JESENSKA AKADEMIJA SUPLEMENTACIJE U MEDICINI

OBESITY pharmacological treatment, nutrition, supplementation

Prof. dr. Davor Štimac

Zagreb, October 2026.

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The Global Obesity Epidemic

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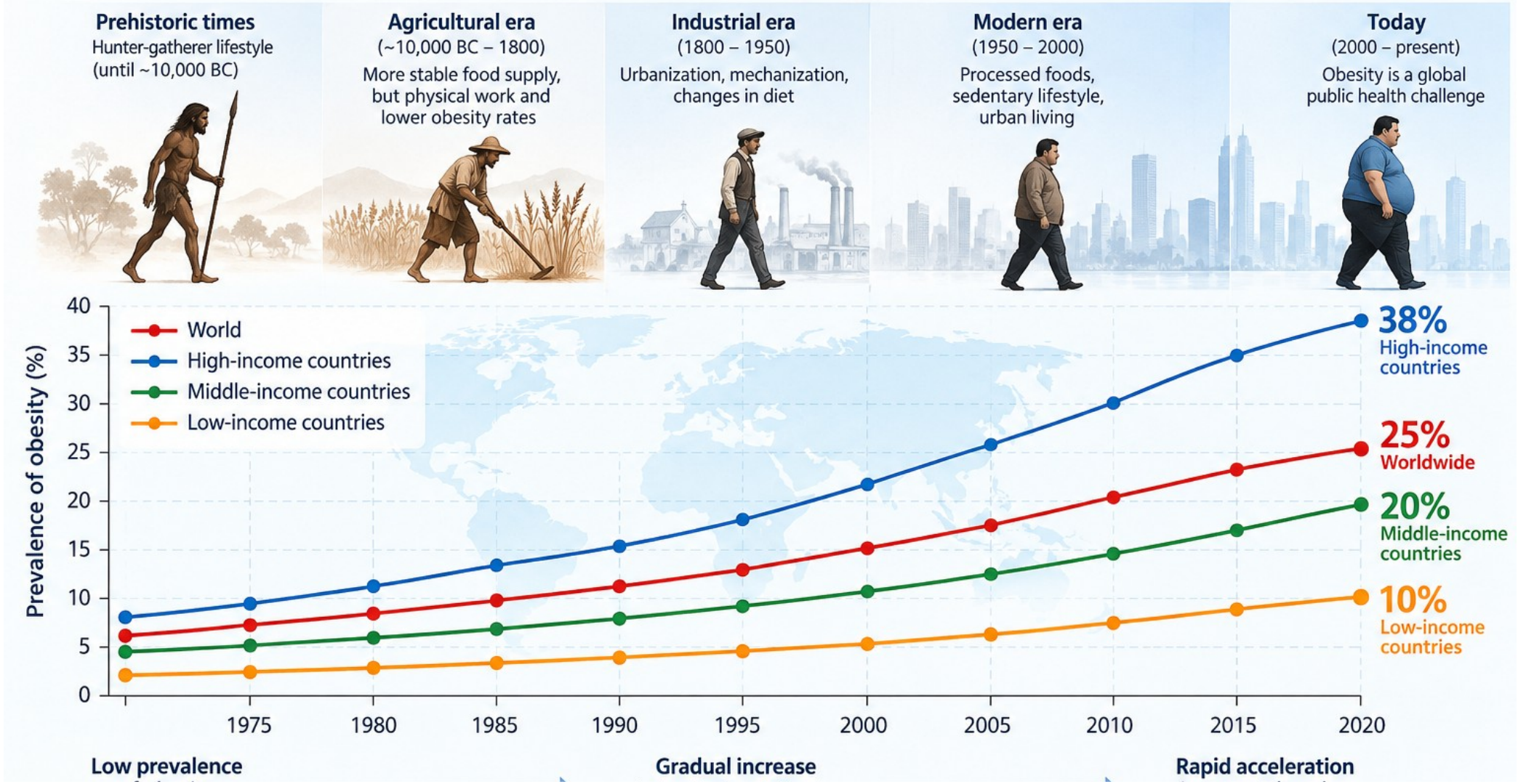
Prehistoric times
Hunter-gatherer lifestyle (until ~10,000 BC)

Agricultural era
(~10,000 BC – 1800)
More stable food supply, but physical work and lower obesity rates

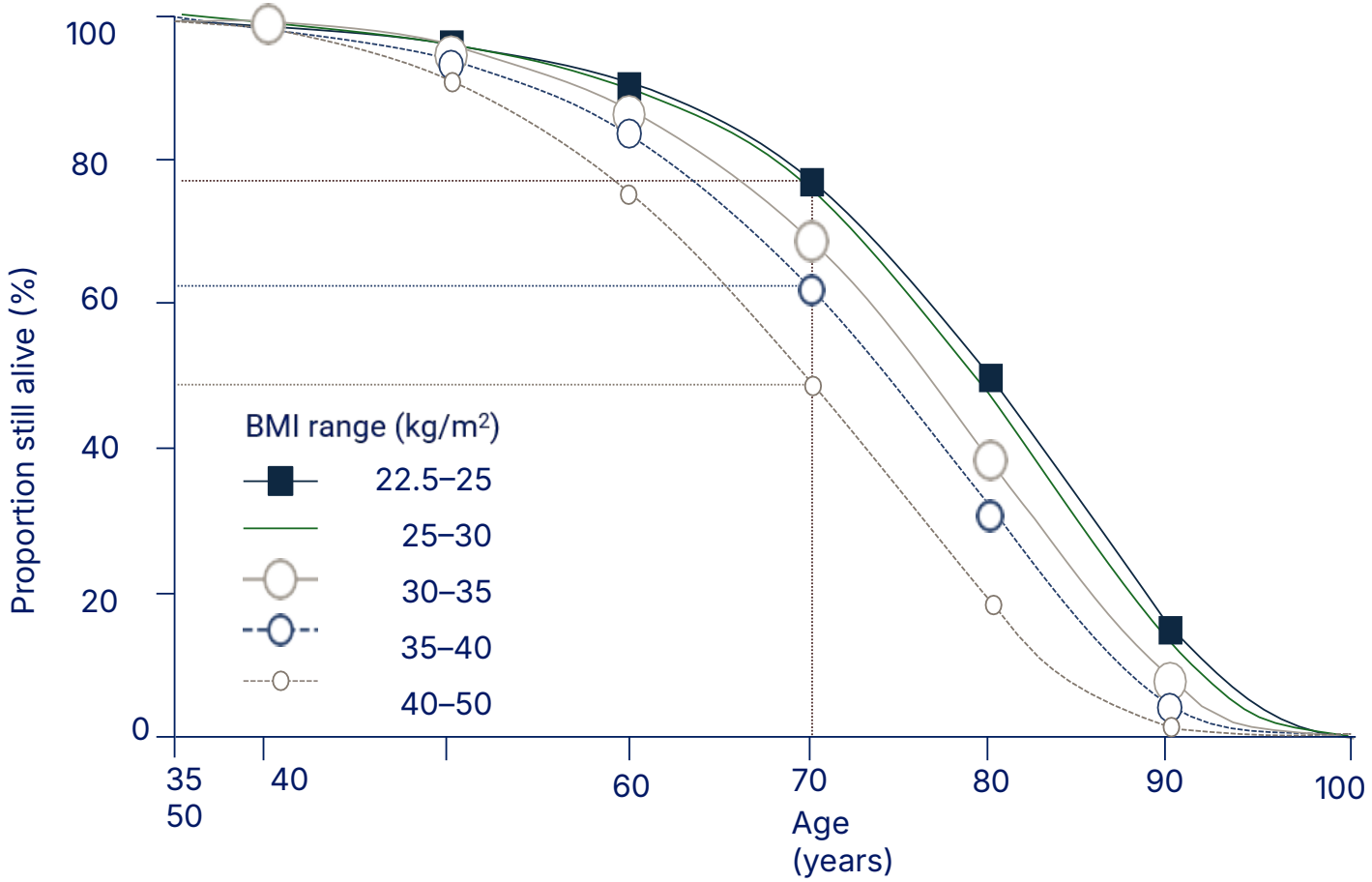
Industrial era
(1800 – 1950)
Urbanization, mechanization, changes in diet

Modern era
(1950 – 2000)
Processed foods, sedentary lifestyle, urban living

Today
(2000 – present)
Obesity is a global public health challenge



Obesity and Longevity – Mission Impossible

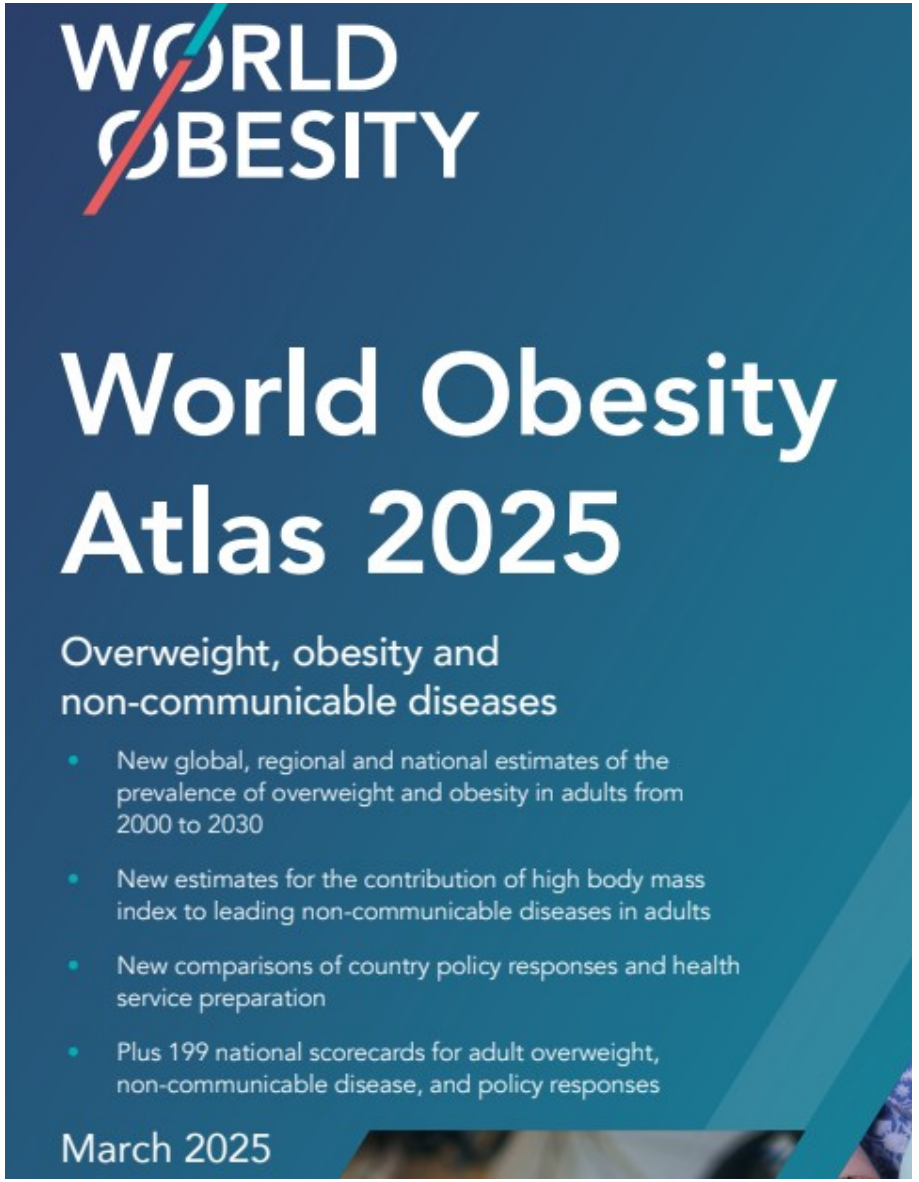


Normal BMI* =
almost 80% chance of reaching age 70

BMI 35–40 kg/m² =
~60% chance of reaching age 70

BMI 40–50 kg/m² =
~50% chance of reaching age 70

Normal BMI was defined as a BMI between 22.5–25 kg/m². Data are based on male subjects; n=541,452. BMI=body mass index. 1. Prospective Studies Collaboration. Lancet. 2009;373(9669): 1083–1096.



https://s3-eu-west-1.amazonaws.com/wof-files/World_Obesity_Atlas_2025.pdf

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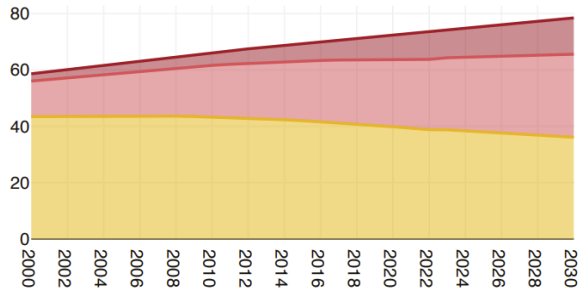


Croatia

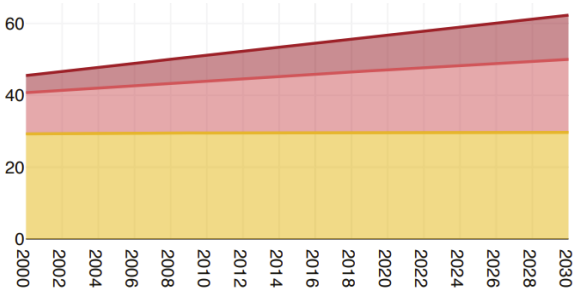
Overweight and obesity prevalence over time

Projected proportion of adults living with high Body Mass Index (25kg/m^2 and above)

% men with high BMI



% women with high BMI



BMI 25-<30 BMI 30-<35 BMI 35+

Adult population living with high BMI estimated in 2010, 2015 and projected to 2030 (in thousands)

	Men			Women		
BMI (kg/m^2)	2010	2015	2030	2010	2015	2030
25-<30	700	660	520	530	520	470
30-<35	290	330	430	260	280	320
35+	74	97	190	130	150	200
All high BMI	**1,060**	**1,090**	**1,140**	**920**	**950**	**990**

Totals may not add up due to rounding

67%

Adults with high BMI in 2025

34%

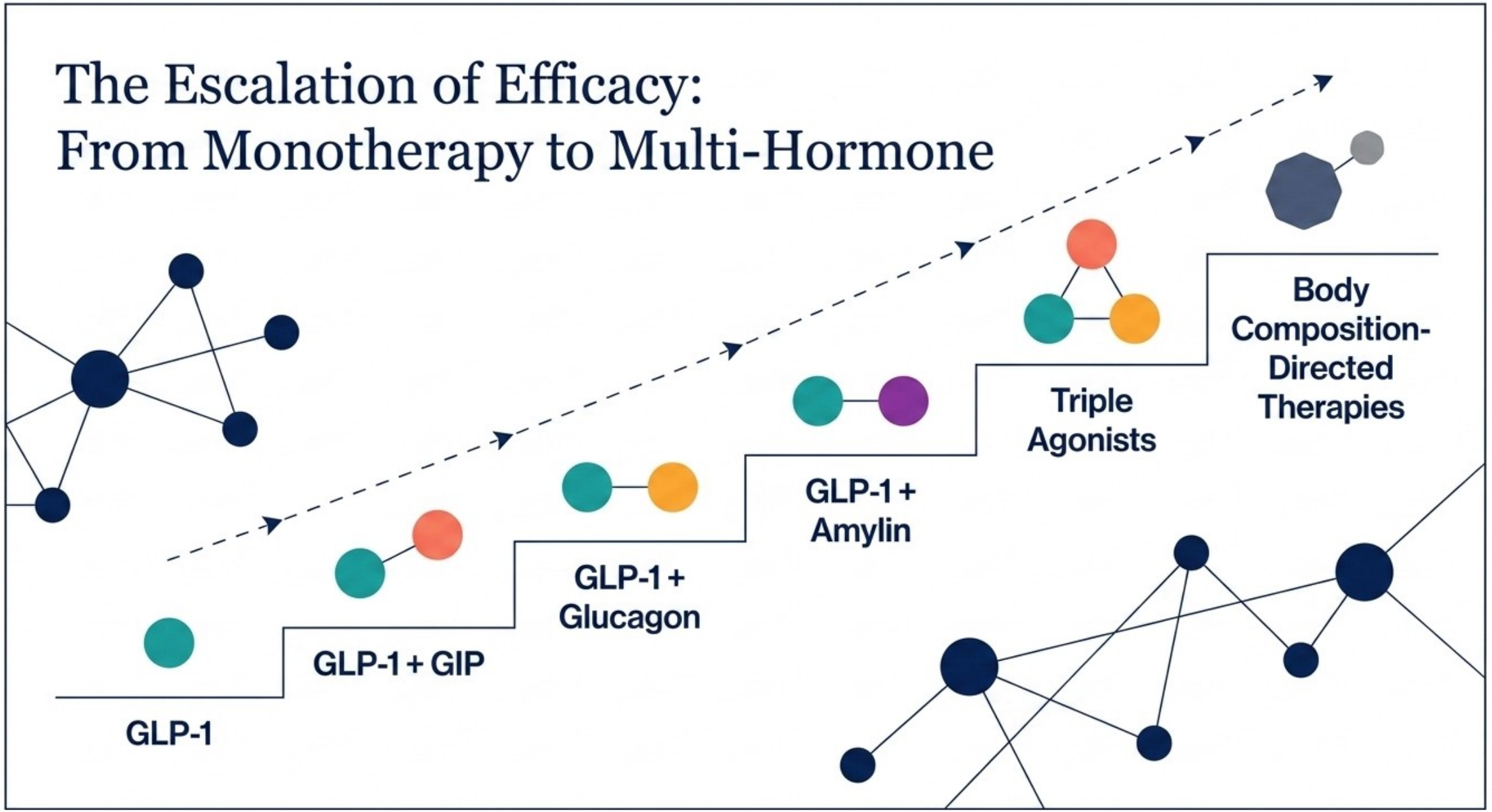
Adults living with obesity in 2025

2.13m

Adults with high BMI in 2030

1,268

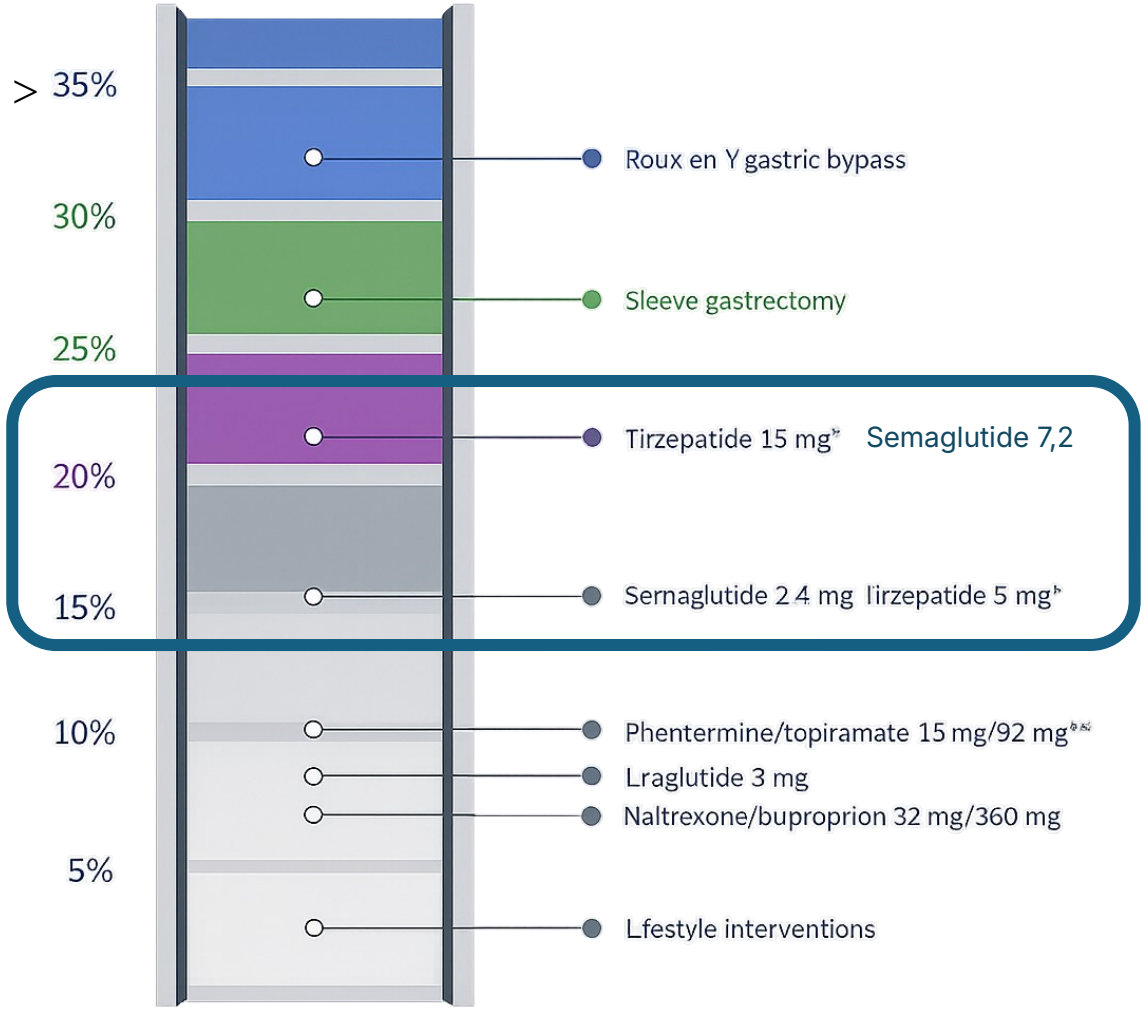
Premature NCD deaths due to high BMI, 2021


The Escalation of Efficacy:
From Monotherapy to Multi-Hormone
GLP-1
GLP-1 + GIP
GLP-1 + Glucagon
GLP-1 + Amylin
Triple Agonists
Body Composition-Directed Therapies

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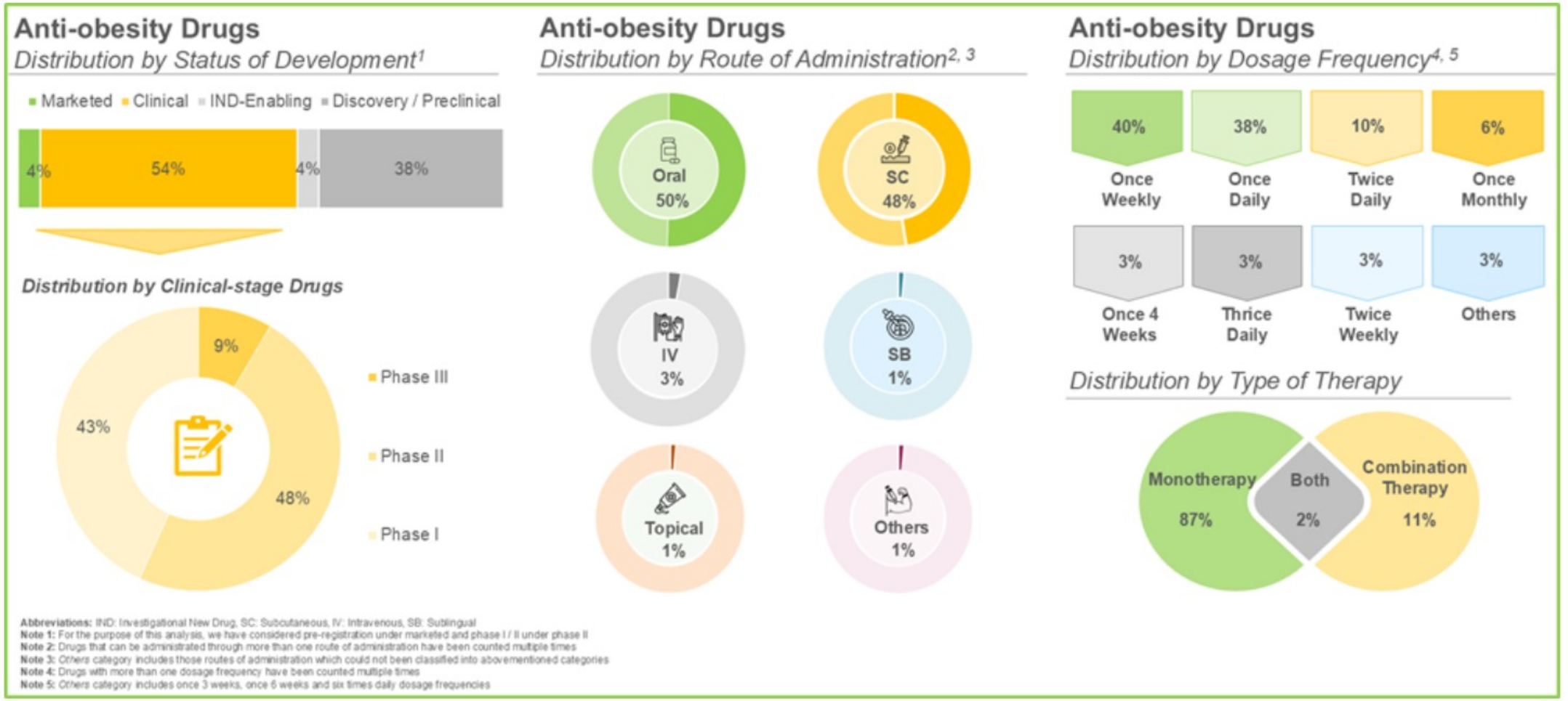
Registrated Antiobesity Drugs

Medication	Trade name	FDA approved	EMA approved
oristat	Xenical / Alli	1999.	1999.
phentermine/topiramate ER	Qsymia	2012.	NO
naltrexone/bupropion	Contrave / Mysimba	2014.	2015.
liraglutide 3.0 mg	Saxenda	2014.	2015.
semaglutide 2.4 mg	Wegovy	2021.	2022.
tirzepatide	Zepbound / Mounjaro	2023.	2023.



Melson E, Miras AD, Papamargaritis D. Future therapies for obesity. Clin Med (Lond). 2023 Jul;23(4):337-346.

Obesity drugs in the registration process



https://www.rootsanalysis.com/reports/anti-obesity-drugs-market/request-quote.html

New Drugs in the Treatment of Obesity

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Drug	Company	Drug Class	Regulatory Approval (2026)
Oral semaglutide (Wegovy® tablets)	Novo Nordisk	Oral **peptide** GLP-1 receptor agonist	**FDA approved** (December 2025); **MHRA approved** (June 2026); **CHMP positive opinion**, European Commission decision pending
Orforglipron (Foundayo®)	Eli Lilly and Company	Oral **non-peptide small-molecule** GLP-1 receptor agonist	**FDA approved** (April 1, 2026); **EMA marketing authorization application under review**

Source: https://investor.lilly.com/node/54076/pdf; https://static.poder360.com.br/2025/12/ca251222-oral-sema-fda-approval.pdf

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Nutrition in the Management of Obesity

Evolution of Dietary Approaches from 1970 to Today

1970s

Low-fat era

- Dietary guidelines promote low-fat diets
- Focus on calorie restriction

1980s

High-carbohydrate diets

- Increased consumption of refined carbohydrates
- Low-fat, high-carb products

1990s

Energy balance concept

- "Calories in – calories out"
- Portion control
- Increased awareness of physical activity

2000s

Improved diet quality

- More focus on whole foods
- Mediterranean diet evidence
- Reduced added sugars and saturated fats

2010s

Individualised nutrition

- Macronutrient approaches (low-carb, low-fat, moderate)
- Intermittent fasting
- Role of diet quality and food patterns

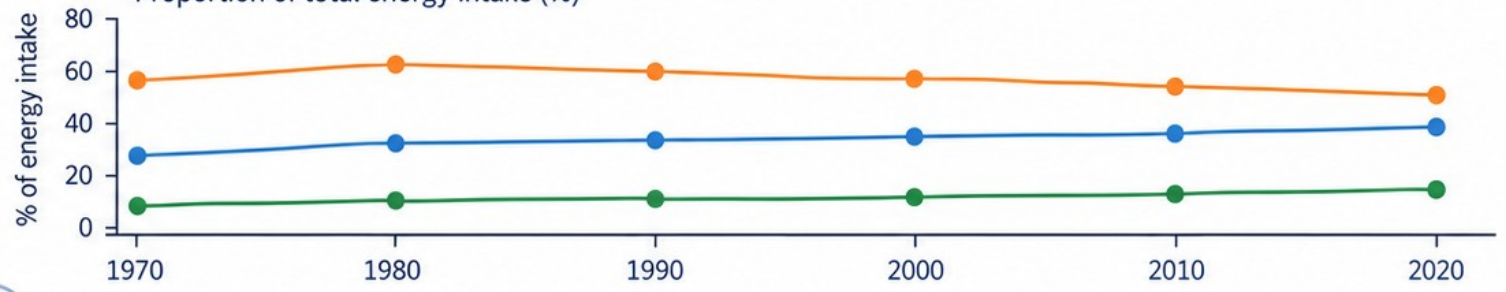
2020s–today

Integrated, sustainable approaches

- Healthy, high-protein, high-fibre diets
- Mediterranean and plant-based dietary patterns
- Personalised nutrition (microbiome, genetics, behaviour)
- Long-term adherence and environmental sustainability

Trends in dietary patterns worldwide (1970–2020)

Proportion of total energy intake (%)



- Carbohydrates 55% → 48%
- Fats 30% → 37%
- Proteins 12% → 15%

Sources: FAO. Food Balance Sheets 2023; Willett et al. Lancet 2019; Astrup et al. Nat Rev Dis Primers 2022.

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Energy Intake Should Be Personalized Based on Individual Needs and Characteristics



WOMEN

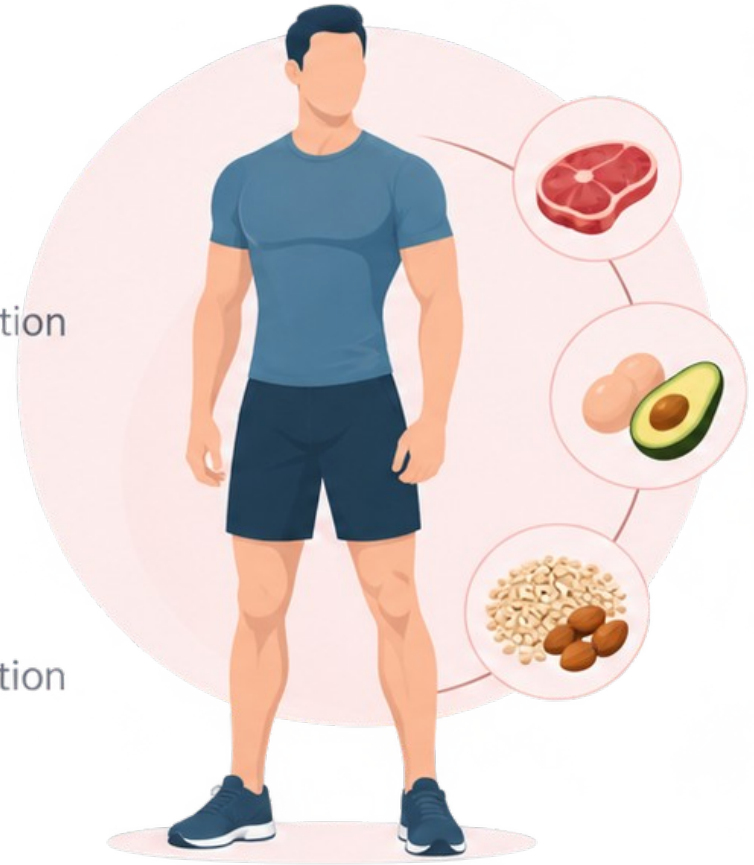
1,200–1,500 kcal/day

has been recommended as safe during weight reduction

MEN

1,500–1,800 kcal/day

has been recommended as safe during weight reduction

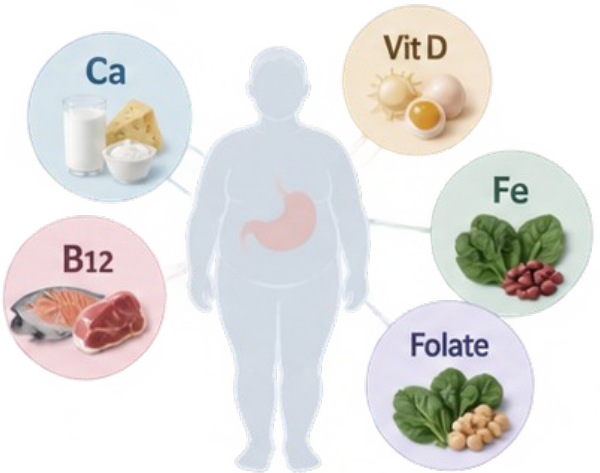


Source: 1. Almandoz JP, et al. Obesity (Silver Spring). 2024;1-19. 2. US Department of Agriculture and US Department of Health and Human Services. Dietary Guidelines for Americans, 2020-2025. 9th edition. 2020. https://www.dietaryguidelines.gov/resources/2020-2025-dietary-guidelines-online-materials 3. AACE. Accessed 29 May 2024. https://www.aace.com/disease-and-conditions/nutrition-and-obesity/meal-prep-how-plan-healthy-eating

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Obesity is a risk factor for nutritional deficiencies and other physiological conditions

- Calcium, vitamin D, vitamin B12, folic acid, and iron are considered dietary components of concern for UK population
  - Individuals with obesity are often deficient in additional micronutrients



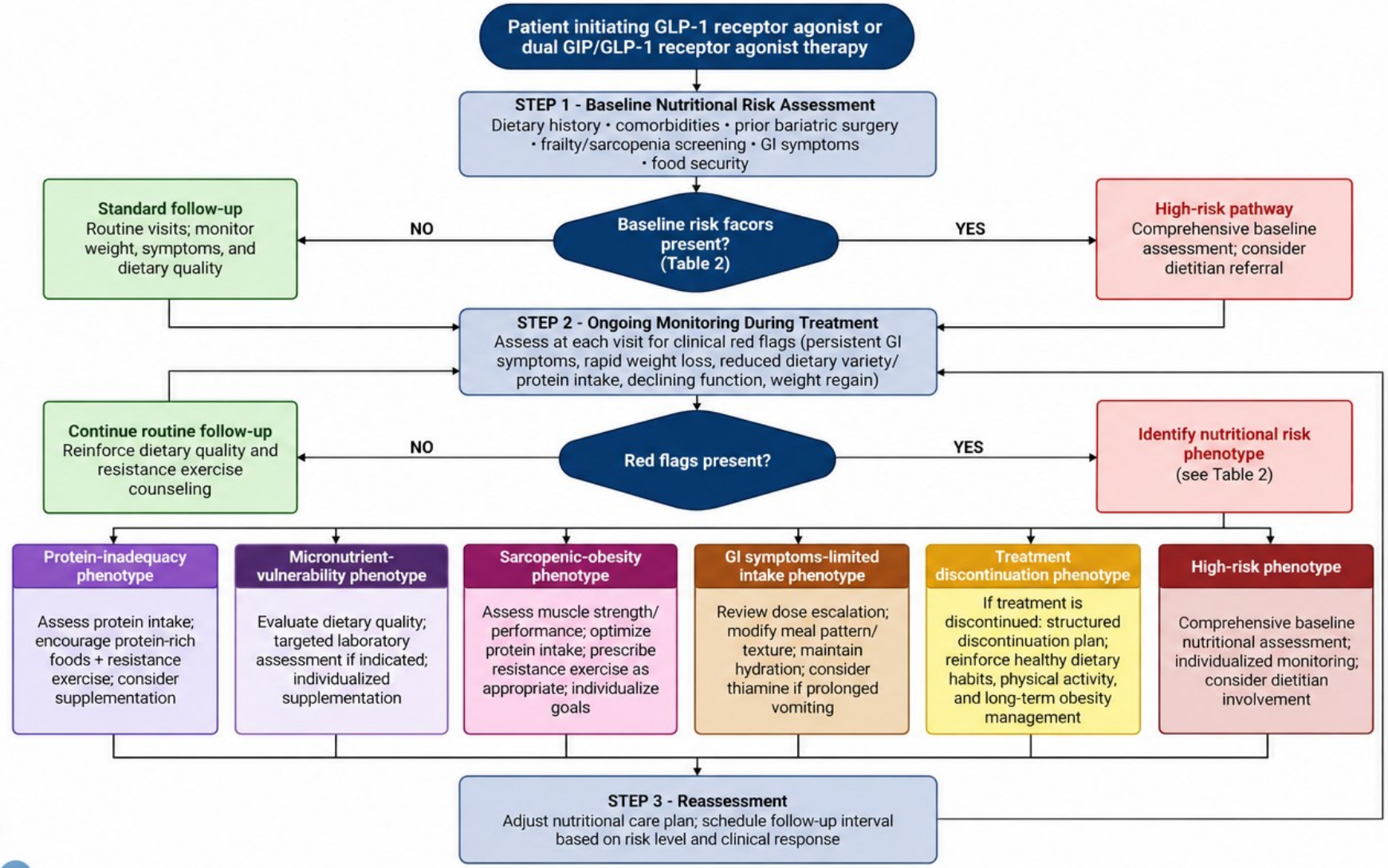
Individuals on OMMs may experience nutritional deficiencies due to:

- Nutrient-poor dietary patterns
- Monotonous dietary patterns
- Prolonged low-calorie and very-low-calorie dietary patterns



Source: 1. Almandoz JP, et al. Obesity (Silver Spring). 2024;1-19. 2. Vitall. Accessed 18 April 2025. https://vitall.co.uk/health-tests-blog/statistics-vitamin-mineral-deficiency-uk 3. Pellegrini M, et al. J Endocrinol Invest. 2021;44(7):1413-1423. 4. Aasheim ET, et al. Am J Clin Nutr. 2008;87(2):362-369. 5. Damms-Machado A, et al. Nutr J. 2012;11:34. 6. Parrott J, et al. Surg Obes Relat Dis. 2017;13(5):727-741. 7. Astrup A, et al. Int J Obes (Lond). 2019;43(2):219-232.

Proposed framework for nutritional risk stratification and management during GLP-1-based therapy.



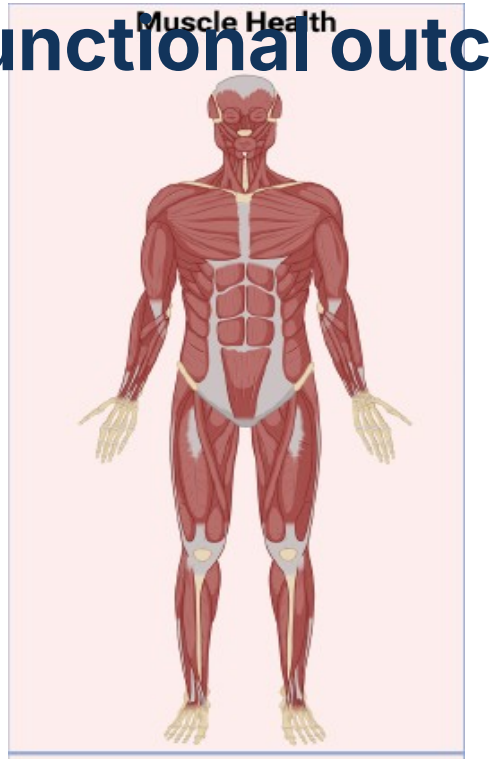
Sorić, T. et al. Hidden Malnutrition in the GLP-1 Era: Micronutrient Status, Protein Adequacy, and Lean Mass as Emerging Nutritional Considerations—A Narrative Review. *Nutrients*. 2026;18:2757. doi:10.3390/nu18172757.

Conceptual framework of multidimensional determinants of muscle health and related functional outcomes

Nutrition



- Total energy intake (deficit vs excess)
- Protein intake (dose, timing, distribution, quality)
- Amino acid profile
- Micronutrients (e.g. vitamin D, omega-3)
- Route & phase (oral, EN, PN; ICU → ward → post-ICU)
- Plant vs animal protein patterns
- Gut microbiome



Muscle Health
Muscle mass
Muscle composition
Muscle-specific strength
(also referred to as muscle quality)
Physical performance
Sarcopenia & Sarcopenic obesity
Cachexia
Physical frailty

Patient-Reported Outcomes (PROMs)

- Physical function
- Fatigue
- Participation
- Quality of life
- Independence / vitality



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Source: van Zanten ARH, Deutz NE, Liberati Prso AM, Prado CM, Schooneman MG, Soeters MR, de van der Schueren MAE, Weijs PJM, Jager-Wittenaar H. Shaping the future of muscle health: A clinical nutrition perspective and research agenda. Clin Nutr. 2026 Jun;61:106652. doi: 10.1016/j.clnu.2026.106652. Epub 2026 Apr 10. PMID: 42030900.

Daily Recommendations for Protein

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Range for healthy adults
10%–35%
of energy intake



Distribute throughout the day
protein



Consume >60–75 g/day
Up to 1.5 g/kg of body weight per day

Start each meal
with a small portion of protein

Examples: eggs, poultry, lean beef and fish, low-fat yogurt, cottage cheese, lentils, peas

Source: 1. Almandoz JP, et al. Obesity (Silver Spring). 2024;1–19. 2. US Department of Agriculture and US Department of Health and Human Services. Dietary Guidelines for Americans, 2020–2025. 9th edition. 2020. 3. AACE. Accessed 29 May 2024. 4. USDA. Accessed 3 April 2024.

Daily Recommendations for Carbohydrates

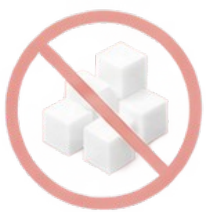
- **Carbohydrate range for healthy adults is 45%-65% of energy intake**
  - ✓ 135-290 g/d for a 1200- to 1800-calorie diet



- **A carbohydrate-restricted diet of 50-150 g/d could be considered**
  - ✓ Severe restriction is not necessary



- **Aim for low-glycaemic, high-fibre, low-sugar or no-sugar-added foods**



Examples: cucumbers, cauliflower, berries, apples, lentils, brown rice

Daily Recommendations for Dietary Fat

- **Range for healthy adults is 20%-35% of energy intake**
  - ✓ 25-70 g/d for a 1200- to 1800-calorie diet



- **Limit intake of foods high in saturated and trans fat choosing unsaturated fats instead**



- **Avoid fried, greasy, and high-fat food to help with GI discomfort**



Examples: avocado, tahini, olive oil, walnuts, pumpkin seeds, low-fat dairy, flax seeds, chia seeds

Source: 1. Almandoz JP, et al. Obesity (Silver Spring), 2024;1-19. 2. US Department of Agriculture and US Department of Health and Humas. Dietary Guidelines for Americans, 2020-2025. 9th edition. 2020. 3. AACE. Accessed 29 May 2024. https://www.aace.com/disease-and-conditions/nutrition-and-obesity/meal-prep-how-plan-healthy-eating 4. Alexander et al. Obes Pillars. 2022;1:1000005. https://www.dietaryguidelines.gov/resources/2020-2025-dietary-guidelines-online-materials

Daily Recommendations for Dietary Fibre

- **Advice varies on country**
  - ✓ aim for 30g
- **Adequate intake may help with GI discomfort**
- **Fibre can be found in many different food groups, including whole grains, nonstarchy vegetables, and fruit**



Examples: broccoli, carrots, peas, beans, brown rice, oats, pears, almonds, avocado

Drink at Least 2-3 L of Fluids per Day

- **Consume water, low-calorie beverages, or nutrient-dense beverages, like low-fat dairy or low-fat dairy alternatives**
- **Limit sugar-sweetened beverages, alcohol, carbonated beverages, and caffeine**



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Nutritional and lifestyle supportive care recommendations for management of obesity with GLP-1-based therapies.

International expert panel

- 15 primary care, endocrinology and nutrition specialists
- Australia, Belgium, Canada, China, Denmark, Germany, **Spain**, UK, USA

Modified Delphi process

52 practical, multidisciplinary recommendations
to guide healthcare professionals in nutritional and lifestyle care for managing overweight/obesity with GLP-1-based therapies

Nutrition and physical activity across treatment phases
before, during, and after GLP-1 based therapy

Management of gastrointestinal adverse effects

Individualized approaches and long-term adherence

Areas for further research

J.L. Sievenpiper, et.al. Nutritional and lifestyle supportive care recommendations for management of obesity with GLP-1 - based therapies: An expert consensus statement using a modified Delphi approach, Obesity Pillars, Volume 17, 2026, 100228, ISSN 2667-3681, https://doi.org/10.1016/j.obpill.2025.100228.

Dietary Sources of Commonly Deficient Micronutrients

Green leafy vegetables, fruits

- Vitamin A
- Vitamin C
- Potassium
- Folate
- Iron
- Vitamin E
- Magnesium

Whole grains, fortified cereals

- Thiamin
- Vitamin D
- Zinc
- Folate
- Vitamin B12
- Iron

Nuts, seeds, beans, peas, lentils

- Magnesium
- Potassium
- Folate
- Thiamin
- Iron
- Zinc
- Vitamin E (nuts)

Milk, dairy products

- Calcium
- Vitamin A (fortified)
- Vitamin D (fortified)
- Magnesium
- Vitamin B12
- Potassium
- Zinc

Meat, seafood, poultry

- Iron
- Zinc
- Vitamin B12
- Vitamin D (fatty fish)
- Thiamin (fish, pork)

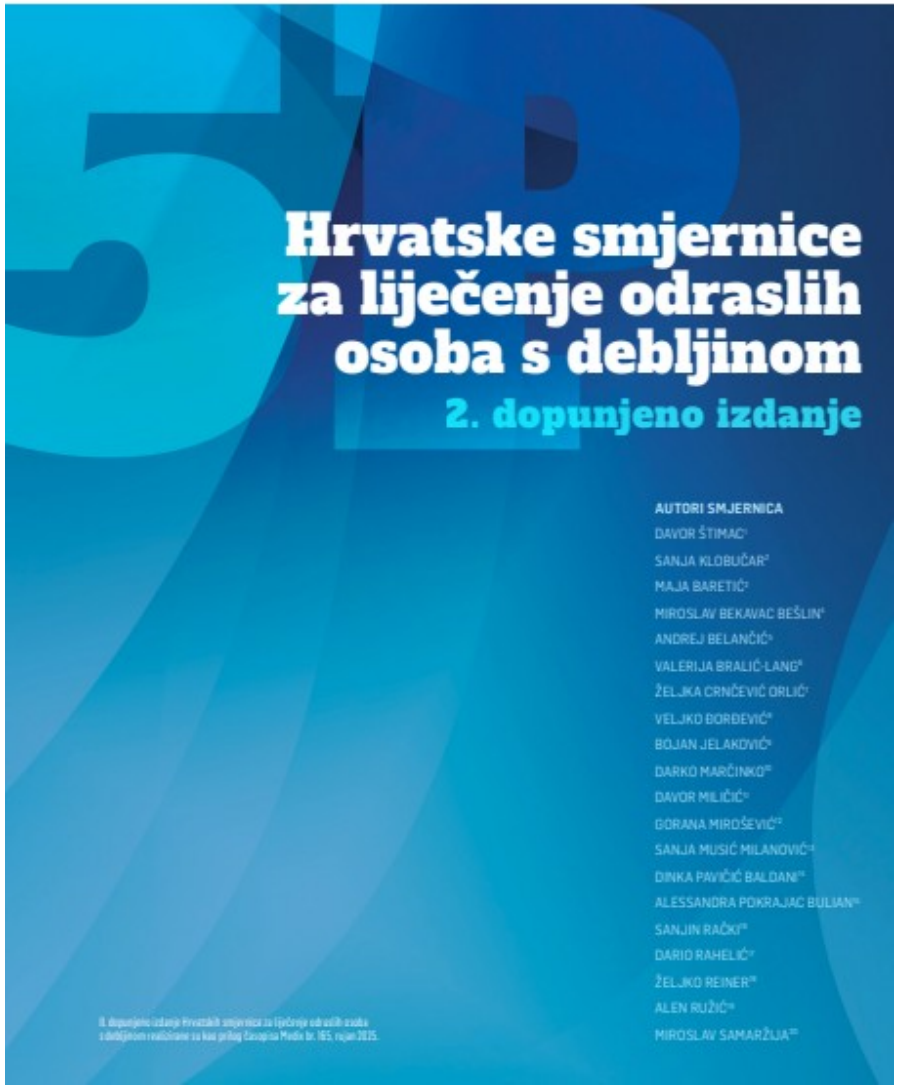
Source: Almandoz JP, et al. Nutritional considerations with antiobesity medications. Obesity (Silver Spring). 2024;1–19.

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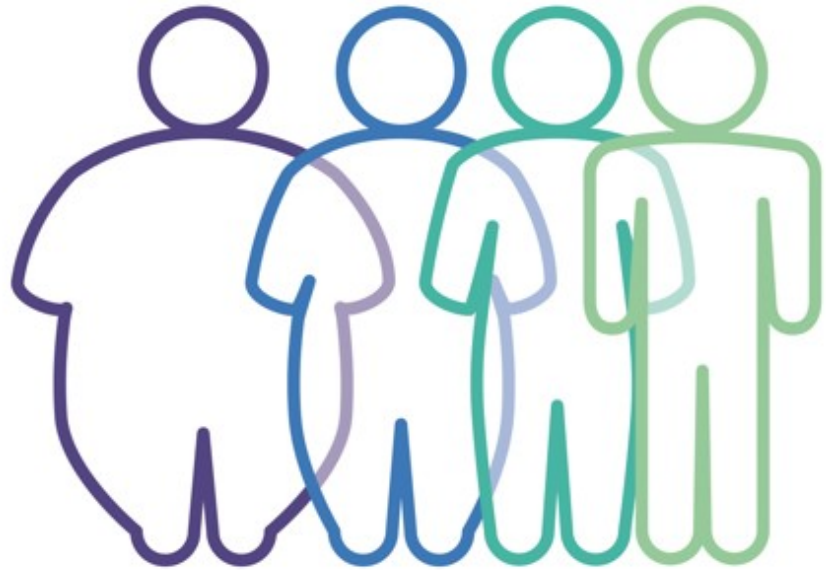
2nd updated edition of the Croatian guidelines for the treatment of adults with obesity, 2025.



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5TH ADRIATIC SYMPOSIUM ON OBESITY



APRIL 23RD – 24TH 2027

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