EFFICACY OF NUTRACEUTICALS ON BLOOD GLUCOSE AND LIPID PROFILE AMONG SOUTH INDIAN TYPE 2 DIABETIC POPULATION

Dr. P. Nazni, M.Sc., M.Phil., Ph.D
Lecturer,
Department of Food Science,
Periyar University, Salem
Tamilnadu, India.
e-mail: naznip@gmail.com
INTRODUCTION

• Diabetes mellitus is emerging as one of the main threads to human health.
• World Health Organization estimated that there were 135 million diabetic individuals in the year 1995 and it projected that this number would increase to 300 million by the year 2025.
• India had now been declared by WHO as the “Diabetes capital of the world”.
Diabetes mellitus is a metabolic disorder characterized by high blood glucose concentration resulting from defects in insulin secretion, liberation and or the combination of both.
SYMPTOMS

- Frequent urination
- Excessive thirst
- Extreme hunger or constant eating
- Unexplained weight loss
- Presence of glucose in urine
- Tiredness or fatigue
- Changes in vision
- Numbness or tingling in the extremities
- Slow-healing wounds or sores
- Abnormally high frequency of infection
NEED FOR THE STUDY

Every 24 hours...

- 3,600 new cases of diabetes are diagnosed
- 580 people die of diabetes-related complications
- 225 people have a diabetes-related amputation
- 120 people with diabetes progress to end-stage renal disease
- 55 people with diabetes become blind

Hence there is an urge to control and prevent the complications in the diabetic population. This study emerges as a basic step to find out the hypoglycemic and hypolipidemic effects of selected nutraceuticals on Type 2 diabetics.
The term nutraceutical was coined in the 1990’s by Dr. Stephen DeFelice. He defined nutraceutical as:

‘A nutraceutical is any substance that is a food or a part of a food and provides medical or health benefits, including the prevention and treatment of disease.

Such products may range from isolated nutrients, dietary supplements and specific diets to genetically engineered designer foods, herbal products, and processed foods such as cereals, soups and beverages.
NUTRACEUTICALS

• Numerous nutraceuticals show promise in diabetes management.
• For the present study nutraceuticals namely **CUMIN SEEDS** (*Cuminum Cyminum*) and **BAY LEAVES** (*Laurus nobilis*) were selected for supplementation to the selected diabetic subjects.
Cumin seed plants are small annual herb native to Mediterranean region.

Cumin is a most popular spice all over the world, especially in Latin America and all over Asia.

Cumin is one of the most typical spices for India especially in south part.

The fruits used as a whole and are fried or dry roasted before usage.
NUTRITIVE VALUE OF *CUMINUM CYMINUM*

- Hundred grams of cumin seeds contains
  - Energy- 356k.cal,
  - Protein - 18.7g,
  - Carbohydrate - 15.0g,
  - Fat -12.0g, and
  - Dietary fiber-12g.
ABOUT **LAURUS NOBILIS**

- Bay leaf (leaf of the sweet bay tree) is an evergreen plant, indigenous to Asia.
- Bay leaves are large, glossy dark green, elliptical and pointed.
- Bay leaves is a useful ingredient in seasoning mixture.
NUTRITIVE VALUE OF LAURUS NOBILIS

• Amounts per 1 tbsp, crumbled (2g)
  ❤️ Energy - 5.5 k.cal,
  ❤️ Protein- 0.1g,
  ❤️ Carbohydrate - 1.3 g,
  ❤️ Fat - 0.1 g, and
  ❤️ Dietary Fiber- 0.5g
OBJECTIVES

• To study the socio-economic, Nutritional status, dietary pattern and personal history of the selected subjects.

• To formulate breads incorporating 5 grams of cumin seed powder and 0.5 grams of bay leaves powder.

• To study the efficacy of selected nutraceuticals on the blood glucose and lipid profile of the diabetic subjects.
PHASE I

Type II diabetic subjects
(N = 500)
(Age 30-60 Years)

- Socio economic survey
- Nutritional assessment
- Dietary Pattern and personal history
PART II

• CRITERIA FOR THE SAMPLE SELECTION FOR SUPPLEMENTATION
  - Age group between 45-55 years
  - Fasting blood glucose between 150-175 mg/dl
  - Post prandial blood glucose between 150-175 mg/dl
  - Glycosylated Hemoglobin between 9-12 %
  - Total cholesterol between 225-275 mg/dl

ALL SPICES
Supplementation studies (N - 45)

Experimental group (N –30) (Supplementation Period 90 days)

Control group (N – 15) (No supplementation)

PARAMETERS

Biochemical Parameters (N-45)
Initial and Final values of
- Fasting and Post prandial Blood Glucose
- Glycosylated haemoglobin
- Total cholesterol
- Triglyceride
- Low Density Lipoprotein (LDL) and
- High Density Lipoprotein (HDL)

(N = 15 for each group)
Cumin seed - 5 g
Bay leaves - 0.5 g
SUPPLEMENTATION WITH CUMIN SEEDS

- Cumin seed (*Cuminum cyminum*) plants are small herbs. The biologically active constituent of cumin seeds was characterized as cumin aldehyde.

- This cumin aldehyde is proved to be a new agent for anti-diabetic therapeutics.

Three bread slices were prepared using five grams of roasted cumin seed powder and 15g of wheat flour and advised the Group II (n=15) selected subjects to consume it as evening snacks.
SUPPLEMENTATION WITH BAY LEAVES

• Bay leaves (*Laurus nobilis*) are used as whole and also in the form of powder in Indian cookery.
• It contains the principle compound called Cineole to regulate the insulin level and help the body to utilize insulin more efficiently.

500 mg of bay leaves powder was incorporated in 15 g of wheat flour and prepared as breads (3 No.) and supplemented daily for Group III (n=15) the selected subjects for their snack time.
STATISTICAL ANALYSIS

• ANOVA, mean and SD were computed using SPSS statistical package version 14.0. Duncan’s Multiple Range test was applied to determine the significant differences between the organoleptic characters of various breads and ‘t’ value for the blood samples.
SALIENT FINDINGS
SOCIO-ECONOMIC BACKGROUND

• It was observed that more than one third of both male and female diabetics were in the age group of 40-49 years.
• The disease was more prevalent among educated population.
• Nearly half of the selected diabetics were involved in sedentary activity and only a small percentage were doing heavy activity.
• Forty seven per cent of the diabetics belonged to nuclear family and 53 per cent of subjects belonged to joint family.
• Income was not an important factor for the occurrence of the disorder, as diabetes mellitus was common in all categories of income level.
SYMPTOMS

Hyperglycemia (23.5%)
Polydipsia (23%)
Polyuria (17.5%)
Poor wound healing (11.5%)
Weight loss (24.5%)
Visual disturbances (4%)
Renal failure (0.6%)
FAMILY HISTORY OF DIABETES MELLITUS

<table>
<thead>
<tr>
<th>Relationship</th>
<th>FAMILY HISTORY</th>
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<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Per cent</td>
<td></td>
</tr>
<tr>
<td>Father</td>
<td>182</td>
<td>36.5</td>
<td></td>
</tr>
<tr>
<td>Mother</td>
<td>88</td>
<td>17.5</td>
<td></td>
</tr>
<tr>
<td>Both parents</td>
<td>168</td>
<td>33.5</td>
<td></td>
</tr>
<tr>
<td>Close relatives</td>
<td>62</td>
<td>12.5</td>
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</tr>
</tbody>
</table>

Tracing the family history of diabetes, all had a family history of diabetes mellitus in which 17.5 per cent of mothers, 36.5 per cent of fathers, 33.5 per cent of both parents and 12.5 per cent of close relatives of the selected subjects had diabetes.
LIFE STYLE PATTERN

- 72 per cent of diabetics strictly adopted regular exercise for one to two hours.
- Among the total male (320) diabetics about 42 per cent had the habit of drinking alcohol before the diagnosis of the disease and only 19 per cent of them pursued the habit even after the diagnosis of diabetes.
- 24 per cent of the male diabetics had the habit of smoking.
- 42.5 per cent of diabetics consumed about two cups of tea and 57.5 per cent were consumed more than two cups of tea.
NUTRITIONAL STATUS ASSESSMENT

Only 19.2 per cent of men subjects and 55 per cent of women were in the standard height specified by NCHS (Brahmam, et al 2005).

About 16.7 per cent of men and 10 per cent of women were of standard weight specified by NCHS (Brahmam, et al 2005).

Grade I obesity was noticed among 31.7 per cent of men and 15 per cent of women subjects. About 12.5 per cent of men and 25 per cent women diabetics were at risk of developing obesity.

WHR was normal among 21.8 per cent of males and 20.1 per cent of females.
EFFICACY OF SUPPLEMENTATION
## ORGANOLEPTIC EVALUATION OF THE DEVELOPED BREADS

<table>
<thead>
<tr>
<th>Recipes</th>
<th>Appearance</th>
<th>Colour</th>
<th>Flavour</th>
<th>Texture</th>
<th>Taste</th>
<th>Overall acceptability</th>
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</thead>
<tbody>
<tr>
<td>Standard</td>
<td>7.73±.70b</td>
<td>7.20±1.2a</td>
<td>7.73±.96b</td>
<td>7.87±.92b</td>
<td>7.93±.59b</td>
<td>7.67±.90b</td>
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<tr>
<td>Cumin bread</td>
<td>6.07±.88a</td>
<td>7.07±1.39a</td>
<td>5.80±1.32a</td>
<td>5.80±1.37a</td>
<td>5.60±.99a</td>
<td>5.60±1.06a</td>
</tr>
<tr>
<td>Bay- leaves bread</td>
<td>6±.93a</td>
<td>7.73±.96a</td>
<td>5.07±1.28a</td>
<td>5.47±1.13a</td>
<td>5.67±1.29a</td>
<td>5.33±1.23a</td>
</tr>
<tr>
<td>F-ratio</td>
<td>20.3</td>
<td>1.301</td>
<td>19.84</td>
<td>19.06</td>
<td>26.5</td>
<td>21.29</td>
</tr>
<tr>
<td>P-value</td>
<td>.000**</td>
<td>.28 NS</td>
<td>.000**</td>
<td>.000**</td>
<td>.000**</td>
<td>.000**</td>
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</tbody>
</table>

** - Significant at 1% level,  * - Significant at 5% level,  ns- No Significant difference

Values with different superscript different from each other on application of Duncan’s multiple range test.

Results of Duncan’s test revealed that there is a significant difference between Bay leaves bread and cumin seed bread with standard for the attributes of appearance, flavor, texture, taste and Overall acceptability and there was no significant difference between the recipes for the attributes of colour.
BLOOD GLUCOSE LEVELS OF DIABETICS SUPPLEMENTED WITH CUMIN SEED

**Fasting Blood Glucose (mg/dl)**

- **Control Group**
- **Supplemented Group**

**Post Prandial Blood Glucose (mg/dl)**

- **Control Group**
- **Supplemented Group**

**Glycosylated Hemoglobin (%)**

- **Control Group**
- **Supplemented Group**
SERUM LIPID PROFILE OF DIABETICS SUPPLEMENTED WITH CUMIN SEED

**TOTAL CHOLESTEROL (mg/dl)**

- Supplemented Group: 246.35, 254.42, 254.1
- Control Group: 223.98, 210.2

**HDL CHOLESTEROL (mg/dl)**

- Supplemented Group: 36.09, 40.18
- Control Group: 36.94, 36.06

**LDL CHOLESTEROL (mg/dl)**

- Supplemented Group: 35.06, 32.66, 31.86
- Control Group: 31.37, 31.37

**VLDL CHOLESTEROL (mg/dl)**

- Supplemented Group: 35.06, 32.66
- Control Group: 31.86, 31.37

**SERUM TRIGLYCERIDE (mg/dl)**

- Supplemented Group: 175.29, 163.4, 164.51
- Control Group: 164.51, 164.37
The result of supplementation with cumin seed powder showed a significant decrease in:

- Fasting blood glucose level by 20 mg/dl
- Post prandial blood glucose level by 11.1 mg/dl
- Glycosylated haemoglobin level by 3.32%
- Serum total cholesterol level by 13.3 mg/dl
- LDL cholesterol level
- VLDL cholesterol level
- Triglyceride level and

A significant increase in HDL cholesterol level from 36.09 to 40.18 mg/dl.
BLOOD GLUCOSE LEVELS OF DIABETICS SUPPLEMENTED WITH BAY LEAVES

**Fasting Blood Glucose (mg/dl)**
- **Supplemented Group**: 164.35, 162.98, 162.81
- **Control Group**: 146.53

**Post Prandial Blood Glucose (mg/dl)**
- **Supplemented Group**: 251.93, 232.58
- **Control Group**: 263.28, 263.14

**Glycosylated Hemoglobin (%)**
- **Supplemented Group**: 10.43, 10.12
- **Control Group**: 7.61, 9.92
SERUM LIPID PROFILE OF DIABETICS SUPPLEMENTED WITH BAY LEAVES

**TOTAL CHOLESTEROL (mg/dl)**

<table>
<thead>
<tr>
<th></th>
<th>Supplemented Group</th>
<th>Control Group</th>
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<tbody>
<tr>
<td>Before</td>
<td>244.69</td>
<td>254.1</td>
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<tr>
<td>After</td>
<td>231.62</td>
<td>254.42</td>
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**HDL CHOLESTEROL (mg/dl)**

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<th>Control Group</th>
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<tbody>
<tr>
<td>Before</td>
<td>38.33</td>
<td>46.08</td>
</tr>
<tr>
<td>After</td>
<td>36.94</td>
<td>36.06</td>
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</table>

**LDL CHOLESTEROL (mg/dl)**

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<tr>
<th></th>
<th>Supplemented Group</th>
<th>Control Group</th>
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<tbody>
<tr>
<td>Before</td>
<td>163.9</td>
<td>149.94</td>
</tr>
<tr>
<td>After</td>
<td>164.55</td>
<td>164.7</td>
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</table>

**VLDL CHOLESTEROL (mg/dl)**

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<th>Supplemented Group</th>
<th>Control Group</th>
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</thead>
<tbody>
<tr>
<td>Before</td>
<td>32.92</td>
<td>31.37</td>
</tr>
<tr>
<td>After</td>
<td>31.86</td>
<td>31.37</td>
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</table>

**SERUM TRIGLYCERIDE (mg/dl)**

<table>
<thead>
<tr>
<th></th>
<th>Supplemented Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before</td>
<td>164.6</td>
<td>164.51</td>
</tr>
<tr>
<td>After</td>
<td>164.32</td>
<td>164.37</td>
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Supplementation of bay leaves significantly lowered the fasting, post prandial blood glucose and HbA1c level.

Significant decrease was recorded with regard to total cholesterol, LDL cholesterol, VLDL cholesterol, and triglycerides and a marked increase in HDL cholesterol level.
CONCLUSION

• Both the selected nutraceuticals showed significant effect in reducing both fasting and post prandial blood glucose, glycosylated haemoglobin level and lipid profile.

• Cumin seeds ranked first in controlling blood glucose followed by bay leaves.
- The study thus provides effective pointers in establishing the hypoglycemic and hypolipidemic potentials of the two selected nutraceuticals studied.

- If India’s biodiversity, richness of the herbs and other vegetation is considerably exploited, she will certainly rank at the nutraceutical capital of the world and such nutraceutical supplements could definitely alleviate the pain and agony of diabetics.
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