Journal of Medicinal Food Plants Vol. 1(2), pp. 64 - 79, July – December 2009
Available online at htt://www.jmedfoodplants.com
ISSN 1947-3710


*Full Paper*

# The benefits of noni juice: an epidemiological evaluation in Europe

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*Accepted 15 September 2009*

*Morinda citrifolia* L. (noni) is a tropical plant with a long tradition of usage for food and medicinal purposes, mainly in the South pacific and tropical parts of Asia. In recent years noni fruit juice has become very popular worldwide with an annual consumption of over 80 million liters. The aim of the present investigation was to qualitatively and quantitatively analyze the beneficial effects of noni juice in Europe. A questionnaire was applied to 1142 participants at a noni user's convention in 2003. Additionally, in 2004, a data bank with the same questionnaire was launched in the internet, resulting in 570 respondents. The median age of all participants was 47 years and a gender distribution of 43% men and 57% women. The number of different benefits reported per person was: 0 (11.5%), 1 (42.2%), 2 (29.1%), 3 (13.1%), 4 (3.5%), and 5 and 6 (0.12% each). Adverse effects of noni juice were reported by 0.35% of the participants. The percentage of women increased with the number of benefits reported per person. About 30 different benefits were reported. The most frequent were: more energy (39.3%), better overall feeling (20.8%), reduction of peripheral pain (17.1%), fewer infections (10.3%), improved sleep (8.4%), fewer problems with digestion and stomach (8.9%), and fewer allergies and asthma (7.1%). Among the less frequent benefits were reductions of blood pressure and cholesterol level, reduction or cessation of smoking, less menstrual or menopausal problems, and a reduction of side effects caused by chemotherapy and irradiation in cancer patients.

*Keywords:* noni, *Morinda citrifolia*, epidemiology, health benefits

## Introduction

Noni juice prepared from the fruit of the tropical tree *Morinda citrifolia* L. has a long tradition as a folk medicine, mainly in the South Pacific area [1, 2]. The ancient Polynesians took noni juice for maintenance of good health and increased endurance [3]. It was also used for the treatment of several diseases and conditions, such as arthritis, headache, muscle pain, wounds, diabetes, broken bones, infections, and even cancer [4]. Prior to the nineties of the last century, little was known in the industrial countries about noni and its benefits.

Following a publication by Heinicke [5], interest in the beneficial effects of noni accelerated and commercial activities began on the islands of Hawaii. On the mainland a noni drink company Morinda Inc. was formed in 1996. It was later re-

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named as Tahitian Noni® International. Their product Tahitian Noni® Juice (TNJ) soon became very popular as a wellness drink in USA, Canada, and Japan. In the European Union TNJ underwent a "novel food" approval process before regular marketing was permitted. The official approval was issued 2003 [6]. Today the product is available in more than 50 countries and annual consumption exceeds 80 million liters.

Before the 1990s, there were few publications about noni. Since 2000, publications about noni have increased considerably. These include studies about the chemical composition and biological activity *in vitro*, animal studies and clinical trials in men [7, 8].

Numerous non-scientific reports on the beneficial effects of noni are available. However, an extensive scientific survey on the beneficial effects of the plant kura (noni) in Fiji was published by Pande [9]. More than 400 people were interviewed or answered a questionnaire about their experiences with noni products. Although noni was reported to be beneficial in about 66 medical conditions, one-third of the reports were concerned with only five different conditions: joint pain and swelling, muscle pain, headache, backache, and blood pressure. This demonstrates a clear preference for the treatment of inflammatory conditions and pain with noni products.

The present investigation was performed to analyze the usage of noni juice in Europe. In order to avoid confusion resulting from the use of products with different quality, only persons drinking Tahitian Noni® juice (TNJ), a highly standardized product marketed by the American company Tahitian Noni® International, were included in the study.

## Materials & Methods

The investigation consisted of two separate studies. The first occurred at an international meeting of independent TNJ distributors held in Copenhagen Denmark in October 2003. The participants were asked to answer a questionnaire about their TNJ usage and possible benefits they experienced. A total of 1142 questionnaires was received and evaluated from > 3000 participants. Secondly, in 2004 an unlimited open evaluation (using the same questionnaire as in the Copenhagen study) was started on the internet at www.tni-study.com. This study is currently ongoing with a total of 570 questionnaires received to date.

Questions asked are:

1. What is your gender and age?
2. How did you get aware of NONI?
3. When did you start to take NONI?
4. How often do you take NONI?
5. What is the average single dose of NONI you take?
6. What was the reason for taking NONI?
7. Did you experience any change in your behaviour after taking NONI?
8. Did you consult a doctor before you took NONI?
9. Do you still consult your doctor after taking NONI?
10. Does your doctor know that you take NONI?
11. Do you think NONI helped you with your disease?
12. Does your doctor recommend you to take NONI?
13. Do you smoke?
14. If yes, since when and how many cigarettes per day?
15. Did your smoking behaviour change after you started drinking NONI?
16. Would you participate in a more detailed investigation schedule?
17. Room for comments

Questions 13-15, regarding the smoking behaviour, were not presented in the Copenhagen questionnaire.

Student's t-test for independent two samples was used for statistically comparison of the age of participants and duration and amount of TNJ intake between subgroups and the total cohort. The

evaluation of statistically significant differences of the fraction of males or females and the involvement of a doctor (yes or no) in subgroups compared to the total cohort was performed using Bernoulli's binominal distribution. Two groups of data were stated "significantly different" if the calculated p-value was ≤ 0.05.

## Results & Discussion

*Copenhagen evaluation*

The Copenhagen meeting was held to celebrate the Novel Food approval of TNJ by the EU commission. Although there were representatives of most European countries, Scandinavian countries and Germany predominated. The questionnaire was provided to the participants in 11 different languages, and included 1142 respondents: Sweden (325), Germany with Austria and Switzerland (302), Norway (204), Denmark (98), Hungary (95), Great Britain (41), Finland (22), The Netherlands (15), France (11), USA (10), other (19).

*General statistics*

A statistical overview of data received from the study is shown in Table 1. About 62% of the participants were female and 38% were male. The average age of all participants was 48.2 years and shows almost a Gaussian distribution. There was a slight but significant difference in the median age between females (48.7 years) and males (47.3 years).

The average daily intake of TNJ was about 52.3 mL per day. An analysis of the daily consumption by the participants is shown in Table 2. Only 8 people took less than 1 oz. (30 mL) per day (0.7%); whereas the majority (1047), consumed 1-3 oz. per day (i.e. 30-90 mL). A few (7.6%) took > 3 oz. TNJ per day. This represents approximately 1 bottle (1 L) per week. There were no significant differences in the TNJ intake between male (52.8 mL) and female (52.0 mL) participants.

The average duration of TNJ intake was 26.4 months. Some participants started drinking TNJ as much as 5 years prior to October 2003. This is shortly after TNJ first became available in Europe. The maximum frequency of the duration of TNJ consumption was 4 months. This indicates that a considerable number of participants began consuming TNJ immediately following the EU approval in May 2003. The period prior to EU approval, when TNJ was only available via the internet, shows a frequency plateau until 44 months and a continuous decrease thereafter. The "oldest" TNJ consumers started 65 months prior to the October meeting (May 1998). The median duration (months) of TNJ intake for the genders was not significantly different (male = 26.9, female = 26.2).

An average of about 27% of the participants reported their family doctor was aware they were taking TNJ. However, significantly more women (28.9%) than men (23.6%) did so.

**Table 1**. Statistics of TNJ usage in European countries evaluation of the Copenhagen study from October 2003.

| Country (N) | Gender % (M/F) | Average Age ± SD | Average daily Intake (mL) ± SD | Average duration of TNJ intake ± SD | % with doctor involved |
|---|---|---|---|---|---|
| All (1142) | 38/62 | 48.2 ± 11.9 | 52.3 ± 24.9 | 26.4 ± 21.8 | 27 |
| Germany (303) | 48/52 | 46.8 ± 11.4 | 51.3 ± 22.3 | 17.0 ± 18.2 | 36 |
| Sweden (325) | 32/68 | 50.2 ± 11.9 | 48.4 ± 22.3 | 33.2 ± 22.2 | 22.5 |
| Norway (204) | 40/60 | 48.7 ± 12.0 | 65.3 ± 25.2 | 33.0 ± 18.2 | 31 |
| Denmark (98) | 34/66 | 48.0 ± 11.1 | 41.6 ± 22.3 | 19.5 ± 18.3 | 24.5 |
| Hungary (95) | 40/60 | 43.5 ± 11.5 | 44.1 ± 22.6 | 25.1 ± 18.3 | 7 |

**Table 2**. Daily intake of TNJ (N = 1143)

| Oz. per day | Total | % |
|---|---|---|
| < 1 | 8 | 0.7 |
| 1 - 2 | 472 | 41.3 |
| 2 - 3 | 575 | 50.4 |
| > 3 | 87 | 7.6 |

*Beneficial effects of TNJ reported in the Copenhagen study*

About 96 participants (8.4%) claimed no benefits, although some had only recently started taking TNJ and had little experience. Among those who acknowledged beneficial effects, many had consumed TNJ for more than one year. They usually reported that they wanted to maintain good health. Some reported a single benefit, while many others experienced a variety. An overview of the most important benefits including all countries is shown in Tables 3 and 4.

About 25% reported an improvement in overall well being. The distribution in gender, mean age, daily intake, and duration of intake was not statistically different among the participants. The involvement of a doctor was less in both sexes compared to the total; however, statistical significance was only achieved in male participants. This indicates that participants reporting this benefit are mostly healthy and like to maintain their health.

An increase of energy and endurance was reported by 29.5% of the participants (25.5% of all men and 31.9% of all women). An increase in energy seems to be a typical symptom associated with the use of TNJ. A man from Denmark expressed this feeling very characteristically by saying: "I feel like a Viking". Some participants reported they needed less sleep. A historical counterpart to this observation was reported from the ancient Polynesians, who took Noni juice before they started long fishing trips on the open sea where they got no sleep for days [3]. A publication performed with mice also demonstrated an improvement of endurance. Treated mice swam longer and their attention and skill increased significantly [10]. A recent human trial performed with highly trained athletes confirmed this finding. Two groups of 20 persons, each drank either blackberry juice or TNJ (200 mL per day) for a total of 21 days. The TNJ group showed a highly significant increase in the time to fatigue on a treadmill [11].

The most frequent real health benefit was directed to peripheral pain. In most cases this was related to inflammatory pain in joints and the back; however the benefit was also directed to muscular and abdominal pain. This benefit was reported by 16.2% of the participants. A survey of different countries showed no change in the frequency of this benefit. It is therefore very unlikely that this benefit is due to a placebo effect. The median age in this subgroup was significantly higher compared to all participants (51.6 versus 48.2 years). This is also observable for both sexes (Table 4). The daily intake in this group was higher compared to the control, although not statistically significant. A separate estimation by sex showed a significant increase for men. Half of the participants in the subgroup reported their doctor knew about their noni usage. This is a highly significant increase compared to the control and is observable for both sexes. Many participants reported a reduction of their medication after they started consuming TNJ. Some ceased their medication entirely. Two women from Sweden, 60 and 66 years old, reported a rapid recovery after a hip surgery, including a significant decrease in use of analgesics. A 37 year-old woman from the same country, with a long history of analgesic consumption for a shoulder muscle, replaced her medication with two oz. of TNJ per day. A 47 years-old man with Morbus Bechterev (a painful stiffening of the backbone) reduced his medication almost completely after starting with TNJ.

Reduction of pain was also the most common benefit from noni use by Fijians [9]. Similar benefits are also reported from traditional use of noni on South Pacific Islands [1, 2]. Experiments performed with mice showed a decrease

**Table 3.** Benefits from TNJ in the order of their frequency.

| Benefit | No. (%) | Gender % (M/F) | Average age in years | Average daily intake (mL) | Duration of TNJ intake (month) | % with doctor involved |
|---|---|---|---|---|---|---|
| All participants | 1142 (100) | 38/62 | 48.2 | 52.3 | 26.4 | 27* |
| More energy | 337 (29.5) | 34/66 | 47.2 | 53.3 | 27.7 | 17.2* |
| Better overall feeling | 285 (25.0) | 38/62 | 48.5 | 51.4 | 24.5 | 19.6* |
| Less peripheral pain | 184 (16.2) | 31/69 | 51.6* | 55.9 | 29.6 | 53.3 |
| Fewer infections | 141 (12.4) | 29/71* | 50.1 | 52.5 | 36.8* | 25.5 |
| Better sleep | 97 (8.6) | 33/67 | 50.2 | 59* | 27.8 | 18.6 |
| Less problems with digestion and stomach | 94 (8.2) | 27/73* | 50 | 55 | 26.6 | 24.2 |
| Fewer allergies and asthma | 79 (7.0) | 37/63 | 45.6 | 58.8* | 32.4* | 41* |
| Improved skin | 67 (5.9) | 27/73 | 45.9 | 51.9 | 23.5 | 29.9 |
| Reduction of headache | 46 (4.1) | 17/83* | 46.9 | 48.9 | 25.7 | 37 |
| Fewer gynaecological problems | 30 (4.4)† | 0/100 | 44.2* | 63* | 26.4 | 33.3 |
| Improved growth of hair and nails | 24 (2.1) | 29/71 | 49 | 46.3 | 27 | 12.5 |
| Reduction of BP and cholesterol | 22 (1.9) | 50/50 | 52 | 50.5 | 32.6 | 50* |
| Reduction of diabetes | 16 (1.4) | 62/38* | 49.1 | 54.4 | 32.2 | 43.8 |
| No effect on diabetes | 4 | 50/50 | 58.3 | 37.5 | 39 | 50 |
| Reduction or stop of smoking | 10 (0.87) | 80/20 | 53.6 | 60 | 30.4 | 0.2 |
| Less gingival problems | 9 (0.79) | 22/78 | 48.1 | 18.9 | 50 | 22.2 |
| Improved wound healing | 5 (0.44) | 40/60 | 47 | 48 | 19.8 | 20 |
| Loss of warts | 5 (0.44) | 0/100 | 49.2 | 36 | 23.6 | 20 |
| Reduction of osteoporosis | 5 (0.44) | 0/100 | 48.5 | 75 | 37.8 | 80 |
| Improve of sexual potency | 5 (0.44) | 100/0 | 44.2 | 42 | 19.6 | 0 |

†Based on female participants: *Significantly different ($P < 0.05$) from all participants

in pain sensitivity estimated by the acetic-acid-induced writhing test [12]. A hot plate test performed in our lab also showed a reduced thermal sensitivity of mice after adding TNJ in the drinking water [13]. A possible mechanism of the pain reduction is the inhibition of the arachidonic acid metabolism, leading to prostaglandins, which are involved in the sensitization of sensory nerve endings. Noni fruit extracts were shown to inhibit cyclooxigenases I and II and lipoxigenases 5 [14, 15]. At least a partial involvement of the endogenous antinociceptive system is also possible because the injection of naloxon, an opioid receptor antagonist, did reduce the pain reduction caused by TNJ in the hot plate test partially.

There is evidence from experimental work that noni fruit contains an oligosaccharide complex (noni PPT) with immune stimulatory efficiency [16, 17]. This is confirmed by our epidemiological observation. About 12.4% of the participants in the Copenhagen study reported a considerable decrease in infections (especially respiratory). The subgroup makeup was predominantly women (71% versus 62% in the control group). The median age was slightly higher (50.1 versus 48.2 years). People with fewer infections consumed the same quantity of TNJ daily as the average participants, indicating that this benefit does not require high doses. However, there was a highly significant increase in the median total duration of TNJ consumption in this subgroup compared to the control (Table 3). Obviously the observation of fewer infections needs at least a full period of seasons, because most infections occur in the winter time. In this context it is interesting to note that the highest reduction of infections was observed in Sweden and Norway. Both countries have long and dark winter periods, as well as the longest history of TNJ usage.

Participants often reported they did not have problems falling asleep, nor did they awaken in the night, in contrast to the time before they took TNJ. This benefit was reported by 97 participants (8.6 %). Many had other health problems which disappeared after beginning use of TNJ. The improvement of sleeping behavior could therefore result from reduction of pain, depression, allergic symptoms or other diseases which make sleeping difficult. The average age of people reporting better sleep is higher compared to the total with a difference approaching significance. There is a highly significant increase in the daily dose (59 versus 52 mL).

Fewer problems with digestion and the stomach were reported by 94 participants (8.2%). This benefit was reported mainly by women. The difference in the gender distribution compared to the control is highly significant. This may be due to the fact that women (medium age 50.0 years) have more problems with digestion, due to the onset of menopause. Apart from this study we often observed that the first effect is an improvement of digestion, mostly by elderly people, after starting TNJ. It sometimes begins with slight diarrhea which disappears after a few weeks.

Asthma and allergies were combined into one group because these diseases are often associated. The total number of persons reporting benefits with these diseases was 79 or 7.0%. There was no difference in the distribution between sexes; however, the average age was reduced compared to all participants (45.6 versus 48.2 years). The daily dose and duration (months) of TNJ intake was significantly increased with respect to the control. This indicates that this benefit is dose and time dependent. Also, the fact that significantly more participants (41%), had physician involvement, indicates they had serious health issues.

Beneficial effects on the skin were reported by 67 individuals (5.9%). As expected, this benefit is mostly observed by women because they take better care of their skin compared to men. All other parameters were non-significant, regardless of gender. This group includes persons

**Table 4.** Benefits from TNJ separated for men and women.

| Benefit | Number (%) | | Average age | | Average daily intake (mL) | | Duration of TNJ intake (month) | | % with doctor involved | |
|---|---|---|---|---|---|---|---|---|---|---|
| | male | female | male | female | male | female | male | female | male | female |
| All participants | 440 | 702 | 47.3 | 48.7 | 52.9 | 52 | 26.9 | 26.2 | 23.6 | 28.9 |
| More energy | 112 (25.5) | 224 (31.9) | 44.8 | 48.6 | 57.3 | 51.6 | 32.6* | 24.9 | 17.6 | 17.5* |
| Better overall feeling | 109 (24.8) | 174 (24.8) | 46.4 | 49.8 | 30.9 | 52.8 | 24.5 | 24.7 | 14.6* | 22.9 |
| Less peripheral pain | 58 (13.2) | 126 (17.9) | 50.6* | 51.9* | 60.5* | 53.8 | 31.8 | 28.8 | 46.5* | 56.3* |
| Fewer infections | 41 (9.3) | 100 (14.2) | 50.9* | 49.8* | 54.8 | 51.6 | 43.3* | 34.3* | 21.9 | 27 |
| Better sleep | 32 (7.3) | 86 (12.3) | 49.8 | 51.2 | 56.2 | 59.8* | 34.8* | 23.8 | 25 | 13.9* |
| Less problems with digestion and stomach | 25 (5.9) | 69 (9.8) | 51.2 | 49.5 | 56.5 | 54.3 | 25.6 | 27 | 30.7 | 21.7 |
| Fewer allergies and asthma | 29 (6.6) | 50 (7.1) | 45.9 | 45.3* | 69.3* | 52.8 | 30.9 | 33.4* | 44.8* | 38 |
| Improved skin | 18 (4.1) | 48 (6.8) | 45.3 | 46.8 | 51.6 | 52.5 | 29.1 | 21.7 | 33.3 | 27.1 |
| Reduction of headache | 8 (1.8) | 38 (5.4) | 47.6 | 46.8 | 15.5 | 47.3 | 56.3 | 27.9 | 37.5 | 36.8 |
| Fewer gynaecological problems | | 30 (4.3) | | 44.2* | | 63.0* | | 26.4 | | 33.3 |
| Improved growth of hair and nails | 6 (1.4) | 17 (2.4) | 53.3 | 47.4 | 50 | 44.1 | 60.1* | 16.3 | 0 | 17.6 |
| Reduction of BP and cholesterol | 11 (2.5) | 10 (1.4) | 52 | 53.6 | 54.5 | 48 | 39.5 | 24.3 | 45.4 | 50 |
| Reduction of diabetes | 10 (2.3) | 6 (0.9) | 51.1 | 45.8 | 60 | 45 | 34.8 | 27.8 | 30 | 66.7* |

*Significantly different ($P < 0.05$) from all participants

who reported cosmetic effects, such as "my skin is softer" or "wrinkles disappeared," and others with skin diseases, such as neurodermatitis or psoriasis. Among this group are also persons who successfully treated their skin topically with TNJ.

Headache was separated from peripheral pain, because it may have totally different causations. Physical and psychic stress, muscular spasms in the shoulder and neck, imbalance of liquor pressure and spasm or dilatation of brain arteries can all cause headaches. The origin of headache is often multi causal and non-specific. Typical answers in the questionnaire were:

Fewer headaches, better sleep, more energy;
More energy, better overall condition, fewer headaches;
Less allergy, fewer headaches, better overall feeling;
Fewer headaches, menopausal symptoms, and muscular spasms in the shoulder area.

Some participants reported fewer headaches as the only benefit received from TNJ. This was especially so if the headache was characterized as "migraine". The total participants with reduced headaches were 46 (4.1%). About 83% of these were female, a highly significant increase compared to the total participants. There was a significant increase in the involvement of a doctor in the migraine group compared to the total headache group. About 75% of persons with migraines contacted a doctor, confirming that the headache was not falsely diagnosed. Patients with migraines typically contact a doctor because they need prescription medicine.

Reduction of gynaecological problems was reported by 30 women (4.4%). Most reported fewer problems with symptoms associated with menstrual bleeding. The average age of this group is therefore significantly less compared to the control (44.2 versus 48.2 years). Extraction of women reporting fewer menopausal symptoms (6 of 30), results in an average age of 51.7 years. There is also a significant increase in the daily amount of TNJ consumed (63 versus 52 mL). Only one-third of the women in this group had a doctor involved. This demonstrates that problems with the menstrual cycle or menopausal symptoms are mostly accepted by women and not interpreted as a disease.

Improved growth of hair and nails was reported by 24 (2.1%) participants, 7 men and 17 women.

A reduction of blood cholesterol and blood pressure was observed by 22 (1.9%) participants (11 men and 10 women). There is also an increase in the average age, daily intake, and duration of intake (not all are statistically significant). Only the percentage of a doctor involvement was significantly increased compared to the control group. This is likely because the diagnosis of blood pressure (BP) and cholesterol needs a physician. Three persons (one man and two women) reported no reduction of BP after consuming TNJ, although they had already consumed two oz. per day for two years. We suggest a clinical study to further evaluate the potential of TNJ to reduce the BP. A reduction of blood cholesterol was demonstrated in a clinical study with smokers [18], in which TNJ was shown to reduce the total cholesterol and quantity of LDL, whereas the HDL level increased.

About 16 participants (1.4%, 10 men and 6 women), reported a reduction of blood sugar and less need for medication with diabetes. Normally the persons have diabetes type II which can be treated with drugs. There was however, one male participant with type I diabetes who reported that after beginning to use TNJ, he was able to reduce the doses of insulin. Four other participants reported no effect from TNJ on their diabetes; although they recognized other benefits of TNJ, such as reduced stomach problems, less loss of hair, better sleep and fewer headaches. One person reported no effect on his diabetes or BP.

Benefits reported by 10 or fewer persons were: reduction of smoking (10), less gingival bleeding (9), improved wound healing (5), loss of warts (5, all women), reduction of osteoporosis (5, all women), and improved sexual potency (5, all men).

*Data bank evaluation*

An open data bank evaluation was launched in 2004. The questionnaire was the same as used for the Copenhagen study, except questions about the smoking history of the participants were added. In contrast to the Copenhagen study, the 2004 study involved more frequent communication with the participants after providing the questionnaire, which provided more detailed information about the cases. If the participant's doctor recommended the patient consume TNJ, we contacted their physician to obtain authorized medicinal information.

**Table 5.** Statistics on the participants of the data bank study (N=570)

| Count | Average age | Average daily intake (mL) | Month after start of TNJ intake | Doctor involved (%) |
|---|---|---|---|---|
| 570 (all) | 44.1 ± 11.1 | 69.5 ± 37.7 | 14.8 ± 16.6 | 21.6 |
| 271 (female) | 44.2 ± 9.7 | 72.0 ± 39.6 | 14.6 ± 15.8 | 29.3 |
| 299 (male) | 43.9 ± 12.3 | 67.3 ± 35.5 | 14.8 ± 20.6 | 14.7 |

*General statistics*

A statistical overview of data received from this study is shown in Table 5. Data were available from 570 individuals (299 males and 271 females). Thus, male participants were more frequent in this study compared to the Copenhagen study (52 versus 38%), and the average age of all participants was lower (44.1 versus 48.2 years). The age distribution is highly symmetrical with a plateau between 35-55 years. There was no significant difference between the median age of males (43.9) and females (44.2).

The average daily intake of TNJ was about 70 mL per day. There was a slight non-significant difference between male (67.3 mL) and female (72.0 mL) participants. A differentiation of the daily intake is shown in Table 6.

**Table 6.** Daily intake of TNJ (N= 570)

| Oz. per day | Total | % |
|---|---|---|
| < 1 | 1 | 0.18 |
| 1-2 | 208 | 36.5 |
| 2-3 | 200 | 35.1 |
| 3-4 | 129 | 22.6 |
| >4 | 32 | 5.6 |

The median duration time of TNJ intake was 14.7 months. About 60% of the participants had a history of TNJ intake < one year. A minor percentage had a history of taking TNJ for several years, with a maximum of 8 years.

About 22% of the participants reported that their family doctor was aware they were consuming TNJ. As in the Copenhagen study, the difference in the frequency of physician awareness (Table 5), between men and women was highly significant (men = 14.7%, women = 29.3). There was a reduction of men with physician involvement compared to the Copenhagen study, whereas the percentage in the women cohort was almost identical in both studies.

*Beneficial effects of TNJ*

An overview of the beneficial effects from TNJ is shown in Table 7. As in the Copenhagen study, an increase in energy was reported by 30.7% of the participants. There was no difference in sex distribution compared to the total, however, there was a significant decrease in the daily intake and involvement of a doctor. A man, age 63, reported a 5% increase in performance of long-distance running.

Seventy-two (12.6%) of the participants (39 men and 33 women), reported an increase in overall well being after drinking TNJ regularly (Tables 7 and 8). There was no significant gender difference in this group.

The second most frequent benefit was reduction of pain. Male and female participants (20.7 and 17.3%, respectively), experienced this benefit (Table 8), more frequently than in the Copenhagen study (Table 4). Also, the average age of this group was significantly higher due to the higher average age of the female participants. There was also a significant increase in daily intake for men. The involvement of a doctor was significantly greater compared to the Copenhagen study for both, men and women. About 58% of pain reduction was directed to joints, 27% to the back and 15% to other areas of the body, except the head. With a frequency of 20% this benefit is judged to be a real medicinal effect.

Better sleep was reported by 24 men and 23 women (8.3% of the total). Except for physician involvement (significantly greater for the females), there were no significant gender differences between the other parameters. Also, about 21 individuals in this group reported an increase in energy, suggesting a possible link between the two benefits.

Forty-three participants (27 men and 16 women) reported benefits on digestion and stomach: 13 (12 men and 1 woman), reported a reduction in heartburn and stomach pain. It is likely that TNJ prevents excess stomach acidity, although TNJ is quite acidic itself. This is very interesting because TNJ is also an effective analgesic. Various pain-releasing drugs acting through the inhibition of cyclooxigenases (AAS, diclophenac, ibuprofen) are known to cause stomach problems. Other participants in this group reported an improvement of digestion with softening of the stool, which is most likely a result of increased intestinal propulsion. The majority of male participants also reported a concomitant increase in energy, whereas several of the females reported better sleep, less problems with menstrual cycle, and a reduction of migraine attacks.

A reduction of allergies and asthma was reported by 43 (7.5%) of the participants, with more women than men reporting this benefit (Table 8). Significantly more women than men also involved a physician. Eight individuals (1.4% of total, 4 men and 4 women) reported reduction of asthma. Each of them had consumed at least 60 mL TNJ per day. It may be that this is the minimum amount to produce this benefit. There were several remarkable cases of reduction of allergies by drinking TNJ: A young woman with severe problems of hay fever, was dependent on strong medications (antiallergics, corticoids, and theophyllin), but experienced a total remission of her disease after consuming TNJ for two weeks. During this period, she experienced an increase in allergy symptoms, which suddenly disappeared after the second week. The patient reported it was as if somebody "switched off" her allergy.

Improvement of skin was reported by 18 (6%) and 21 (7.8%) of the participants, male and female, respectively. As women are much more interested in their skin condition than men, these significant differences are not surprising.

Eighteen participants (10.5%) reported beneficial effects of TNJ on psoriasis (Table 9), with predominance in men over woman. The average age of this group was slightly higher than the total skin beneficial group. Psoriasis is a hereditary and thus chronic disease characterized by a hyper-proliferation of keratinocytes. The discomfort caused by the eczematous skin alterations can be significant and the medication used for the treatment often has severe side effects. TNJ has no such side effects and its beneficial effects are remarkable. Some of the patients reported that they also applied the TNJ topically. A more detailed investigation by controlled clinical studies is warranted.

Neurodermatitis is another eczematous skin disease with increasing incidence. The symptoms often occur in children. Some disappear after puberty, but many persist for life. Gluco-corticoids are mostly used to treat the skin symptoms; however, these drugs have many, and sometimes severe side effects which can cause a continuous destruction of the skin architecture. We observed 20 cases of beneficial effects (predominantly in women) of TNJ on neurodermatitis or other skin eczemas (Table 9). There were no noticeable differences in median age, daily amount or duration of intake.
However, involvement of a physician did increase. A variety of patients reported a total loss of symptoms, whereas others reported only a partial loss. As with psoriasis, the beneficial effects of TNJ on neurodermatitis are remarkable and warrant clinical trials.

**Table 7.** Benefits from TNJ in the order of their frequency.

| Benefit | Number (%) | Gender % (M/F) | Average age in years | Average daily intake (mL) | Duration of TNJ intake (month) | % with doctor involved |
|---|---|---|---|---|---|---|
| All participants | 570 (100) | 52/48 | 44.1 | 69.5 | 14.7 | 21.6 |
| More energy | 175 (30.7) | 53/47 | 43.4 | 60.2* | 14.1 | 11.0* |
| Less peripheral pain | 109 (19.1) | 57/43 | 47.6* | 73.4 | 16.7 | 40.4* |
| Better overall feeling | 72 (12.6) | 54/46 | 44.9 | 68.6 | 24.5 | 19.6 |
| Better sleep | 47 (8.3) | 49/51 | 42.7 | 66 | 15.6 | 14.9 |
| Less problems with digestion and stomach | 43 (7.5) | 60/40 | 42.1 | 67.7 | 13.1 | 18.6 |
| Fewer allergies and asthma | 43 (7.5) | 39/61 | 41.3 | 60 | 16.7 | 39.5* |
| Improved skin | 39 (6.8) | 46/54 | 41.9 | 65.1 | 12.7 | 28.2 |
| Reduction of headache | 39 (6.8) | 36/64 | 41.7 | 66.7 | 17.2 | 41.0* |
| Fewer infections | 35 (6.1) | 69/31 | 42 | 63.1 | 23.4* | 11.4 |
| Reduction or stop of smoking | 28 (4.9) | 40/60 | 41.5 | 61.8 | 13.3 | 21.4 |
| Fewer gynaecological problems | 18 (7.1)† | | 43.6 | 66.3 | 13.3 | 26.3 |
| *Fewer menstrual problems* | *12* | 0/100 | *39.8* | *67.5* | *11.6* | *25* |
| *Fewer menopausal problems* | *6* | | *52* | *58.3* | *15.8* | *16.7* |
| Improved growth of hair and nails | 15 (2.6) | 40/60 | 40.4 | 52.6 | 12.4 | 26.7 |
| Reduction of BP and cholesterol | 14 (2.5) | 64/36 | 51.2* | 82.8 | 14.5 | 71.4* |
| Reduction of depression | 8 (1.4) | 25/75 | 42.6 | 48.8 | 12.5 | 63.0* |
| Improved wound healing | 7 (1.2) | 57/43 | 49.3 | 61.4 | 15 | 43 |
| Reduction of diabetes | 5 (0.88) | 33/66 | 43 | 108 | 15.8 | 100* |
| Less gingival problems | 4 (0.70) | 100/0 | 43.5 | 6 | 62.5 | 0 |
| Reduction of fibromyalgia | 3 (0.53) | 0/100 | 45.6 | 1.03 | 24 | 66 |

†Based on female participants: *Significantly different ($P < 0.05$) from all participants

**Table 8.** Benefits from TNJ separated for men and women

| Benefits | No. (%) | | Average age | | Average daily intake (mL) | | Duration of TNJ intake (month) | | % with doctor involved | |
|---|---|---|---|---|---|---|---|---|---|---|
| | male | female | male | female | male | female | male | female | male | female |
| All participants | 299 | 271 | 43.9 | 44.2 | 67.3 | 72 | 14.8 | 14.6 | 14 | 29.3 |
| More energy | 92 (30.8) | 83 (30.6) | 42.4 | 44.5 | 57.6 | 63.1 | 14.2 | 14.1 | 5.0* | 18.1* |
| Less peripheral pain | 62 (20.7) | 47 (17.3) | 46.1 | 49.6* | 74.4* | 72.1 | 15.8 | 17.9 | 30.6* | 53.2* |
| Better overall feeling | 39 (13.0) | 33 (12.2) | 44.4 | 45.5 | 63.6 | 74.6 | 15.5 | 13.9 | 17.9 | 21.2 |
| Better sleep | 24 (8.0) | 23 (8.5) | 41.9 | 43.6 | 59.8 | 73 | 15.6 | 17.3 | 4.2 | 26.1 |
| Less problems with digestion and stomach | 27 (9.0) | 16 (5.9) | 41.5 | 43.2 | 70 | 64.1 | 16.7 | 7.5 | 11.5 | 29.4 |
| Fewer allergies and asthma | 17 (5.7) | 26 (9.6) | 40.3 | 42.1 | 68.3 | 53.6 | 15 | 17.8 | 16.7 | 48 |
| Improved skin | 18 (6.0) | 21 (7.8) | 43.2 | 40.9 | 63.3 | 66.7 | 12.9 | 12.5 | 22.2 | 33.3 |
| Reduction of headache | 14 (4.7) | 25 (9.2) | 42.9 | 40.9 | 68.5 | 65.6 | 23.3 | 13.8 | 35.7* | 44 |
| Fewer infections | 11 (3.7) | 24 (8.9) | 40.5 | 42.7 | 63.6 | 62.9 | 27.5* | 21.5* | 9.1 | 12.5 |
| Reduction of smoking | 17 (5.7) | 11 (4.0) | 41.7 | 41.3 | 58.2 | 67.3 | 11.4 | 16.4 | 17.6 | 27.3 |
| Fewer gynaecological problems | | 19 (7.1) | | 43.6 | | 66.3 | | 13.3 | | 26.3 |
| Improved growth of hair and nails | 6 (2.0) | 9 (3.3) | 38.5 | 41.6 | 61.7 | 46.7 | 13 | 12 | 16.7 | 33.3 |
| Reduction of BP and cholesterol | 9 (3.0) | 5 (1.9) | 52.4 | 49.2 | 74.4 | 98.0* | 15.4 | 12.8 | 77.8* | 60 |

*Significantly different ($P < 0.05$) from all participants

**Table 9.** Differential investigation of skin benefits

| Benefits on skin | No. (%) | Gender % (M/F) | Average age in years | Average daily intake (mL) | Duration of TNJ intake (month) | % with doctor involved |
|---|---|---|---|---|---|---|
| All skin benefits | 39 (100) | 46/54 | 41.9 | 65.1 | 12.7 | 28.2 |
| Reduction of psoriasis | 7 (17.9) | 71/29 | 46.4 | 57.1 | 17 | 29 |
| Reduction of neurodermatitis and other eczemas | 20 (51.3) | 40/60 | 43.1 | 65.5 | 16.3 | 35 |
| General improvement of skin | 12 (30.8) | 42/58 | 36.9 | 69.1 | 7.5 | 16.7 |

**Table 10.** Effects of TNJ on smoking behaviour

| Smoking behaviour | No. (% of smokers) | Gender % (M/F) | Average age in years | Average cigarettes per day |
|---|---|---|---|---|
| All smokers | 148 | 55/45 | 41.57 | 16.57 |
| No change of smoking behaviour | 82 (55.4) | 45/55 | 40.8 | 18.2 |
| Change of smoking behaviour | 63 (42.6) | 68/32* | 42.2 | 14.6 |
| Improved smoking | 3 (2.0) | 33/67 | 48.3 | 12.3 |
| Quit smoking | 6 | 50/50 | 46.2 | |

*Significantly different ($P < 0.05$) from all participants

The data bank group also reported a non-differentiated effect of TNJ on the skin, expressed as "my skin looks much better". This benefit was reported by 12 participants (5 men and 7 women). The median age of this group was only 37 years. The median duration time was also shorter, with some individuals reporting TNJ-induced skin benefits after only 1 month of consumption.

As in the Copenhagen study, headache was separated from other body pains. This benefit was reported with the same frequency as improved skin, however the percentage of women was higher (64%) and significantly different from the total. About 54% (21 individuals) in this group reported a reduction of migraine (only 3 were men). A similar observation was noted in the Copenhagen study. Thus, TNJ-induced migraine reduction is predominantly a female response. Although duration and quantity of TNJ intake was normal, physician involvement was increased to 52%.

Fewer infections were reported by 35 individuals. There was a significant increase in men over women and the duration time of TNJ intake was also increased significantly in both, men and women. Many participants in this group reported an increase in energy together with a decrease of infections. Some reported a cure of special infections, mainly associated with the respiratory tract (laryngitis, pharyngitis, tonsillitis, and sinusitis). These patients suffered from chronic infections, which disappeared totally after regularly intake of 2-3 oz. TNJ per day. A woman with age 52 reported that she had no more herpes infections after drinking two oz. of TNJ and another woman, 40 years old, was cured from *Candida albicans* infections after drinking three oz. of TNJ.

The questionnaire used for the data bank study included questions about the smoking behaviour. About 148 participants (26% of total) were smokers. There was a slight non significant increase in men over women in this group (55% versus 45%). The average age was 41.5 years and thus, significantly reduced compared to the total (44.1 years). The average number of cigarettes smoked per day was 16.6. There was no significant difference between men (16.1 cig./day) and women (17.1 cig./day).

About 82 persons reported no change in their smoking behaviour after starting with TNJ. Among these were 54.9% women. This is a considerable, even not significant increase compared to the total group of smokers. The average cigarettes per day were slightly (not significantly) increased compared to all smokers.

63 smokers (42.6%) reported a change in their smoking behaviour. Among these were only 32% women. This is a highly significant reduction compared to the total group of smokers. Obviously are woman less willing or able to reduce

their smoking. Age and cigarettes per day were not significantly different to the total, although there was a slight decrease in the average cigarettes smoked per day compared to all smokers.

More interesting perspectives occur if this subgroup is further analyzed. 19 persons in this group (30.5%) reported a decrease in addiction to tobacco. Only 4 of them (21%) were female. This is a significant decrease compared to the total group of smokers. The question, which cannot be answered here is, what makes men more susceptible to TNJ compared to women with respect to the reduction in tobacco addiction

The number of people who reported to totally quit smoking after drinking TNJ was only 6 (3 men and 3 women). However, there were 22 persons who reduced their smoking. Among these were only 8 (38%) females. Some smokers (mainly women) reported to smoke only slightly less after TNJ, but there are others who reduced their cigarette consume considerably (from 50-60 to 20 or less per day). Three smokers (two women and one man) reported to smoke more after starting to drink TNJ.

There were 18 women (7.1%) who reported benefits of TNJ on gynaecological problems. The average age, amount of TNJ per day and duration of TNJ intake were all not significantly different from the total group of woman in the data bank. The group can be divided into a subgroup with less menstrual and with less menopausal problems. The average age of women with less menstrual problems is 39.7 years and the median age of woman with reduction in menopausal symptoms is 52.0 years. Differences between the subgroups reporting benefits of TNJ in menstrual cycle and menopausal symptoms were also observed in the median duration time of TNJ intake (11.6 versus 15.8 month), the daily intake of TNJ (67.5 versus 58.3 mL) and the percentage of a doctor involved (25.0 versus 16.7%). These observations are similar to the corresponding data received from the Copenhagen study.

About 13 persons (6 men and 7 women) reported an increase in the growth of hair. Among these was one woman at age 51 who reported that her loss of hair decreased after drinking 30 mL TNJ per day for a period of seven month. She contacted a doctor for this problem before starting with TNJ. Two women experienced an increase of growth and quality of nails.

A 64 years old woman took TNJ (60 mL/day) to protect her vascular system, because of a history of heart infarction. She observed a decrease of her blood cholesterol level. 13 persons (9 men and 4 woman) suffering from an increased blood pressure reported a decrease after drinking TNJ. The average age of this group was significantly higher compared to the total. (51.2 versus 43.1). There was also a highly significant increase in the percentage of a doctor involved.

Two men and 6 women reported positive effects of TNJ on mental depression. Most of the persons had benefits of TNJ on other disorders at the same time (migraine, arthritic pain, menstrual or menopausal problems). The depression seems, therefore, to be more a reaction on the discomfort caused by the peripheral problems rather than a real mental disease.

Four male participants reported a decrease of gingival bleeding and three women experienced a reduction of pain related to fibromyalgia. The report of one of these patients is doubtful because she takes only 30 mL per day and a doctor is not involved. The other two have their doctors involved, who recommend their patients to take TNJ. Both women took up to 4 oz. or more of TNJ per day. One of these women reports that her overall health condition is much better and that she is almost free of pain, which only returns if the weather conditions are bad. In such a case she is able to reduce the pain if she increases the dose of TNJ.

A relatively high daily intake of 3-4 oz. of TNJ was also reported from 2 men and

3 women with diabetes type II. We know personally other patients with diabetes, not involved in this study, who are able to control their disease with TNJ. After a while of drinking 2-4 oz. TNJ per day they were able to reduce or even quit their medication although they were eating cookies and other sweets.

One man, 71 years old with Parkinson's disease reported a significant improve of his behaviour. Before taking TNJ he had problems with speaking and remembering words, his movement was retarded and he was not interested in anything. Three weeks after starting to drink 3-4 oz. TNJ per day he observed a remarkable improvement in mental and physical behaviour. He became interested in his life and friends and he could speak fluidly. The stiffness of his right arm is still present, but much less than before. His doctor, who is the head of a clinic specialised in Parkinson's disease is very impressed about the effect of TNJ on his patient and recommends him to continue with it. The patient is also organized in a Parkinson's self help group and his wife is the leader of this group. Some other patients in this group recognized the same benefits as our patient after starting to drink TNJ.

Almost no adverse effects were reported by the participants of this study. After personal interviews a few people reported diarrhoea at the beginning of taking TNJ. This normally disappears after a few days. Sometimes it persists up to two weeks. If it takes longer, this normally causes the person to quit the intake of TNJ. A slight softening of the stool is frequent and normally welcome. One female reported an increase of a condition of unrest after starting with TNJ. This condition disappeared after a few days. No serious side effects were reported to us during this investigation.

The lack of side effects of TNJ is also confirmed by vigorous toxicological studies in tissue culture, animal models and in a clinical trial [19, 20].

No side effects could be observed in any of these experiments.

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