

STUDY ON THE NUTRACEUTICAL FUNCTIONS OF NONI JUICE FOR THE HEALTH CARE

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Abstract—The noni juice was prepared by the use of honey. According to nutritional analysis, Calcium, Vitamin C and Carbohydrate were prominently present in the noni juice. Moreover, the pH values of these juices products were acceptable and it was 3 ± 1 . As the alcohol percent of the noni juice products were very low and it was less than 1%, the final products of noni are called as fermented juice. No microbial population was observed on standard plate count media, EMB media, Mac-Conkey media, Baird Parker media and PDA media at overnight culture. Antimicrobial activity showed that the juice can inhibit the growth of human pathogenic bacteria such as MRSA, Escherichia coli, Enterococcus faecalis and Bacillus cereus. The zone diameter of the product was investigated as 11mm for 50 μ l concentration and 16mm for 100 μ l conc: respectively for S.aureus. And for Escherichia coli, the inhibition zone diameters were observed as 13mm for 25 μ l conc:, 15mm for 50 μ l conc: and 18mm for 100 μ l conc:. The sensitivity zone of the product was found as 12mm for 25 μ l conc:, 15mm for 50 μ l conc: and 22mm for 100 μ l conc: respectively. The effect of the noni juice product on Bacillus cereus was seen as inhibition zone diameter 12mm, 15mm and 19mm for 25 μ l, 50 μ l and 100 μ l respectively. Therefore, the noni juice product was more active against target pathogenic bacteria. According to anti-diabetic activity using mice model, the noni juice sample was highly significant like that of the positive control (Glibenclamide). Therefore, the product was potential to use as a routine drug as Glibenclamide. Due to the observational study on in vivo toxicity test, the noni juice product was safe to drink as nutraceutical food or as an alternative medicine.

Index Terms— noni juice, Morinda citrifolia, nutraceutical, antimicrobial activity, anti-diabetic, toxicity, Health care.

I. INTRODUCTION

A nutraceutical is a food or a part of a food that provides medical or health benefits. It is a combination of nutrition and pharmaceutical that has a medicinal effect on human health. Traditionally the nutraceutical was contained in a medicinal format such as a capsule, tablet or powder in a prescribed dose, although more modern nutraceuticals such as Probiotic drinks and

yogurt are now found in ordinary supermarkets alongside normally everyday versions of the product.

Many herbs and parts of the plants (fruits, bulk, leaves and root) exhibit hypoglycemic activity when taken orally. Some of these parts of the plants have also been pharmacologically tested and shown to be of some values in diabetes. In Myanmar, diabetes mellitus can be counted as a single health problem occurring at all ages as reported by various workers. Myanmar is rich in plants, many of which are of medicinal values. But, so far, there has not been full and systematic exploitation of these natural resources with regard to hypoglycaemic effect. So, in this research work, there are rational to screen the various ratios of noni juice samples preliminarily on laboratory test models in vitro and in vivo. Morinda citrifolia is a tree of coffee family, Rubiaceae. Its native range extends through Southeast Asia and Australasia, and the species is now cultivated all over the world. The more common English names among some 100 names for the fruit of different regions are great morinda, Indian mulberry, noni, beach mulberry, and cheese fruit.

According to Ethnobotanical data, the fruit, leaves, and root of the plant are used. In Hawaii, noni fruit was used for both internal and topical applications and is widely used by the local population for sugar control diseases, high vascular pressure, heart health maintenance, abnormal growths, and other chronic disorders. According to a study reported at the American Heart Association's 46th Annual Conference on Cardiovascular Disease Epidemiology and Prevention, noni may lower total cholesterol and triglycerides. After one month's use, noni juice significantly reduced cholesterol and triglycerides in current smokers with elevated cholesterol levels.

Based on clinical practice and animal studies, a polysaccharide-rich substance from noni fruit juice attacks abnormal cells in several different ways. Noni fruit juice seems to act indirectly against abnormal growths, primarily through immunostimulatory effects. In Myanmar, some herbal and higher plants' parts (e.g. barks, stems, seeds, roots, leaves, flowers, and fruits)

may be insignificant as to their morphology and appearance but the components they possess may be of great value in curing serious diseases. For the reasons of expensiveness of western medicine and easy accessibility of indigenous medicinal plants, we can substitute nutraceutical noni juice as an alternative medicine in place of western medicine.

Although the juice has an unpleasant taste and odor, it is generally safe to drink. However, noni juice is high in potassium. For this reason, it should be used with caution if at all in people with chronic kidney disease or who take potassium-sparing diuretics, because it could cause dangerously elevated blood levels of potassium (hyperkalemia).

Honey is used as the supplement in most of the traditional medicine in Myanmar. That is why; to investigate the functional properties of the fermented noni juice amended with honey was carried out. In this study, the preparation of various ratios of juice from noni fruits in Myanmar for the Human health care was determined.

The study was expected to help expand the current knowledge and practice of the nutraceutical properties of noni juice in Myanmar.

The aims and objectives of the research work are as follow: To evaluate the valuable alternative medicine for human being, to study the processing of noni juice and to study the greater understanding on noni products and evaluate their potent activities in health care.

II. MATERIALS AND METHODS

A. Sample collection

Noni fruits were collected from Kyaukse Township, Myanmar. The fruit is picked when it is 'white' in colour. Honey, sugars, culture media and other chemicals used in this research work were collected or purchased from local market and Biotechnological Research Department. All the chemicals were analytical grade and distilled water was used for all analyzed process.

B. Preparation of fermented noni juice

These fruits are washed with water and normal saline. Then it is stored in plastic drum for one day. When the fruits are ripened, they are pressed by blender. After blending, the appropriate ratio of noni paste, honey and warm water were fermented for three months.

C. Filtration, Pasteurization and Aging

After fermentation, the juice was filtrated by sterilized thin cloth to remove unwanted sediments and floating things. After one month, fermented noni supernatant was collected and then allowed for pasteurization of 80°C for 10 minutes to stabilize the juice. No preservatives, additives, colors or flavors are added to fermented noni juice. The resulting noni juice is bottled and stored at 27°C ±2 for aging. This noni

juice was tested for chemical analysis and microbial analysis.

D. Analysis of chemical and microbial profile

Minerals and nutritional composition of the noni juice were analyzed by Department of Research and Innovation. Fermented noni juice was serially diluted with sterilized water and total microbial count was detected on standard plate count agar.

E. Screening of antimicrobial activity

Staphylococcus aureus (MRSA), Escherichia coli,[9] Enterococcus faecalis and Bacillus cereus [8] were used as target pathogens. Escherichia coli, Staphylococcus aureus, Salmonella typhi and Shigella boydii were used as target human pathogens. Agar well diffusion test called the Nathan's agar well diffusion technique was used for the testing of the antimicrobial activity of the noni juice products [14]. Tetracycline hydrochloride was used as standard antimicrobial agent for comparing the antimicrobial potential with that of the noni juice products. The results were carried out three replications.

F. Screening of Antidiabetic Activity

The antidiabetic activity was screened by using the albino strain mice (*Mus musculus*). The mice were made diabetic by injecting them subcutaneously with 0.2 ml/kg of adrenaline. The blood glucose levels were monitored and the results were recorded. After duration of one week, the same mice were made diabetic and administered with the noni juice products. The dosage was calculated on the body weight basis for each animal. The animals were treated at the dosage rate of 0.2ml/mice/day. The administration was done orally. After injecting adrenaline, the animal was held by hand and immediately one drop of blood was collected from the tail. This blood was dropped on the GLUCOTIDE Test Strip and then this strip was inserted to the Easy Touch Blood Glucose Meter. Result with GLUCOTIDE Test strip displayed in millimole of glucose per 1000 ml (mmol/l) on the Easy Touch Blood Glucose Meter screen. Similar samples were also collected and blood glucose levels were determined at 0:45, 1:30, 2:15, 3:00, and 3:45 hour time intervals. The standard drug (Glibenclamide) is used as a positive control for comparing the antidiabetic potential with that of the noni juice. Water is used as a negative control (Fig 3.2).

G. Observational Study on in vivo Toxicity Test Using Mice Model

The animals were grouped into four having five mice of either sex in each group. Four groups for each test noni juice were administered orally with respective noni juice samples. They received the test noni juice in the dose level ranging from 0.2ml /day, 0.4ml /day and 0.6ml /day respectively. During administration of the noni juice, normal feed was given to all animals; water was supplied freely by means of inverted bottles, which were placed on the

top of covers. 25% ethanol was used as control. Tested samples were administered for six days, observation was done for sixteen days and both dead and alive outcome of animals was daily recorded.

III. RESULTS AND DISCUSSIONS

A. Analysis of chemical and microbial profile

According to the nutritional data, Manganese and Iron were detected as small amount and Phosphorous was not detected in the noni juice. Vitamin C and

Carbohydrate were prominently present in the noni juice. Because of the high content of Vitamin C, drinking noni juice was very effective for human health and for the anti-aging activity in human as Vitamin C is a powerful antioxidant. The nutritional value of the noni juice was shown in table (1). Microbial growth in the juice was not detected on the standard plate count agar. Therefore, it can be said that there was no microbe in the juice of noni fruits that was shown in table (2).

Table 1: Mineral and nutritional analysis

Moisture	76.69%
Ash	0.60%
Fat	0.13%
Carbohydrate	9.08%
Protein	0.20%
Vitamin C	9.06%
Potassium	0.17%
Sodium	0.08%
Phosphorous	N.D
Calcium	220.23ppm
Iron	7.79ppm
Magnesium	146.00ppm
Manganese	1.92ppm

Table 2: Typical Microbiological Results for Noni Juices

Microbes/species	In fresh juice
<i>Salmonella typhi</i>	nil
<i>Escherichia coli</i>	nil
<i>Shigella boydii</i>	nil
<i>Staphylococcus aureus</i>	nil
Yeast	Nil

Table 3: Screening of antimicrobial activity of noni juice on pathogenic strains (diameter - well 6 mm)

Bacteria	Tetra	25µl	50 µl	100 µl
<i>Staphylococcus aureus</i>	12	-	11	16
<i>Escherichia coli</i>	26	13	15	18
<i>Enterococcus faecalis</i>	15	12	15	22
<i>Bacillus cereus</i>	22	12	15	19

B. Screening of antimicrobial activity

Antimicrobial activity of fermented noni juices was shown in Table (4) and figure (1). Noni juice was tested by Agar Well Diffusion Method to screen their antimicrobial activities. According to the results, the juice was observed as higher inhibition zone diameter

upon *Staphylococcus aureus* (MRSA), *Escherichia coli*, *Enterococcus faecalis* and *Bacillus cereus*; 16mm, 18mm, 22mm, 19mm respectively for 100 µl per well concentration [7]. The antimicrobial results were shown in table (3) and fig (1).

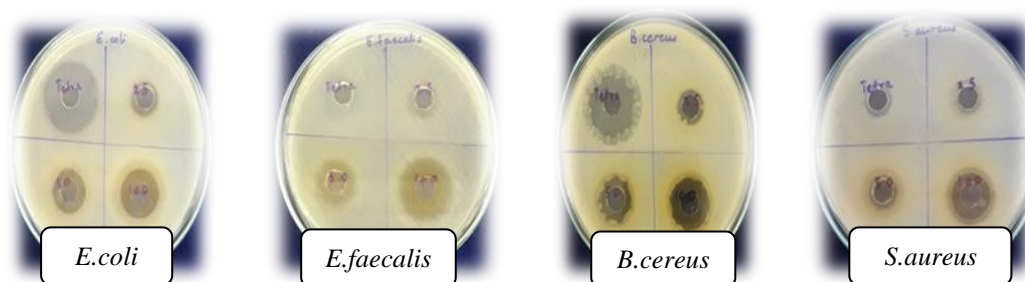


Figure 1: Screening of antimicrobial activity of noni juice on pathogenic strains

C. Screening of Antidiabetic Activity

From the results of the experiment carried out on diabetic mice, it had been shown that the noni juice produced highly significant than the normal (water) and has consistent hypoglycaemic effect. These noni juice products may be classified as direct hypoglycaemic agent by inhibiting hyperglycaemia

due to adrenaline-induced diabetes. Positive control (Glibenclamide) was also highly significant than the water. Therefore, the juice was potential to use as routine drug like the positive control (Glibenclamide). The mean results were shown in table(4) and Fig (2).

Table 4. Mean results of Antidiabetic activity

Group	Fasting Blood Sugar (mmol/L)					
	0 hr	0:45 hr	1:30 hr	2:15 hr	3:00 hr	3:45 hr
Noni juice	180.8	197	172.8	133	131.4	126.6
Glibenclamide	220.2	270	234.6	96	83.5	94.5
Normal	140.6	144.2	154.4	144	144.4	136

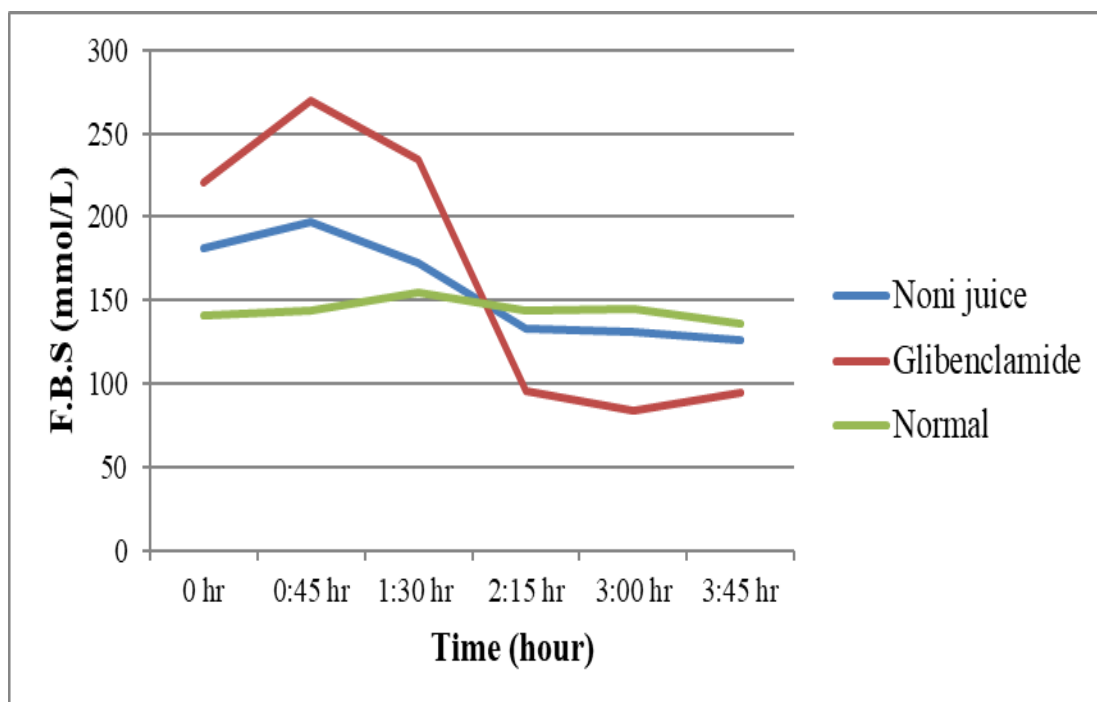


Fig 2. Results of the antidiabetic activity of noni juice

Table 5. After six days oral administration of different doses for acute toxicity test

Dose	Total	Observation	Oral Administration (Day)							Observation Period (Day)								
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0.6 ml	5	Alive	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
		Dead	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.4 ml	5	Alive	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
		Dead	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.2 ml	5	Alive	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
		Dead	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Control (25% Ethanol)	5	Alive	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
		Dead	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

D. Observational Study on in vivo Toxicity Test Using Mice Model

In the in vivo toxicity test, the noni juice was tested with serial doses of 0.2ml/day, 0.4ml /day and 0.6ml /day respectively given for six days. In this study, the

dosages of noni juice was found to be more than 0.6ml /day as the lethal effect was not detected in all mice. There were not toxic to the mice up to the highest concentration tested in this experiment, i.e., up to 0.6ml /day. The results were shown in table (5).

IV. CONCLUSION

Fruit juice productions are becoming increasingly popular, and are more likely to drink in Myanmar people. The aim of this research work was to produce the nutraceutical health fruit juice fortified with noni (Ye' Yo) fruits. Antimicrobial activity showed that the juice can inhibit the growth of human pathogenic bacteria such as MRSA strain *Staphylococcus aureus*, *Escherichia coli*, *Enterococcus faecalis* and *Bacillus cereus*. The juice was observed as higher inhibition zone diameter for 100 µl conc: Therefore, the juice was active against target pathogenic bacteria. In this way, drinking noni juice may have disease protection effect for food poisoning, diarrhea and may also have antibacterial properties that can protect against the wound in digestive tract and heart damage. The juice of the noni fruits was investigated for its hypoglycaemic activity by using adrenaline-induced hyperglycaemic mice models. The significant findings were that the noni juice product possessed highly significant hypoglycaemic effects like that of the standard drug, Glibenclamide which was used as positive control. In this way, the fermented product of noni can be said to use as nutraceutical food (or) as an alternative medicine. In vivo model using *Mus musculus* mice were also detected for the noni juice in the toxicity test. Toxicity was observed after oral administration of the noni juice in in vivo toxicity tests; the noni juice was observed up to be more than 0.6ml /day dosage. Therefore, the noni juice was assumed to be safe as nutraceutical food product for the prevention of diabetes and arthritis.

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