Obesity in Indigenous Australians: health impacts

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Contemporary social circumstances for many Indigenous Australians

• Extreme social disadvantage
  • high unemployment
  • welfare dependency
  • poor education
  • overcrowded living conditions

• Poor health
  • heavy burden of infectious diseases, particularly among children
  • heavy burden of lifestyle-related chronic diseases among adults

• Poor quality diet
  • high cost and limited availability of fresh vegetables and fruit in rural and remote Australia
  • High consumption of sugar and fat
Chronic diseases in Indigenous Australians: an escalating epidemic

- Obesity
  - centralised fat distribution in both men and women
- Early onset type 2 diabetes
  - 10 times higher in those aged 20-50 yr
- Premature cardiovascular disease
  - 10 times higher in the 25-45 yr age group
    - dyslipidemia (high TG, low HDL-chol)
    - hypertension
    - microalbuminuria
- heavy burden of infectious diseases?
- Kidney failure
  - Up to 100 times higher than in Australia generally
Age-specific prevalence of diabetes in Australia: AusDiab, Aborigines, Torres Strait Islanders

Diabetes: according to WHO, 1999
Diabetes incidence and BMI in Central Australian Aborigines 1987/88 - 1995

Daniel et al., Diabetes Care, 1999, 22:1993-8
Body fat distribution with weight gain

- Central pattern in both men and women
- Associated strongly with dylipidemia, insulin resistance
- Women are not protected from heart disease or diabetes premenopausally
Inter-relationships of the major chronic diseases

- Indigenous Australians already at very high risk of premature death from vascular disease
  - Poor quality diet, high rates of smoking, central obesity, diabetes, renal disease and their risk factors
- Diabetes increases the risk of CHD 3-6 fold
  - Over weight is the strongest risk factor
- Renal disease increases CHD 12-20 fold
Escalating risk of early onset Type 2 diabetes in Indigenous women

• Recent studies from a range of populations indicate high incidence of diabetes among Indigenous women aged 15-34 yr
  – Darwin, NT (DRUID Study): 14% of young women had diabetes or IGT (O’Dea et al, DRCP 2008)
  – Remote Northern Territory communities: 10% of young women have diabetes (Hoy et al, ANZJPH, 2007)
  – North Queensland: Incidence of diabetes 29 cases/1000 p.y., weight gain 1.5 kg/year (McDermott et al, MJA 2010)

• Overweight/obesity the strongest risk factor for diabetes, and young women are gaining weight fast
Pathways to chronic diseases begin in *utero*

- Intrauterine influences on health in later life
  - Fetal under nutrition
  - Fetal over nutrition (maternal diabetes)
- A life course approach to understanding the causal pathways
  - Amplification or attenuation in later life
    - Diet, physical activity
    - Other influences on insulin action
      - Obesity, psychosocial stress
Role of adverse early life experiences

- **Pre-pregnancy**
  - Substance abuse
  - Poor nutrition status

- **Intra-uterine**
  - As above
  - Mother’s perceived stress
  - Maternal smoking

- **Infancy**
  - ‘failure-to-thrive’
  - Repeated infections

- **Intergenerational impacts?**
Prevalence of low HDL (< 1.0mmol/L) in Aboriginal population and AusDiab

Shemesh et al, IJO, 31:103-8, 2007
Low Birth Weight

Causes?
• Low birth weight associated with social disadvantage
  – Poor quality maternal diet
  – Maternal smoking
  – Overcrowded living conditions
  – Mother’s perceived stress

Consequences
• Low birth weight associated with higher risk (and early age of onset) of
  – Central obesity
  – Type 2 diabetes
  – Kidney failure
  – High blood pressure
  – Heart disease
Not just under nutrition *in utero*

- Impact of maternal diabetes
  - GDM
  - Pre-gestational diabetes
    - Usually type 1
    - Increasingly type 2
- Particular problem for high risk populations such as Indigenous Australians
  - Increasing prevalence and earlier age of onset of obesity and type 2 diabetes
Cycles of disease risk

Figure 7: Cycles of disease risk

Intergenerational switching of pathways

- Women malnourished
- Low pregnancy weight gain

Very poor postnatal environment

- Stunting

Suboptimal fetal development

- Premature death and morbidity
- Material morbidity

Gestational diabetes

Enriched postnatal environment due to nutritional transition

- Obesity
- Insulin resistance

Large babies

Material morbidity

Premature death and morbidity

Stunting

Very poor postnatal environment

Women malnourished

Low pregnancy weight gain
Exposure to diabetes *in utero* increases risk of diabetes in offspring (Pima Indians)

Exposure to hyperglycemia *in utero*

- Hypothesis that maternal fuel metabolism may exert long term effects on the offspring (Freinkel, 1980)
- Comparison of offspring (10-16 yr) of diabetic mothers (*mostly type 1*) with controls (Chicago cohort)
  - higher BMI (22.8 vs 20.3)
  - higher 2-hr glucose (6.8 vs 5.2 mmol/l)
  - higher IGT (19.3 vs 2.5%)
  - higher 2-hr insulin (660 vs 455pmol/l)

*Silverman et al Diabetes Care, 18:611-7, 1995*
Obesity in the offspring

Chicago cohort, 14-17 years of age

Silverman. Diab Care 1998;21(S2) B142-B149
Implications for Indigenous health

• High risk population
  – High prevalence of LBW
  – High prevalence of smoking
  – Poor quality diet
    • Low in fresh fruit and vegetables
    • High in fat and sugar
  – Central adiposity
    • relatively more body fat for given BMI
  – High prevalence of diabetes, with early age of onset in reproductive years
    • likely high prevalence of GDM and pre gestational diabetes
Potential intervention points

• During pregnancy
  – Tight glucose control of the diabetic pregnancy
    • Circumstantial evidence from fetal insulin levels

• Post natal
  – Breast feeding
    • Minimise excessive energy intake?
      – Increased fat content of breast milk late in the feed
    • Improve insulin sensitivity?
      – Higher intake of highly polyunsaturated fat
        » Impact on membrane composition?
      – Regular exercise throughout life
Can we prevent obesity in the offspring of the diabetic pregnancy by good glycemic control?

Simmons. Diab Med 1997;14:762-765

* p<0.05
Lower prevalence of Type 2 diabetes in breast fed Pima Indians

- 257 Pima women, 684 offspring 10-39 yr
- Comparison of offspring breast fed for at least 2 months with those not breast fed
  - Breast fed offspring were less obese (p<0.01)
  - Lower diabetes prevalence in breast fed offspring (OR 0.51, 95% c.i. 0.28-0.93) after controlling for age, sex, birth weight, parental diabetes and diabetes in pregnancy
  - After controlling for relative weight, the difference was not quite significant (OR 0.51, 95% c.i 0.3-1.03)

Pettitt et al, 1995
Type 2 diabetes in adolescent Native Canadians

- Case-control study in 46 patients, 92 age- and sex-matched controls aged younger than 18 yr
- Maternal diabetes the strongest predictor
  - OR = 4.4 (1.38-14.1) for GDM
  - OR = 14.4 (2.86-72.5) for pre-existing
    - Associated with high birthweight, and obesity, dyslipidemia, hyperinsulinemia in adolescence
- Exclusive breast feeding protective
  - OR = 0.24 (0.07-0.84) for ≥ 12 months


• Seventeen studies met inclusion criteria
  – Exclusively formula-fed subjects were the referent
  – Duration of breastfeeding was inversely associated with risk of overweight
  – Risk of overweight was reduced by 4% for each month of breastfeeding
Preventive strategies relevant to Indigenous Australian populations

• Strong focus on maternal and child health
  • Reduce LBW
  • Smoking cessation – young women in particular
  • Screen and manage GDM and diabetic pregnancy
    – Promote breastfeeding
  • Reduce the heavy burden of infectious diseases
    – eg, link between PSGN and later renal disease
• Improve diet quality, regular physical activity
• Minimise excessive weight gain in adolescence and throughout life
  • Incorporate regular physical activity into daily routines
  • Diet derived from a wide variety of plants foods, whole grain cereals, lean meat, fish
Aboriginal people as hunter-gatherers

- Lean and fit
- No evidence of lifestyle-related chronic diseases
- Very healthy diet and lifestyle
Diet and lifestyle of Aborigines as hunter gatherers

- Diet
  - Derived from non domesticated animals, marine foods and uncultivated plant foods
    - Low fat, esp. saturated fat – lean meat, fish, crustacea
    - Relatively rich in polyunsaturated fat with low ratio of n-6/n-3 PUFA
    - Rich source of bioactive phytochemicals from uncultivated plant foods
      - Carotenoids, flavonoids, polyphenols, etc
  - High nutrient quality - anti-oxidant and anti-inflammatory
  - Low energy density - high bulk
- Physical activity built into daily routines
- No evidence of substance abuse
- High level of social cohesion
Consistent pattern of food intake over many decades

- Very high intakes of refined carbohydrates, soft drinks, fatty meats
- Very low intakes of fresh fruits and vegetables and lean meats and fish
Why have these patterns persisted for over 20 years?

- Ignorance or poverty??
- Widely held assumption that food preferences are conservative: “flour, sugar, tea”
- Our observations are very different
  - People appreciate high quality food
  - Keen to taste new dishes
  - Understand quite well the qualities of healthy western foods

Interventions to improve diet quality in remote community stores

• The Minjilang Project: Amanda Lee et al, 20 years ago

• Looma Healthy Lifestyle:15 years ago
  – Both interventions showed that the quality of the food supply could be improved
    • Increased consumption of fresh fruit and vegetables
    • Reductions in fat and sugar
  – This translated into reduction in CVD risk factors

• BUT the dietary quality changes were still below ideal
The economics of food choice

• Maximising calories
• Reducing food spending by changing quality before reducing quantity
• Over eating when food is available
• Women restricting their own intake to protect children

Drewnowski and Darmon, AJCN, 2005
Poverty and the food supply

Drewnowski and Darmon, AJCN, 2005
Thank you to the Indigenous communities who have participated so constructively in health research on diet- and lifestyle-related chronic diseases over 3 decades, and to the many colleagues who have contributed so valuably.