OPTIMIZING FOOD SYSTEMS FOR HUMAN HEALTH

The global nutrition transition from undernutrition to obesity - can it be prevented?

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Prevalence of undernutrition and overweight in children < 5 y in two decades in Mexico

Average reductions of stunting in Latin America (percent point/year)

<table>
<thead>
<tr>
<th></th>
<th>1990-2000</th>
<th>2000-2010</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-0.56</td>
<td>-0.46</td>
</tr>
</tbody>
</table>

Prevalences

- Underweight
- Stunting
- Wasting
- Overweight


http://bvs.insp.mx/rsp/inicio
Prevalence of stunting in children < 5 y in two decades by quintiles of well-being conditions

Average reduction of stunting in Mexico (pp/year)

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>-0.49</td>
<td>-0.86</td>
<td></td>
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</tbody>
</table>

Prevalence of stunting in children < 5 y by ethnic group

Average reduction of stunting in Mexico (pp/year)

<table>
<thead>
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<tbody>
<tr>
<td>-0.52 pp/y</td>
<td>-2.16 pp/y</td>
<td></td>
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</tbody>
</table>
Height in Mexican adult women (20-49 y) by birth cohort in rural and urban areas

Evolution of income poverty in Mexico from 1992 to 2006 (percentage of people)
Mortality rates of children under 5 years old 1988 - 2006


Prevalence of stunting* in children under 5 years of age by subpopulations in 1988

* 2006 WHO norms

Rivera et al, 1993
Distribution of stunted children < 5 y and beneficiaries of food programs by region in 1988

<table>
<thead>
<tr>
<th>Region</th>
<th>Stunted children (%)</th>
<th>Beneficiaries of food programs (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>North</td>
<td>7.8</td>
<td>16.9</td>
</tr>
<tr>
<td>Center</td>
<td>16.9</td>
<td>33.6</td>
</tr>
<tr>
<td>México City</td>
<td>8.7</td>
<td>51.1</td>
</tr>
<tr>
<td>South</td>
<td>15.1</td>
<td>44.9</td>
</tr>
</tbody>
</table>

Reasons for lack of effectiveness of nutritional programs and changes introduced by *Oportunidades*

### Reasons of the lack of effectiveness
- Ineffective targeting
  - Emphasis in Urban areas
  - Lack of targeting on poor population and children < 2 y
- Food Distributed
  - Inappropriate for young children
  - Non rich micronutrient source
- Weak Communication/ education
- Duplicity of programs and actions
  - Lack of coordination
  - Non multi-sector programs
- Lack of evaluation

### Changes introduced by *Oportunidades*
- Targeted to vulnerable groups
  - Families in low-income rural areas
  - Children under < 2 year old, pregnant and lactating women
- Nutrition component
  - Food specifically designed for children, fortified with micronutrients
- More emphasis communication strategies
- Multi-sector actions: Nutrition, Health, Education
- Evaluation component
Nutrition Component of Oportunidades

- Fortified supplements:
  - Children 6-23 months
  - Pregnant and lactating women
- Supplements are low in energy and provide high quality protein and micronutrients
- More effective communications/education strategy
- Primary health care

Distribution of stunted children < 5 years old and beneficiaries of Oportunidades by region in 1999

Impact of Oportunidades on growth and anemia

- Positive effects on:
  - Growth
    - Younger age (0-6 mo)
    - Lower Socioeconomic Status
  - 2 yrs vs 1 y exposure
  - Anemia
    - Overall effect

Rivera et al, JAMA 2004

Possible explanations of undernutrition reduction from 1999 to 2006

- Sustained decline in poverty and more access to foods
- Reduction of infant and under 5 y mortality due to improvement in water and sanitation services, health services quality and coverage, improvement in prevention (immunizations), better living conditions
- High investment in Nutrition (Oportunidades: covers 6 million families)
- Targeted to the poorest population (indigenous, rural, low socio-economical level) and children < 2 years of age
- High coverage rates
- Evaluation
Possible explanations of undernutrition reduction from 1999 to 2006

- Distribution of food supplements
  - Specifically designed for children 6-24 months, good acceptance
  - Supplements with low energy and adequate protein and micronutrients
- Conditional Cash transfers
  - Improved dietary diversity (although not quality or quantity of complementary foods)
  - Possible improvement in infrastructure and services in homes
- More primary health care services utilization
- Nutritional education


Rivera et al, 2007
Prevalence of overweight and obesity in Mexican women 20 to 49 years old (1988, 1999 and 2006)

![Graph showing prevalence of overweight and obesity in Mexican women 1988 to 2006.]

Rivera et al, 2007

Prevalence of overweight and obesity in school-age children and adolescent girls 1999 to 2006.

![Graph showing prevalence of overweight and obesity in school-age children and adolescent girls 1999 to 2006.]

** International Obesity Task Force System

Rivera et al, 2007
Overweight and obesity in women 20-49 years by living conditions in 1988, 1999 and 2006

Prevalence of hypertension in Mexican adults

*SBP ≥ 140 o DBP ≥ 90 o Previous Dx); Source: Barquera et al, SPM (2010)
Prevalence of Diabetes Mellitus type 2 *

Source: Villalpando et al., con datos de la ENSANUT 2006 (INSP, 2009)

Metabolic Syndrome indicators by BMI in Mexican adolescents (11-19 y)

WCRF/AICR Expert panel conclusions on obesity risk factors

<table>
<thead>
<tr>
<th>Evidence</th>
<th>Decreased Risk</th>
<th>Increased Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Convincing</td>
<td>Physical Activity</td>
<td>Sedentary Living</td>
</tr>
<tr>
<td>Probable</td>
<td>Low Energy-dense Foods</td>
<td>Energy-Dense Foods</td>
</tr>
<tr>
<td></td>
<td>Being Breastfed</td>
<td>Sugary drinks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“Fast Foods”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Television Viewing</td>
</tr>
</tbody>
</table>


Conceptual framework of causes of obesity

Rivera and González de Cossío, in press
Social determinantes of obesity

• “Food deserts” are poor communities where supply of healthy food is restricted
• In Mexico we have described lower supply of fruits and vegetables and high supply of unhealthy foods in poor communities
• In a study of rural communities we found no regular supply of fruits and vegetables in 21% and 13%, respectively
• While sugar sweetened beverages and food with high contents of sugar or fat were found in all communities

Social determinantes of obesity

• Among indigenous households, only 12.7% and 37.5%, respectively, had amounts of vegetables and fruits that were equal or higher than recommendations by INSP
• Among non-indigenous households 36.2% and 64%, respectively, complied with INSP recommendations for fruits and vegetables
• In contrast over 70% of indigenous and 80% of non-indigenous households had foods that were of poor nutritional quality (high in sugar and fat)
• This results show how poverty is linked to low availability of healthy foods and high availability of unhealthy foods, leading to unhealthy diets
### Cost of 1000 calories by energy density category and income quintile in 1992 and 2000 in Mexico

<table>
<thead>
<tr>
<th>Energy density of food groups</th>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
<th>Q4</th>
<th>Q5</th>
<th>NATIONAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low (&lt; 145 Kcal/100g)</td>
<td>33.1</td>
<td>28.3</td>
<td>29.1</td>
<td>29.1</td>
<td>36.4</td>
<td>31.5</td>
</tr>
<tr>
<td>Medium (145-300 Kcal/100g)</td>
<td>9.9</td>
<td>10.7</td>
<td>12.2</td>
<td>12.2</td>
<td>21.2</td>
<td>14.6</td>
</tr>
<tr>
<td>High (300-900 Kcal/100 g)</td>
<td>3.2</td>
<td>4.4</td>
<td>5.2</td>
<td>5.2</td>
<td>8.4</td>
<td>5.2</td>
</tr>
<tr>
<td>TOTAL</td>
<td>5.9</td>
<td>8.5</td>
<td>10.7</td>
<td>10.7</td>
<td>18.4</td>
<td>11.6</td>
</tr>
</tbody>
</table>

| Low (< 145 Kcal/100g)       | 27.6| 25.5| 26.1| 30.2| 30.2| 27.7     |
| Medium (145-300 Kcal/100g)  | 7.9 | 8.8 | 9.9 | 9.9 | 10.9 | 11.0     |
| High (300-900 Kcal/100 g)   | 2.5 | 3.9 | 5.1 | 5.1 | 7.2  | 4.6      |
| TOTAL                        | 4.8 | 7.9 | 10.0| 10.0| 14.6 | 9.9      |

Using Mexican Income and expenditure surveys 1992, 2000 (ENIGH)

### Changes in food purchases between 1984 and 1998 (%) for different food groups

<table>
<thead>
<tr>
<th>Food Group</th>
<th>1984-1998 Change (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruits &amp; Vegetables</td>
<td>26.7</td>
</tr>
<tr>
<td>Milk</td>
<td>26.7</td>
</tr>
<tr>
<td>Meat</td>
<td>-18.8</td>
</tr>
<tr>
<td>Refined CHO</td>
<td>6.3</td>
</tr>
<tr>
<td>Beverages with sugars</td>
<td>37.2</td>
</tr>
</tbody>
</table>

Adapted from: Rivera JA et al. Epidemiological and nutritional transition in Mexico: Rapid increase of non-communicable chronic diseases and obesity. Public Health Nutrition. 5: (1A) 113-122, 2002
Consumption of fruits and vegetables in school aged children in México

![Bar graph showing consumption of fruits and vegetables by quintiles of living conditions, rural vs. urban, and by sex (girls vs. boys).](image)

*Medias ajustadas por sexo, edad, nivel social y diseño*

Ramírez-Silva I, Rivera JA, Ponce X, Hernández-Avila M. 2009, Salud Pub Mex

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Consumption patterns of alcoholic energy intake in adults (≥19 years) by sex in 2006 Mexican

![Bar graph showing alcoholic energy intake in kcal for men and women](image)

Beverage Consumption Trends in adolescent and adult women in Mexico in 1999 and 2006.

High sugar, includes soft drinks, sweetened juice, fruit drinks sweetened with sugar and alcohol
High energy and low benefit, mainly full-fat milk
Low energy, coffee with little sugar and skim milk


Median age of introduction of various food groups in Mexican infants and children < 2 y

Time spent watching TV or playing video games in children 9-16 y in Mexico City


Percent of adolescents reporting different levels of physical activity in México (2006)

Active: ≥ 7 hs/week of Moderate to vigorous physical activity (MVPA)
Moderately active: 4-6.9 Hs/week of MVPA
Inactive: < 4 hs/week of MVPA

Shamah y col., 2006
Factors promoting obesity in the school environment in Mexico

Opportunities to eat
- Children spend 4 ½ hours at school (most school are part time)
  - Most children have breakfast at home and about 25% at school
  - Children return home for their main meal
  - Therefore a “collation” (light repast) rather than a formal lunch should be consumed at school
- Five opportunities to eat during school period
  - School entrance (in streets), school breakfast distributed by Government, in classrooms during classes, during recess (main collation), when leaving school (in streets)


Factors promoting obesity in the school environment

FOOD AVAILABILITY
- Wide availability of high- sugar and high- fat food and beverages
  - High availability of sugar sweetened beverages (Soft drinks, “aguas frescas”, juices)
  - Wide availability of high energy dense foods
  - Limited availability of fruits, vegetables and drinking water

Factors promoting obesity in the school environment

ENERGY INTAKE ELEMENTARY SCHOOL

• During school period
  – 560 kcals (95% CI 114 – 1186)
  – Intake contributes 31 % of total daily energy intake

• During recess
  – 433 kcal (CI 95% 392.0-474.4 kcal)
  – Intake contributes 24% of total daily energy intake


Time spent by Mexican primary school students in different activities during the physical education class

Minuts

Laying 0 0
Sitting 6.2 4.7
Standing 22.2 21.8
Walking 6.6 8.2
More active 3.5 3.9

MVPA= 10.1 (girls) 12.1 (boys)

Girls Boys

Unethical Marketing of food and beverages which increases risk of obesity

It states that 200 ml of the sugar sweetened beverage, with an energy value of 84 Kcal (21 g of sugar) provides only 17% of the recommended intake of sugar per day.

But in fact, 200 ml provide 42% of the maximum limit of sugar as recommended by WHO (10% of the total energy intake).

The title of the add is “Nothing to hide”; that is, the company is proud of the nutrition content of the beverage.

The true is that the can contains 355 ml... so the add is hiding the real content of the can which is 37g of sugar (150 Kcal), which provides 74% of the upper level of sugar intake as recommended by WHO without contributing with any other nutrient (empty calories).

So, nothing to hide, really?

National Strategy for Obesity Prevention

1. Promote Physical Activity
2. Increase availability and intake of water
3. Increase intake of vegetables, fruits, legumes, whole grains and fiber
4. Communication/Education on healthy diet
5. Promote breastfeeding
6. Reduce intake of sugars and fat in beverages and liquid foods
7. Reduce intake of added sugar to food
8. Reduce intake of total, saturated and trans fats
9. Reduce portion sizes
10. Reduce intake of sodium
Food regulations in the schools in Mexico

As part of the National Strategy, since 2010 food sold in school is regulated. Regulations are becoming increasingly strict. The second phase started last month (2011-2012)

<table>
<thead>
<tr>
<th>Energy per portion or portion size</th>
<th>Healthy Dishes</th>
<th>Savory Snacks (Cookies and desserts)</th>
<th>Sweet snacks (with sugar)</th>
<th>Milk and Dairy</th>
<th>Fruit Juices and nectars</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein</td>
<td>≤180 Kcal</td>
<td>≤130 Kcal</td>
<td>≤130 Kcal</td>
<td>≤200 ml</td>
<td>≤125 ml</td>
</tr>
<tr>
<td>Sugar and sweeteners</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>w/o added sugar</td>
<td></td>
<td></td>
<td>≤10% of total calories</td>
<td></td>
<td></td>
</tr>
<tr>
<td>added sugar</td>
<td></td>
<td></td>
<td>≤20% of total calories</td>
<td></td>
<td></td>
</tr>
<tr>
<td>added sugar</td>
<td></td>
<td></td>
<td>No added sugar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>added sugar (non-caloric sweeteners)</td>
<td></td>
<td></td>
<td>No added sugar (non-caloric sweeteners)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fat</td>
<td></td>
<td></td>
<td>&lt;15% of total calories from staturated fat</td>
<td>≤1 g en 100 g of milk</td>
<td>No added fat</td>
</tr>
<tr>
<td>Trans FA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sodium (mg)</td>
<td>≤220 (1.22 mg/Kcal)</td>
<td>≤160 (1.3 mg /Kcal)</td>
<td>≤140 (1.08 mg/Kcal)</td>
<td></td>
<td>≤60 (in processed juices)</td>
</tr>
<tr>
<td>Dietary fiber (mg/Kcal)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy Density</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>other</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Banned from primary schools SSB
Allowed non caloric sweetened beverages in Secondary school
Conclusions

• México is undergoing a rapid nutrition transition.

• Wasting virtually eliminated, stunting reduced to half

• However, overweight and obesity increased in most age groups, rural and urban areas and all socioeconomic levels

• Also, nutrition related chronic diseases (NRCD): T2D and CVD have also increased.

Conclusions

• Factors likely responsible for decline in undernutrition may be also partially responsible for the obesity epidemic:
  – Sustained poverty reduction and therefore more access to food
  – Improvements in water, sanitation and public health programs with decline in infections
  – Evidence based nutrition programs, well designed, high coverage, were well targeted and evaluated.
Conclusions

• Rise of excess BMI parallel increases in risk factors for obesity:
  – Increased availability and intake of: total fat, Sugar sweetened beverages, sugar and refined carbohydrates
  – Decline in intake of whole grains, beans, fruits and vegetables
  – Evidence of low levels of physical activity

Conclusions

• Obesogenic environments:
  – Schools and other settings promote intake of energy dense foods and SSB and offer little opportunities for physical activity
  – Reduced cost of calories and lower cost of calories from energy dense foods
  – Trend of loss of mesoamerican food culture and social norms regarding foods

• The government is implementing a national strategy for the prevention of obesity, it is evidence based and involves different sectors of government and industry, which is promising
### Critical points in the food system for intervention and roles of public health, agriculture, other sectors and food industry for improving human health in Mexico

<table>
<thead>
<tr>
<th>Critical Points</th>
<th>Roles and Policies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production of enough healthy foods to cover population needs (vegetables, fruits, healthy vegetable oils, leaner meat)</td>
<td>Agriculture and fiscal* policy</td>
</tr>
<tr>
<td>Increase production and demand of declining healthy traditional food (beans and whole corn tortilla)</td>
<td>Agriculture and fiscal policy</td>
</tr>
<tr>
<td>Substitution of land used to produce foods which are consumed in excess (sugar)</td>
<td>Agriculture and fiscal policy</td>
</tr>
<tr>
<td>Provide incentives for local production and commercialization of healthy food in poor areas (indigenous areas)</td>
<td>Agriculture and fiscal policy</td>
</tr>
<tr>
<td>Increase availability of clean drinking water in poor settings</td>
<td>Social development and fiscal policy</td>
</tr>
<tr>
<td>Facilitate healthy food choices at purchase point</td>
<td>Public health and trade</td>
</tr>
<tr>
<td>Make the healthy choice the easy choice in particular settings (schools, working place)</td>
<td>Regulations (public health and congress)</td>
</tr>
<tr>
<td>Reduce portion size, sugar, refined carbohydrates, energy density of foods and energy content in beverages</td>
<td>Regulations (industry and public health)</td>
</tr>
<tr>
<td>Education campaigns to promote healthy eating</td>
<td>Public Health, Education and media</td>
</tr>
</tbody>
</table>

*Government expenditure and taxation

### What are the priority research questions in Mexico?

- Better understanding of risk and protective dietary factors in different subpopulations
- Obstacles and facilitating factors for improving healthy eating patterns
- Obstacles and facilitating factors for preserving and promoting the traditional Mexican food culture
- Potential effects of taxation and subsidies to influence intake
- Effects of different food labeling strategies on food choices and dietary intake, including potential negative effects on unpacked foods
- Process evaluation of food and beverage regulations in the School system for improving implementation
- Process and impact evaluation of national policy for the prevention of obesity
Thank you

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