A Double-Blind Clinical Safety Study of Noni Fruit Juice

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Abstract

A safety study of TAHITIAN NONI® Juice from Tahiti was conducted with ninety-six healthy volunteers. For 28 days, participants consumed one of four daily quantities of noni juice: 0 mL (placebo), 30 mL, 300 mL, or 750 mL. All daily dose formulations were standardized to 750 mL by making up any volume differences with the placebo. Hematology, biochemistry, urinalysis, vital signs, and adverse events measurements were made at 0 (baseline), 2, and 4 weeks, as well as during a two-week follow up (week 6). Electrocardiogram (ECG) measurements were also made for each volunteer during the pre-study screen and at week 6. During the trial, those in the noni groups experienced 20 to 50% fewer total adverse events than those in the placebo group. A marginally significant ($P < 0.1$) reduction in the number of constant adverse events experienced by the volunteers was also found in the 300 mL noni juice group. A similar trend was observed in the other noni juice groups, as well. No other clinically significant differences between any of the groups were noted in the parameters and measurements of this study, nor was there evidence suggesting any adverse dose-related effects. The results of this study indicate that drinking up to 750 mL TAHITIAN NONI Juice per day is safe.
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Introduction

Noni (*Morinda citrifolia*) is a plant that is widely distributed among the tropics. It is a small to medium sized tree (3-10 meters high) that has large, evergreen, dark, glossy, prominently veined, elliptical to oblong leaves.[1] (Morton 1992). Pacificans[2] (Pacific Islanders) aided the dispersal of this plant by carrying it with them as one of the "canoe plants" as they colonized islands scattered over the vast Pacific Ocean.[3] Noni was highly valued for its variety of uses. Prominent among these were its role as food and medicine. The potential health benefits of the fruit may be attributed to nutritionally important phytochemicals, such as antioxidant flavonoids and lignans.[4-6]

While noni fruit is most famous for its role in folk medicine, there are numerous reports of its use as food.[7-18] This food use was not limited to only times of scarcity, as it was eaten often by Rarotongans,[19] was a favorite ingredient in curries prepared by Burmese,[20] and the Australian Aborigines were known to be very fond of the fruit.[21] The written record of food use dates from 1769, when Sydney Parkinson, one of Captain James Cook's crew on the *Endeavour*, recorded that Tahitians ate noni fruit.[22] Nearly two centuries later, in 1943, a United States military emergency survival manual described the fruit as edible.[23] The noni plant, specifically the leaves, are included in the World Health Organization's (WHO) and Food and Agriculture Organization's (FAO) food composition tables for East Asia and the Islands of the Pacific.[24, 25]

The popularity of noni fruit juice is growing rapidly throughout the world. More than 80,000,000 bottles of just one commercial brand have been sold since 1996,[26] with hundreds of other commercial sources also available to consumers.[27] With such a large global consumption and limited familiarity among many health professionals of noni's use as a supplementary food, it was necessary to conduct a clinical safety study.

Materials and Methods

This study was conducted as a single-center, double-blind, three-dose level, parallel-group, placebo-controlled trial to better understand the suitability of commercial noni fruit juice as a safe food. A commercial source of the juice (TAHITIAN NONI® Juice), was supplied by Tahitian Noni International Inc., Provo, Utah, USA, in its pasteurized form in dark-green glass bottles at a volume of 750 mL each. In its commercial form, it is a blend of noni, grape, and blueberry juices.

Ripe noni fruits contain fatty acids commonly found in cheese, particularly octanoic and hexanoic acids.[28] This property is responsible for the cheese-like flavor of noni and one of its vernacular names, cheesefruit.[29] Therefore, the placebo for this study contained a food-grade natural-cheese flavor in a grape and blueberry juice blend. The placebo was pasteurized and bottled in the same bottle and fill volume (750 mL) as the commercial noni juice.

Three formulations of the commercial noni juice were used: 1) low dose, consisting of a blend of 30 mL commercial noni juice and 720 mL placebo, 2) mid dose, containing 300 mL commercial noni juice with 450 mL placebo, and 3) high dose, consisting of 750 mL commercial noni juice. All formulations were pasteurized and filled into dark green glass bottles containing color-coded caps.

Ninety-six subjects, 28 males and 68 females, ages 18-64 years, were randomly assigned, in blocks, to four groups. These groups included a placebo and the three dose groups, as determined by color coding of the bottle caps. The clinical investigators and subjects were blinded as to the composition of the bottles. The color coding was only revealed to the statistician after the statistical analysis was made.

Subjects were prescreened prior to enrollment. Inclusion criteria included adult (18-64 years) males and females with a body mass index (BMI) between 19 and 30 kg/m^2, documented medical history, normal blood biochemistry, hematology, and urinalysis within 21 days of study commencement.

Excluded from the study were those with any evidence or history of hepatic, renal, cardiovascular, respiratory, metabolic, immunological, neurological, psychiatric or gastrointestinal disease. Also excluded were those with a positive test for hepatitis B or C, a history of alcohol abuse, asthma, allergies, or hypersensitivities or intolerances to drugs. Activities which required exclusion included smoking more than five cigarettes/day, participation in another clinical trial, donation of more than 500 mL of blood within the previous three months, use of over-the-counter drugs, vitamins, or herbal remedies within one week of the start of the study, and current use of prescription medication. However, concurrent use of hormone replacement therapy or contraceptive pills was allowed. Females of child-bearing age who were lactating, pregnant, or trying to become pregnant were not enrolled in the study.

The primary variables measured were hematology, biochemistry, urinalysis, vital signs, and 12 lead electrocardiograms (ECG). Secondary variables were adverse events and screening of sera for immuno-reactive molecules where a hypersensitivity response is suspected. Hematological measurements included

hemoglobin, hematocrit, mean cell volume, red cell count, prothrombin time, activated partial thrombin time, total and differential white cell count (basophils, eosinophils, lymphocytes, monocytes, and neutrophils), and platelet count. Biochemistry analysis included alkaline phosphatase, alanine aminotransferase, aspartate aminotransferase, total bilirubin, lipids (LDL, HDL, cholesterol, triglycerides), creatine kinase, creatinine, gamma-glutamyl transferase, glucose, total protein, and uric acid.

Urinalysis involved semi-quantitative analysis for leucocytes, nitrite, urobilinogen, protein, blood, ketones, bilirubin, and glucose. When any of the foregoing measurements was positive, a urine cyto-bacteriological examination was performed to characterize or count crystals, casts, epithelial cells, white blood cells, red blood cells, and bacteria. Urinalysis also included pH and specific gravity determinations. Measured vital signs included systolic and diastolic blood pressure, and heart rate. Body weights were also recorded. Adverse events were recorded on two-week diary cards, which were replaced at each visit.

Volunteers consumed up to 750 mL daily of either the placebo or juice containing one of three doses of commercial noni. All variables were measured during subject attendance at the clinic at weeks 0 (study start), 2, and 4. Two weeks following the in-use phase a follow-up visit was also scheduled for all subjects (week 6), where all variables were again measured. However, ECG measurements were only made for each subject at the pre-study screen and at week 6. Subjects were instructed to fast 10 hours prior to attending the clinic, but water was permitted during the fast.

Comparisons of variables at weeks 0 (baseline), 2, 4, and 6 were made between the treatment groups and the placebo groups, as well as against baseline values. Dose-related trends over all the groups were evaluated. Descriptive statistics of demographics were also determined. Presence/absence variables were analyzed with Fisher's exact test. Continuous and semi-continuous variables were analyzed with the Kruskal-Wallis test, although in some instances analysis of variance was performed for intergroup differences and dose-related trends after Bartlett's test determined homogeneity of variance. To evaluate change over time within groups, the Wilcoxon signed-rank test was used.

Informed consent was obtained from all participants, and this study was conducted according to the declaration of Helsinki, the ABPI Guidelines for Medical Experiments in Non patient Human Volunteers, the Report of The Royal College of Physicians on Research on Healthy Volunteers, the CPMP note on Good Clinical Practice for Trials on Medicinal Products, and ICH Harmonized Tripartite Guideline for Good Clinical Practice. All non-clinical portions were conducted according to internationally recognized standards of Good Laboratory Practice. Written unanimous approval to proceed with the study was given by the Carshalton Medical Research Ethics Committee (CMREC), Carshalton, Surrey, U.K.

Results

the study screening, all participants satisfied the inclusion and exclusion criteria, and there were no substantive differences between the groups in demographics (Table 1), lifestyle factors, vital signs, ECG, medication use, and medical histories. Females were predominant in the trial, 2.5 times more women than men. No participant was older than 64 years, with the average age of each group being 38-39 years. The mean BMI of each group was below 25. The range of BMI's for all volunteers was 19.1-30, with only one male and one female at 30.

Table 1: Participant Demographics by Dose Group

Parameter	Placebo	30 mL	300 mL	750 mL
Mean age (yr)	38	38	39	38
Age range (yr)	23-64	19-64	18-63	18-58
Males	7	7	7	7
Females	17	17	17	17
Mean BMI at screening	24.56	24.18	24.66	24.25

The study completion rate was 97%. Three volunteers, from the placebo and noni juice groups, were later excluded from the study. Two volunteers satisfied the inclusion criteria at screening, but subsequently failed to do so before the start of the trial (week 0). One was a female who experienced an elevation in liver enzymes between screening and week 0. The second was a male subject whose total and LDL cholesterol had also increased above normal limits before week 0. The observed elevations in liver enzymes and cholesterol were not related to noni juice, as these occurred before either volunteer consumed any noni juice or placebo. Another female dropped out after experiencing an intermittent increase in bowel movements, an effect that may be expected from drinking large quantities of fruit juice, especially when previous dietary patterns are low in fruits and vegetables. Compliance was very high in those completing the study, where all subjects ingested the assigned dose formulations every day for four weeks, with the exception of only one volunteer missing one day.

Noni juice did not have any significant effect on weight or vital signs (Table 2).

Table 2: Mean Weight and Vital Signs

Parameter	Week	Placebo	30 mL	300 mL	750 mL
Weight (kg)	0	69.93	67.69	69.32	70.05
	2	70.08	67.61	69.51	69.77
	4	70.23	67.78	69.20	70.61
	6	70.22	67.67	69.11	69.57
Heart Rate (bpm)	0	66.79	65.21	67.29	64.83
	2	64.04	64.54	65.92	63.54
	4	64.71	66.75	66.79	63.87
	6	67.88	64.58	65.88	63.67
Systolic Blood Pressure (mmHg)	0	116.38	118.83	120.13	120.29
	2	114.96	117.29	122.21	117.50
	4	118.00	118.54	122.04	119.83
	6	119.21	121.50	119.13	117.04
Diastolic Blood Pressure (mmHg)	0	68.88	67.75	73.21	71.38
	2	68.33	68.63	73.63	70.88
	4	69.33	69.92	70.79	71.09
	6	68.96	68.83	70.75	72.63

The mean diastolic blood pressure was 6-12 mmHg below the upper normal limit of 80 mmHg in all groups at all time points. There was no more than 3 mmHg difference in mean systolic blood pressure between all weeks in all noni juice groups. Over the course of the trial, the largest difference in the placebo group's mean systolic blood pressure was approximately 5 mmHg. During the in-use phase of the trial there were no substantial differences in mean weight between the groups. Week 6 ECG results were similar to those at week 0. No ECG abnormalities were found in the 750 mL noni juice group. Further, no clinically significant differences existed in heart rate, PR, QRS, QT, QTc axes between the groups. Clinically significant blood and urine tests were rarely reported. No significant dose-related trends in urinalysis, hematology, and biochemistry test results were observed (Tables 3 - 5).

Table 3: Urinalysis

Parameter	Week	placebo	30 mL	300 mL	750 mL
Leucocytes (≥ small)	0	3	3	1	4
	2	5	6	1	4
	4	3	6	5	6
	6	1	4	3	4
Blood (≥ small)	0	2	2	5	5
	2	6	3	4	2
	4	6	5	6	4
	6	2	4	4	1
Nitrites (positive)	0	0	1	0	0
	2	0	2	0	0
	4	0	1	0	0
	6	0	1	0	0
Protein (≥ 1 mg/L)	0-6	0	0	0	0
Ketones (≥ 2 mmol/L)	0	0	0	0	1
	2-4	0	0	0	0
	6	2	0	0	1
Urobilinogen (> 3 µmol/L)	0-4	0	0	0	0
	6	1	0	0	0
Bilirubin (positive)	0-6	0	0	0	0
Glucose (positive)	0-6	0	0	0	0
pH (mean)	0	5.979	6.021	5.708	5.859
	2	6.271	6.087	6.130	6.063
	4	6.375	6.104	6.042	6.043
	6	6.521	5.896	6.063	5.750
Specific gravity (mean)	0	1.012	1.013	1.013	1.013
	2	1.007	1.013	1.014	1.012
	4	1.015	1.014	1.013	1.016
	6	1.012	1.016	1.014	1.016

Table 4: Mean Hematology Values

Parameter	Week	Placebo	30 mL	300 mL	750 mL
Hematocrit (%)	0	40.24	39.96	40.03	40.12
	2	40.17	40.59	39.85	40.63
	4	40.44	40.11	40.51	40.45
	6	40.05	39.83	40.25	40.25
Hemoglobin (g/dL)	0	13.55	13.52	13.55	13.43
	2	13.44	13.61	13.36	13.50
	4	13.43	13.40	13.53	13.38
	6	13.35	13.32	13.40	13.32
MCV (femtoliter)	0	90.70	89.23	89.51	88.65
	2	91.35	89.78	89.96	89.22
	4	91.99	90.50	90.82	89.73
	6	91.76	90.55	90.94	90.04
Platelets (10^3/µL)	0	255.29	237.63	242.13	244.38
	2	254.46	243.79	251.29	244.42
	4	259.13	242.88	243.38	239.91
	6	251.08	232.04	251.04	236.92
Red cell count (10^6/µL)	0	4.44	4.50	4.48	4.54
	2	4.40	4.54	4.43	4.56
	4	4.40	4.45	4.46	4.52
	6	4.37	4.42	4.43	4.48
White cell count (10^3/µL)	0	5.74	6.02	5.65	5.32
	2	5.65	5.75	5.69	5.40
	4	5.66	5.56	5.63	5.21
	6	5.53	5.56	5.37	4.94
Basophils (10^3/µL)	0	0.034	0.03	0.026	0.027
	2	0.033	0.03	0.027	0.027
	4	0.035	0.027	0.026	0.026
	6	0.030	0.030	0.026	0.026
Eosinophils (10^3/µL)	0	0.18	0.17	0.18	0.15
	2	0.17	0.17	0.18	0.15
	4	0.19	0.17	0.20	0.14
	6	0.16	0.17	0.23	0.15
Lymphocytes (10^3/µL)	0	1.79	1.69	1.73	1.77
	2	1.79	1.73	1.73	1.77
	4	1.79	1.69	1.73	1.73
	6	1.71	1.64	1.66	1.71
Monocytes (10^3/µL)	0	0.51	0.55	0.51	0.46
	2	0.50	0.53	0.51	0.46
	4	0.49	0.49	0.51	0.46

	6	0.50	0.51	0.51	0.45
Neutrophils (10^3/μL)	0	3.22	3.59	3.20	2.91
	2	3.16	3.29	3.24	2.99
	4	3.15	3.19	3.16	2.85
	6	3.14	3.20	2.95	2.61
Activated partial	0	29.44	29.4	29.93	29.55
thromboplastin time (sec)	2	29.61	30.03	30.66	29.48
	4	30.35	30.5	30.39	30.22
	6	30.40	30.81	31.24	30.58
Prothrombin time (sec)	0	12.12	12.23	12.18	12.18
	2	11.9	11.95	12.06	11.99
	4	11.54	11.58	11.65	11.61
	6	11.83	11.76	11.81	11.75

Table 5: Mean Biochemistry Values

Parameter	Week	Placebo	30 mL	300 mL	750 mL
Alkaline phosphatase (U/L)	0	61.67	58.65	54.00	54.44
	2	55.80	57.83	51.16	54.47
	4	63.56	59.48	54.99	53.07
	6	62.69	61.50	58.22	55.04
Alanine aminotransferase (U/L)	0	17.80	18.00	17.88	21.98
	2	18.53	19.53	17.80	24.11
	4	18.99	20.10	17.75	22.71
	6	19.21	16.90	17.63	20.92
Aspartate aminotransferase (U/L)	0	18.30	18.55	18.27	20.71
	2	18.04	19.67	19.18	22.32
	4	18.93	19.55	19.19	20.90
	6	18.42	18.95	18.64	19.87
Total bilirubin (μmol/L)	0	12.12	10.55	10.93	11.3
	2	13.19	11.31	11.47	14.2
	4	12.23	11.63	12.07	14.03
	6	14.77	11.99	11.44	13.98
Cholesterol (mmol/L)	0	5.20	4.91	4.77	4.99
	2	5.11	5.09	4.78	5.15
	4	5.04	4.99	4.68	4.97
	6	4.91	4.90	4.61	4.99
Creatine kinase (U/L)	0	98.29	94.4	93.66	97.52

	2	102.5	96.88	97.32	98.74
	4	102.06	109.84	105.28	102.7
	6	97.25	121.97	100.41	93.90
Creatinine (µmol/L)	0	78.56	79.75	79.57	77.43
	2	74.73	76.28	77.20	75.74
	4	73.43	73.47	75.52	74.12
	6	70.91	74.86	74.39	73.51
y-Glutamyl transferase (U/L)	0	20.31	24.74	22.51	21.36
	2	21.19	26.74	23.03	20.99
	4	21.87	26.54	21.14	21.21
	6	21.11	24.22	20.00	21.07
Glucose (mmol/L)	0	4.59	4.51	4.74	4.70
	2	4.69	4.55	4.69	4.56
	4	4.75	4.58	4.6	4.62
	6	4.76	4.64	4.71	4.68
HDL cholesterol (mmol/L)	0	1.74	1.71	1.64	1.72
	2	1.71	1.72	1.58	1.70
	4	1.70	1.70	1.59	1.68
	6	1.73	1.73	1.62	1.76
LDL cholesterol (mmol/L)	0	3.04	2.78	2.67	2.86
	2	2.97	2.95	2.75	3.02
	4	3.02	2.94	2.75	2.99
	6	2.97	2.95	2.75	3.04
Total protein (g/L)	0	70.37	70.66	70.80	70.92
	2	69.60	70.65	69.37	70.72
	4	69.37	69.80	70.14	70.57
	6	68.70	69.26	69.45	69.61
Triglycerides (mmol/L)	0	0.95	0.94	1.02	0.86
	2	1.02	0.93	1.09	0.94
	4	0.81	1.03	1.00	0.89
	6	1.08	0.96	1.06	0.89
Uric acid (µmol/L)	0	267.93	268.37	261.49	273.01
	2	257.41	263.60	254.29	274.22
	4	265.90	284.91	265.89	298.11
	6	286.98	298.26	271.89	300.67

Adverse events, both intermittent and constant, reported in the placebo and noni juice groups were headache, cough, nausea, menstrual cramps, nasal discharge, stomachache, toothache, other aches, sore throat, vomiting, increased bowel movements, gum, upper respiratory, and urinary tract infections. During the trial, 20 to 50% fewer total adverse events were experienced by the noni groups than in the placebo group. A marginally significant decrease in the number of constant adverse events was evident in the 300 mL noni juice group, compared to the placebo ($P < 0.1$). A similar trend of lower constant adverse events was observed in the other noni juice groups, as well. Headache was the most commonly reported constant adverse event; however, a lower incidence was reported for this and other aches in the noni juice groups. No increased use of concomitant medications was observed in any of the noni juice groups.

Discussion

This clinical safety study substantiates the use of noni juice as a safe food, and revealed a lack of adverse effects from any of the biochemical and physiological parameters tested. Noni fruit was commonly consumed among past generations of Pacificans as a supplementary food;[30] not eaten in every meal as some staples were, but quite often nevertheless. Other examples of supplementary foods consumed by Pacificans are telie or tavola (*Terminalia catappa*) nuts and fruit, *fao* or *vao* (*Neisosperma oppositifolia*), and louakau or hala (*Pandanus tectorius*).[30, 31] Noni fruit was also used to promote endurance on long ocean voyages, no doubt a function of its antioxidant properties.[30, 32] It is likely that this use, and its value as food and medicine, was the motivation for Pacificans to take noni with them from island to island as they colonized the Pacific.

Through generations of use, Pacificans understood the nature of the fruit and found it suitable for use among the elderly. It was reportedly consumed frequently by the elderly in Kiribati after boiling.[30] We have observed frequent consumption of the fruit by elderly Tongans, as well. Once a week, the fruit was washed and cut into several pieces, chewed, and then swallowed. This was thought to strengthen the body and promote gastrointestinal health. The flesh of the coconut was also scraped, mixed with noni fruit, and then eaten. Over time, any toxic or side effects from noni fruit would have become apparent, as the elderly are typically more susceptible than younger adults. Use of noni fruit by the elderly seems to agree with the results of this trial.

In vitro toxicity tests and oral toxicity tests in vivo have not revealed any toxic effects from high doses of noni juice.[33-35] Clinical symptoms, body weights, blood tests, and histopathology examinations did not suggest any potential or actual toxic effects. The results of this study confirm that the previous *in vitro* and *in vivo* conclusions of safety are applicable to humans, even at relatively high quantities of noni juice ingestion.
A lower number of constant, as well as total, adverse events in the noni juice groups indicate that noni juice may positively influence health, especially headaches and other aches. However, this trial was conducted in healthy adult volunteers and not during the typical cold and influenza season. Thus, large differences in illness rates would not be expected.

The differential leukocyte counts reveal much about the possible mechanism behind potential increased resistance to infection, as well as potential for any adverse effects from noni juice. Increases in certain leukocyte populations may result in unhealthy states, such as eosinophilia. However, no such proliferation occurred, and there were no differences between any groups. It seems apparent, therefore, that any improvement in immune system performance is kept under control through feedback mechanisms and is specific. Research conducted *ex vivo* reveals that specific and controlled immunomodulatory effects

follow oral administration of noni juice, where an increase in interferon-y and a decrease in interleukin-4 (associated with eosinophilia) production were observed.[36] It appears that leukocyte performance is apparently modulated, and not white cell count.

Noni juice had no effect on liver function tests. Alkaline phosphatase, alanine aminotransferase, aspartate aminotransferase, and y-glutamyl transferase were all within normal levels. Recent case reports of liver toxicity from noni juice[37-39] are not supported by the results of this trial.[40-42]

Conclusion

There was some limited indication that noni juice may improve overall health. However, the ability of this trial to reveal such effects is limited since the design of the trial was to evaluate the safety of noni juice. No adverse changes to weight, vital signs, or ECG results occurred. Further, adverse physiological effects were not evident in urinalysis, hematology, or biochemistry tests. Although there were no statistically significant differences between the placebo and noni juice groups, relative to occurrence and severity of adverse events, there was a decreasing trend among consumers of all noni juice doses compared to the placebo group. A marginally significant decrease in the number of subjects experiencing constant adverse events was evident in the 300 mL noni juice group, when compared to the placebo group. This human clinical safety study reveals that daily consumption of noni juice is well tolerated, even at high doses.

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References

1. Morton JF. 1992. The ocean going noni, or Indian Mulberry (Morinda citrifolia, Rubiaceae) and some of its 'colorful' relatives. Econ Bot 46(3):241 56.
2. Finau SA. 2001. Marching from the margin: a health vision for Pacificans of Aotearoa. N Z Med J. 114(1134):296-298.
3. (CTHAR) College of Tropical Agriculture and Human Resources. University of Hawaii at Manoa. The Noni Website. Noni's Natural Habitats in Hawaii. http://www.ctahr.hawaii.edu/noni/natural_habitats.asp. Accessed 7 December 2006.
4. Deng S, Palu AK, West BJ, Su CX, Zhou BN, Jensen JC. Lipoxygenase Inhibitory Constituents of the Fruits of Noni (Morinda citrifolia) Collected in Tahiti. J Nat Prod. 2007 May;70 (5): 859-862.
5. Mohd Zin Z, Hamid AA, Osman A and Saari N, Antioxidative activities of chromatographic fractions obtained from root, fruit and leaf of Mengkudu (Morinda citrifolia L.). Food Chem 94:169-178 (2006).
6. Kamiya K, Tanaka Y, Endang H, Umar M, Satake T. Chemical constituents of Morinda citrifolia fruits inhibit copper-induced low-density lipoprotein oxidation. J Agric Food Chem. 2004 Sep 22; 52(19):5843-8.
7. Rock JF. 1913. The indigenous trees of the Hawaiian Islands. Honolulu: Patronage. 467p.
8. Wilder GP. 1934. The flora of Makatea. Bernice P. Bishop Museum Bull 120. Honolulu: Bishop Museum Press. 45 p.

9. Brown FBH. 1935. Flora of southeastern Polynesia. III. Dicotyledons. Bishop Museum Bull 130. Honolulu. 386 p.
10. Yuncker TG. 1943. The Flora of Niue Island. Bernice P. Bishop Museum Bull, 178. Honolulu: Bishop Museum Press. 113 p.
11. Turbott IG. 1949. Diets, Gilbert and Ellice Islands colony. J Polynesian Soc 58(1):36-46.
12. Stone BC. 1970. "Morinda Linnaeus" Micronesica 6:5512.
13. Degener 0. 1973. Plants of Hawaii national park illustrative of plants and customs of the South Seas. Ann Arbor, Michigan: Photo Lithoprint Reproductions, Braun Brumfield, Inc. 285 p.
14. Uhe G. 1974. In: Wayside plants of the South Pacific. Albany, New Zealand: Stockton House. 155 p.
15. Seemann B. 1977. Flora vitiensis: a description of the plants of the Viti or Fiji islands with an account of their history, uses, and properties. J. Cramer. Reprint 129.
16. Whistler WA. 1992. Polynesian herbal medicine. Hong Kong: National Botanical Garden. 173 p.
17. Krauss BH. 1993. Plants in Hawaiian culture. Honolulu: Univ Hawaii press. 16 p.
18. Terra JA. 1996. Tropical Vegetables. Knoninklyk Instituut voor de Tropen, Amsterdam. 61 p.
19. Cheeseman TF. 1903. The flora of Raratonga, the chief island of the Cook group. Transactions of the Linnean Society London 6:261-313.
20. Sturtevant EL.1919. Sturtevant's notes on edible plants. (edited by Hedrick, UP) Geneva, New York: New York Agr. Exper. Sta. 368 p.
21. Maiden JH. 1889. Useful native plants of Australia (and Tasmania). Technol Museum of New South Wales, Sydney. 45 p.
22. Parkinson S. 1773. A journal of a voyage to the South Seas, in His Majesty's ship the Endeavour. London. Available from: http://nla.gov.au/nla.cs-ss-jrnl-parkinson-068.
23. Merrill E D. 1943. Technical manual (TM 10-420): emergency food plants and poisonous plants of the islands of the Pacific. Washington DC: US GPO. 71 p.
24. Dignan C, Burlingame B, Kumar S and Aalbersberg W. The Pacific Islands Food Composition Tables. 2nd ed., UN FAO, Rome, (2004).
25. Leung WTW, Butrum RR, Chang FH, Rao MN and Polacchi W. Food composition table for use in East Asia, in US Dept Health, Education,Welfare (DHEW) Publ (NIH) 73-465, Bethesda, MD (1972).
26. [EFSA] European Food Safety Authority. 2006. Opinion on a request from the Commission related to the safety of noni juice (juice of the fruits of Morinda citrifolia). EFSA J 376:1–12.
27. West BJ, Tolson CB, Vest RG, Jensen S, Lundell TG. Mineral variability among 177 commercial noni juices. International Journal of Food Sciences and Nutrition 2006a. Nov-Dec;57(7):556-8.
28. Farine, J.P., Legal, L., Moreteau, B., and Le Quere, J.L. (1996). Volatile components of ripe fruits of Morinda citrifolia and their effects on Drosophila. Phytochemistry Oxford 41(2):433-438.
29. Peerzada, N., Renaud, S., and Ryan, P. (1990). Vitamin C and elemental composition of some bushfruits. Journal of Plant Nutrition 13(7):787-784.
30. Thaman RR. 1992. Batiri kei bravi: the ethnobotany of Pacific island coastal plants. Atoll Res Bull 361:1-62.
31. Barrau, J. 1958. Subsistence Agriculture in Melanesia. Honolulu: Bernice P. Bishop Museum, Bulletin 219. 111 pp.
32. Ma DL, West BJ, Su CX, Gao JH, Liu TZ, Liu YW. Evaluation of the ergogenic potential of noni juice. Phytotherapy Research. 2007 Nov; 21(11):1100-1101.
33. Westendorf J, Effenberger K, Iznaguen H, Basar S. Toxicological and analytical investigations of noni (Morinda citrifolia) fruit juice. J Agric Food Chem. 2007 Jan 24;55(2):529-37.

34. West BJ, Jensen CJ, Westendorf J. 2006b. Noni juice not hepatotoxic. World J Gastroenterol 12(22): 3616-9.
35. Mancebo A, Scull I, Gonzales Y, Arteaga ME, Gonzales BO, Fuentes D, Hernandez O, Correa M. 2002. Ensayo de toxicidad a dosis repetidas (28 dias) por via oral del extracto acuoso de Morinda citrifolia en rata Sprague Dawley. Rev Toxicol 19:73-7.
36. Palu AK, Kim AH, West BJ, Deng S, Jensen J, White L. The effects of Morinda citrifolia L. (noni) on the immune system: Its molecular mechanisms of action. J Ethnopharmacol. 2008 Feb 12;115(3):502-6.
37. Millonig G, Stadlmann S, Vogel W. Herbal hepatotoxicity: acute hepatitis caused by a Noni preparation (Morinda citrifolia). Eur J Gastroenterol Hepatol 2005; 17: 445-447.
38. Stadlbauer V, Fickert P, Lackner C, Schmerlaib J, Krisper P, Trauner M, Stauber RE. Hepatotoxicity of NONI juice: report of two cases. World J Gastroenterol 2005; 14: 4758-4760.
39. Yuce B, Gulberg V, Diebold J, et al.: Hepatitis Induced by Noni Juice from Morinda citrifolia: A Rare Cause of hepatotoxicity or the Tip of the Iceberg?. Digestion 2006; 73:167-170.
40. West BJ. Hepatotoxicity from interferon-beta not noni juice. Digestion 2006;74:47-48.
41. Jensen CJ, Westendorf J, Wang MY, Wadsworth DP. Noni juice protects the liver. Eur J Gastroenterol Hepatol. 2005 Apr;17(4):445-7.
42. Wang MY, Nowicki D, Anderson G, Jensen J, West B. Liver Protective Effects of Morinda citrifolia (Noni). Plant Foods Hum Nutr. 2008 Mar 4 [Epub ahead of print].

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