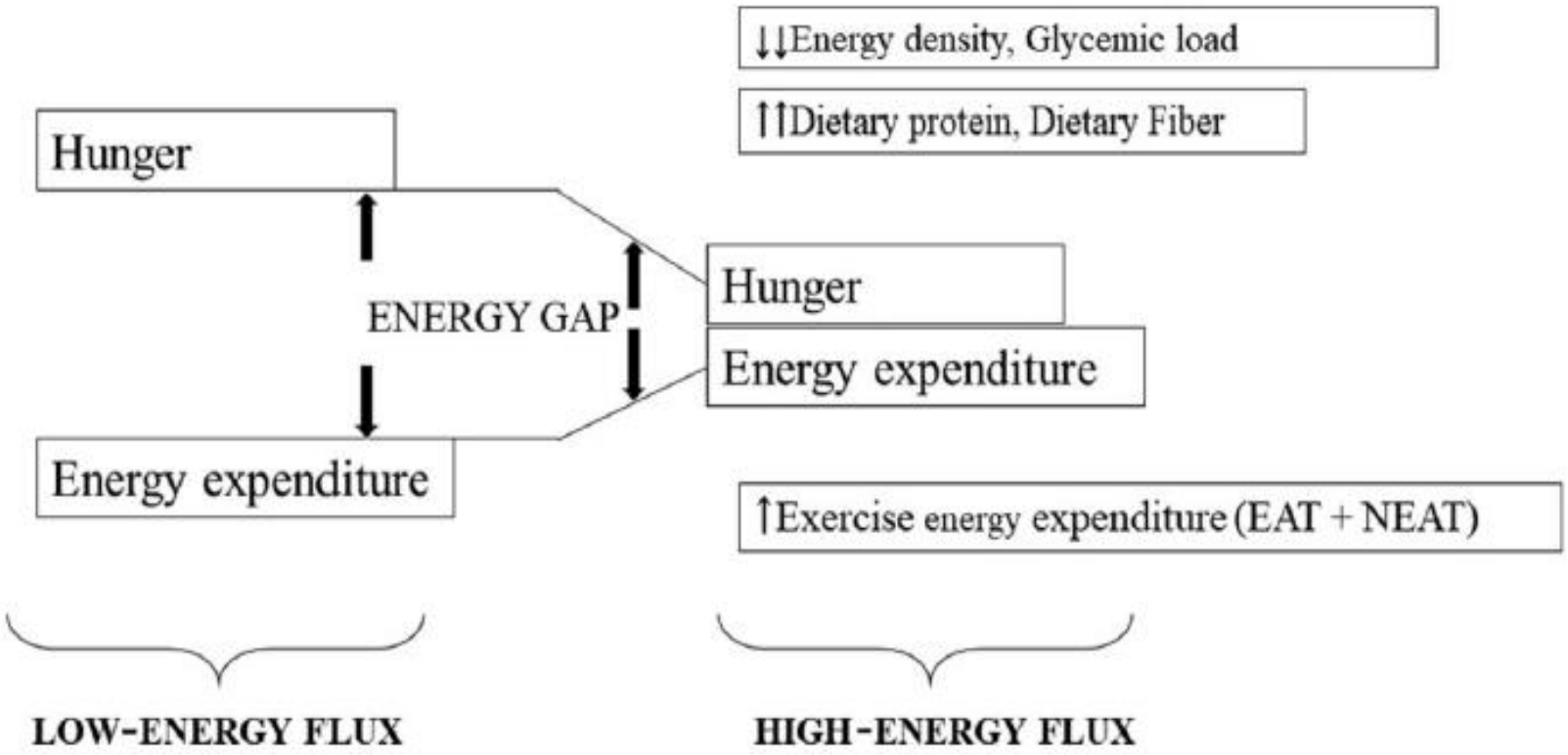
Greenway. Int J Obes 2015;39(8): 1188-96

Disturbance in homeostasis and hedonism



Greenway. Int J Obes 2015;39(8): 1188-96

Decreasing energy gap



Knowing what works and what doesn't work is the key

1. 얼마나 먹을지

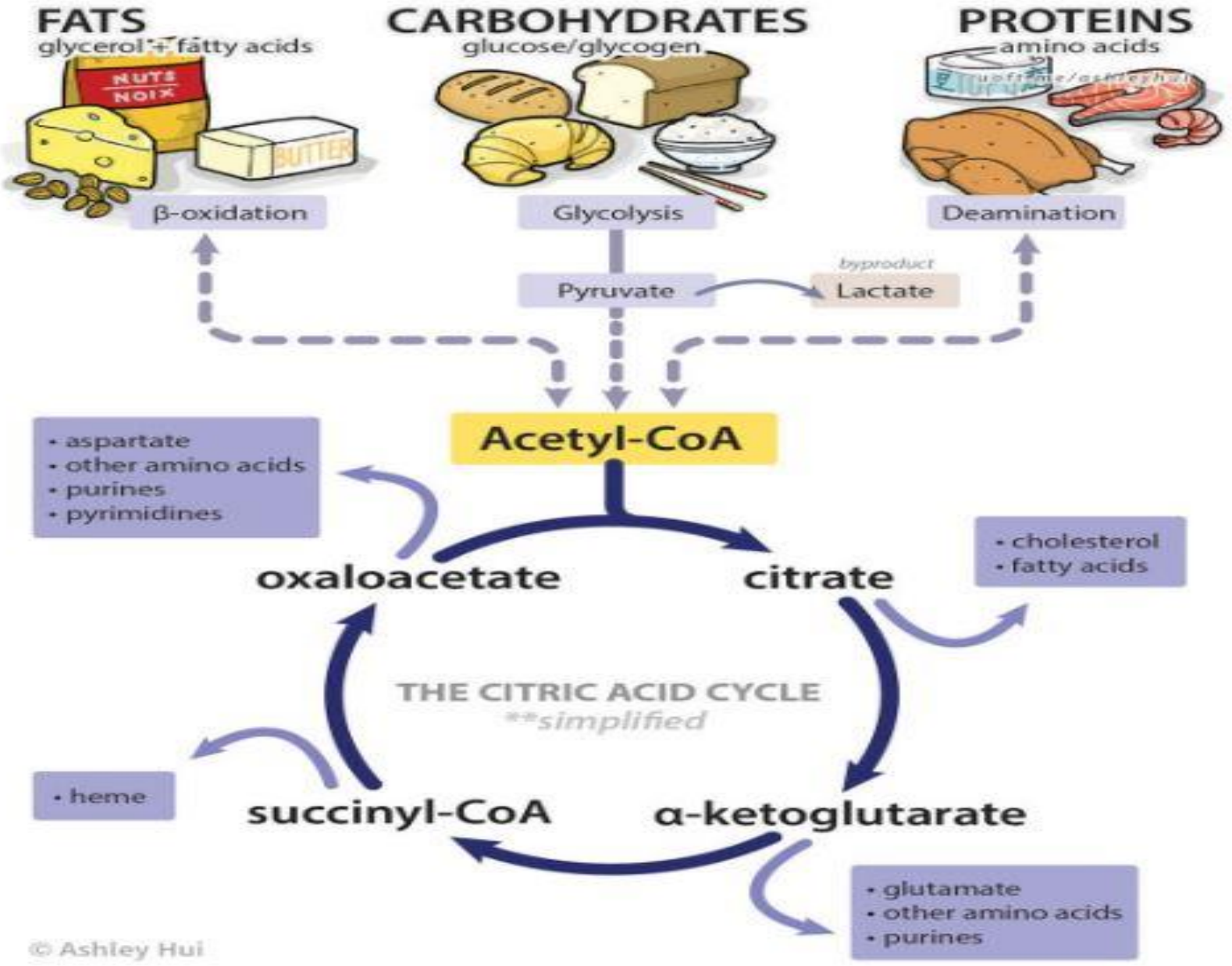
2. 어떻게 먹을지

3. 언제 먹을지

Prescription 1 – 얼마나 먹을 것인가?

바이오뉴트리온
김주영

Macronutrient metabolism



환자에게 필요한 칼로리 산정

1) 표준 체중 계산 : Broca 방법

키>160cm: 표준체중kg =(키cm -100) x 0.9

키 150~160 cm : 표준체중kg =(키cm -150) x 0.5 +50

키<150cm: 표준체중kg =(키cm -100)

조정체중: 표준체중 +(실제체중- 표준체중)/4

2) 표준 체중에 따른 비만도와 목표 열량 구하기

≥ 200 : 병적 비만 : 조정체중 *20

>120: 비만 : 조정체중 *20

111~120 : 과체중 : 조정체중 *25

90-110: 정상 : 조정체중 *25

80-89: 저체중 : 조정체중 *30

환자에게 필요한 칼로리 산정 예시

키 172cm
체중 90kg
표준 체중: 64.8kg
조정 체중 : 64.8 + (90-64.8)/4=71.1
비만도 : 138%
목표 열량 : 1422Cal

저열량 다이어트


먹을만큼만 덜어내어 한접시로!!
접시의 1/4은
단백질
식품
접시의 1/4는
탄수화물
식품
접시의 절반은
채소반찬
나물, 샐러드

저열량 다이어트

한 끼 권장 단백질 양

80g

육류 (돼지고기, 닭고기, 쇠고기, 오리고기 등)

100g

각종 생선류 (고등어, 연어, 갈치, 새우, 오징어등)

160g

두부

2개

계란

한 끼 권장 탄수화물 양

밥1/3공기, 70g

식빵 1쪽, 30g

고구마 1/2개, 70g

삶은국수90g, 1/2공기

마른국수 30g

감자 1개, 140g

씨리얼 30g,3/4컵

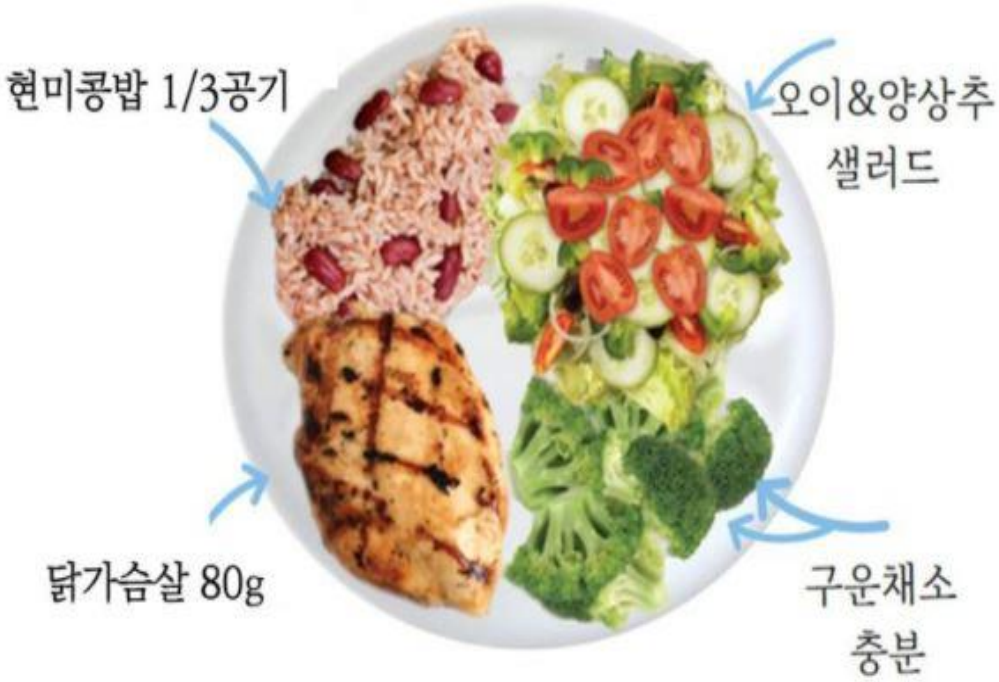
옥수수 70g

떡 50g

* 한 개만 골라요

저열량 다이어트


쇠고기구이 80g
밥 1/3공기(70g)
양상치, 파프리카 등 채소는
접시의 반이상 충분

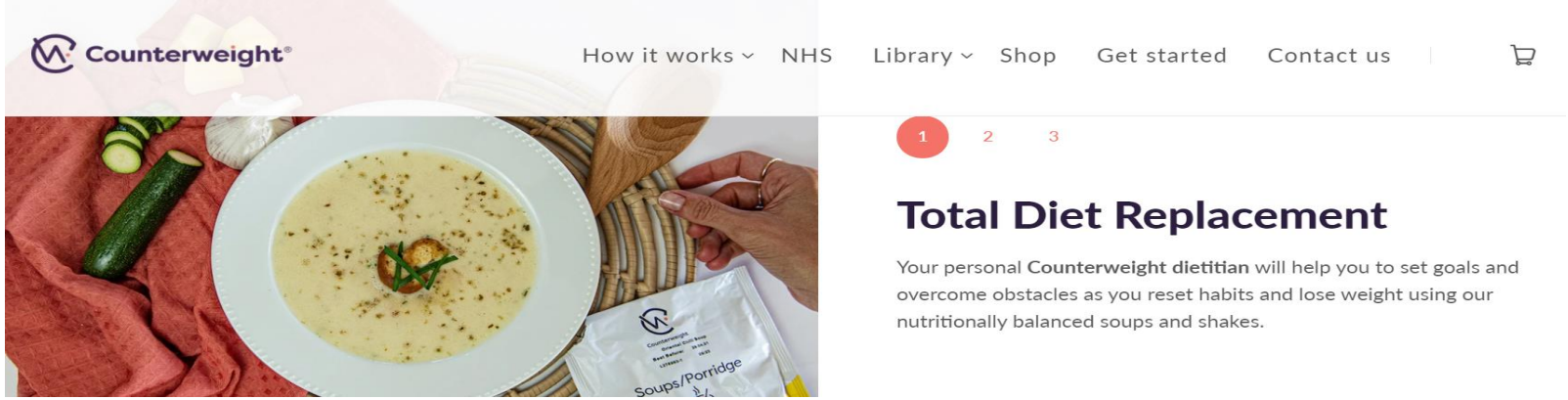

현미콩밥 1/3공기
오이&양상추
샐러드
닭가슴살 80g
구운채소
충분

초저열량식 (very low calorie diet)

- 하루 500- 900 Cal 이내로 열량 섭취를 제한
- DiRECT trial (Diabetes Remission Clinical Trial)

대조군 :
당뇨 진료 지침에 따른
일반적 당뇨 관리

실험군 :
구조화된 초저열량식 이후
저열량식으로의 전환



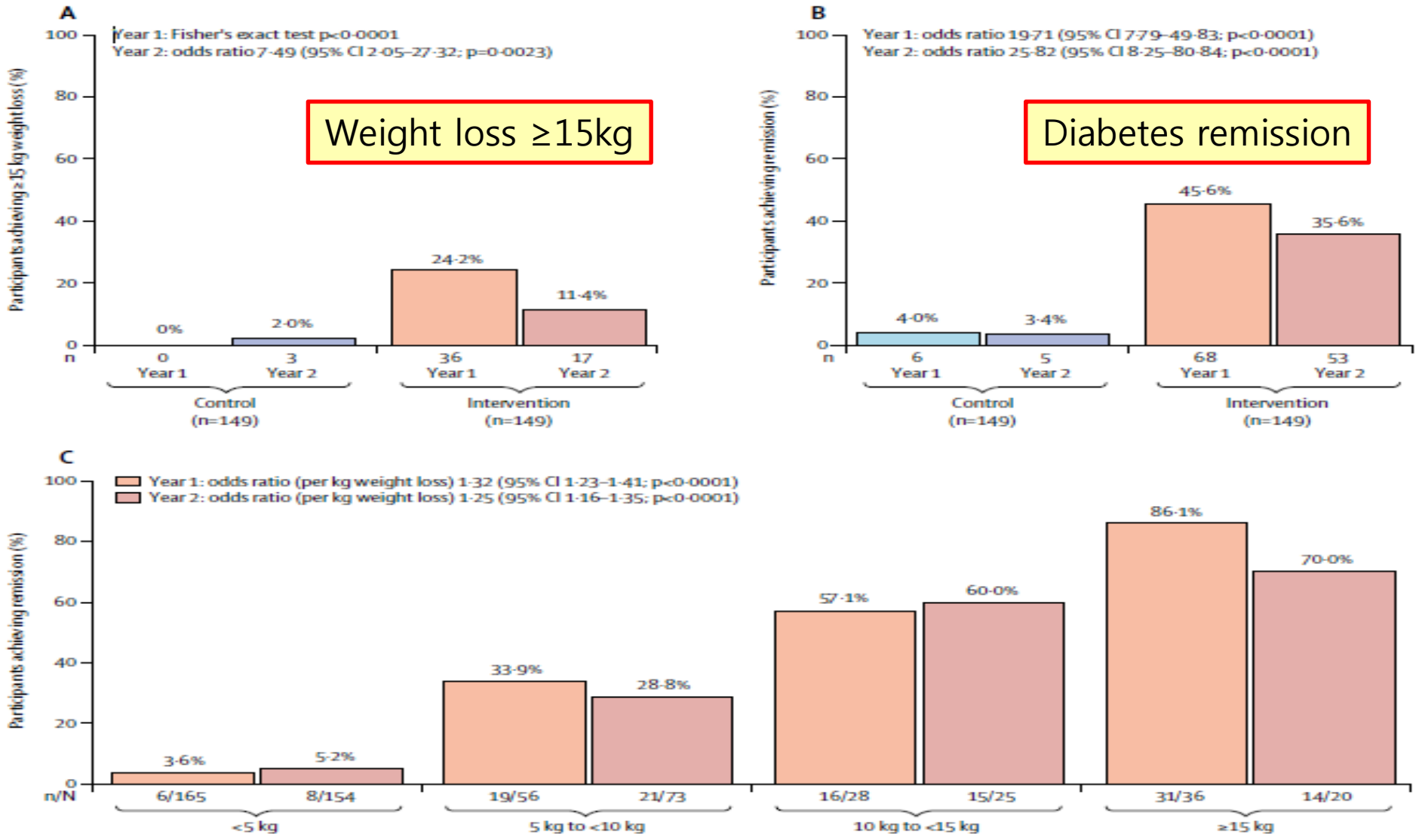
DiRECT Study

Structured Program in Primary Care Setting

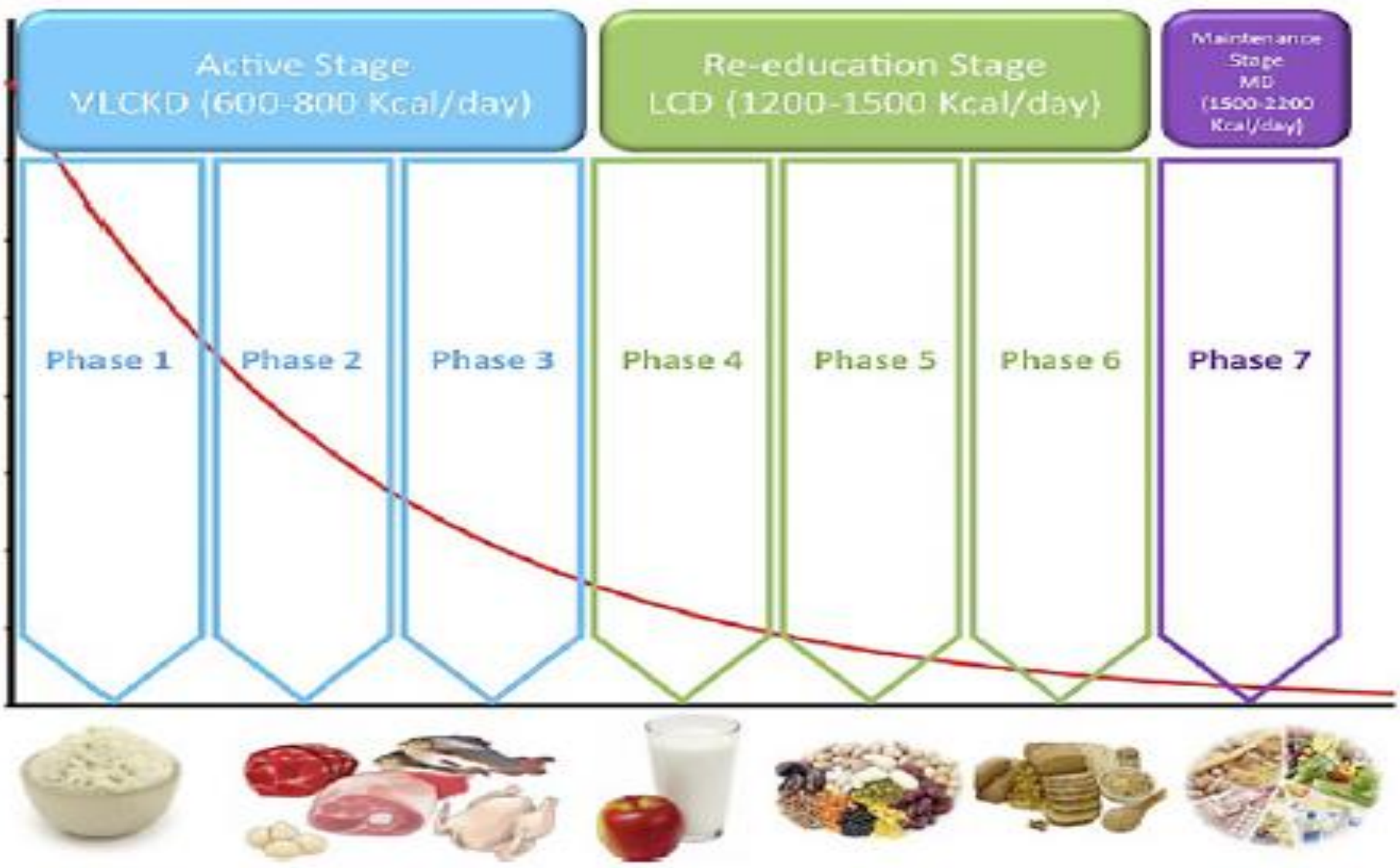
Practice nurse/dietitian program delivery

Withdraw Anti-diabetic and anti-hypertensive medications	Total Diet Replacement	Food Reintroduction	Weight loss Maintenance
Start of TDR	~3months	~2months	To 24 months

Primary outcomes



Very Low Calorie Ketogenic Diet

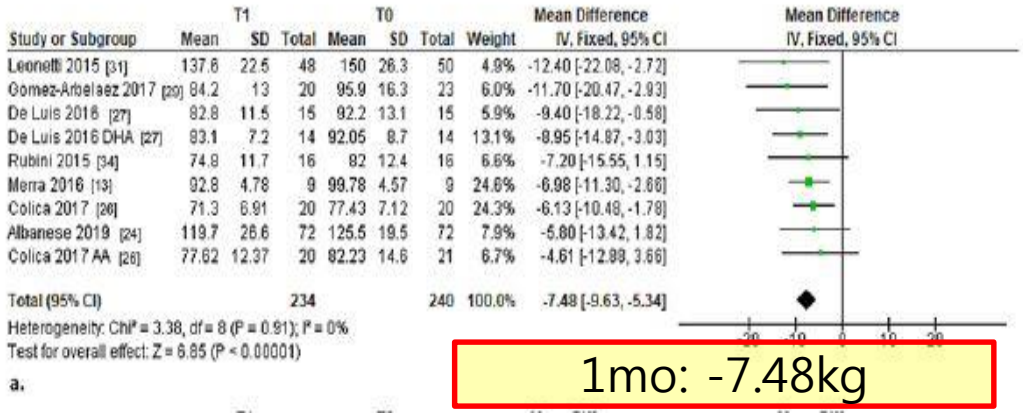


Obes Facts 20221;14:222-245

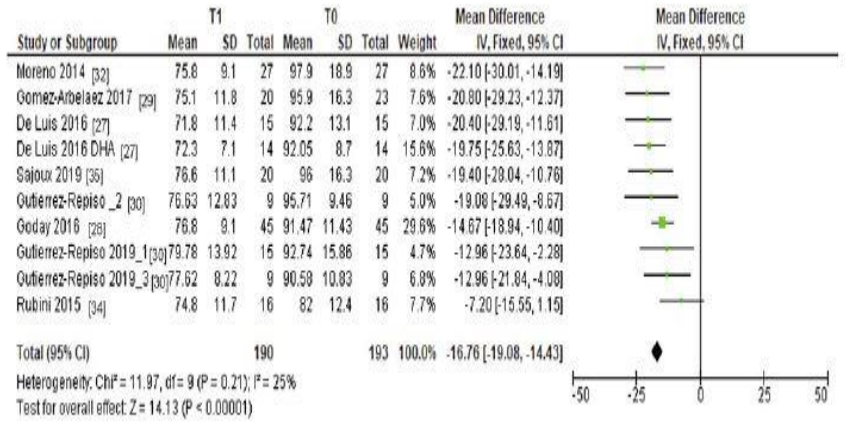
Very Low Calorie Ketogenic Diet

- **Active stage**
  - Carb; <50g from vegetables
  - Protein: high biological value ranged between 0.8-1.2g/kg of ideal body weight
  - Lipid: 10g of olive oil per day
  - Supplementation of multivitamin and minerals, omega-3
- **Re-education stage**
  - Carbs first reintroduced with lowest glycemic index (fruit and dairy products)
  - Carbs second moderate (legumes)
  - Calories between 800 and 1500kcal /day
- **Maintenance stage**
  - Calories from 1500-2000kcal/day

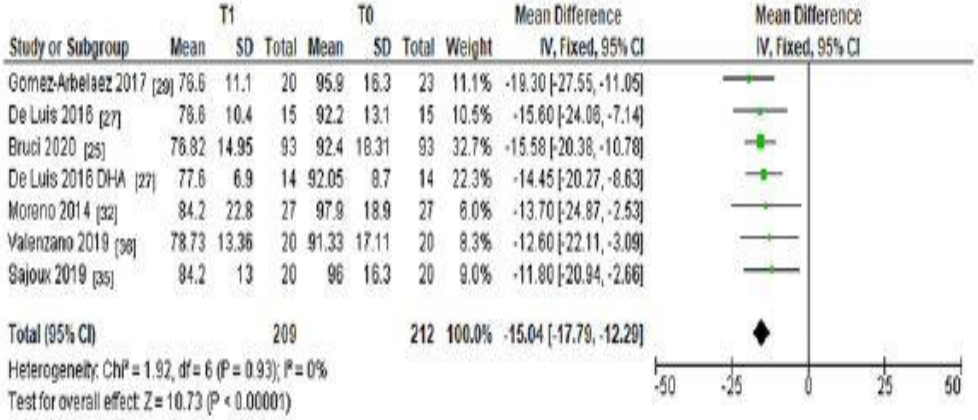
Meta-analysis of weight loss by time



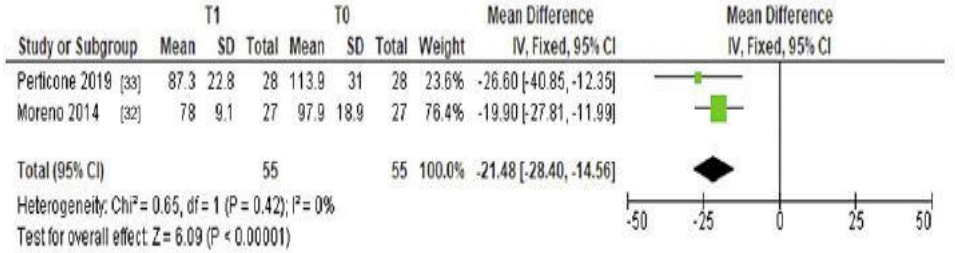
1mo: -7.48kg



4-6mo: -16.76kg



2mo: -15.04kg



12mo: -21.48kg

Adverse events

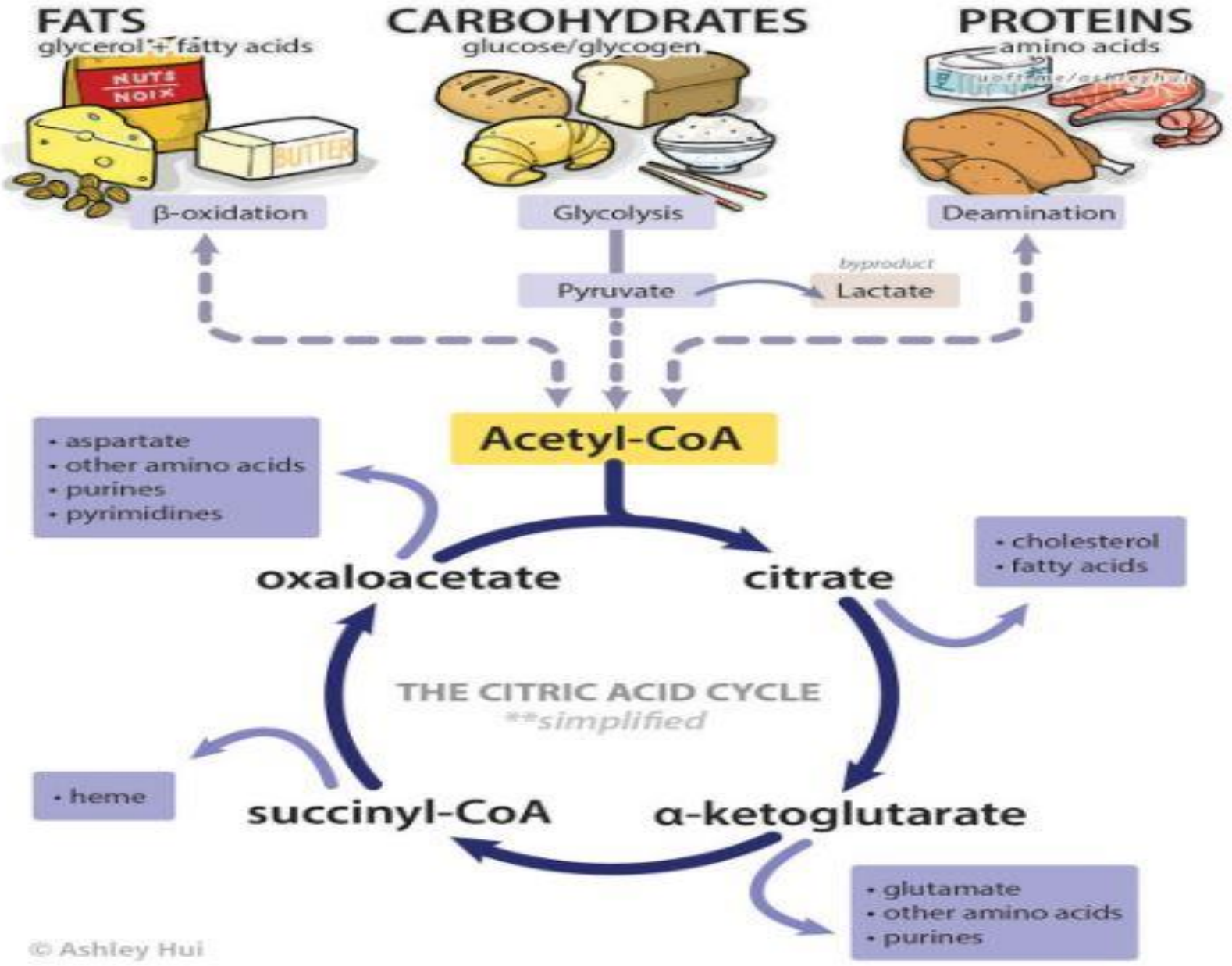
- Absolute contraindication
  - Type 1 diabetes mellitus
  - Beta-cell failure
  - Pregnancy and breastfeeding
  - On insulin treatment or sulfonylurea
  - SGLT2 inhibitor : case report of normoglycemic DKA
  - Severe chronic kidney disease
  - Liver failure
  - Heart failure
  - Respiratory insufficiency
  - Unstable angina
  - Recent stroke or myocardial infarction
  - Cardiac arrhythmia
  - Eating disorder
  - Other severe mental illness
  - Alcohol and substance abuse
  - Active infection
  - Frail elderly patients
  - 48h prior to an elective surgery

Adverse events

- **Dehydration related disorder**
  - Especially in ketogenic stage: dry mouth, headache, dizziness/orthostatic hypotension, lethargy, visual disturbance
  - Hyponatremia, hypomagnesemia
  - Muscle cramps and sleep disturbances
- Transient hypoglycemia
- Halitosis
- Gastrointestinal side effects
  - Nausea/vomiting/Diarrhea and constipation
- Hyperuricemia
- Lipid profile changes
- Rarely : urolithiasis, gallstone, hypocalcemia and bone damage, hair loss

Prescription 2 – 어떻게 먹을 것인가?

Macronutrient metabolism



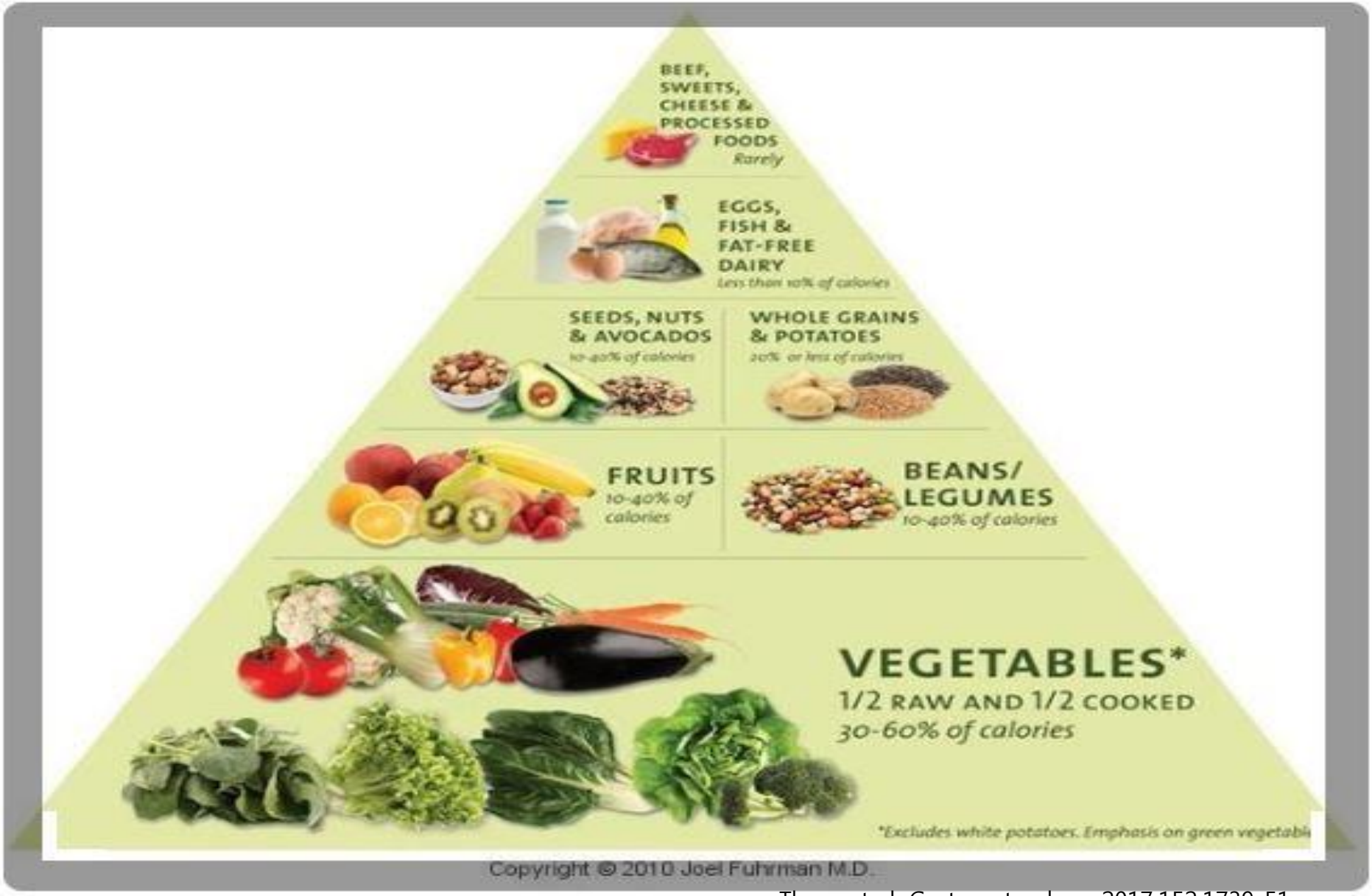
Characteristics of main macro-nutrients

	Fat	Protein	Carbohydrate
Ability to bring eating to an end	Low	High	Intermediate
Ability to suppress hunger	Low	High	High
Contribution to daily energy intake	High	Low	High
Energy density	High	Low	Low
Storage capacity in the body	High	None	Low
Metabolic pathway to transfer excess intake to another department	No	Yes	Yes
Autoregulation (ability to stimulate own oxidation on intake)	Poor	Good	Good
Calories per gram	9	4	3.75

Caloric restriction below metabolic requirements

Thom et al. Gastroenterology 2017;152:1739-51

Low Fat Diet –Ornish diet



Thom et al. Gastroenterology 2017;152:1739-51

Diabetes Prevention Program

Session 2: Be a Fat and Calorie Detective

Session 2: Overview

Be a Fat and Calorie Detective

Reducing the fat and calories in our meals is one of the most important steps we can take to improve our health. To reach healthy eating goals, we need to track our weight and how much we eat. Our role as a "fat and calorie detective" is to find the high-fat, high-calorie foods in our meals and figure out ways to make them healthier.

Monitor Our Food and Weight

Monitoring what we eat is a smart way of making sure we make healthy choices. Monitoring what we do is the most important part of changing our behavior. Therefore, an important part of this program is to write down everything you eat and drink in your *Food and Activity Tracker*.

How Am I Doing?

Use the *How Am I Doing?* weight chart to track your weight at home and before each session. This chart is important because it shows how

Quick Fact

Why does it matter if I get type 2 diabetes?

People with diabetes are twice as likely as people without diabetes to die early.

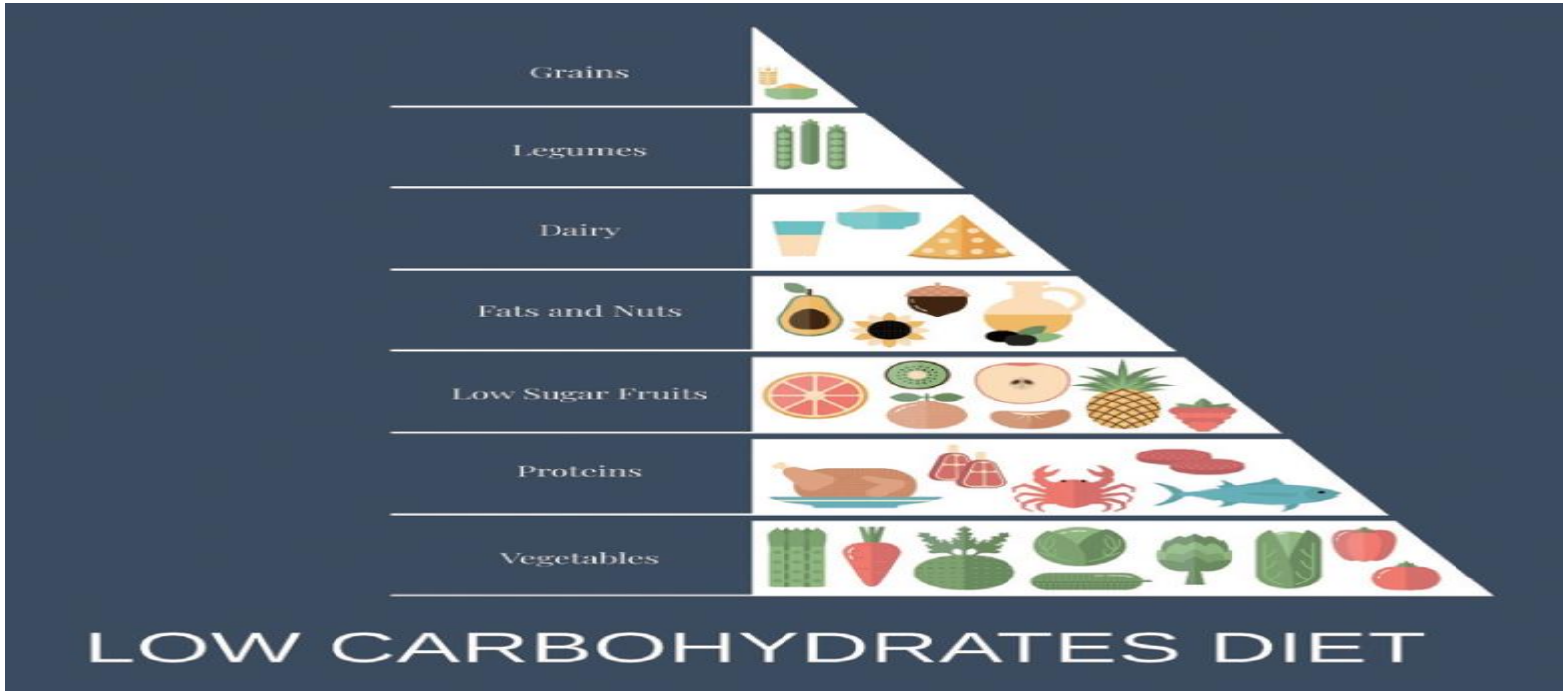
The good news is that by making smart choices in eating and physical activity, you can delay or prevent type 2 diabetes.

But there's more good news. Even with diabetes, people can lower their chances of blindness, kidney disease, heart attack, and stroke by eating healthy and getting regular

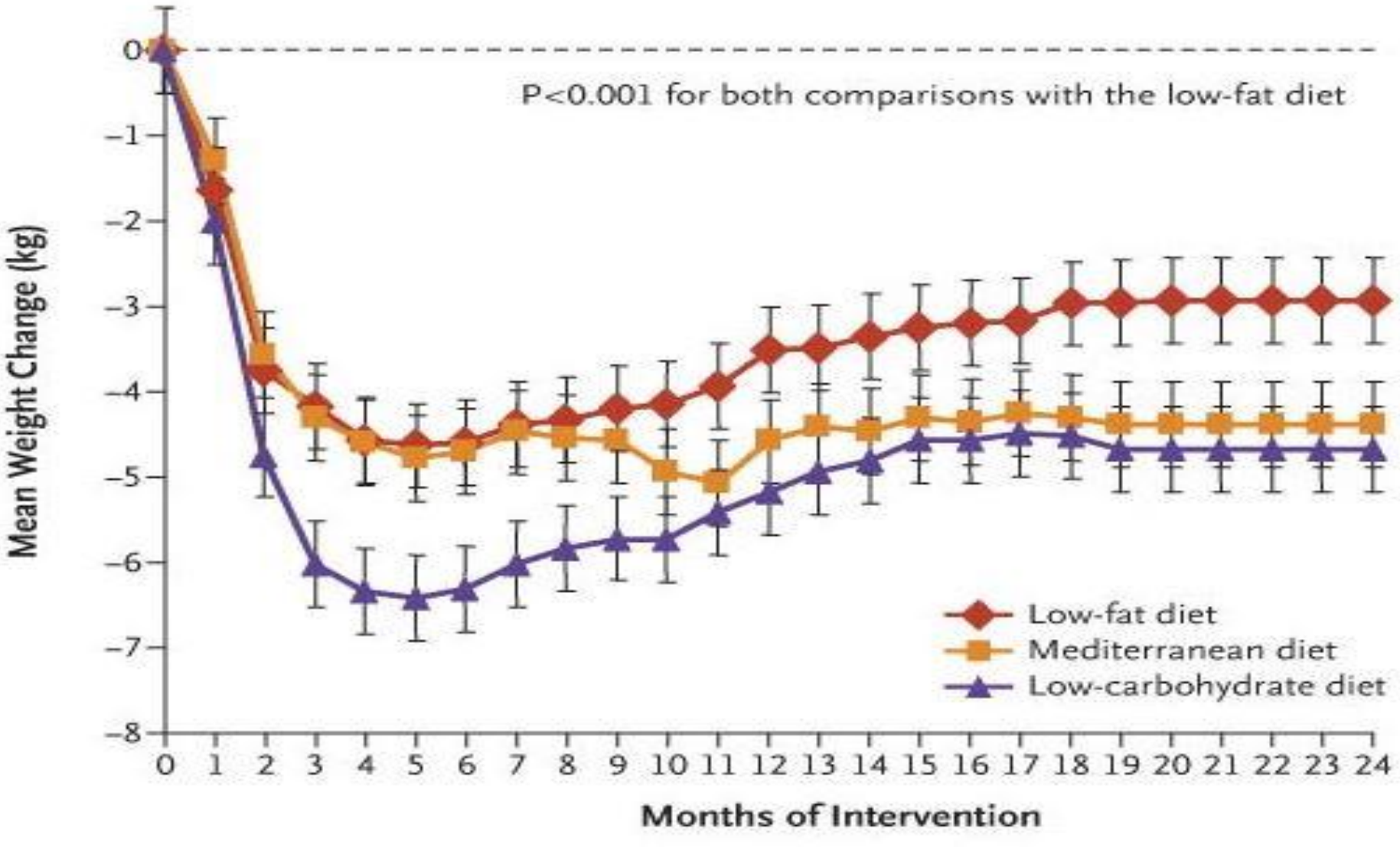
Low carbohydrate diet

정의	탄수화물 섭취량	칼로리 중 탄수화물 비중 (%)
Ketogenic diet	< 20-50g	<10%
Low carbohydrate diet	< 130g	<26%
Optimal carbohydrate diet	130~230g	26-45%
High carbohydrate diet	≥ 230g	≥ 45%

- 밥 한공기 150g 에 포함된 탄수화물양은 53.4g



Is there an optimal diet for metabolic health?

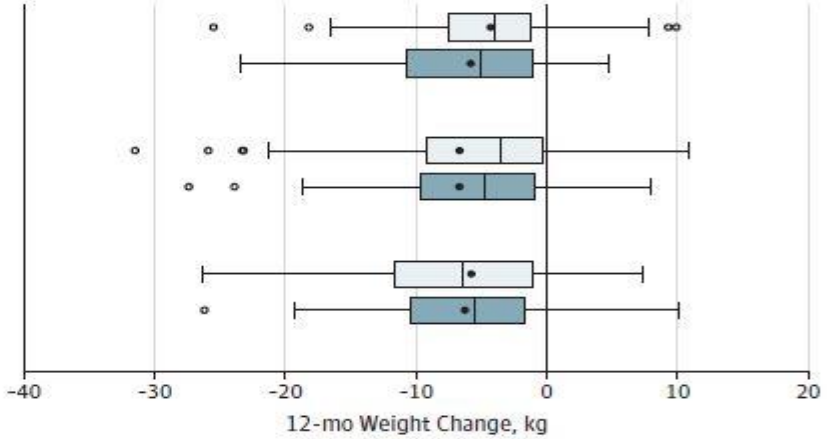


N Engl J Med 2008;359:229-41

Low fat VS low carb– DIETFITS trial

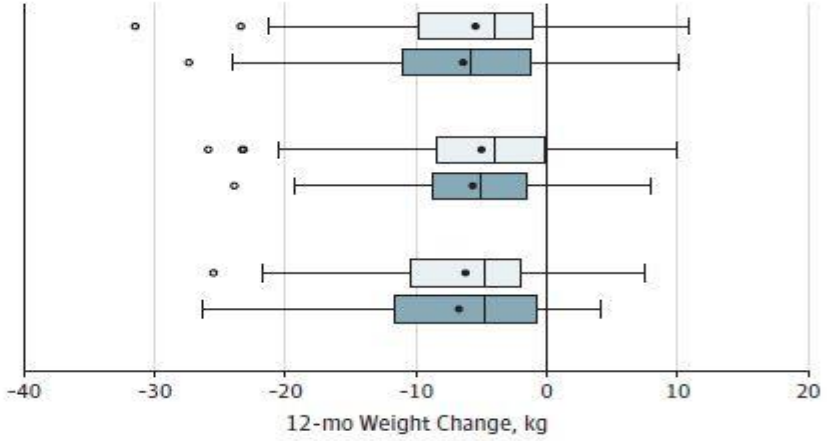
A 12-mo Weight loss by diet and genotype

	No. of Participants
Low-fat genotype	
Healthy low-fat diet	83
Healthy low-carbohydrate diet	70
Low-carbohydrate genotype	
Healthy low-fat diet	63
Healthy low-carbohydrate diet	81
Neither genotype	
Healthy low-fat diet	79
Healthy low-carbohydrate diet	60



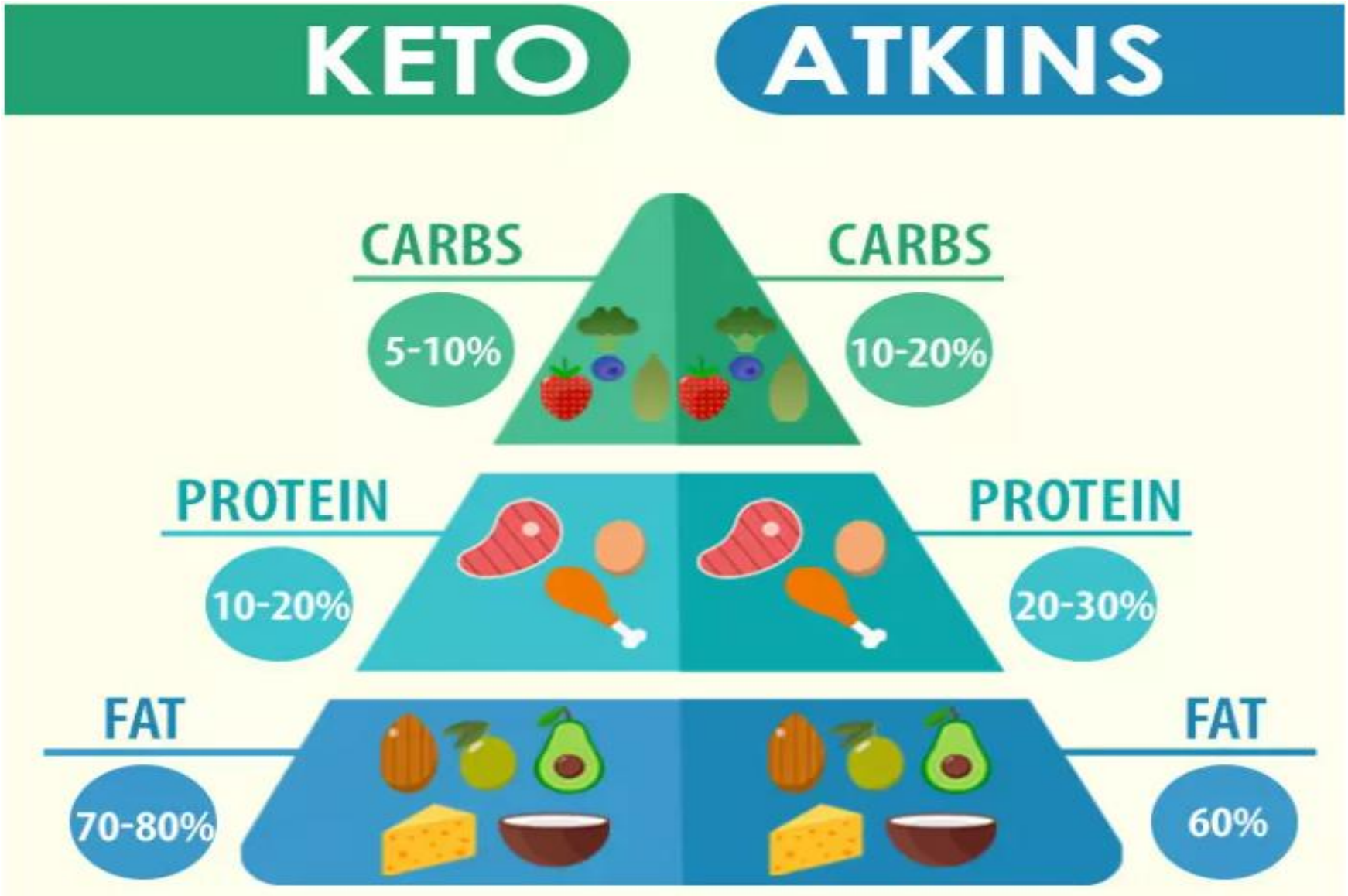
B 12-mo Weight loss by diet and insulin-30 tertile at baseline

	No. of Participants
Lowest insulin-30 tertile	
Healthy low-fat diet	66
Healthy low-carbohydrate diet	85
Middle insulin-30 tertile	
Healthy low-fat diet	81
Healthy low-carbohydrate diet	71
Highest insulin-30 tertile	
Healthy low-fat diet	68
Healthy low-carbohydrate diet	64



JAMA. 2018;319(7):667-679

Atkins diet VS Ketogenic diet



Paleo diet

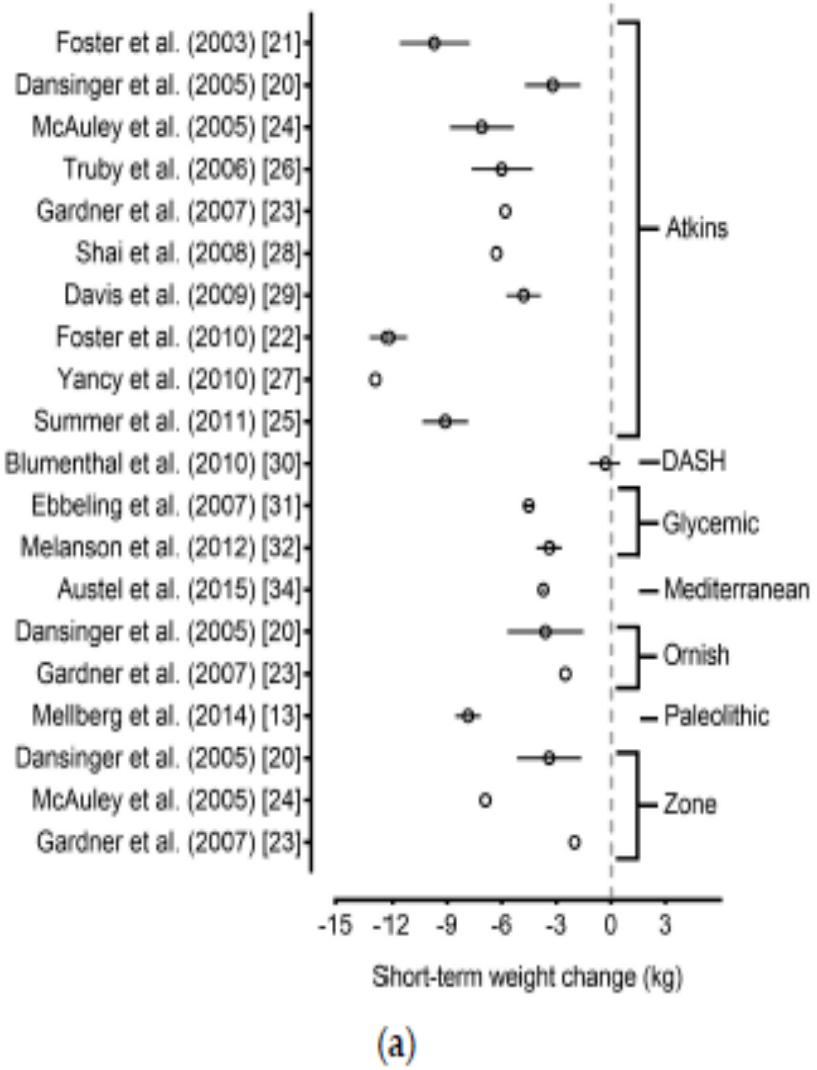

VITAMINS
WATER
FRUITS
BERRIES
SALT
SAFE STARCHES
VEGETABLES
SEAFOOD
MEAT
FISH
EGGS
OIL SEEDS
PROTEIN
FATS
OILS
BREAD
SUGAR
MILK
RICE
CORN
BEANS
POTATOES

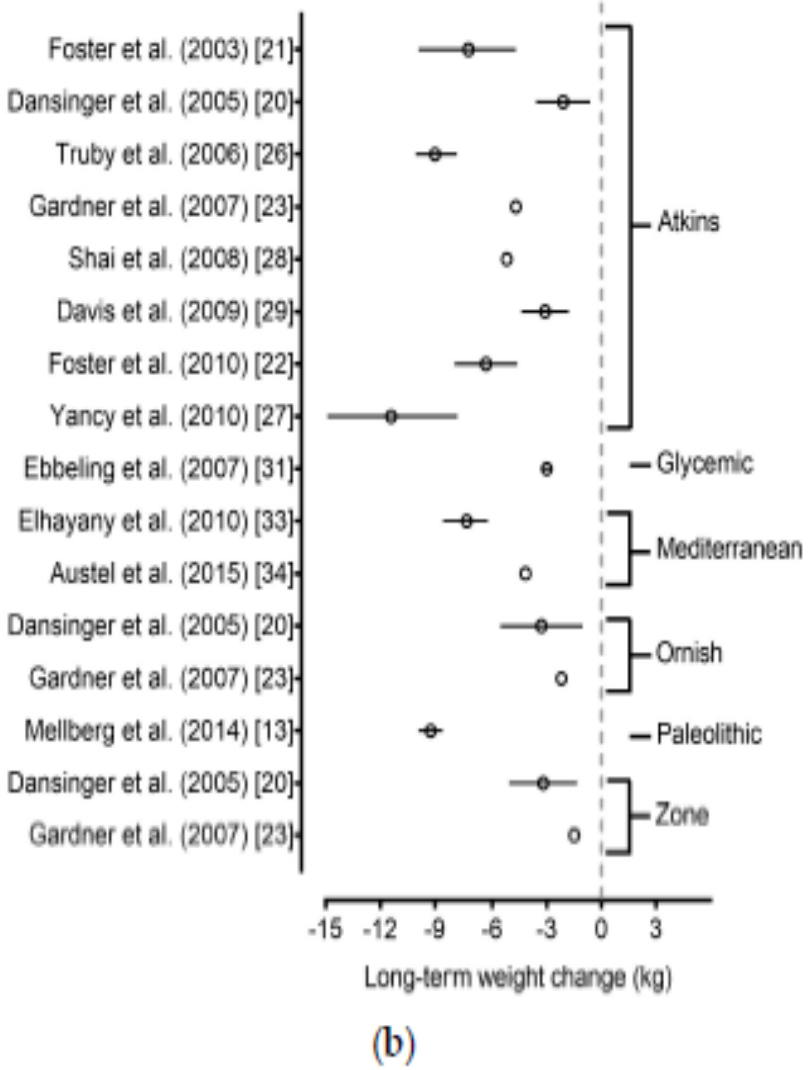
Vegetarian diet

Effects of different fat on appetite, food intake and weight

Fat variation	Effects on appetite/satiety, food intake and weight
LCFA	C18 fatty acids reduce food intake; effect is not related to rate of absorption but partly by CCK release
MCFA	No significant effect of fatty acid chain length (LCFA vs MCFA for 3 days) on ratings of hunger, fullness, satisfaction, or current thoughts of food, energy, and macronutrient intake at next meal did not differ between diets
Triacylglycerol	Olestra does not influence signals of satiation including cholecystokinin and stomach emptying; most studies of olestra on human satiation found no additional energy consumption when olestra was substituted for dietary fat
MUFA, PUFA, SFA	Short-term studies indicated that PUFA may exert a relatively stronger control over appetite than MUFA and SFA SFA-rich meal elicited greater subjective feelings of fullness compared with MUFA- and PUFA-rich meals; postprandial PYY response (area under the curve) was significantly lower for the MUFA-rich meal vs the SFA-rich or PUFA-rich meals
Long chain omega-3 PUFA	Observational studies (Health Professional Follow-up Study and Nurses' Health Study) and RCTs provide conflicting evidence of weight gain or loss High amount (>1300 mg/day; n ¼ 121) associated with lower hunger sensations immediately after test dinner (fullness) and after 120 min (fullness and hunger) compared with low amount (

Macronutrient pattern





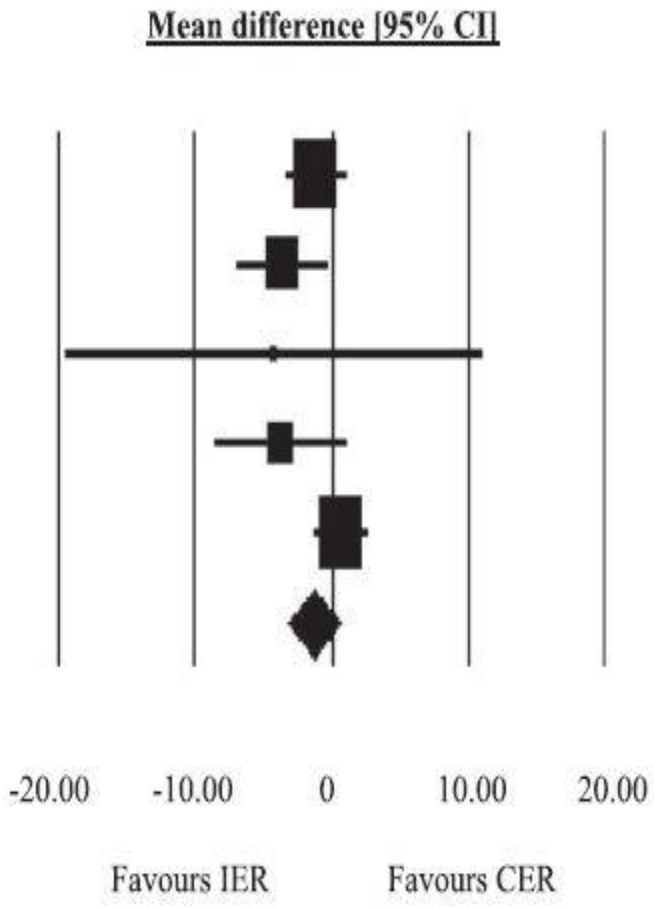
Nutrients. 2017 Jul 31;9(8):822

Prescription 3 – 언제 먹을 것인가?

Intermittent Energy Restriction and Fasting Diets

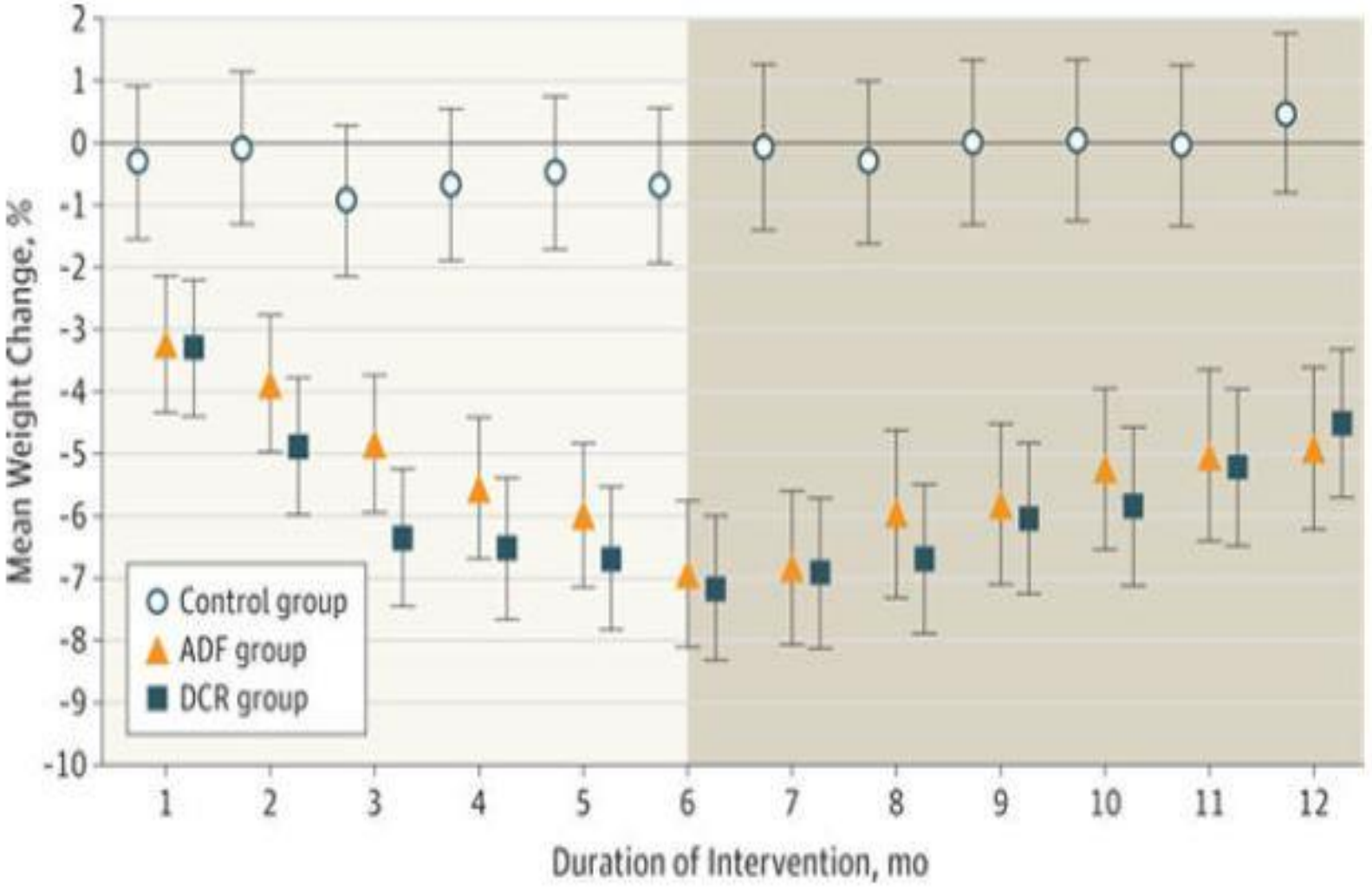
Reference	Intermittent energy restriction [IER]		Continuous energy restriction [CER]		Mean difference [95% CI]
	Mean [SD]	N	Mean [SD]	N	
Arguin *et al.* (29)	-10.70 [3.00]	12	-9.50 [2.10]	10	-1.20 [-3.41, 1.01]
Rossner, (34)	-17.60 [8.74]	42	-13.97 [7.02]	41	-3.63 [-7.05, -0.22]
Wadden *et al.* (28)	-15.40 [10.47]	8	-11.20 [19.12]	7	-4.20 [-19.51, 11.11]
Wing *et al.* (32)	-14.20 [10.30]	38	-10.50 [11.60]	41	-3.70 [-8.55, 1.15]
Wing & Jeffery, (33)	-7.54 [5.60]	80	-8.20 [3.70]	38	0.66 [-1.30, 2.62]
Pooled Estimate [Random Effect]		180		137	-1.36 [-3.23, 0.51]

Tests for heterogeneity: $T^2 = 1.58$; $Q = 6.42$, $df = 4$ [$p = 0.17$]; $I^2 = 37.67\%$
Tests for overall effect: $Z = -1.43$ [$p = 0.15$]



Harris L et al. Obes Rev 2018;19(1):1-13

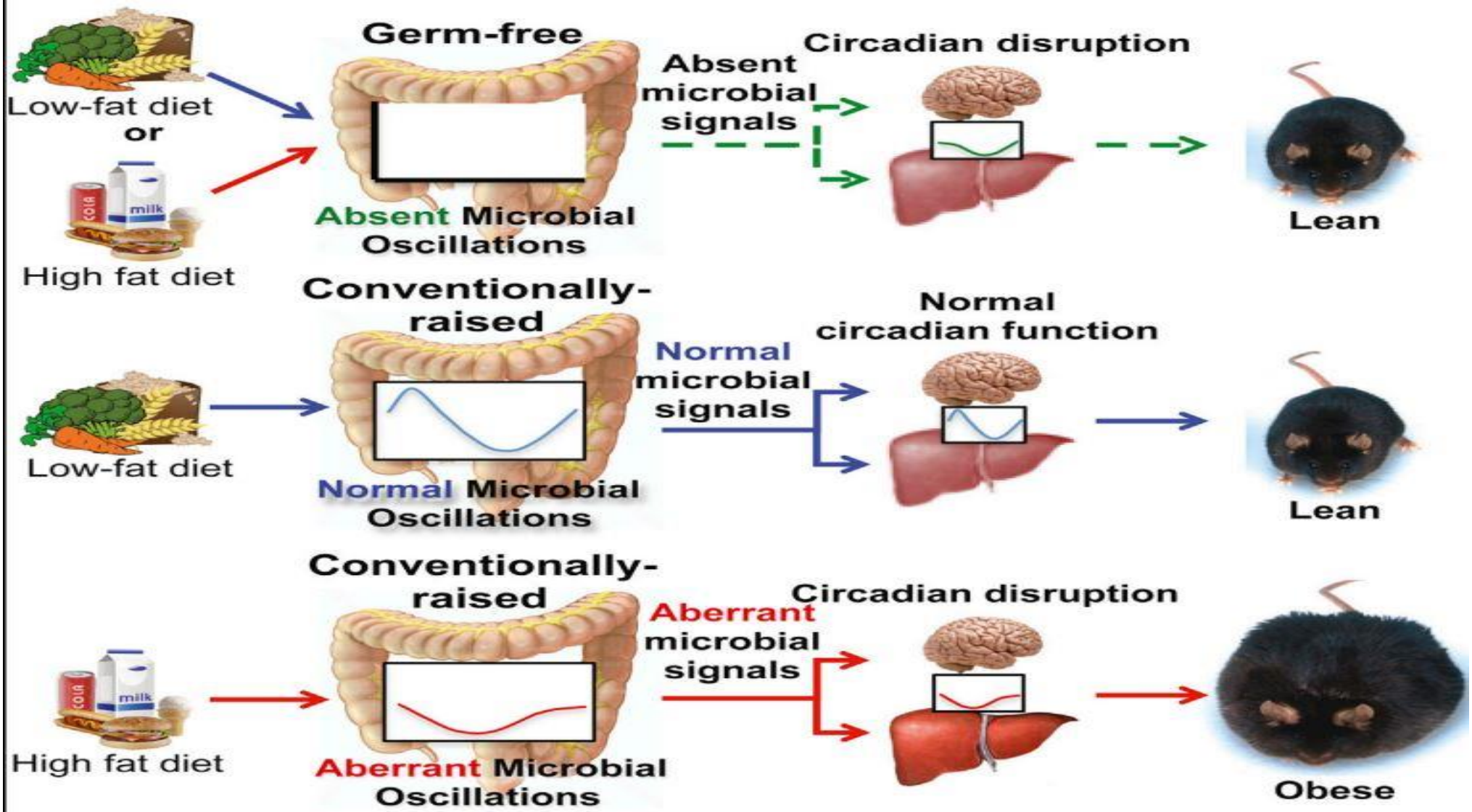
Intermittent Energy Restriction and Fasting Diets



Trepanoski et al. JAMA Intern Med 2017;177 (7): 930-938

Diurnal variation of gut microbes and high fat on host circadian clock

Leone et alCell Host & Microbe 2015;17;681-689



감사합니다