Food consumption pattern data and physical activity: Sri Lanka Perspective

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Wayamba University of Sri Lanka
NCDs, diet and physical activity

Urbanization

Socioeconomic factors

21st Century lifestyle

Prolong sitting

TV watching

Physical activity patterns

NCDs

Genetics

Sedentary behaviour

BMI / Body fat

Dietary habits

Other factors: Alcohol / tobacco

Alcohol / tobacco

BMI / Body fat

Sedentary behaviour

Physical activity patterns

NCDs

Urbanization

Socioeconomic factors

21st Century lifestyle

Prolong sitting

TV watching
Evolution of workplace obesity

Paleolithic man
Millions of yrs ago

Neolithic man
10,000 yrs ago

Computer and
digital age

DNA
Prevalence of NCDs in Sri Lanka

- Diabetes 10.3%
- IGT 5.4%
- IFG 4.4%
- Hypertension 20.0%
- Central Obesity 26.2%
- Obesity (BMI) 25.2%
- Childhood obesity
- Metabolic syndrome
- CHD & Cerebrovascular disease – major causes of death
Combined Low-Risk Behaviors and the Population Preventable Proportions of MI

The combination of the 5 low-risk dietary and lifestyle factors, the proposed intermediate biological factors, and the population preventable proportions of myocardial infarction.
The Y-Y Paradox: Limitations of BMI as Measure of Adiposity Across Populations

Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies

A WHO expert consultation addressed the debate about interpretation of recommended body-mass index (BMI) cut-off points for determining overweight and obesity in Asian populations, and considered whether population-specific cut-off points for BMI are necessary. They reviewed scientific evidence that suggests that Asian populations have different associations between BMI, percentage of body fat, and health risks than do European populations. The consultation concluded that the proportion of Asian people with a high risk of type 2 diabetes and cardiovascular disease is substantial at BMIs lower than the existing WHO cut-off point for overweight (>25 kg/m²). However, available data do not necessarily indicate a clear BMI cut-off point for all Asians for overweight or obesity. The cut-off point for observed risk varies from 22 kg/m² to 25 kg/m² in different Asian populations; for high risk it varies from 26 kg/m² to 31 kg/m². No attempt was made, therefore, to redefine cut-off points for each population separately. The consultation also agreed that the WHO BMI cut-off points should be retained as international classifications. The consultation identified further potential public health action points (23-0, 27-5, 32-5, and 37-5 kg/m²) along the continuum of BMI, and proposed methods by which countries could make decisions about the definitions of increased risk for their population.

Lancet, 2004

Identical BMIs

BMI > 23 kg/m² overweight
BMI > 25 kg/m² obese

Public health


Big difference in body fat

9.1%  21.2%
Contents

- NCDs, diet and physical activity
- Food consumption patterns – History and agrobiodiversity
  - Dietary intakes and food consumption patterns – food balance sheets & research
- Physical activity patterns
- Lifestyle patterns
- What we don’t know about our diet
- Food composition data, national dietary survey
Food consumption patterns – Historical perspective
Agrobiodiversity

Fruits

Rice

Vegetables

Yams

GLVs
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- 94% calories from plants
- 6% from animal sources (milk>fish>meat)
- >50% calories come from grains
- Non-grain veg products (eg sugar, sweeteners, oil crops and vegetables) – 1/3
- Starchy roots and tubers ↓ 2.5%
- Fruit ↓ 1%
- Oils – no change
- Sugar ↑ 4%

Fig 1
Share of per capita daily calorie supply by major food source, Sri Lanka; 1985-2009
Share of per capita daily calories (Kcal) derived from grain food products, by food source Sri Lanka (1985-2009)

- Share of rice ↓
- Wheat products, sorghum, maize ↑
- Pulses ↑
Share of per capita daily calories (Kcal) derived from protein, by main food source, Sri Lanka (1985-2009)

- Low supply
- Majority – from plants (60%)
- Protein from rice ↓ wheat and pulses ↑
Share of per capita daily calories (Kcal) derived from fat, by main food source, Sri Lanka (1985-2009)

- 16.4% - 18.3%
- Vegetable food 1/4
- 78% from non-grain vegetables
- Coconut 1/5
- Milk > fish > meat
Energy 843 kcal
CHO 149 g
Protein 33 g
Fat 16.7 g
SFA 10.4 g
MUFA 2 g
PUFA 2 g
Na 1.6 g (Salt 2 g)

Raw rice consumption
200 – 250 g (Estate)
200 – 300 g (Urban)
250 – 400 g (Rural)
150-220 g (Jaffna)
Indian
Japanese
South Korea
Sri Lanka
- Nationally representative sample of adults (n=463)
- Urban, rural and estate
- Single 24 h recall
## Dietary intakes of adults

<table>
<thead>
<tr>
<th></th>
<th>Urban</th>
<th>Rural</th>
<th>Estate</th>
<th>Total</th>
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<tbody>
<tr>
<td>Energy (kcal)</td>
<td>1669</td>
<td>1677</td>
<td>1439</td>
<td>304</td>
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<tr>
<td>CHO (g)</td>
<td>306</td>
<td>308</td>
<td>270</td>
<td>304</td>
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<tr>
<td>Protein (g)</td>
<td>48</td>
<td>43</td>
<td>44</td>
<td>47</td>
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<tr>
<td>Fat (g)</td>
<td>35</td>
<td>36</td>
<td>25</td>
<td>35</td>
</tr>
<tr>
<td>% E CHO</td>
<td></td>
<td></td>
<td>71.2</td>
<td></td>
</tr>
<tr>
<td>% E protein</td>
<td></td>
<td></td>
<td>10.8</td>
<td></td>
</tr>
<tr>
<td>% E fat</td>
<td></td>
<td></td>
<td>18.9</td>
<td></td>
</tr>
<tr>
<td>Dietary fibre (g)</td>
<td>18</td>
<td>18</td>
<td>21</td>
<td>18</td>
</tr>
<tr>
<td>Sodium (mg)</td>
<td>2.7</td>
<td>2.9</td>
<td>2.5</td>
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</tbody>
</table>

(Jayawardena et al, 2014)
## Dietary intakes of adult women in urban, rural and estate communities (2013-14)

<table>
<thead>
<tr>
<th></th>
<th>RDA (WHO)</th>
<th>Urban (n 1100)</th>
<th>Rural (n 950)</th>
<th>Estate (n 700)</th>
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<tbody>
<tr>
<td>Energy (kcal)</td>
<td>2210</td>
<td>1610</td>
<td>1541</td>
<td>1561</td>
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<tr>
<td>% E CHO</td>
<td>55</td>
<td>63</td>
<td>68</td>
<td>67</td>
</tr>
<tr>
<td>% E Protein</td>
<td>10-15</td>
<td>12</td>
<td>11</td>
<td>11</td>
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<tr>
<td>% E Fat</td>
<td>15-30</td>
<td>24</td>
<td>21</td>
<td>23</td>
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<tr>
<td>% E SFA</td>
<td>&lt;10</td>
<td>15</td>
<td>14</td>
<td>16</td>
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<td>Iron (mg)</td>
<td>24</td>
<td>14.5</td>
<td>10.4</td>
<td>9.6</td>
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<tr>
<td>Calcium (mg)</td>
<td>1000</td>
<td>423</td>
<td>315</td>
<td>333</td>
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<tr>
<td>Folate (µg)</td>
<td>400</td>
<td>170</td>
<td>143</td>
<td>154</td>
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<tr>
<td>Sodium (g)</td>
<td>2.3</td>
<td>2.7</td>
<td>2.1</td>
<td>1.6</td>
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<tr>
<td>Vitamin C (mg)</td>
<td>45</td>
<td>25</td>
<td>28</td>
<td>13</td>
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</tbody>
</table>

MUFA 2.3 - 4.3
PUFA 1.2 - 1.9
n-3 0.1 - 0.5
n-6 1.0 - 1.5

60% fat from Coconut

Unpublished
Dietary intakes of 2-5 y old children in urban, rural and estate communities (2013-14)

<table>
<thead>
<tr>
<th></th>
<th>RDA (WHO)</th>
<th>Urban (n 1100)</th>
<th>Rural (n 950)</th>
<th>Estate (n 700)</th>
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<tbody>
<tr>
<td>Energy (kcal)</td>
<td>1350-1600</td>
<td>1043</td>
<td>998</td>
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<tr>
<td>CHO (g)</td>
<td></td>
<td>165 (60%)</td>
<td>161 (61%)</td>
<td>163 (61%)</td>
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<tr>
<td>Protein (g)</td>
<td></td>
<td>33</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Fat (g)</td>
<td></td>
<td>32 (27%)</td>
<td>30 (27%)</td>
<td>30 (26%)</td>
</tr>
<tr>
<td>Vitamin A (µg)</td>
<td>400-450</td>
<td>235</td>
<td>209</td>
<td>158</td>
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<tr>
<td>Iron (mg)</td>
<td>5</td>
<td>9</td>
<td>8</td>
<td>8</td>
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<tr>
<td>Calcium (mg)</td>
<td>500-600</td>
<td>351</td>
<td>341</td>
<td>317</td>
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<td>Folate (µg)</td>
<td>160-200</td>
<td>131</td>
<td>112</td>
<td>112</td>
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<tr>
<td>Zinc (mg)</td>
<td>4.8</td>
<td>4.3</td>
<td>3.9</td>
<td>3.9</td>
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<tr>
<td>Vitamin C</td>
<td>30</td>
<td>17</td>
<td>25</td>
<td>11</td>
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Unpublished
## Dietary intakes of urban and rural adolescent schoolgirls (2008)

<table>
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<th>Urban (n 178)</th>
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<tbody>
<tr>
<td>Energy (MJ)</td>
<td>8.8</td>
<td>6.2</td>
<td>6.9*</td>
</tr>
<tr>
<td>%E CHO</td>
<td></td>
<td>68</td>
<td>61</td>
</tr>
<tr>
<td>% E Fat</td>
<td></td>
<td>25</td>
<td>27</td>
</tr>
<tr>
<td>% E protein</td>
<td></td>
<td>7</td>
<td>12</td>
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<tr>
<td>Calcium (mg)</td>
<td>1000</td>
<td>384</td>
<td>578*</td>
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<tr>
<td>Iron (mg)</td>
<td>18</td>
<td>14</td>
<td>15</td>
</tr>
<tr>
<td>Zinc (mg)</td>
<td>7.8</td>
<td>7.8</td>
<td>6.2</td>
</tr>
<tr>
<td>Vitamin C (mg)</td>
<td>40</td>
<td>51</td>
<td>44</td>
</tr>
<tr>
<td>Vitamin A (μg)</td>
<td>600</td>
<td>258</td>
<td>385*</td>
</tr>
<tr>
<td>Vitamin D (μg)</td>
<td>15</td>
<td>4.4</td>
<td>6.9</td>
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</tbody>
</table>

Ranathunga et al, (manuscript in preparation)
Food Based Dietary Guidelines

- Nuts and oil Seeds: 2 - 4 Servings Daily
- Fat, Sugar Sparingly
- Milk and or Milk Products: 1 - 2 Servings Daily
- Fish, pulses, meat and eggs: 3 - 4 Servings Daily
- Fruits: 2 - 3 Servings Daily
- Rice, bread, other cereals and yams: 6 - 11 Servings Daily
- Vegetables: 3 - 5 Servings Daily
Almost 70% of those studied exceeded the upper limit of the recommendations for starch intake.

A substantial proportion of the Sri Lankan population studied failed to achieve recommendations of food based dietary guidelines.
**Dietary Diversity: Dietary diversity score, Food Variety Score, Dietary Servings Score**

**Use of dietary diversity score as a proxy indicator of nutrient adequacy of rural elderly people in Sri Lanka**

Kumari Malkanthi Rathnayake*, PAE Madushani and KDRR Silva

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Mean intake</th>
<th>SD</th>
<th>NAR</th>
<th>Correlations</th>
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<tr>
<td></td>
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<td>FVS</td>
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<tr>
<td>Energy (kcal/d)</td>
<td>951</td>
<td>300</td>
<td>0.49</td>
<td>0.35*</td>
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<tr>
<td>Protein (g/day)</td>
<td>23.4</td>
<td>8.9</td>
<td>0.50</td>
<td>0.35*</td>
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<tr>
<td>Calcium (mg/d)</td>
<td>2183</td>
<td>1189</td>
<td>0.17</td>
<td>0.33*</td>
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<td>Iron (mg/d)</td>
<td>7.2</td>
<td>4.6</td>
<td>0.50</td>
<td>0.29*</td>
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<tr>
<td>Thiamin (mg/d)</td>
<td>0.96</td>
<td>0.65</td>
<td>0.66</td>
<td>0.25*</td>
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<td>Riboflavin (mg/d)</td>
<td>0.68</td>
<td>0.42</td>
<td>0.51</td>
<td>0.33*</td>
</tr>
<tr>
<td>Niacin (mg/d)</td>
<td>7.6</td>
<td>3.4</td>
<td>0.48</td>
<td>0.23*</td>
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<tr>
<td>Vitamin B₁₂ (mg/d)</td>
<td>0.82</td>
<td>0.82</td>
<td>0.34</td>
<td>0.02</td>
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<tr>
<td>Folic acid (g/d)</td>
<td>44.8</td>
<td>27.4</td>
<td>0.11</td>
<td>0.30*</td>
</tr>
<tr>
<td>Vitamin C (mg/d)</td>
<td>24.4</td>
<td>20.7</td>
<td>0.54</td>
<td>0.22*</td>
</tr>
<tr>
<td>Vitamin A (µg/d)</td>
<td>170.8</td>
<td>129.3</td>
<td>0.28</td>
<td>0.28*</td>
</tr>
<tr>
<td>Vitamin D (µg/d)</td>
<td>1.82</td>
<td>3.6</td>
<td>0.12</td>
<td>-0.04</td>
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<tr>
<td>MAR</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.39</td>
</tr>
</tbody>
</table>

*p<0.01, *p<0.05.

**Food group**

- **Oil/sugar**: 92%
- **Eggs**: 5%
- **Fish**: 77%
- **Meat**: 4%
- **Milk & milk products**: 59%
- **Legumes**: 94%
- **Fruits**: 41%
- **Green leaves**: 48%
- **Vegetables**: 85%
- **Cereals/roots**: 100%

**Percentage intake**
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Physical activity patterns and correlates among adults from a developing country: the Sri Lanka Diabetes and Cardiovascular Study

Prasad Katulanda¹,²,* , Ranil Jayawardana¹,³, Priyanga Ranasinghe¹,⁴, MH Rezvi Sheriff¹ and David R Matthews²

- 60% of Sri Lankan adults were ‘highly active’ physically, while only 11% were ‘inactive’.
- Female gender, older age (>70y), urban living, Muslim ethnicity and tertiary education were all significant predictors of physical inactivity.
- Physical inactivity was associated with obesity, diabetes, hypertension and metabolic syndrome.
Physical activity and sedentary behaviour contributed to dysglycaemia. Exposure attributable fractions for dysglycaemia were: lower physical activity: 78%, higher waist circumference: 94%, and TV viewing time: 85%.

**Conclusions:** Urban South Asian women are at risk of dysglycaemia at lower levels of sedentary behaviour and greater physical activity than western populations, indicating the need for re-visiting current physical activity guidelines for South Asians.
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Biochemical markers of dysglycaemia and cardiometabolic risk in relation to lifestyle patterns

- **Pattern 1**: rice and rice flour-based products, pulses, seafood, fruits, vegetables and green leafy vegetables.

- **Pattern 2** (14.0% of the model variance): wheat, wheat-based products and tubers, red meat and processed meat.

- **Pattern 3** (10.4% of the model variance): snacks, dairy products and poultry and less physical activity.
Synergistic effects of lifestyle patterns

Physically inactive
Snacks and dairy
Cardiometabolic risk

WC, FM%, BMI
↓FFM%
↑HbA1c, FBG, TC, TAG, hs-CRP
↓HDL

Obesity

Wheat and wheat products
Red meat processed meat
Tubers

No difference between dysglycemia and normoglycemia; Improved lipids

Rice, rice flour products
Pulses
Sea foods
Fruits and Veg / GLV
Prevalence of challenging nutritional problems among adolescents in Sri Lanka

- Previous 6 months - 10.4% of the subjects had usually not eaten breakfast.
- During the week before the interview:
  - 24.4% had not consumed green leafy vegetables
  - 26.6% had not consumed fruit
  - 19.0% had not participated in physical activities
  - 27.5% had watched television >2 h / day.

Jayatissa and Ranbanda, 2006 (Food and Nutrition Bulletin)
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We don’t know.....

- Data on the food and nutrient intake, sources of nutrients, and nutritional status
- Who are the individuals with intakes of specific nutrients that are above or below the national average?
- Extent to which the diets of population sub-groups vary from expert recommendations/dietary guidelines?
- Trends in food consumption, nutrient intake and nutritional status in different age groups?
- Relate nutritional status to dietary, physiological and social data
We don’t know…..

- Relationship between measurements of body size and social, dietary, biochemical and health data
- Physical activity levels
- Likely dietary exposure to natural toxicants, contaminants, additives and other food chemicals for risk assessment
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Food composition data in Sri Lanka

- Badly outdated FCTs – first published in 1979
- Several universities and research institutes generates food composition data.
- Wayamba University - developed electronic food composition database compiling food composition data (McCance & Widdowson, USDA, ASEAN, Indian FCTs and research publications).
- Composition of >120 Sri Lankan mixed dishes - recipe calculation
- Biodiversity for Food and Nutrition (BFN) project - analyze the composition of 30 varieties of locally available foods in Sri Lanka
National Dietary Survey

- Current FBDG, fortification, supplementation programs – not based on dietary intake data
- Government, health institutions and Organizations - conduct larger national-level dietary and nutrition surveys
- Practical public health initiatives to improve the quality of the Sri Lankan diet.
Summary

- Co-existent NCDs and undernutrition
- There is a shift in diet and physical activity patterns
- High carbohydrate and high saturated fat intake with low PUFA and MUFA
- Low fruit and vegetable, animal food consumption
- Sedentary lifestyle? /High physical activity reported!
- No comprehensive national dietary and nutrition studies
Acknowledgements

- Thamilini Joshepkumar – PhD student
- Thilanka Ranathunga – PhD Student
- Nutrition Research Group of Wayamba University