بِسْمِ اللَّهِ رَحْمَةً وَبِلَاءً
Nutritional and Health Attributes of Malaysian Palm Oil
Potential of Red Palm Oil For Combating Vitamin “A” Deficiency

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Vitamin “A” Status in World

- Vitamin A deficiency in over 70 countries of Asia & Africa
- Affectees:
  i. Pre-school & school-going children (>78 m)
     About 3 m of these have eye disease.
  ii. Women of child-bearing age
Vitamin-A Deficiency in Pakistan

- Clinical = 0.8%
- Sub-clinical = 17.6%
- Mandatory requirement in ghee & cooking oils = 3,300 IU (9.9 µg/g)
- Fortification cost = US $ 4-6 per ton
INTERVENTION STRATEGIES TO COMBAT “Vitamin A” DEFICIENCIES

- Supplementation vitamin A capsule
- Fortification with Synthetic Vitamin A
- Oil/Vanaspati ghee
- Milk/Dairy products
- Sugar, Salt, Rice
- Food fortification with natural sources
Advantages of Fortification of Vegetable Oils/Ghee

- Consumed by every one.
- Cost effective method
- Socially acceptable,
- require no change in food habits
- easy to monitor, safe.
- A viable food vehicle to deliver micronutrients.
RED PALM OIL

Malaysian Palm Oil Board (MPOB) commercial product

crude palm oil refined by special technology, retaining its minor components.

Carotenoids = 500 – 700 ppm  
Vitamin E = 800 – 1000 ppm

β –carotene : retinol = 5.7 : 1

Metabolic Vitamin A value = 0.17 mg retinol absorbed / mg of β-carotene consumed
# Chemical characteristics of Red Palm Oil

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fatty acid %</strong></td>
<td></td>
</tr>
<tr>
<td>Myristic 14:0</td>
<td>0.80</td>
</tr>
<tr>
<td>Palmitic 16:0</td>
<td>42.2</td>
</tr>
<tr>
<td>Stearic 18:0</td>
<td>51.1</td>
</tr>
<tr>
<td>Oleic 18:1</td>
<td>42.0</td>
</tr>
<tr>
<td>Linoleic 18:2</td>
<td>10.0</td>
</tr>
<tr>
<td>Total carotenes (µg/g)</td>
<td>550</td>
</tr>
<tr>
<td>β carotenes (µg/g)</td>
<td>375</td>
</tr>
<tr>
<td>Tocopherols &amp; tocotrienols µg/L</td>
<td>468</td>
</tr>
</tbody>
</table>
OBJECTIVES

★ To improve the Vitamin A status of Pakistani population by Fortification of Vanaspati Ghee with natural carotenes sourced from RPO replacing the synthetic Vitamin “A”

★ Shelf life extension of vanaspati ghee by natural antioxidant sourced from RPO.
Production of RPOFV

- Collaboration, AIL Nowshera.
- Vanaspati Ghee Standard Formulation i.e. 80% PO+20% HCSO or 20% HSBO+ Synthetic Vitamins.
- Vanaspati Ghee Was Blended With 6% RPO (Instead Of Synthetic Vitamin “A”)
- Packed In One Kg Colored Polyethylene Pouches Under The Existing Commercial Brand Names (Shama)
SELECTION CRITERIA

- Low to average income group.
- Age limit 6-60 year.
- Explanation of Protocol of the project to head of families.
- Consent proforma, Family profile, personal profile and sensoric evaluation proformae were issued.
- Experimental ghee was issued @ 1 kg/person/month for 2 months.
- Volunteers were advised to restrict to use test ghee for their all-cooking practices.
# Selection of Volunteers

<table>
<thead>
<tr>
<th>PHASES</th>
<th>LOCALITY</th>
<th>NO. OF VOLUNTEER</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>PESHAWAR</td>
<td>295</td>
</tr>
<tr>
<td></td>
<td>1. NIFA</td>
<td>(20 families)</td>
</tr>
<tr>
<td></td>
<td>2. FEROZ SONS</td>
<td></td>
</tr>
</tbody>
</table>
PERCENTAGE OF OILS, FATS AND VITAMIN SUPPLEMENTS CONSUMED BY SUBJECTS

<table>
<thead>
<tr>
<th>Subject</th>
<th>% of Subjects</th>
<th>% of Subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Consuming Vanaspati Ghee</td>
<td>Consuming Cooking Oil</td>
</tr>
<tr>
<td>Male (n =95) *</td>
<td>76</td>
<td>23</td>
</tr>
<tr>
<td>Female (n =77)</td>
<td>75.3</td>
<td>24.67</td>
</tr>
<tr>
<td>Children (n =123) **</td>
<td>81.3</td>
<td>18.6</td>
</tr>
</tbody>
</table>

* n = number of subjects  ** Children under 18 years old
Physico-Chemical Analysis of Blended/Control Ghee

- Colour Measurements (Lovibond)
- Peroxide value (meq/kg)
- Free Fatty Acid (FFA)
- Carotenoids Concentration (β-Carotene)
- Stability Test (Active oxygen method)
## Product Quality Evaluation

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>CONTROL GHEE</th>
<th>RPOFV GHEE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0-DAY</td>
<td>2-MONTHS</td>
</tr>
<tr>
<td>POV ( Meq/kg)</td>
<td>1.096±0.175</td>
<td>4.25±0.24</td>
</tr>
<tr>
<td>FFA (%)</td>
<td>0.153±0.103</td>
<td>0.32±0.015</td>
</tr>
<tr>
<td>Color</td>
<td>2.7(RED)</td>
<td>2.7(RED)</td>
</tr>
</tbody>
</table>

Values are averages of at least three determinations
AOM Evaluation of RPOFV and Control Vanaspati

POV meq/kg

AOM hours

- Control
- Blended
Sensory Evaluation

A questionnaire having five points hedonic scale was issued, for first fortnight and subsequently in the middle and before the end of two months period.
# Sensoric Evaluation of the RPOFV Ghee

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Evaluation</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1st</td>
<td>2nd</td>
<td>3rd</td>
</tr>
<tr>
<td>Appearance (1-5)</td>
<td>3.18 ± 0.20</td>
<td>3.70 ± 0.17</td>
<td>3.97 ± 0.51</td>
<td></td>
</tr>
<tr>
<td>Colour (1-5)</td>
<td>2.07 ± 0.83</td>
<td>2.18 ± 0.78</td>
<td>2.82 ± 0.58</td>
<td></td>
</tr>
<tr>
<td>Aroma (1-5)</td>
<td>4.07 ± 0.49</td>
<td>3.90 ± 0.26</td>
<td>3.95 ± 0.43</td>
<td></td>
</tr>
<tr>
<td>Texture (1-5)</td>
<td>4.08 ± 0.30</td>
<td>3.75 ± 0.23</td>
<td>4.25 ± 0.22</td>
<td></td>
</tr>
<tr>
<td>Taste (1-5)</td>
<td>4.37 ± 0.32</td>
<td>4.12 ± 0.28</td>
<td>4.27 ± 0.35</td>
<td></td>
</tr>
<tr>
<td>Overall Acceptability (1-5)</td>
<td>3.59 ± 0.27</td>
<td>3.56 ± 0.21</td>
<td>3.78 ± 0.37</td>
<td></td>
</tr>
</tbody>
</table>

1. Values are averages of 60 volunteer families
2. 1-5 hedonic scale was used with 5 = much better, and 1 = very bad
A Overall acceptability values are average values of appearance, colour, aroma, texture and taste.
BLOOD COLLECTION AND ANALYSIS

- Pre feeding (0-day)
- Post feeding (2-months)
- Blood Samples (4-5 ml) were collected in test tubes having EDTA
- Plasma separation by centrifugation.
- Vitamin A/β-Carotene analysis
β-Carotene and Vitamin “A” Assays

Plasma 3ml → 3mlEthanol → Protein precipitation →
Addition of 6ml pet-ether → Mixing by vortex mixer
Centrifugation → Separation of the upper β-carotene layer
Absorption at 440 nm (β-Carotene → Evaporation of Pet-
ether layer with CO₂ → Dissolution of residue in 0.5ml
chloroform → Addition 2 drops acetic anhydride
Shaking → Addition of carr price Reagent →
Development blue color at 620 nm (Vitamin A)
CONCLUSIONS

- The consumption of RPOFV ghee increased Vitamin A over 30% in the circulating levels of individuals.
- Sensorically the RPOFV was found excellent
- RPO imparts stability to other oils
- On the basis of physiological performance, RPO could be recommended for Pakistan to combat vitamin A deficiency
Thanks