BMI and % body fat

BMI = 22.3

body fat

9.1 % 21.2 %
WHO international classification retained with new subcategories:

- **BMI <18.5** – underweight
- **BMI 18.5-23** – increasing but acceptable risk
- **BMI 23-27.5 kg/m²** – increased
- **BMI >27.5 kg/m²** – high risk.
Changes in BMI with age 0-20 yrs (Cole et al, 2000)

![Graph showing changes in BMI with age for males and females from birth to 20 years, with points of adiposity rebound highlighted.](image-url)
Dietary Energy Supply (DES)
National, regional, and global trends in body-mass index since 1980: systematic analysis of health examination surveys and epidemiological studies with 960 country-years and 9.1 million participants


Trends and uncertainties of mean BMI for adults 20 years and older in 199 countries and territories. Data from published and unpublished health surveys (960 country-yrs 9.1 million participants)

Bayesian hierarchical model to estimate mean BMI by age, country, and year, accounting for whether a study was nationally representative.

Published NEJM: Feb 4, 2011 DOI:10.1016/S0140-6736(10)62037-5
Age-standardised mean BMI by gender 1980 - 2008

Males

Change = 0.4 kg/m² per decade (0.2 to 0.6)

Females

Change = 0.5 kg/m² per decade (0.3 to 0.7)
Between 1980 -2008, mean BMI worldwide increased by 0.4 kg/m² per decade (95% CI 0.2–0.6) for men 0.5 kg/m² per decade (95% CI 0.3–0.7) for women.

National BMI change for women ranged from no change in 19 countries to increases > 2.0 kg/m² per decade in nine.

Male & female BMIs in 2008 were highest in Oceania reaching 34 kg/m² (32.8–35.0) for men and 35 kg/m² (33.6–36.3) for women in Nauru. The USA had the highest BMI of high-income countries.
Obesity Trends* Among U.S. Adults
(*BMI \(\geq\) 30, or about 30 lbs. overweight for 5’4” person)
In 2008, an estimated 1.46 billion adults (1.4–1.5) worldwide had BMI of 25 kg/m² or greater, of these 205 million men (193–217 million) and 297 million women (280–315 million) were obese.

Globally, mean BMI has increased since 1980. The trends since 1980, and mean population BMI in 2008, varied substantially between nations.

Interventions and policies that can curb or reverse the increase, and mitigate the health consequences of high BMI by targeting its metabolic mediators, are needed.

Published NEJM: Feb 4, 2011 DOI:10.1016/S0140-6736(10)62037-5
Global epidemic of obesity

“The epidemic of obesity, with its attendant comorbidities --- heart disease, hypertension, stroke, and diabetes --- is not a problem limited to industrialized countries” – WHO TRS 916

300 million  BMI >30
1.5 billion  BMI >25
1.7 billion  BMI >23
155 m school-age children overweight
22 m under 5 yrs overweight
Energy Intake

Energy Expenditure

**Primitive Life**

- Limited Intake
- Expenditure > Intake
- Low Energy Stores (body fat)
- Increase in Energy Stores
- Energy balance established at unhealthy weight.

**Modern Life**

- Unlimited Intake
- Intake > Expenditure
- Increase Expenditure
- Reduce Intake
- Increase in Energy Stores
Joint WHO/FAO expert consultation on diet, nutrition and the prevention of chronic diseases

Geneva, Switzerland
28 January – 1 February 2002

Diet, nutrition and the prevention of chronic diseases

Report of the Joint WHO/FAO expert consultation

www.who.int/hpr/nutrition/ExpertConsultationGE.htm
Levels of prevention

Targeted prevention (directed at high-risk individuals and groups)

Selective prevention (directed at those with existing problems)

Universal prevention (directed at everyone in a community)

Energy dense foods are high in fat &/or sugar. Low energy density (or energy dilute) foods are high in fibre and water, such as fruit, legumes, vegetables & whole grain cereals, as well as lean meat and fish.

<table>
<thead>
<tr>
<th>Evidence</th>
<th>Decreases risk</th>
<th>None</th>
<th>Increases risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Convincing</td>
<td>Regular physical activity</td>
<td></td>
<td>Increased intake energy-dense foods</td>
</tr>
<tr>
<td></td>
<td>High dietary NSP (fibre) intake</td>
<td></td>
<td>Sedentary lifestyles</td>
</tr>
<tr>
<td>Probable</td>
<td>Home and school environments that support healthy food choices for children**</td>
<td></td>
<td>Heavy marketing of energy-dense foods** and fast-foods</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Adverse socio-economic conditions (for women in developed world)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Sugar-sweetened drinks /juices</td>
</tr>
<tr>
<td>Possible</td>
<td>Low glycemic index foods</td>
<td>Protein content of the diet</td>
<td>Large portion sizes</td>
</tr>
<tr>
<td></td>
<td>Breastfeeding</td>
<td></td>
<td>High proportion of food prepared outside the home (western countries)</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Restraint/disinhibition eating pattern</td>
</tr>
</tbody>
</table>
Principal nutrient/food changes

**Reduce**
- Total fat
- Saturated Fats (C14,C16)
- Trans fatty acids
- Free sugars
- Refined starches
- Sodium/salt
- Preserved meats

**Increase**
- Vegetables,
- Fruits, legumes
- Fibre/NSP
- $\omega$ - 3 fatty ac (LNA,EPA,DHA)
- Iron/iodine
- Zinc/folate?
- PHYSICAL ACTIVITY
A Low-Fat, Average-Protein

Change in weight from baseline to 2Yr (kg)

Low fat average protein

N = 169
Slope = -0.179

No. of Sessions Attended

B Low-Fat, High-Protein

Change in weight from baseline to 2Yr (kg)

Low fat high protein

N = 157
Slope = -0.191

No. of Sessions Attended

C High-Fat, Average-Protein

Change in weight from baseline to 2Yr (kg)

High fat average protein

N = 151
Slope = -0.252

No. of Sessions Attended

D High-Fat, High-Protein

Change in weight from baseline to 2Yr (kg)

High fat high protein

N = 168
Slope = -0.217

No. of Sessions Attended
Reductions in dietary energy density are associated with weight loss in overweight and obese participants in the PREMIER trial\textsuperscript{1-4}

Jenny H Ledikwe, Barbara J Rolls, Helen Smiciklas-Wright, Diane C Mitchell, Jamy D Ard, Catherine Champagne, Njeri Karanja, Pao-Hwa Lin, Victor J Stevens, and Lawrence J Appel


**Objective:** examined the effects of behavioral interventions on ED values and explored how 6-mo ED changes relate to BW.

**Design:** prospective study of 658 adults participating in the PREMIER trial, an 18-mo randomized, controlled, behavioral hypertensive persons were randomly assigned to 1 of 3 groups: the established group received monthly sessions implementing well-established hypertension recommendations and the Dietary Approaches to Stop Hypertension (DASH) increase plant foods, lower intake of meats, sugar, fats and sodium. Weight of food taken increased but Kcal intake dropped.

**Both large and modest reductions in energy density were associated with weight loss & better diet quality.**
Reduction in consumption of sugar-sweetened beverages is associated with weight loss: the PREMIER trial

Liwei Chen, Lawrence J Appel, Catherine Loria, Pao-Hwa Lin, Catherine M Champagne, Patricia J Elmer, Jamy D Ard, Diane Mitchell, Bryan C Batch, Laura P Svetkey, and Benjamin Caballero


Objective: examine how changes in beverage consumption affect weight change among adults.

Design: prospective study of 810 adults participating in the PREMIER trial, an 18-mo randomized, controlled, behavioral intervention trial. Measurements (weight, height, and 24-h dietary recall) were made at baseline, 6 mo, and 18 mo.

Results: Liquid calorie intake had a stronger effect on weight loss than did solid calorie intake. Intake of sugar-sweetened beverages (SSBs) was significantly associated with weight. A reduction in SSB intake of 1 serving/d associated with a loss of 0.49 kg (0.11-0.82) p< 0.006) at 6 mo and of 0.65 kg (0.22- 1.09; p<0.003) at 18 mo.
Models were adjusted for baseline age, sex, race, education, income, BMI status, intervention groups, concurrent change in fitness, physical activity, and solid calorie intake.
Model-adjusted mean 6-mo weight change and 95% CIs (6 mo – baseline) by tertile of 6-mo sugar-sweetened beverage (SSB) intake change and 18-mo weight change (18 mo – baseline) by tertile of 18-mo SSB intake change.
Principal nutrient/food changes

Reduce

- Total fat
- Saturated Fats (C14,C16)
- Trans fatty acids
- Free sugars
- Refined starches
- Sodium/ salt
- Preserved meats

Increase

- Vegetables,
- Fruits, legumes
- Fibre/ NSP
- $\omega$ - 3 fatty ac (LNA,EPA,DHA)
- Iron/ iodine
- Zinc/ folate?
- PHYSICAL ACTIVITY
**Principal nutrient/food changes**

**Reduce**
- TOTAL ENERGY

**Increase**
- Vegetables,
- Fruits, legumes
- Fibre/NSP
- ω-3 fatty acids (LNA, EPA, DHA)
- Iron/iodine
- Zinc/folate?
- PHYSICAL ACTIVITY
Life Course approach to address obesity risk

- **Fetal Life**
  - SES
  - Mother's Nutrition
  - Growth
  - Birth weight

- **Infancy and Childhood**
  - Breast Feeding
  - SES
  - Infection
  - PEM/Stunting
  - Micronutrients
  - Growth rate
  - Tallness
  - Physical Activity
  - Food behaviour
  - TV viewing
  - Sugary drinks

- **Adolescence**
  - Childhood Obesity
  - Inactivity
  - TV viewing
  - Smoking
  - Physical Activity
  - Food behaviour
  - Sugary drinks

- **Adult Life**
  - Established adult risky behaviours
    - Diet/Physical activity
    - Tobacco
    - Alcohol
  - Biological risks
  - Socioeconomic status
  - Environment
  - Poverty

- **Elderly**
  - Genetic susceptibility to disease
  - Accumulated risk

Age

Death and Disability