Global Conference on Health and Lifestyle

Today’s Lifestyle, Tomorrow’s Epidemic

E. Albert Reece, MD, PhD, MBA
Vice President for Medical Affairs, University of Maryland
John Z. and Akiko K. Bowers Distinguished Professor and
Dean, School of Medicine

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Overview

• Definition
  Causes and consequences
• Focus on Obesity and Diabetes
• Diabetes-induced birth defects
• Children in peril
• The Adventist model for prevention and intervention

Life-Style Diseases

• Are caused by an inappropriate relationship of people with their environment
• Take years to develop
• Are not easily treated or cured once they develop

Life-Style Diseases Are:

• Diseases that become widespread as countries become more industrialized
• Potentially preventable by changes in diet, exercise, and/or environment

Historical Overview: Early 1900’s

Communicable diseases accounted for 2/3 of all deaths worldwide. The top 10 causes of death were:

1. Tuberculosis
2. Pneumonia and influenza
3. Diseases of the heart
4. Diarrhea, enteritis, and ulceration of the intestines
5. Intracranial lesions of vascular origin
6. Nephritis (all forms)
7. Accidents excluding motor-vehicles
8. Cancer and other malignant tumors
9. Senility
10. Bronchitis

Fast Forward: Today!

Life-style diseases account for the majority of deaths, particularly in more affluent countries. The top 10 causes of death in these countries are:

1. Heart disease
2. Stroke
3. Lung cancer
4. Lower respiratory infections
5. Chronic obstructive pulmonary
6. Colon and rectum cancers
7. Alzheimer's disease
8. Type 2 diabetes
9. Breast cancer
10. Stomach cancer
**Selected Examples of Lifestyle Diseases**

- Cardiovascular Disease
- Lung Disease
- Cancer
- Obesity
- Type 2 diabetes

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**FOCUS ON OBESITY**

- Approximately 1.6 billion adults (age 15+) are overweight
- At least 400 million adults are obese
- At least 20 million children under the age of 5 years are overweight

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**A Focus on Type 2 Diabetes**

- Accounts for about 90% to 95% of all diagnosed cases of diabetes
- Often diagnosed several years after onset, once complications have already arisen
- Until recently, seen only in adults, but now it is common in obese children

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**Prevalence and Incidence of Diabetes Worldwide**

- At least 171 million people worldwide have diabetes
- Approximately 3.2 million die each year worldwide from the complications of diabetes
- Worldwide incidence likely to more than double by 2030

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**Countries with Largest Likely Increases**

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**Worldwide Economic Consequences of T2DM**

- In 2007, the world spent $232 billion to treat and prevent diabetes and its complications
- Approx $174 billion in the U.S. alone
Diabetes that is present before pregnancy
- **gestational diabetes** - can cause serious birth defects in her developing infant (i.e., diabetic embryopathy)

Diabetes that develops during pregnancy
- **pregestational diabetes** - can cause serious birth defects in her developing infant (i.e., diabetic embryopathy)

**Consequence of Diabetes for the Unborn**

- Central Nervous System
  - Neural tube defects
    - Non-diabetic mothers: 0.1-0.2% of live births
    - Diabetic mothers: 1-2% of live births

- Cardiovascular
  - Cyanotic disease
  - Acyanotic disease
  - Ventral septal defects
  - Atrial septal defects
  - Gastrointestinal
  - Genitourinary
  - Skeletal system (limb-reduction defects)

**Prevalence of Diabetic Embryopathy**

- Birth defects occur in 6-10% of newborns of diabetic mothers
  - Compared to 3% in general population

  In the U.S.:
  - 4 of 10 babies with a congenital heart defect (CHD) will die
  - 1 of 10 babies with a neural tube defect (NTD) will die

- By 2010, 8,000 babies born each year are expected to have congenital anomalies secondary to maternal diabetes

**Types of Defects: A closer look**

- Central Nervous System
  - Neural tube defects
    - Non-diabetic mothers: 0.1-0.2% of live births
    - Diabetic mothers: 1-2% of live births

- Cardiovascular
  - Cyanotic disease
  - Acyanotic disease
  - Ventral septal defects
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**Incidence of defects: linked to severity of hyperglycemia**

<table>
<thead>
<tr>
<th>1st trimester HbA1c levels (SD above mean)</th>
<th>% of infants with major malformations (n)</th>
<th>Risk Ratio (95% confidence interval)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 6</td>
<td>3 (99)</td>
<td>1.0</td>
</tr>
<tr>
<td>6.1-9.0</td>
<td>5.2 (77)</td>
<td>1.7 (0.4-1.7)</td>
</tr>
<tr>
<td>9.1-12.0</td>
<td>4.3 (46)</td>
<td>1.4 (0.3-8.3)</td>
</tr>
<tr>
<td>12.1-15.0</td>
<td>38.9 (18)</td>
<td>12.8 (4.7-35.0)</td>
</tr>
<tr>
<td>&gt;15.0</td>
<td>40.0 (10)</td>
<td>13.2 (4.3-40.4)</td>
</tr>
</tbody>
</table>

**HYPOTHESIS**

- **Hypoxia**
- **Hyperglycemia**
- **Glucose**
- **ROS**
- **Apoptosis**
- **Caspase-3**
- **AKT**
- **BAX**
- **JUN**

**MATERNAL DIABETES**

- **GLUCOSE**
- **ROS**
- **APOPTOSIS**
- **EMBRYOPATHY**

**Stress Activated Signaling Pathways**

- **MAPK**
- **ERK**
- **JNK**
- **P-Raf**
- **P-JUN**
- **AKT**
- **BAX**
- **CASP-3**
Method – 1 (in vivo)

- Diabetes induced (hyperglycemia > 250 mg/dl) in 8-week old Sprague-Dawley rats (250 gms) by IV injection of STZ (65 mg/kg) in saline in the tail vein
- Control rats received saline sham injections
- Sustained release insulin pellets (Lehren Pack, Linshin, Canada) were inserted to normalize glucose
- Rats were mated following normalization of glucose

Method – 2 (in vivo)

- On gestational day 4, implants removed to induce hyperglycemia (> 250 mg/dL)
- Rats sacrificed on day 12 after organogenesis, and conceptuses examined and stored (-80ºC)
- Protein lysates (50 ugm) were separated on 10% SDS-PAGE and protein expression – evaluated by Western blotting using affinity purified mouse monoclonal antibody for PKC, cPLA2 and COX-2
- Resulting bands quantified by densitometry

Supplements and Prevention of Diabetic Embryopathy

Adventist Health Study (cont’d)

- Adventist Health Study-1; 1976-1988 (cont.)
  - Increased consumption of meat was associated with INCREASE RISK of colon cancer; Legumes was protective against the colonic cancer risks
  - Risk of heart attack reduced by 50% from eating nuts several times a week
  - Heart attack risk reduced by 45% from eating whole meal bread instead of white
  - Drinking 5 or more glasses of water a day may reduce heart disease by 50%
  - Prostate cancer was reduced by 40% in men who had a high consumption of tomatoes
  - Drinking soy milk more than once daily may reduce prostate cancer risk by 78%

Adventist Health Study (cont’d)

- Adventist Health Study-2; 2002-2011
  - Cohort: 100,000 Seventh-day Adventist in USA and Canada. The study will continue to explore the links between lifestyle, diet and disease among the broader base of Seventh-day Adventists in American and Canada
  - It will investigate the role of:
    - Soy
    - Calcium
    - Other foods
    - Lifestyle factors in:
      - Heart disease
      - Breast, prostate and colon cancers
      - Osteoporosis

Evidence From Adventist Health Studies

Loma Linda University researchers in the U.S. have conducted three large longitudinal studies of Seventh-day Adventist in North America. Data were obtained by each participant completing a diet and lifestyle questionnaire. Following are the results:

- Adventist Mortality Study; 1958-1966
  - Cohort: 23,000 Seventh-day Adventists in California, aged 35 years and older. This study specifically compared death rates of Adventist to other Californians
  - Adventist men and women lived 6.2 and 3.7 years longer respectively than other Californians
  - Lower risk of many diseases

- Adventist Health Study-1; 1976-1988
  - Cohort: 34,000 Seventh-day Adventists in California, aged 30 years and older were studied to find out which components of the Adventist lifestyle gave protection against disease
  - Adventist men and women lived 7.3 and 4.4 years longer respectively than Californians
  - Simple health behaviors increased life span up to 10 years
  - Fruit and vegetables lowered heart disease and cancer risk

- Adventist Health Study-2; 2002-2011
  - Cohort: 100,000 Seventh-day Adventist in USA and Canada. The study will continue to explore the links between lifestyle, diet and disease among the broader base of Seventh-day Adventists in American and Canada
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The Finnish Diabetes Prevention Study (DPS): Lifestyle Intervention and 3-Year Result on Diet and Physical Activity

• Goal
  – Lifestyle intervention
  – Change diet and exercise behavior
• Research Design and Methods
  – Randomized 522 middle age overweight subjects with impaired glucose tolerance to lifestyle intervention vs. “usual” lifestyle
  – Goals of the intervention were to
    • Reduce body weight
    • Reduce fat intake
    • Increase physical activity
    • Increase fiber intake

The Finnish Diabetes Prevention Study (cont.)

• Results
  – Significant improvement in each intervention goal
    • Weight reductions were 4.5 and 3.5kg in the intervention group and 1.0 and 0.9kg in the control group
    • Improved glycemia and lipidemia in the intervention group
• Conclusions:
  – Lifestyle changes produced beneficial changes in
    • Diet
    • Physical activity
    • Clinical and biochemical parameters
    • Reduced diabetes risk

Summary

Today’s Lifestyle is Indeed Becoming Tomorrow’s Epidemic

• Type 2 diabetes is a lifestyle disease that affects approximately 170 million people worldwide and is greatly impacted by the growing epidemic of obesity.
• Intensive lifestyle modifications can prevent Type 2 diabetes in high risk individuals and may elivate the need (in some cases) for drug therapy.
• Vegetarian diet is associated with significant reduction in risk for obesity, diabetes and other diseases.
• It may be possible to prevent diabetes-induced birth defect with nutritional supplementation therapy.
• Overall, Lifestyle changes has been shown to have a positive impact on preventing certain diseases and improving physical health.