The nutrition transition and implications for CVD and chronic diseases

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• Engines of nutrition transition
• Trends in overweight
• Factors associated with the overweight epidemic
• Health consequences of the overweight epidemic
• Control and prevention
• Conclusions
From traditional to modern nutrition ....
From traditional to modern food marketing ....
From ancient to modern work ....
From traditional to modern transportation ....
Mean % of energy from macronutrients among African urban (L) and rural (R) adults in South Africa

Stein K
Calories from major commodities in developing countries
Changes in socio-economic structures underlie the physical activity-nutrition transition

- **Shift from preindustrial agrarian economy to industrialization**
  - Less active physical activity for individuals (sedentary habits)
  - Higher availability of cheap processed foods (high fat, high sugar)

- **Profound changes in household technology** *(leads to less PA)*
  - Food availability: canning, refrigeration, freezing, radiation, packaging
  - Food preparation: fossil fuels, electricity, appliances (cooker, mixers)

- **Dramatic shift in leisure activities for adults and children**
  - Time spent for viewing television, computers (sedentary habits)
  - Images/marketing brought to each household (alters consumption)

  ➢ “Pedestrian-hostile, activity-discouraging, fast food-intensive environment”

Nutrition transition

- **Increase**
  - Fats (saturated fats, hydrogenated, trans)
  - Added sugar
  - Animal foods

- **Decrease**
  - Cereals, whole grains (complex carbohydrates)
  - Fibers

- In association with **decrease in physical activity**

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Source: International Obesity Task Force (IOTF)
Prevalence of overweight/obesity across the world, adults ≥20 y
Relationship of Mean Population BMI, SBP, and Cholesterol with Average National Income and Proportion of Population in Urban Areas

Proximal factors associated with obesity epidemic

- High calories density foods
- Increased portion sizes
- Easy access to plentiful
- Inexpensive foods (particularly unhealthy)
- Sedentary lifestyle
- Cultural influences
- Commercial practices

- What is first: increased intake or less exercise?

Changes in socio-economic structures underlie the physical activity-nutrition transition

- **Social**
  - Less active physical activity (transport, TV, house technology, etc)
- **Economic**
  - Higher availability of cheap processed foods (high fat, high carb.)
- **Biological**
  - Preference for fats and sugar
  - Thrifty genotype
- **Cultural**
  - Social status, worry of disease, protection against disease (babies)
- **Political-macroeconomic**
  - Overproduction of foods, competition, lobbies, interest to several economic sectors (*Nestle M, Food politics, Science*)

- People do not make fully free and informed choices
- Strategies that merely increase awareness may not be sufficient
Globalization as a main engine for nutrition transition

Trade liberalization

• Expanded markets at intercontinental scale
• Concentration of the food production, favoring processed foods
• Threat to local production/distribution of local foods

Communications revolution

• Global marketing campaigns through mass media, global advertising agencies, electronic channels
• Coca Cola: main sponsor of Football World Championship…

➢ Profound changes in consumption patterns worldwide

• Soft drinks ("coca-colonization"),
• Energy dense foods (replacing locally produced low-fat/fiber-rich foods)
• Cigarettes
Relationship between energy density and energy cost for selected foods

Cultural factors

Body weight
• Overweight as evidence of social status
• Westernized diet as symbol of social status
• Purported protection of overweight against infection (babies, HIV)

Avoidance of physical exercise
• Social status
• Cultural barriers
• Techno-urban chic: no sweat, no smell, button down clothes
• Focus on family vs. individual: less attention to leisure exercise and/or appearance
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Relation between BMI and diabetes, HBP and IHD mortality

Health Prof FU Study, initially aged 40-65, FU 10y, Am J Epidemiol 1995;141:1117

Nurses' Health Study, initially aged 30-55, FU 18 y, Ann Int Med 1998;128,81

Millions of cases of DM in 2000 and projections for 2030

Trends in conventional and metabolic risk factors in Seychelles 1989-2004

- BP ≥140/90 or treatment
- BP ≥140/90
- LDL cholesterol ≥3.0
- Total cholesterol ≥5.2
- HDL cholesterol <1.0
- Triglyceride ≥1.7
- Glucose ≥5.6
- Diabetes
- HOMA ≥4.0 (upper quartile)
- BMI ≥30
- BMI ≥25

Relative change (% in 2004 vs. 1989)

Bovet et al. Divergent fifteen-year trends in traditional and cardiometabolic risk factors of cardiovascular diseases in the Seychelles, Cardiovasc Diab 2009, 8:34
**Population attributable fraction of DM in the population:**

Overweight accounts for ~50% of all DM cases in the population

<table>
<thead>
<tr>
<th></th>
<th>Men</th>
<th></th>
<th>Women</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Prevalence (%)</td>
<td>Odds ratio*</td>
<td>PAF (%)</td>
<td>Prevalence (%)</td>
</tr>
<tr>
<td>Overweight (BMI: 25–29 kg/m²)</td>
<td>37 (33–41)</td>
<td>2.1 (1.9–2.2)</td>
<td>26 (16–36)</td>
<td>33 (30–37)</td>
</tr>
<tr>
<td>Obesity (BMI ≥ 30 kg/m²)</td>
<td>15 (12–18)</td>
<td>2.6 (2.4–2.9)</td>
<td>17 (11–23)</td>
<td>35 (32–29)</td>
</tr>
<tr>
<td>Overweight or obesity (BMI ≥ 25 kg/m²)</td>
<td>52 (48–56)</td>
<td>2.2 (2.1–2.4)</td>
<td>43 (29–55)</td>
<td>68 (64–72)</td>
</tr>
</tbody>
</table>

Prevalence, awareness and control of diabetes in the Seychelles and relationship with excess body weight.  
*BMC Public Health* 2007, 7:163(e).
Large mortality avoidable with healthy diet: WHR 2002

- High blood pressure
- Tobacco
- High cholesterol
- Low fruit and vegetable intake
- Overweight
- Physical inactivity
- Alcohol
- Underweight
- Unsafe sex
- Unsafe water, sanitation & hygiene
- Indoor smoke from solid fuels
- Iron deficiency
- Vitamin A deficiency

Millions deaths per year

Developing countries, high mortality
Developing countries, low mortality
Developed countries
• Experts warn that the obesity epidemic will decrease life expectancy over the next decade, for the first time ever in history in high income countries

• Experts warn that the epidemic of obesity, and its complications (diabetes, hypertension), if not curbed, will bankrupt health care systems in the next 1-2 decades (cost of treatment, loss productivity among middle aged persons)

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Can diabetes be prevented?
Clinical trial of lifestyle modification over 3 years in pre-diabetes

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Incidence (/100/yr)</th>
<th>Relative reduction (%)</th>
<th>NNP (3 yrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Placebo</td>
<td>11.0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2) Metformin (850 mg twice daily)</td>
<td>7.8</td>
<td>-29%</td>
<td>31</td>
</tr>
<tr>
<td>3) <strong>Lifestyle-modification program</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;7% weight loss &amp; &gt;150 min PE/w</td>
<td>4.8</td>
<td>-56%</td>
<td>16</td>
</tr>
</tbody>
</table>

- 3234 non-diabetic persons with IFG (5.3-6.9) and IGT (7.8-11)
- mean age: 51 yrs, mean BMI: 34, follow-up: 2.8 yrs.

Physical activity and prevention of type 2 diabetes

Primary vs. secondary prevention of diabetes

Predisposing factors | Early metabolic abnormalities | Currently measured risk factors | Vascular disease | Clinical disease

- Genes
- Overweight (50-80% of all DM cases)
- Lifestyle (PA)

Early metabolic abnormalities:
- Insulin resistance
- Elevated glucose (glucose intolerance)
- Metabolic risk factors (BP, lipids, etc)

Currently measured risk factors:
- Microvascular disease
- Macrovascular disease

Vascular disease:
- Renal failure
- Retinopathy
- Neuropathy
- Coronary HD
- Stroke
- Peripheral vascular disease

Primary prevention (avoid new cases in pop):
- Weight control (diet), PA in entire population

Secondary prevention (delay complications in current DM cases):
- Comprehensive case management among diabetic patients of all metabolic disorders (medic & lifestyle)
Treatment of obesity

• Diet rarely successful to lose weight beyond short term
  – But effective to maintain weight
  – Role of adjunct physical activity
• All diets similar in effectiveness conditional to adherence
• Medications poorly effective
• Surgery highly effective, reduces HBP/DM
  – Costs, side effects, effects on mortality unknown yet

➢ Prevention +++

• Truby et al. Randomised controlled trial of four commercial weight loss programmes in the UK:BMJ, BMJ 23 May 2006)
• Nordmann et al. Effects of low-CHe vs low-fat diets on weight loss and CVD RF. Arch Intern Med 2006;166:285-293.
• Dansinger ML. Comparison of the Atkins, Ornish, WW, and Zone Diets for weight loss…. JAMA. 2005;293:43-53
Meta-analyses of changes in BMI of dietary counseling based interventions

Major reduction of CVD RF after bariatric surgery

- Reduction of weight excess by 61%
  - 47% gastric banding, 62% gastric bypass, 68% gastroplasty; 70% biliopancreatic diversion/duodenal switch
- Operative mortality (30d): 0.1% / 0.5% / 1.1%

- Diabetes completely resolved in 76.8%
- Hyperlipidemia improved in 70%
- Hypertension resolved in 62% (resolved/improved in 79%)
- Obstructive sleep apnea resolved in 86%

Ecologic model relating the built environment to physical activity, diet, and body weight

Societal policies and processes with direct and indirect influences on the prevalence of obesity

The challenge of obesity in the WHO European Region and the strategies for response: summary. WHO 2007. (Kumanyika)
Environnement physique
Individual vs. social response to the obesity epidemic (clinical vs. public health response)

There is little point in highlighting healthy messages/treatment in school if kids are exposed to junk foods at school or elsewhere and/or are bombarded with confusing messages on billboards when they go home or on TV when they get home.
Energy intake, physical activity, and population-wide weight loss and mortality of diabetes an CVD in Cuba

Selected interventions targeting entire population

1) Educational interventions
2) Transportation policies
3) Improve food supply
4) Economic policies: incentives and disincentives
5) Initiatives at the community level
Examples of societal measures that can improve the environment of food choices

- Small taxes on junk foods and soft drinks
  - reduces consumption & raise funds on anti-obesity campaigns
- Restrictions on food marketing to children
  - e.g. ban on vending machines in schools and on TV
- Calorie labels on all foods (including fast foods)
- Changes in farm subsidies and trade taxes to promote production / consumption of fruits and vegetables
- Revisit sponsoring by food industry (campaigns contributions)
- Advocate for a government agency -independent of food industry- with clear responsibility to food, nutrition and health
Micro-level interventions

Family-based
- Healthy diet and baby care programs for new mothers
- Parent involvement in school-based interventions
- Home visits to monitor/promote nutrition behavior change
- Distribution of nutrition education material to families
- Home gardening projects

Individual-based
- Referral networks for high risk individuals
- Provision of nutrition counseling services
- Follow-up programs to monitor high risk individuals
- Development of effective patient education materials

Intermediate-level interventions

Community-based
• Supermarket nutrition education programs
• Partnerships with restaurants and grocers
• Increased exercise facilities, transport policies (environment shaping)
• NCD-nutrition clinics at local health centers
• Screening

Worksite-based
• Cafeteria programs (healthy meals), screening

School-based
• Modification of school food services
• Nutrition education curricula & nutrition training to teachers
• Nutrition counseling programs for high risk children
• Increase exercise uptake in/out school, ‘safe-route’ programs

Health professionals
• Training, seminars, newsletters promoting preventive nutrition

Macro-level interventions: increase availability and desirability of nutritious foods

Food supply
• Agricultural policies
• Food importation policies
• Price and tax legislation/regulations
• Partnership with food industry
• Increased marketing of desirable foods
• Food labeling policies

Mass media
• Programs in mass media, promotion of healthy eating & NCD
• Reduction of advertising on calorie dense foods

Schools

- Food policies that limit foods high in sugar, saturated fats, and trans fats while encouraging consumption of fruits, vegetables, whole grain and low fat dairy (vending, a la carte, stores)
- Ensure availability daily of heart-healthy lunches offering non-fried items (fish) and at least one meal/d low in sat/trans fat
- Offer and require daily physical education at all grade levels
- Expand physical activity opportunities (sports, walk, dance, bike, use of facilities in week end for general public)
- Include nutrition and healthy lifestyle in school curriculum
- Training to teachers
Food industry

• Reduce sugar (and salt) content of processed foods
• Reduce saturated and trans fats in prepared foods with low saturated vegetable liquid oils
• Increase the proportion of whole grain foods available
• Package foods in smaller individual portion sizes
• Develop packaging that allows for greater stability, preservation and palatability of fresh fruits and vegetables (social marketing)
• Labeling of nutrients
Restaurants, canteens

- Display calorie content on menus or at point of decision
- Reduce portion sizes and provide options for reduced sizes
- Reformulate products to reduce calories, sodium, saturated & trans
- Provide more vegetable options and prepare with minimal fats/salt
- Provide more fruit options, and serve without added sugar
- Develop creative healthy menus to make them attractive
- Allow substitution of nonfried options and low-fat vegetables for usual side dishes
Influencing Food Choice
A Multi-level Framework for Identifying Facilitators or Barriers to Attaining AHA Dietary Recommendations

- Local Community
- School Settings
- Worksites
- Restaurants & fast food outlets

- Economic policies
- Laws
- Government Policy
- Industry Relations
- Media
- Technology
- Transportation

- Biology/Genetics
- Flavor Experiences
- Learning History
- Demographic Factors

- Role modeling
- Feeding Styles
- Availability
- Culture
- etc

WHO Global Strategy on Diet, Physical Activity and Health (2003)

**Dietary goals at individual level**
- Limit saturated fats, trans fatty acids, salt (<5g) and sugars (<10% tot E)
- Increase fruit and vegetables (>400g/d)
- Increase physical activity (1 h of walking or similar / day)
- Specific recommendations for special subgroups (infants, children, etc)

**Guiding principles**
- Strong evidence for efficacy of policy (K on diet ~ NCD)
- Need for advocacy for policy change
- Role of stakeholders in implementing global strategy
- Strategic framework for action
• Diet coke
• Skimmed milk
• Lack of variety of diet
• Crossing streets in Kampala
Conclusions

• Accelerated shift toward positive energy balance
  – Shift in dietary structure (energy dense) and physical exercise
  – Shift might be quicker in developing countries
• Obesity and related disease burden is shifting to the poor
• Co-existence of under-nutrition
• Expected major impact on health (diabetes, NCD)
• Need to understand and address cultural factors
• Need to understand underlying societal forces (economic)
• Treatment at individual level limited
• Need for a prompt public health response, mainly at public health level to respond to obesogenic environment
Thank you