Fighting Disease with Fruit

Dr Raymond Jones
This program is an extension of research conducted in a remote NSW Aboriginal community.

Initially students at the local primary school experienced high rates of skin infections and recurrent otitis media.

Hearing loss was so severe that teachers used a surround-sound system to amplify their voices in the classroom.

Prescribing antibiotics on a regular basis was ineffective at controlling these infections.
Vitamin C

- Vitamin C levels were tested on 9/9/03 before implementation of the fruit program and repeated on 28/6/06
- At baseline, all students were deficient in vitamin C
- Therefore a program was established to supplement the students’ diets with fresh fruit, as well as vegetables grown in the school garden
- Repeat vitamin C results were available for 9 children
- Of these, 4/9 (44%) of students now have vitamin C levels within the normal range and 5/9 (56%) are still deficient in vitamin C
Blood Tests – Vitamin C

![Graph showing Vitamin C levels over time with normal range.]
Hearing Results

- Hearing testing was conducted by the Royal Institute for Deaf and Blind Children on 25/1/03 and 26/5/04.
- At baseline, only 5/12 (42%) of students had normal hearing.
- Hearing tests repeated on 30/5/06 revealed that 9/11 (82%) of students had normal hearing.
- Hearing was tested again on 7/2/07 after the Christmas holidays, which revealed that once again 9/11 (82%) had normal hearing.
Hearing Loss in Left Ear

Hearing Loss

% of Students

Pre-intervention 25/1/03
Post-intervention 26/5/04
Post-intervention 30/5/06

Hearing Loss

Normal
Slight
Mild
Moderate
Moderate - Severe
Severe
Not tested - active ear infection

Hearing Loss in Left Ear

% of Students

0
10
20
30
40
50
60
70
80
90

Pre-intervention 25/1/03
Post-intervention 26/5/04
Post-intervention 30/5/06
Hearing Loss in Right Ear

Hearing Loss in Right Ear

% of Students

- Normal
- Slight
- Mild
- Moderate
- Moderate - Severe
- Severe
- Not tested - active ear infection

Hearing Loss

Pre-intervention 25/1/03
Post-intervention 26/5/04
Post-intervention 30/5/06
Results – Infections

- Rates of staphylococcal skin infections were observed to drop to almost negligible levels.
- Rates of chronic suppurative otitis media dropped considerably as reflected in the improved hearing results on audiometry.
- Use of the surround sound system has been discontinued.
Discussion

- Other school based activities that complement this program are:
  - Student participation in a school vegetable garden
  - Initially, student participation in cooking classes run by the Bulgarr Ngaru dietitians, based on healthy recipes using vegetables from the school garden. This has been replaced with a weekly “healthy lunch” day organised by the school. Bulgarr Ngaru assists with providing fruit and vegetables for this.
- The AMS continues to provide fruit for the students to receive on a daily basis.
The program has been extended to families of other Aboriginal communities.

Initially there were 10 families in each of the 5 communities that we service - Grafton/ South, Baryulgil, Malabugilmah, Yamba, Maclean.

Families pay $5 per week to receive $40 worth of fresh fruit and vegetables.

The $35 difference is subsidised by the Aboriginal Medical Service.
Extension of Program

- Aboriginal students at the local primary school and playgroup of another community that we service underwent pre-intervention blood tests on the 7/3/05 and 20/9/05
- This is a coastal community with a good range of grocery shops
Blood Tests

- Pre-intervention blood samples were obtained from 27 students
- The families of 15 of these students have since joined the fruit and vegetable program
- The remaining 12 students are not participating in the program
Blood Tests

- The baseline results revealed that 7/27 (26%) students were deficient in vitamin C.
- Of these, 6/15 (40%) students on the program were deficient in vitamin C.
- 1/12 (8%) of students not on the program were deficient in vitamin C.
- This indicates that the families chosen to participate in the program had the children with the highest incidence of vitamin C deficiency and potentially the most diet-related health problems.
Blood Tests - Vitamin C

![Line graph showing Vitamin C levels (umol/L) with normal range of 40-100. The graph compares subjects on and off program, with data points indicating varying levels of Vitamin C.]
Skin Infections

- Screening conducted at the playgroup on 6/9/05 *before* implementation of the program revealed that 6/8 (75%) of students had skin infections

- This compares with screening repeated on 4/4/06 *after* implementation of the program, which revealed that 1/5 (20%) of students had skin infections
Ear Infections

- Otoscopy conducted at the playgroup on 6/9/05 before implementation of the program revealed that 3/8 (38%) of children had active ear infections, 2/8 (25%) had grommets, 1/8 (13%) had wax, 2/8 had normal ear drums (25%)

- This compares with otoscopy repeated on 4/4/06 after implementation of the program, which revealed that 4/5 (80%) of children had normal ear drums and 1/5 (20%) had wax
Further Extension & Evaluation

- We are fortunate to have Dr Andrew Black working at Bulgarr Ngaru conducting his PhD research into the health benefits of our fruit and vegetable program.

- Aims:
  - To determine the impacts of the Bulgarr Ngaru Fruit and vegetable program on Children’s nutritional status.
  - If there are nutritional benefits, are there any short-term health benefits from the program?
Bulgarr Ngaru Fruit and Vegetable program

- Subsidised fruit and vegetable program for disadvantaged Aboriginal families with 0-14 yo children
- Families pay $5 per week to receive $40 box of fresh fruit and vegetables.
- Currently 62 families across the five communities in the Clarence Valley participate in the program
- Regional initiative:
  - Galambila Aboriginal Medical Service, Coffs Harbour, Giingan Darrunday Marlaanggu Health Clinic Bowraville, Nambucca Valley
Eligibility Criteria

- Regular Bulgarr Ngaru clients (2 or more visits in previous 24 months).
- Receive Centrelink payments/CDEP as the major source of family income.
- Be prepared for you/your children to have a health check-up including dental and hearing checks, a diet assessment and a blood test.
- Children with identified nutritional risk
  - Anthropometric - abnormal growth (under or overweight, slow growth), low birth weight.
  - Biomedical - nutritional deficiency disease, iron deficiency anaemia, chronic or recurrent infections etc
  - Dietary risk - highly restricted diets, inappropriate infant feeding.
Initial Screening Required

- Child Health Assessment – Medicare Item 708
- Hearing check
- Dental check

- These screenings are then repeated after 12 months on the program
Evaluation

- Dietary Intake- 24 hour recall
- Blood test- Nutritional markers-Iron, FBC, Vitamin A, E, Carotenoids, Red cell folate, Vitamin D.
- Health record review before and after program.
- Focus groups
Eligibility for program:
- Aboriginal families with children 0-14 years or pregnant women
- Centrelink benefits as main income
- Regular Bulgarr Ngaru clients
- Agree to annual health assessment
- Children have identified nutritional risk

Consent Y/N

Initial assessments:
- 24 Hour Dietary recall
- Pathology test- Carotenoids, Folate, Vitamins A, C, E, Iron
- Anthropometric measurements

Process evaluation
- Interviews- key stakeholders
- Focus groups- participants
- Uptake assessed using greengrocer receipts

Follow-up assessment at 12 months:
- 24 Hour Dietary recall
- Pathology test- Carotenoids, Folate, Vitamins A, C, E, Iron
- Anthropometric measurements

The Program
- Receive weekly box of fruit and vegetables with seasonal recipes
- Nutrition promotion
- Cooking classes

Health record audit (12 months prior to and during program)
- Antibiotic prescriptions
- Episodes of otitis media
- Episodes of pyoderma
Fruit and vegetable intake of children 0-14 years (n=121)

<table>
<thead>
<tr>
<th>Serves Per day</th>
<th>24 hr Recall</th>
<th>Short Questions</th>
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<tbody>
<tr>
<td></td>
<td>Fruit</td>
<td>Vegetables</td>
</tr>
<tr>
<td><strong>Before</strong></td>
<td>1.0 (1.4)</td>
<td>0.6 (0.9)</td>
</tr>
<tr>
<td><strong>Mean (SD)</strong></td>
<td></td>
<td></td>
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<tr>
<td><strong>After</strong></td>
<td>1.0 (1.1)</td>
<td>0.5 (0.8)</td>
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<tr>
<td><strong>Mean (SD)</strong></td>
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# Serum Biomarkers in children 0-14 years (n=115)

<table>
<thead>
<tr>
<th></th>
<th>Mean (nMol/L)</th>
<th>Change (Post-Pre) (nMol/L)</th>
<th>P value</th>
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<tbody>
<tr>
<td><strong>β-carotene</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Post</td>
<td>339</td>
<td>-7.7</td>
<td>.630</td>
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<tr>
<td>Pre</td>
<td>347</td>
<td></td>
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<td><strong>α-carotene</strong></td>
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</tr>
<tr>
<td>Post</td>
<td>82</td>
<td>15.8</td>
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<tr>
<td>Pre</td>
<td>66</td>
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<tr>
<td><strong>Lycopene</strong></td>
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<tr>
<td>Post</td>
<td>587</td>
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<tr>
<td>Pre</td>
<td>638</td>
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<td><strong>β-Cryptoxanthin</strong></td>
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</tr>
<tr>
<td>Post</td>
<td>184</td>
<td>25.0</td>
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<tr>
<td>Pre</td>
<td>159</td>
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<tr>
<td><strong>Lutein-Zeaxanthin</strong></td>
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<tr>
<td>Pre</td>
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<td><strong>Red Cell Folate</strong></td>
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<td>Post</td>
<td>956</td>
<td>192.9</td>
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<tr>
<td>Pre</td>
<td>763</td>
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<td><strong>Vitamin C (uMol/L)</strong></td>
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<td>.013</td>
</tr>
<tr>
<td>Pre</td>
<td>49</td>
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Serum Biomarkers in children 0-14 years (n=115)

- There were statistically significant increases in the following serum biomarkers:
  - β-Cryptoxanthin (found in fruit, particularly citrus fruit)
  - Lutein-Zeaxanthin (found in vegetables, particularly leafy green vegetables)
  - Red Cell Folate (mandatory fortification of bread with folate was introduced between our 2 blood tests)
  - Vitamin C
Health outcomes in children 0-14 years (n=167)

- Sick visits
- Well visits
- Otitis media
- Pyoderma
- Hospital attendances
- Gastrointestinal symptoms
- Topical antibiotics
- Oral antibiotics

Pre vs. Post comparison with *P < .05.*
Highly Commended for Aboriginal Health Research

Presented to

Raymond Jones

For a highly commended Scientific Abstract
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"Partnerships for Aboriginal Health Research"

Professor Michael Reid
Director General
Ministry for Science and Medical Research
18th October 2005
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