Natural Products in prevention of brain diseases – Road map for value addition

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Ceylon Natural Products as a Therapeutic Strategy

- **Tea** *(Camellia Sinensis)*
- **Turmeric** *(Curcuma longa)*
- **Cinnamon** *(Cinnamomum Zeylanicum)*
- **Pepper** *(Piper nigrum)*

**Protect the Brain**
- Natural Abundance
- Easy Administration
- Absence of Undesirable Effects

**Health Drink**
Parkinson’s Disease (PD)

- **6.3 million people** have Parkinson’s worldwide

**In the United States:**
- 50-60 thousand new cases of PD each year.
- **$14.4 Billion Economic Burden** of PD per year.

*Among individuals over 50 in the world’s ten most and Western Europe’s five most populous nations.*

(Dorsey et al, 2007)

The distribution of projected growth of Parkinson’s disease by country from 2005 to 2030.
Influence of Black Tea and Coffee consumption & onset of Parkinson’s Disease: A Sri Lankan Outlook

Tea Consumption

Coffee Consumption

A significant trend between:

- Increased in age at onset of PD in >3 cups/day tea intake
- Regular coffee intake and reduced PD risk

More detailed, larger studies are required to investigate the trend seen with tea intake in Sri Lanka.

Stroke

Every 6 seconds regardless of age or gender - someone, somewhere, will die from stroke.

- Sri Lanka: 25,000/year
  People suffer from Stroke

1 in 6 people worldwide will have a stroke in their lifetime. IT COULD BE YOU!

- US: $73.7 billion
- Australia: $49.3 billion
- UK: $13.32 billion
- China: $6.56 billion
- Canada: $3.6 billion

The cost of stroke between 2005 and 2050 estimated to exceed $2 trillion.
Influence of Black Tea Consumption on the onset of Stroke

The 10th Biennial Conference of the Chinese Neuroscience Society, Beijing, 19th - 22nd September 2013.


### Significantly delayed age of onset of Ischemic stroke with the daily intake of Ceylon tea (≥3 cups/day).

<table>
<thead>
<tr>
<th>Daily Intake (cups/day)</th>
<th>Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 cup</td>
<td>14</td>
</tr>
<tr>
<td>2 cups</td>
<td>66</td>
</tr>
<tr>
<td>≥3 cups</td>
<td>150</td>
</tr>
</tbody>
</table>

![Graph showing delayed age of onset of Ischemic stroke with different daily intakes of Ceylon tea](image)
Alzheimer’s Disease

Worldwide Sufferers

- In 2006 - 26.6 million
- In 2010 - 36 million
- In 2050 - greater than 120 million
- Predicted to affect 1 in 85 people globally by 2050.

USA

- Global cost of Alzheimer’s and related Dementias is more than $600 billion
- If dementia care were a country, it would be the world’s 18th largest economy that will be higher than Switzerland.

Cost of dementia compared to national economies

Consumption of Ceylon Tea on Age Associated Pathologies

Wijesinghe P.1, Yasha T.C.2, Shankar S.K.2, Amaratunga D.3, Samarasinghe K.4, Sunil Kumar K.5, Hulathduwa S.R.6, Gorrie C.A.7, Suh Y.H.8 and De Silva K.R.D. Age Related Cytoskeletal Pathology in Human Brain: A Morpho-pathological Comparison Between Sri Lankan (Colombo) and Indian (Karnataka) Samples. 33rd Annual Meeting of the Australian Neuroscience Society, Melbourne, 3 - 6 February 2013

People who had consumed tea hold a comparatively lower in AD related pathological stages/grade than who had never consumed tea.
This is the **first autopsy study** of Sri Lankan aged brains; an unbiased sample collection from an urban area

*A collective funding of approximately $80,000 (USD).*

**Molecular Components**
- Ubiquitin, Beta amyloid
- Hyperphosphorylated tau

**Neuropathological diagnosis:**
- AD, PD, PSP, DLB, CAA, FTLD (MSTD)

**Age Matched Autopsy Elderly Human Brains**
- 50 (76) Sri Lankan
- 42 Indian

**Role of Natural Products**
- Ceylon tea flavanoids.

**Role of Curcumin?**
- Role of Cinnamon?
Neurodegenerative Diseases & Natural Products

In 2010
- EU member countries: €798 billion
- USA: $200 billion
- 493 drugs tested in 45,512 Animals (O’Collins)
- 1026 experimental treatments in Acute Stroke

Prevention/treatment ??
Ceylon Natural products ??
- Cinnamon
- Pepper
- Turmeric
- Tea
- Ginger

Research & Development
Novel Value Added products
High Revenue

Health Drink
**World is aging**

The Over-60 Population

<table>
<thead>
<tr>
<th>Year</th>
<th>2008</th>
<th>2030</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>World</td>
<td>30million</td>
<td>50million</td>
<td>&gt;100million</td>
</tr>
</tbody>
</table>
Big or Small Natural products can protect all??

The Lord Wilson of Rievaulx - Harold Wilson
Prime Minister UK
Later developed Alzheimer’s disease

Charlton Heston and Ronald Reagan at a meeting in the White House.
Both later developed Alzheimer's disease

Muhammed Ali
Parkinson’s Disease

Prof. Charles K. Kao
2009 Nobel Prize
Father of Fiber Optic Communications
Later developed Alzheimer's Disease
Tea industry in Sri Lanka

Is this Real Value Addition?

1Department of Census and Statistics; 2Sri Lanka Customs; 3Central Bank of Sri Lanka
http://www.cbsl.gov.lk/pics_n_docs/10_pub/_docs/statistics/other/econ_ss_2013_e.pdf
Minor Export Crops

Ceylon cinnamon - Share from total export (%)

- Mexico: 59%
- Colombia: 7%
- Peru: 4.7%
- Guatema: 2.7%
- Ecuador: 5.5%
- El.: 3.4%
- EU: 2.2%
- USA: 9%

Sri Lanka have only minor value added forms...

How to penetrate the Economical markets?
—USA, European, US, Japan

True Cinnamon (Cinnamomum Zeylanicum) 90% of world production originates from Sri Lanka

1. Good scientifically proven evidence
2. Innovation and Invention
3. High ended & high revenue value added quality conscious
4. Consumer protection/human health

Need R & D
Are they scientifically proven?
Our findings with Ceylon Tea

Two PhD’s

Tea industry in Sri Lanka - to promote “Ceylon Tea” as a Health Drink - to protect the brain

<table>
<thead>
<tr>
<th>Category</th>
<th>Avg. price Rs/Kg</th>
<th>Percentage Production Of Tea Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulk</td>
<td>537.53</td>
<td>41%</td>
</tr>
<tr>
<td>Packets</td>
<td>552.65</td>
<td>50%</td>
</tr>
<tr>
<td>Tea Bags</td>
<td>1,084.18</td>
<td>7%</td>
</tr>
<tr>
<td>Instant Tea</td>
<td>1,003.23</td>
<td>0.5%</td>
</tr>
<tr>
<td>Green Tea</td>
<td>1,215.69</td>
<td>0.9%</td>
</tr>
<tr>
<td>RTD</td>
<td>1,726.10</td>
<td>0.01%</td>
</tr>
</tbody>
</table>

1Department of Census and Statistics; 2Sri Lanka Customs; 3Central Bank of Sri Lanka

Black Tea

“Age related cytoskeletal pathology in human brain: A comparison between Sri Lankan and Indian samples and a detailed study of the risk factors and pathological changes associated with age in Sri Lanka and evaluation of the possible antioxidant protective role of Ceylon tea on the outcome”

Green Tea

“Therapeutic effects of flavonoids from Ceylon green Tea on hypoxic human brain epithelial cells”
Green Tea

In a collaboration with;
– Faculty of Medicine, National University of Singapore (NUS).
  • NUS funded S$ 55,000 for consumables

Road Map of Green Tea composition through HPLC DNA damage products Analysis by (GC/MS) at NUS

Visit of Prof. Y. Z. Zhu to University of Sri Jayewardenepura

Simulate hypoxia-induced ischemic model
Ceylon Green Tea – Stroke Model

Human Brain Epithelial Cells

Hypoxia

Normoxia

Ceylon tea

Losartan
Comparison of Chinese and Ceylon Green Tea

1) Inhibition of ABTS Test

2) Pyrogallol Red (PR) Bleaching

The Ceylon Tea Extract showed 68.2 ± 7.8% of TEAC value compared with Ascorbic Acid

His Excellency, Karunatilaka Amunugama, the Sri Lankan Ambassador to China (2010), TV interview on health benefits of Ceylon Tea with CCTV, China
Research Published In Popular Media
National Patent Granted

- 2009 -

National Patent Granted

Patents Application No:
LK/P/1/15499

DATE : 2.8.2009

Title of Invention:
Technique *in vitro* simulated hypoxia-induced ischemic model using Human Brain Epithelial Cells (HBEC) in testing flavonoids from Ceylon Green Tea.

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National Awards on Natural Products

Presidential Award on Scientific Research on Natural Products

At the Presidential Awards for Research on Science Citation Index 2006 and 2009
Chinese Neuroscience Society

Poster Presentation at
“The 10th Biennial conference of the Chinese Neuroscience Society”
-Beijing 19th – 22nd September 2013 -

Dr. N. L. A. Karunaratna, The Vice Chancellor, USJP and Prof. Shigang He, Secretary, CNS and delegates from the CNS
12th December 2013, University of Sri Jayewardenepura

Meeting with the Sri Lanka - China Business Council
12th December 2013, Ceylon Chamber of Commerce
University of Chinese Academy of Sciences (UCAS)

CAS -TWAS President’s Postgraduate Fellowship Programme
- For students to pursue PhD degrees at UCAS, the University of Science and Technology of China (USTC) and Institutes of CAS around China.

Academic Visit to Beijing (23rd September 2013): Prof. Wu Yueliang, The Executive Vice-President, UCAS
University of Chinese Academy of Sciences, Beijing

Signing of an MOU (23rd January 2014): Prof. Zhu Xiangbin, Assistant President, UCAS and Dr. N. L. A. Karunaratna, The Vice Chancellor, USJP
At the Ministry of Mass Media
Facts and Figures About CAS

• 727 Members
  – 64 Foreign Members (2011)

• 60,600 regular staff and 48,917 Postgraduates

• 118 Subordinated institutions;
  – 12 Branches across China
  – 98 Research institutes
  – 2 Universities: USTC and GUCAS
  – 3 Supporting organizations
    • incl. China Science Library

• 459 spin-offs;
  – 22 CAS-holding Companies
    • Lenovo

CAS, China’s leading and premier national research organization.

Visit of Prof. Bai Chunli
President of the Chinese Academy of Sciences (CAS)
- April 2014 -
International Outlook

Hands on Training:
• Cell Culture Techniques
• Western Blotting
• Confocal Microscopy

Foreign Hands on training for Sri Lankan Students at Fudan University, Shanghai

Hands on Training:
• Cell Culture Techniques
• Western Blotting
• Confocal Microscopy

Total 21 fellowships

International Fellowships, RA/PG For Training/Attend International Workshops (2006 - 2014)

USA - 01
Canada - 01
India - 09
China - 04
Malaysia - 01
Singapore - 01
Sweden - 01
Australia - 01

Hong Kong - 01
Switzerland - 01

Prof. Dr. med. J.-M. Burgunder, University of Bern.

Prof. Eric P Hoffman, George Washington University.

Prof. Toshiki Mizuno, Kyoto Prefectural University of Medicine

Dr. Yuan Liu, Chief, Office of International Activities, NIH/NINDS

Prof. Yoo-Hun Suh, Seoul National University
International Publications and Presentations on Natural Products

Publications:

Presentations:
6. S.H. Huang, Yi Zhun Zhu, Ranil De Silva Therapeutic effects of flavonoids from Ceylon tea on human brain epithelial cells., 4th Congress of Federation of Asian-Oceanian Neuroscience Societies, (FAONS), Hong Kong, November 30 - December 2, 2006

Through my academic collaborations with China, my PhD students and I received the opportunity to visit China to attend the following international conferences under the fellowship of the respective invitee institutions in China.
1. Human Brain Tissue Repository
The one and only “Brain Bank’ in Sri Lanka with 76 aging and diseased brain tissues stored in formalin and -80°C

2. Blood/DNA/Data Bank
Socio-demographic, Clinical data of over 1300 patients

- Stroke
  500 Patients

- Parkinson’s Disease
  230 Patients

- Dementia
  550 Patients (clinical data)

- Other Neuromuscular and Neurodegenerative Diseases
  137

- Controls
  300
International Presence


40 Resource Personal of highest academic stature (Australia, India, Italy, Israel, Canada, Hong Kong, Sweden, Netherlands, Japan, Korea, Singapore, USA and UK).

Participants Sri Lanka (151) and neighboring countries (20) from; Bangladesh, India, Pakistan, Thailand and Singapore, Sweden, UK. (full fellowships including travel to selected participants were offered).
Success Through Innovation

Gatorade... an American Sports Drink??

Success:

Published in the British medical journal Lancet


1960s: Bangladesh Cholera outbreak

Century Old Formula as a form of Oral Rehydration Therapy

Key Ingredients:
- Coconut Water
- Carrot Juice
- Rice Water
- Carob Flour
- Dehydrated Bananas
- And Salt.

Reverse Innovation: University of Florida utilized this formula to rapidly hydrate athletes

Today !!: Leader in the sports nutrition category World's 86th Most Powerful Brands

Actually rooted in Bangladesh!!

CEYLON TEA
- Directly and indirectly 2 Million employed
- 10% of the population of Sri Lanka depends on the industry.
- 548,574 Acres

Annual Revenue (2012)

CEYLON TEA - $1.4 billion
GATORADE - $3.3 Billion

Success: actually rooted in Bangladesh!!

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- Directly and indirectly 2 Million employed
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GATORADE - $3.3 Billion
World Class University Project

About USJP
Lecturers: 514
Students: 10455

2 M.O.U.s
Double Doctoral Degree Program EURON& USJP
CAS-TWAS President’s Postgraduate Fellowship Programme UCAS & USJP

WEBOMETRICS

5 Faculties

<table>
<thead>
<tr>
<th>Ranking</th>
<th>World Rank</th>
<th>University</th>
<th>Det.</th>
<th>Presence Rank*</th>
<th>Impact Rank*</th>
<th>Openness Rank*</th>
<th>Excellence Rank*</th>
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<td>6097</td>
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<td>8140</td>
<td>2560</td>
<td>5155</td>
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<td>8</td>
<td>6716</td>
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<tr>
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<td>10153</td>
<td>Rajarata University</td>
<td>7273</td>
<td>12059</td>
<td>8142</td>
<td>5155</td>
<td></td>
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<tr>
<td>10</td>
<td>10779</td>
<td>Sabaragamuwa University</td>
<td>12321</td>
<td>11065</td>
<td>8527</td>
<td>5155</td>
<td></td>
</tr>
</tbody>
</table>

http://www.webometrics.info/en/Asia/Sri%20Lanka%20
Strategy + Business = Innovative products + Profits

Sri Lankan Government
1. Triple deduction of Tax.
2. 50% National Research Council (NRC)

University of Sri Jayewardenepura
1. Infrastructure
2. Human Resource Development

Harnessing the potential of Local Innovation

Journey To Development
"Launching Business Cells to initiate Business Enterprises through Universities"
Public–Private partnership

USJP → Public–Private partnership → Industry
Acknowledgements