Maharishi AyurVeda®

Summary of Research Findings

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Introduction

Maharishi Ayurveda is a comprehensive health care system with its roots dating back more than 5000 years to the ancient Vedic civilization of India. Ayurveda is translated as the 'Science of Life.' Maharishi Mahesh Yogi, founder of the Transcendental Meditation technique, recently established Ayurveda in its completeness in accordance with the classical texts, in association with Ayurvedic scholars, and made it available worldwide. Maharishi Ayurveda encompasses all facets of life, including mind (consciousness), physiology, behavior, and environment. It is prevention-oriented and also provides effective treatment modalities for chronic illnesses.

Maharishi Ayurveda uses various technologies for promotion of health and prevention of disease. These include diet, daily and seasonal routines, purification procedures, and use of herbal food supplements. During the last 30 years, there has been extensive research conducted on the various modalities of Maharishi Ayurveda. Over 600 studies have been carried out at more than 200 independent institutions and universities in 30 countries. In addition, there are thousands of published studies on the wide-ranging health benefits of Ayurvedic herbs. Herein is presented a summary of research on Maharishi Ayurveda, focusing specifically on the studies conducted on Maharishi Ayurveda herbal formulas. This research demonstrates striking health benefits and profound possibilities for Maharishi Ayurveda in the health care field.

Maharishi Ayurveda herbal formulas nourish the natural structures and functions of the physiology rather than treating superficial symptoms, through the use of whole herbs that display the full range of biological intelligence. The ingredients of these herbal formulas function synergistically to maximize the health-promoting benefits. Maharishi Ayurveda herbal formulas combine time-tested wisdom from the ancient Ayurvedic texts with cutting-edge manufacturing and quality control technologies.

The ancient Ayurvedic texts teach *samyoga*—the science of combining various herbs into precise blends that offer the added value of synergy and balance. Maharishi Ayurveda formulas are not single herbs or random combinations of ingredients—they are carefully formulated combinations:

- Primary herbs strengthen specific functions of the mind and body.
- Bioavailability herbs improve assimilation.
- Herbal co-factors remove impurities that can block the full benefits of a formula.
- Balancing herbs cancel out any potential discomforts or side effects that may arise if you use individual herbs, rather than balanced combinations.

Equally important in Ayurveda is *sanskar*—preparing the herbs in such a way that the innate intelligence and healing wisdom of each plant is carefully preserved in the final product. Maharishi Ayurveda formulas are prepared meticulously according to the Ayurvedic texts. No short cuts are taken in preparation.

The Ayurvedic science of harvesting herbs standardizes the herb potency at its natural maximum without the use of chemical additives. Herbs naturally vary in potency with seasons, cycles of the moon, and time of day. Herbs used in the Maharishi Ayurveda formulations are harvested at their freshest in India. Where possible without threatening the natural ecological balance, Maharishi Ayurveda herbs are gathered in the wild, because wild-crafted herbs can be as much as 100 times more potent than their cultivated counterparts(continued)

The effectiveness of the Maharishi Ayurveda herbal preparations is assured by stringent quality control measures that include the following:

Expert herbalists. After the harvest, each type of plant must be inspected, sorted, cleaned, and stored in a particular way. Specialists in *Dravyaguna*—the identification of plant species—inspect each batch of plants. The whole batch is rejected unless it meets strict standards of purity and potency.

Herbal fingerprints. Each batch of plants is also inspected by a modern, government-recognized laboratory. The herbs are then tested using advanced technology such as high-pressure liquid chromatography (HPLC) to reveal the 'fingerprint' or exact species and potency of each herb.

State-of-the-art manufacturing. Advanced, hygienic processing facilities, designed by eminent vaidyas (traditional Ayurvedic physicians), scientists, and food technologists, incorporate the most modern technology in every aspect of the ancient Ayurvedic processes. This is the only ISO 9001 certified Ayurvedic production facility in the world. ISO certification is the international standard for assessing quality control in management, testing, and manufacturing.

Triple-tested for quality. High-tech scans are utilized for the detection of heavy metals, biological contaminants, and chemical residues. The ingredients are tested before preparation of the formulas, after manufacturing, and again by an independent lab, to exceed rigorous U.S. standards.

1. Title

Antineoplastic Properties of Maharishi-4 [MAK-4] Against DMBA-Induced Mammary Tumors in Rats

Publication

Pharmacology, Biochemistry and Behavior, Vol. 35, pp. 767-773, 1990.

Authors

Hari M. Sharma,* Chandradhar Dwivedi,** Bryan C. Satter,** Krishnamurthy P. Gudehithlu,* Hussein Abou-Issa,* William Malarkey,* and Gopi A. Tejwani.*

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Summary

The herbal mixture MAK-4 (Maharishi Amrit Kalash-4) was tested for anticarcinogenic and anticancer properties against 7,12–dimethylbenz(a)anthracene (DMBA)-induced mammary tumors in rats. The 6% MAK-4-supplemented diet protected against DMBA-induced carcinogenesis by reducing both tumor incidence and multiplicity during initiation and promotion phases. MAK-4 provided up to 88% protection ($p<0.05$) during the promotion phase, and 60% ($p<0.05$) during the initiation phase of carcinogenesis. Also, 60% of the control animals which had developed fully-formed tumors showed tumor regression when their diet was subsequently supplemented with MAK-4 for four weeks. In 50% of these rats, the tumor regressed completely. There was no significant difference in the food intake or weight gain in rats on the MAK-4-supplemented diet compared to the control group

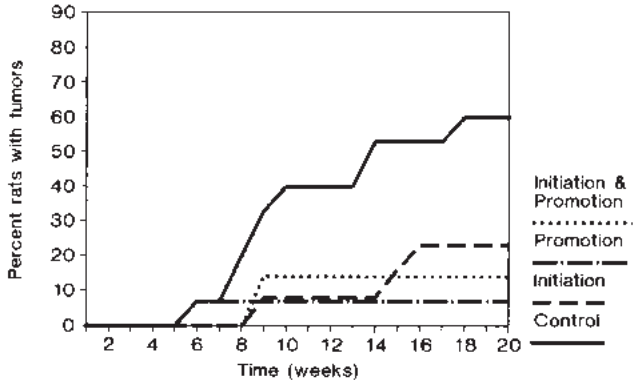

FIG. 1. Effect of 6% M-4-supplemented diet on tumor incidence. Tumor incidences in all groups were statistically analyzed using Chi-square test. C=60%, I=21%, P=7%, I&P=14%. I, P and I+P group were significantly different from C group ($p<0.05$).

TABLE 1.

CHANGES IN TUMOR VOLUME OF THE RATS IN THE REGRESSION GROUP TREATED WITH 6% M-4-SUPPLEMENTED DIET FOR FOUR WEEKS

Rat Number	Tumor Size (CM^3) 1st Week	2nd Week	3rd Week	4th Week	Change in Tumor Volume (CM^3)
1	0.36	0.21	0.03	0	−0.36
2	1.37	1.09	0.67	0.08	−1.29
3	3.16	4.63	6.78	6.78	+3.62
4	6.08	6.08	14.89	16.38	+10.30
5	0.30	0.11	0	0	−0.30
6	14.89	19.65	19.65	27.43	+12.54
7	5.32	6.78	9.84	10.97	+5.65
8	0.36	0.11	0.03	0	−0.36
9	0.36	0.01	0.01	0.01	−0.35
10	0.36	0.21	0.01	0.00	−0.36

+ Increase in tumor size.
− Decrease in tumor size.

Study 1 **Research Highlights**

A MAK-4-supplemented diet protected against DMBA-induced carcinogenesis in experimental rats by reducing both tumor incidence and multiplicity during the initiation and promotion phases. Subsequent MAK-4 supplementation produced partial to complete tumor regression in control animals.

2. Title

Antineoplastic Properties of Maharishi Amrit Kalash [MAK-5], An Ayurvedic Food Supplement, Against 7,12-Dimethylbenz(a)anthracene-Induced Mammary Tumors in Rats

Publication

Journal of Research and Education in Indian Medicine, Vol. 10, No. 3, pp. 1-8, July-September 1991.

Authors

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Summary

The herbal mixture Maharishi Amrit Kalash-5 (MAK-5) was tested for antineoplastic properties against 7,12-dimethylbenz(a)anthracene (DMBA)-induced mammary tumors in rats. The 0.2% (w/w) MAK-5-supplemented diet protected against DMBA-induced carcinogenesis during the promotion phase by reducing both tumor incidence and multiplicity. MAK-5 provided up to 62.5% protection ($p<0.05$) during the promotion phase of carcinogenesis. Also, a MAK-5-supplemented diet fed for four weeks to control rats which had developed mammary tumors, decreased tumor size in 60% of these rats. There was no significant difference in weight gain in rats on the MAK-5-supplemented diet. Thus, the MAK-5-supplemented diet did not influence the food intake, but protected against DMBA-induced mammary tumors in rats.

Study 2 **Research Highlights**

A MAK-5 supplemented diet protected against DMBA-induced mammary tumors in rats and supported tumor regression in control animals.

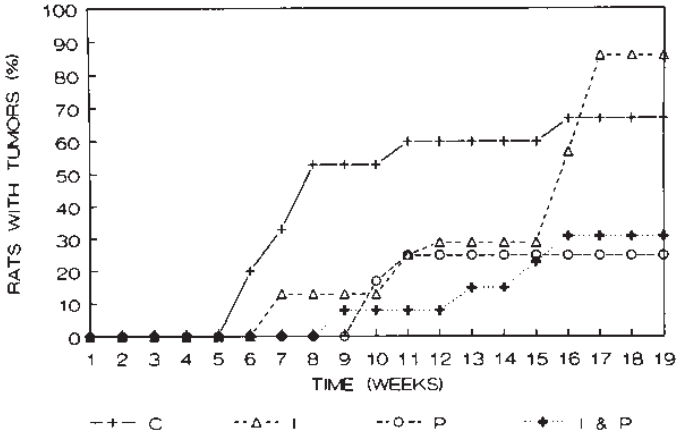

FIG. 2. Effect of 0.2% MAK-5-supplemented diet on tumor incidence. Tumor incidence in all groups was statistically analyzed using Chi-square test. The P and I+P groups were significantly different from C group ($p<0.05$). Groups: C=control; I=initiation; P=promotion; I+P=initiation and promotion.

TABLE 2.
CHANGE OF TUMOR VOLUME OF THE RATS IN THE REGRESSION GROUP TREATED WITH 0.2% MAK-5-SUPPLEMENTED DIET FOR FOUR WEEKS

RAT NUMBER	TUMOR VOLUME (CM^3) WEEK 1	WEEK 2	WEEK 3	WEEK 4	CHANGE IN TUMOR VOLUME (CM^3)
1	1.68	1.37	16.38	0.86	−0.82
2	3.70	4.00	10.97	19.65	+15.95
3	16.38	16.38	16.38	21.43	+5.05
4	0.36	0	0	0	−0.36
5	3.42	4.63	13.50	16.38	+12.96
6	0.86	0.36	0.36	0.36	−0.50
7	0.50	0.11	0	0	−0.50
8	1.37	0.88	0.86	0.66	−0.71
9	0.86	0.66	0.66	0.66	−0.20
10	0.86	2.05	2.05	2.92	+2.06

CM^3: CUBIC CENTIMETERS + : INCREASE IN TUMOR VOLUME
− : DECREASE IN TUMOR VOLUME

3. Title

Reduction of Metastases of Lewis Lung Carcinoma by an Ayurvedic Food Supplement [MAK-4] in Mice

Publication

Nutrition Research, Vol. 12, pp. 51-61, 1992.

Authors

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Summary

This study investigated the effect of oral feeding of an Ayurvedic rasayana (health-promoting/therapeutic herbal preparation) called Maharishi Amrit Kalash-4 (MAK-4) on metastasis of Lewis Lung Carcinoma (LLC) in mice. The mice were fed either chow containing 3% MAK-4 or standard laboratory chow, and inoculated subcutaneously with LLC tumor cells. After 4-5 weeks, the animals receiving the MAK-4-supplemented chow had a 65% reduction ($p<0.01$) in the number of metastatic nodules, and a 45% reduction ($p<0.01$) in the size of the nodules, compared to the control group.

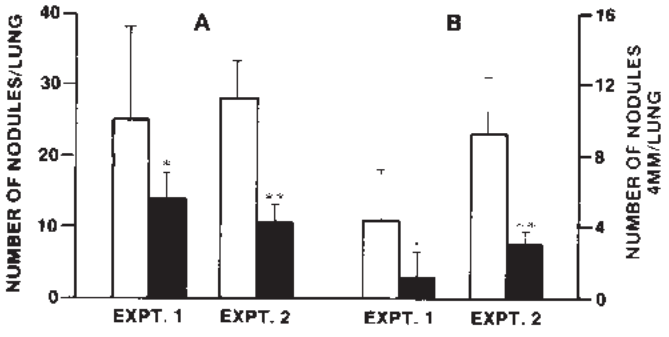

FIG. 1. Metastatic lung nodules (numbers/lung left side and size > 4 mm/lung right side) in animals on M-4-containing chow (Darkened Bars) and laboratory chow (Open Bars).
*P < .01 & **P < .001.

Study 3 **Research Highlights**

Mice fed MAK-4 supplemented diets experienced a significant reduction in both number and size of metastatic nodules.

4. Title

Ayurvedic (Science of Life) Agents [MAK-4 and MAK-5] Induce Differentiation in Murine Neuroblastoma Cells in Culture

Publication

Neuropharmacology, Vol. 31, No. 6, pp. 599-607, 1992.

Authors

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Summary

This study shows that an ethanol extract of MAK-5 (also known as Maharishi Amrit Kalash Ambrosia) induced morphological differentiation (neurite formation) and biochemical differentiation (increased activity of tyrosine hydroxylase by about 15-fold) in 75% of murine neuroblastoma cells in culture ($p<0.05$), indicative of reversal of the malignant process. An aqueous extract of MAK-5 increased only the activity of tyrosine hydroxylase and to a lesser extent than the ethanol extract. A treatment time of 3 days was needed for the expression of maximum differentiation. Ethanol and aqueous extracts of MAK-5 also increased the intracellular level of adenosine 3',5'-cyclic monophosphate (cAMP) by about 4-fold in 3 days. Ethanol extracts of MAK-5 also induced neurite formation in neuroblastoma cells grown in serum-free medium, but the concentration requirement was about a fifth of that needed in serum. A treatment time of 24 hours was sufficient to induce optimal differentiation in neuroblastoma cells grown in serum-free medium. The differentiating agents in the ethanol extract of MAK-5 were resistant to heat and light and could not be removed by treatment with activated charcoal. Neither the ethanol nor the aqueous extracts of MAK-4 (also known as Maharishi Amrit Kalash Nectar) induced differentiation in neuroblastoma cells.

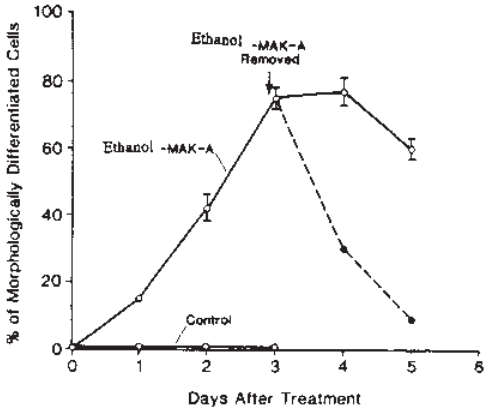

Fig. 2. Effect of an ethanol extract of MAK-A on morphological differentiation, as a function of treatment time. Ethanol-MAK-A (50 μg/ml) was added 1 day after plating. After 3 days of treatment, ethanol-MAK-A was removed and the number of morphologically differentiated cells was determined after 1 and 2 days of removal. Each value represents an average of 9 samples ± SEM. The sizes of bars for the SEM at some points did not exceed the size of the symbol; therefore, they were not represented.

Table 2. Effects of extracts of Maharishi Amrit Kalash-Ambrosia (MAK-A) on activity of tyrosine hydroxylase in neuroblastoma cells in culture

Treatments	Activity of tyrosine hydroxylase (pmol/hr/mg protein) 15 min	3 days
Control	8 ± 1*	8 ± 1
Solvent (0.2% ethanol)	—	17 ± 1**
Ethanol-MAK-A (50 μg/ml)	12 ± 1**	127 ± 9***
Ethanol-MAK-A (25 μg/ml)	—	25 ± 2***
Aqueous-MAK-A (170 μg/ml)	11 ± 1**	22 ± 4***
Aqueous-MAK-A (85 μg/ml)	—	16 ± 1**

Cells (0.25×10^6) for all groups, except those which received 50 μg/ml of ethanol-MAK-A and 170 μg/ml of aqueous-MAK-A; the latter were plated with 1×10^6 cells and were plated in tissue culture dishes (100 mm) and an ethanol extract and aqueous extract of MAK-A, were added separately 24 hr later. The medium and extracts were changed after 2 days of treatment and the activity of the enzyme was determined after 15 min and 3 days of treatment. Each value represents an average of 4 samples. Experiments were repeated 3 times and similar changes were observed in the treated groups, in comparison to controls.
*Standard error of the mean.
**Significantly different ($P < 0.05$) from control.
***Significantly different ($P < 0.05$) from solvent-treated control.

Table 3. Effects of extracts of Maharishi Amrit Kalish-Ambrosia (MAK-A) on the intracellular level of cAMP in neuroblastoma cells in culture

Treatments	Level of cAMP (pmol/hr/mg protein) 15 min	3 days
Control	13 ± 2*	11 ± 2*
Solvent (0.2% ethanol)	14 ± 1	15 ± 2**
Ethanol-MAK-A (25 μg/ml)	12 ± 1	23 ± 1***
Ethanol-MAK-A (50 μg/ml)	12 ± 1	47 ± 4***
Aqueous-MAK-A (85 μg/ml)	18 ± 2**	25 ± 2***
Aqueous-MAK-A (85 μg/ml)	19 ± 2**	42 ± 3***

Cells (50,000 cells for all groups except those which received 50 μg/ml and 170 μg/ml of ethanol-MAK-A, the latter were plated with 10^5 cells) plated in tissue culture dishes (60 mm) and an ethanol extract and an aqueous extract of MAK-A were added separately 24 hr later. The medium and extracts were changed after 2 days of treatment and the level of cAMP was determined after 15 min and 3 days of treatment. Each value represents an average of 3 samples. Experiments were repeated 3 times and similar changes were observed in the treated groups, in comparison to controls.
*Standard error of the mean.
**Significantly different ($P < 0.05$) from control.
***Significantly different ($P < 0.05$) from solvent-treated control

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Study 4 **Research Highlights**
An ethanol extract of MAK-5 induced morphological and biochemical changes in murine neuroblastoma cells in culture, indicative of a reversal of the malignant process.

5. Title

Anti-Tumor Effects of Natural Products Maharishi Amrit Kalash-4 (MAK-4) and Maharishi Amrit Kalash-5 (MAK-5) on Cell Transformation In Vitro and in Liver Carcinogenesis in Mice

Presented at

Nineteenth Annual Convention of Indian Association for Cancer Research and Symposium on Cancer Biology, Amala Cancer Hospital and Research Center, Thrissur, India, January 21-23, 2000.

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Summary

Background: Maharishi Amrit Kalash-4 (MAK-4) and Maharishi Amrit Kalash-5 (MAK-5) are herbal mixtures with anticancer and anticarcinogenic properties. This investigation evaluated the cancer-inhibiting effects of MAK-4 and MAK-5 in vitro and in vivo. Methods: Aqueous extracts of MAK-4 and MAK-5 were tested for effects on ras-induced cell transformation in the Rat 6 cell line assessed by focus formation assay. Urethane-treated mice were put on a standard pellet diet or a diet supplemented with MAK-4 and MAK-5. At 36 weeks, livers were examined for tumors, sera for oxygen radical absorbance capacity (ORAC), and liver homogenates for enzyme activities of glutathione peroxidase (GPX), glutathione-S-transferase (GST), and NAD(P)H: quinone reductase (QR). Liver fragments of MAK-fed mice were analyzed for connexin (cx) protein expression. Results: MAK-5 and a combination of MAK-5 plus MAK-4, inhibited ras-induced cell transformation. There was a 46% reduction in the number of mice that developed liver nodules when fed with MAK. MAK-treated mice had a significantly higher ORAC (two-sided $p<0.05$) compared to controls (200.2 ± 33.7 vs. 152.2 ± 15.7 ORAC units, respectively). MAK-treated mice had significantly higher activities of GPX, GST, and QR compared to controls (two-sided $p<0.05$, $p<0.01$, and $p<0.01$, respectively). Livers of MAK-treated mice showed a time-dependent increased expression of cx32. Conclusions: A MAK-supplemented diet inhibits liver carcinogenesis in urethane-treated mice. Possible mechanisms involving inhibition of oxidative damage and up-regulation of connexin expression are discussed.

Study 5 **Research Highlights**
A diet supplemented with MAK-4 and MAK-5 inhibited liver carcinogenesis in urethane-treated mice.

6. Title

Antineoplastic Properties of Dietary Maharishi-4 [MAK-4] and Maharishi Amrit Kalash [MAK-5], Ayurvedic Food Supplements

Publication

European Journal of Pharmacology, Vol. 183, No. 2, p. 193, 1990 (Abstract).

Authors
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Summary
Ayurveda (Ayu = life, Veda = knowledge, meaning the science of life) is an ancient medical science originated from Vedic tradition and widely practiced in India. Maharishi-4 (M-4) and Maharishi Amrit Kalash (MAK), ayurvedic food supplements belong to a group of substances known as rasayanas (Glazer, 1988). In ayurveda, rasayanas are given to bring homeostasis in the physiology, retard aging, and enhance vitality and immunity (Sharma, 1985).

M-4 and MAK have been shown to inhibit 7,12-dimethylbenz(a)antracene (DMBA)-induced mammary tumors in rats when given individually as a dietary supplement (Sharma et al., 1989). The purpose of this investigation is to study the effectiveness of the combination of M-4 and MAK dietary supplementation on DMBA-induced mammary tumors in rats.

Fifty-day-old Sprague-Dawley rats were divided into 4 groups, having 20 rats in each group. Group 1 (C) and group 3 (P) were placed on a rodent chow diet (Wayne Research Animal Diets, Chicago, IL, USA). Groups 2 (I) and 4 (I and P) were placed on rodent chow supplemented with 6% M-4 and 0.2% MAK (provided by Maharishi Ayurveda Products International). All rats were given DMBA (75 mg/kg in 1 ml of sesame oil) by gavage after being on the diet for one week. One week after DMBA administration, the I group was placed back on the normal diet and the P group was placed on M-4 and MAK-supplemented diets. Rats were weighed and examined weekly for the presence of mammary tumors for a period of 20 weeks. In the other set of the experiment, animals with mammary tumors were placed on either M-4 or MAK-supplemented diets. Tumor size was measured once a week for 4 weeks. Histopathologies of tumors from different groups were also performed.

After 20 weeks of DMBA administration, the tumor incidence was 60, 30, 25, 15% in C, I, P, and I and P groups respectively; the average number of tumors per rat was 0.65, 0.5, 0.35, and 0.35 for C, I, P, and I and P groups respectively. M-4 and MAK-supplemented diets caused tumor regression in 60% of rats. There was no significant difference in weight gain of rats in all the groups. The tumors from the C group had adenocarcinomas. The tumors from the I and P groups showed adenocarcinoma with extensive fibrosis and focal areas of necrosis and calcification. The tumors from the I and P group showed lobular adenofibroma with inflammation.

These results indicate the M-4 and MAK-supplemented diets protect against DMBA-induced carcinogenesis. Similar results were observed when M-4 and MAK were supplemented in the diet individually at the same dosages. The combination of M-4 and MAK together in the diet does not produce synergistic effects.

Abstract reprinted from European Journal of Pharmacology, *Vol. 183, No. 2, p. 193, Copyright 1990, with permission from Elsevier Science.*

Study 6 **Research Highlights**
MAK-4 and MAK-5 supplemented diets protected against DMBA-induced carcinogenesis in rats. Supplementing MAK-4 and MAK-5 individually at the same dosages achieved similar results as combined supplementation.

Research on Reduction of Chemotherapy Toxicity

1. Title

Antioxidant Adjuvant Therapy Using Natural Herbal Mixtures [MAK-4 and MAK-5] During Intensive Chemotherapy: Reduction in Toxicity. A Prospective Study of 62 Patients

Publication

Rao, R.S., Deo, M.G., and Sanghvi, L.D. (eds). Proceedings of the XVI International Cancer Congress. Bologna, Italy: Monduzzi Editore, 1994: pp. 3099-3102.

Authors

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Summary

The use of chemotherapeutic agents in the treatment of cancer is hampered and complicated by toxic side effects manifested by these agents. Many types of chemotherapy destroy cancer cells by generating free radicals, unstable molecules which can cause cellular damage. Unfortunately, these free radicals are not discriminatory in their destructive action, leading to undesirable side effects and sometimes even new cancers. In this clinical study, MAK-4 and MAK-5 were shown to be effective in reducing the toxic side effects associated with chemotherapy. This controlled prospective study was conducted on 62 patients undergoing intensive chemotherapy. The patients had various types of cancer, including non-Hodgkin's lymphoma, ovarian cancer, breast cancer, oral cancer, and osteogenic sarcoma. All patients were receiving combination chemotherapy; the chemotherapeutic agents included cyclophosphamide, vincristine, methotrexate, doxorubicin, prednisone, cisplatinum, adriamycin, and 5-fluorouracil. In the patients who received MAK-4 and MAK-5 along with their chemotherapy, there was reduced hemotologic toxicity, vomiting, and diarrhea, and improved sleep, weight, and an overall feeling of well-being. The patients taking MAK-4 and MAK-5 also showed a significant reduction ($p<0.03$) in lipid peroxide compared to the control group.

Study 1 **Research Highlights**

MAK-4 and MAK-5 supplementation was effective in reducing toxic chemotherapy side effects in patients undergoing intensive chemotherapy. Patients receiving the supplements experienced reduced hematologic toxicity, vomiting, and diarrhea, and improved sleep, weight, and well-being.

2. Title

Effects of Ayurvedic Food Supplement MAK-4 on Cisplatin-Induced Changes in Glutathione and Glutathione-S-transferase Activity

Publication

Rao, R.S., Deo, M.G., and Sanghvi, L.D. (eds). Proceedings of the XVI International Cancer Congress. Bologna, Italy: Monduzzi Editore, 1994: 589-592.

Authors

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Conducted at

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**South Dakota State University, Brookings, SD

Summary

Cisplatin, a chemotherapeutic drug used to treat testicular, ovarian, and other cancers, causes toxic side effects in the kidneys. A decrease in glutathione (GSH) and glutathione-S-transferase (GST) activities may play a role in this nephrotoxicity. This study on cisplatin and MAK-4 showed that cisplatin significantly decreases GSH and GST activity in both rat kidney and liver. Dietary MAK-4 supplementation reversed this effect of cisplatin on liver and kidney GSH and GST activity ($p<0.05$). Thus, MAK-4 may protect against cisplatin-induced toxicity in patients receiving this type of chemotherapy.

Table 1
Effects of cisplatin and M-4 treatment on GSH and GST levels in rat liver and kidney.

Group	Treatment	GSH (µg/g tissue) Liver	GSH (µg/g tissue) Kidney	GST (µmole/mg/min) Liver	GST (µmole/mg/min) Kidney
1	Control	11619±1574	4581±1125	1.91±0.5	1.47±0.2
2	Cisplatin	8899±1606*	2839± 920*	1.13±0.2*	1.18±0.3*
3	M-4	10942± 747	4495± 264	1.98±0.4	1.62±0.1
4	Cisplatin & M-4	10635±1262**	4374± 188**	1.86±0.4**	1.96±0.2**

*Significantly lower than control group (P<0.05)
**Significantly higher than cisplatin alone group (P<0.05)

Study 2 **Research Highlights**

This study on cisplatin and MAK-4 showed that cisplatin significantly decreased GSH and GST activity in both rat kidney and liver. Dietary MAK-4 supplementation reversed this effect of cisplatin on kidney and liver. Thus, dietary MAK-4 supplementation may protect against cisplatin-induced toxicity in patients receiving this type of chemotherapy.

3. Title

Protective Effects of MAK-4 and MAK-5 on Adriamycin-Induced Microsomal Lipid Peroxidation and Mortality

Publication

Biochemical Archives, Vol. 8, pp. 267-272, 1992.

Authors

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**College of Medicine, The Ohio State University, Columbus, OH

Summary

Use of the chemotherapeutic agent Adriamycin is complicated by its potentially lethal cardiac toxicity. DNA base pair damage induced by Adriamycin results in its effectiveness against cancer; however, simultaneous production of free radicals results in toxic side effects. In this study on mice, Adriamycin-induced mortality reached 60% in the control group (regular chow diet), compared to 20% in the group receiving a 6% MAK-4-supplemented diet ($p<0.05$), and 40% in the group receiving a 0.2% MAK-5-supplemented diet.

See Antioxidant Research for more information on this study.

Table 1
Adriamycin-induced Mortality*

Group	Mortality (%)
Control	60
M-4 (6%)	20
M-5 (0.2%)	40

*CDF_1 mice were treated with Adriamycin, 15 mg/kg, i.p. and animals were observed for four weeks for mortality.

Study 3 **Research Highlights**
Mice receiving the chemotherapeutic agent Adriamycin experienced a reduction in mortality when supplemented with MAK-4 or MAK-5.

4. Title
Maharishi Amrit Kalash [MAK-4 and MAK-5] Reduces Chemotherapy Toxicity in Breast Cancer Patients

Publication
Federation of American Societies for Experimental Biology Journal, Vol. 14, No. 4, p. A720, 2000 (Abstract).

Authors
A. Srivastava,* A. Samaiya,* V. Taranikanti,* P. Kachroo,* O.H. Coshic,* R. Parshad,* V. Seenu,* S. Chumber,* and M.C. Misra.*

Conducted at
* All India Institute of Medical Sciences, New Delhi, India 110029

and Title
Reducing the Toxic Effects of Chemotherapy: New Research Reports a Significant Decrease in Chemo Toxicity with a Natural, Ayurvedic Herbal Formula

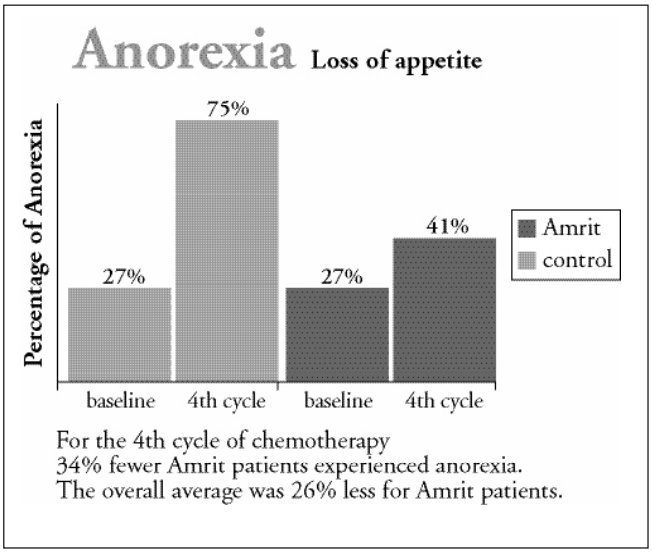
Publication
Townsend Letter for Doctors and Patients, August/September 2000, pp. 134-138.

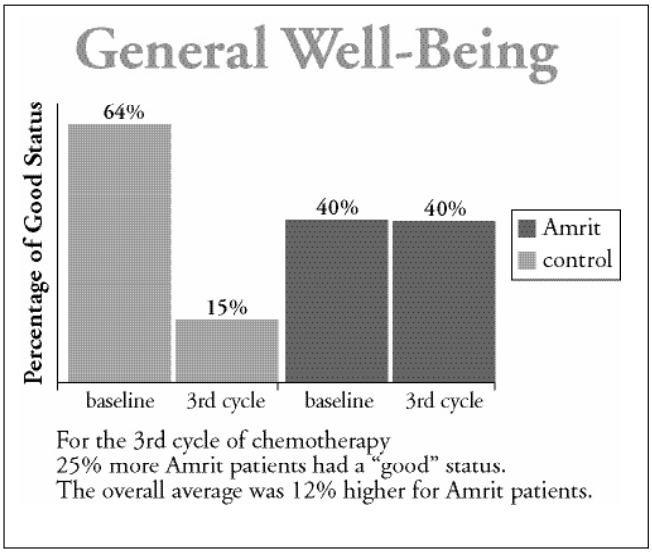
Author
John Thill.

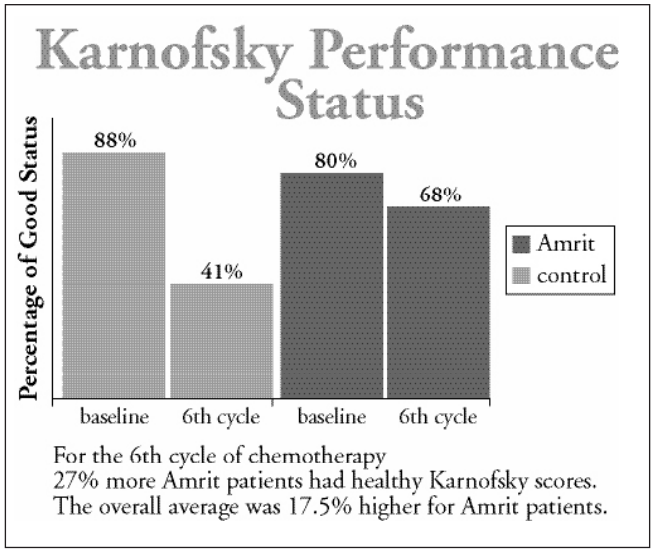
Summary

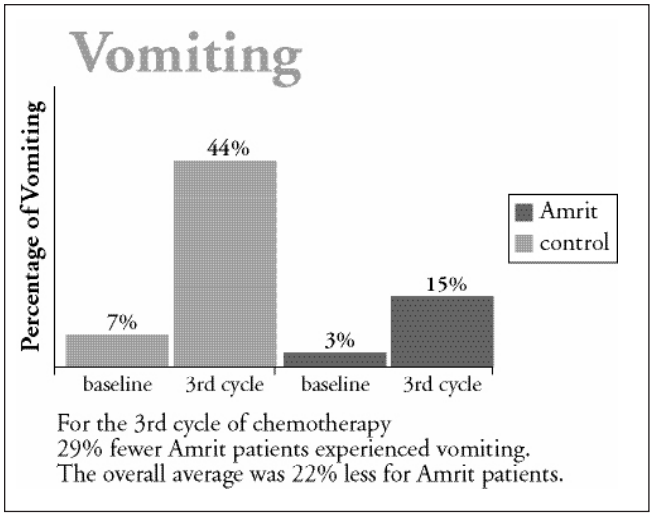
This randomized trial was conducted to determine the effect of the herbal mixtures MAK-4 and MAK-5 on reduction of toxic side effects in breast cancer patients receiving chemotherapy. There were 129 breast cancer patients (124 females and 5 males) involved in the study; 61 patients took MAK-4 and MAK-5 along with chemotherapy and 68 received chemotherapy alone and served as controls. There were two chemotherapy protocols

used: cyclophosphamide plus adriamycin plus 5-fluorouracil (33 MAK patients and 32 control patients); and cyclophosphamide plus methotrexate plus 5-fluorouracil (28 MAK patients and 36 control patients). Patients received six cycles of chemotherapy at 28-day intervals and received ondansetron as an anti-emetic agent. Patients were evaluated for toxic side effects per World Health Organization (WHO) criteria. The mean age of the MAK patients and controls was similar: 43 ± 10 for the MAK group and 46 ± 9 for the controls. Results of the study showed improvement in several parameters for patients taking MAK as compared to controls: Karnofsky performance status, anorexia, vomiting, general well-being, and body weight. For the sixth cycle of chemotherapy, 27% more MAK patients had healthy Karnofsky scores, a scale that measures the ability to perform normal day-to-day activities. The overall average was 17.5% higher for MAK patients. For the fourth cycle of chemotherapy, 34% fewer MAK patients experienced loss of appetite (anorexia). The overall average was 26% less for patients taking MAK. For the third cycle of chemotherapy, 29% fewer MAK patients experienced vomiting. The overall average was 22% less for MAK patients. Also in the third cycle, 25% more MAK patients had a 'good' status of general well-being, with the overall average being 12% higher for MAK patients compared to controls. There was a statistically insignificant mean weight gain of 0.43 kg in the MAK patients, in comparison to a statistically significant mean weight loss of 1.12 kg in the control patients. Thus, patients on MAK were able to maintain their weight during treatment. Another important finding in this study was that there was no significant difference in tumor regression between the MAK patients and the controls. The MAK group had a statistically insignificant increase in the number of patients with tumor regression. This indicates that MAK does not impede the anti-cancer effects of chemotherapy. Thus, MAK is effective in reducing toxicity of chemotherapy treatment without impairing the anti-cancer effects of the chemotherapy.









Bar graphs reprinted with permission from Townsend Letter for Doctors and Patients, *August/September 2000, pp. 134-138, Tel. 360-385-6021.*

Study 4 **Research Highlights**
MAK-4 and MAK-5 supplemented diets were effective in reducing chemotherapy toxicity in breast cancer patients receiving chemotherapy and effectively supported weight maintenance. It also was found that MAK does not impede the anti-cancer effects of chemotherapy.

5. Title

An Ayurvedic Herbal Compound to reduce Toxicity to Cancer chemotherapy: A Randomized Controlled Trial

Publication:

Indian Journal Of Medical & Paediatric Oncology, Vol. 29 No. 2, 2008

Principal Investigator:

Anurag Srivastava**,
M. C. Misra**,

Co- Investigator:

Sandeep Aggarwal**, Vuthaluru Seenu**, Rajinder Prashad**, Varna Tarnikanti**, Abha Saxena*, Smita Dixit*, S. M. Bhushan*

Background:

Maharishi Amrit Kalash (MAK) is an Ayurvedic compound containing many herbs rich in antioxidants. We evaluated its role in reduction of chemotherapy toxicity among women with breast cancer.

Patient and Methods:

We recruited 214 patients with breast carcinoma receiving cyclophosphamide, methotrexate and 5-flourouracil (CMF) or cyclophosphamide, adriamycine, & 5- flourouracil (CAF), adjuvant or neo-adjuvant chemotherapy. The toxicity of chemotherapy was assessed according to WHO criteria. Statistical analysis was carried out on Epi-info 6 and STATA-7. All patients received same anti-emetic therapy with ondensetron and dexamethasone.

Introduction:

Incidence of breast carcinoma has increased exponentially in the last decade. Surgery is most effective local therapy with chemotherapy and radiotherapy used as an adjunct. Chemotherapy is associated with significant side effects and toxicities, resulting in high dropout rates and morbidity. Many drugs like mesna with Ifosfamide have been tried to prevent or control chemotherapy related toxicities, but these agents have their own side effects1. Other cytoprotector like Amifostine have also showed side effects like transient hypotension, dizziness and hypocalcaemia2. There is a need to explore an ideal chemoprotective agent without toxic effects.

The modern health care provider is exploring the beneficial effects of many herbs and natural products in treating and preventing many disease states. Maharishi Amrit Kalash (MAK), MAK-4 & MAK-5 collectively is an herbal formulation derived from the Indian system of medicine known as 'Ayurveda'. This herbal formulation has been used for general betterment of health since antiquity. The MAK-4 is prepared in a paste form while MAK-5 is dispensed as tablets.

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MAK seems to have a potential to reduce the chemo-toxicity[3-4], as well as tumouricidal activities in animals[5-6]. MAK has also been shown to reduce metastasis in animal models[7] Antioxidant properties of MAK have been reported by many experimental and clinical studies[3,8,9,10,11]. Misra et. al. (1994) conducted initial prospective study in 62 patients receiving a variety of combinations. Chemotherapy (in one of the combinations of cyclophosphamide, methotrexate, vincristine, doxorubicin, cisplatin, prednisolone and 5-FU) for various types of tumours including non-Hodgkin's lymphoma, ovarian cancer, breast cancer, oral cancer and osteogenic sarcoma. They demonstrated a reduction in severity of vomiting and diarrhea and improvement in sleep and general well being.

In another study, we observed protective effect of MAK in vomiting, diarrhea and maintenance of general well being of patients with breast carcinoma in 129 cases.[4] The present paper describes the detailed results of a randomized trial carried out on a larger sample size to assess the effectiveness of MAK in reducing the chemotherapy related side effects.

Material and Methods:

A total of 214 breast cancer patients, receiving chemotherapy were included in the study from Breast Cancer Clinic, Department of Surgery, All India Institute of Medical Sciences, New Delhi. The study was commenced in May 1997 and ended in January 2003. We hypothesized that the administration of MAK herbal compound can reduce the toxicity of anti-cancer chemotherapy in women with breast cancer.

The project was formally approved by Hospital Ethics Committee. Patients with breast cancer receiving chemotherapy were included in the study. The diagnosis of breast cancer was confirmed histologically. Patients suffering from diabetes mellitus were excluded from study, as MAK-4 is a sugar based compound.

Patients with early stage of breast cancer were offered initial surgery followed by six cycles of CMF, as adjuvant chemotherapy at 21 days interval.

Patients with inoperable or locally advanced carcinomas were given 3 cycles of CAF as neo-adjuvant chemotherapy followed by surgery provided there was complete or partial response to the therapy and then remaining 3 cycles were given as completion chemotherapy. In general the CMF regimen was employed as a postoperative adjuvant, following mastectomy or wide excision along with full axillary dissection in T1, T2 - N0 or N1 disease. The CAF regimen was used as neo-adjuvant therapy in women with locally advanced breast cancer (LABC) women were randomized to receive MAK supplement along with chemotherapy while the other half served as control and given CMF or CAF alone. Patients were monitored for toxicity.

Method of Randomization:

We used simple randomization method with an allocation ratio of 1:1. The randomization schedule was generated from a table of random numbers. The patients were given written information about the nature of trial and requested to sign a consent form.The patients were randomized into two groups - MAK and control group by two Ayurvedic physicians, using sealed numbered envelopes. Patients in MAK group received MAK-4 paste with dosage of 2 tablespoonfuls twice daily with a glass of milk and MAK-5, 2 tablets twice daily with lukewarm water half an hour after MAK-4. This MAK supplementation was given throughout the chemotherapy i.e. for approximately 18 weeks and responses were evaluated by questionnaire and direct physical examination at 21 days interval. Both groups of patients received ondansetron intravenously with each dose of chemotherapy and then orally for 2-3 days. Dexamethasone was also injected just prior to chemotherapy in a dosage of 8mg intramuscular and 8mg intravenous. Pain killers and antibiotics for infections has been used as concomitant therapy during study. Compliance was checked by our research fellows by checking the bottle of tablets (MAK-5) from time to time and counting the number of tablets.

Tumour regression was measured according to EORTC response criteria.[12]

Statistical analysis:
Analysis was carried out on Epi-info6 (WHO, Geneva, Switzerland) and STATA-7 (Stata Statistical Package, Texas, USA).

Result and Analysis:
Out of 214 patients, 102 patients were recruited in MAK group and 112 patients in the control group. We have included 181 (85 in MAK & 96 in control) patients (those completing at least three cycles of chemotherapy) in final analysis of data (please see flow chart). The data of remaining 33 patients were not evaluated due to following reasons.

Table : 1

VARIABLES (mean {SD})	MAK (n=102)	CONTROL (n=112)
AGE (Years)	44(10)	44.9 (8.9)
WEIGHT (KG)	57.1 (11.6)	59 (13.1)
Mean WBC ($x10^9$/L)	7474 (2445)	7877 (2227)

(1) Lost to follow up during study.
(2) Due to progressive disease chemotherapy was stopped in some patients.
(3) Some patients refused further treatment and went away.

Anorexia:
Throughout chemotherapy patients receiving MAK had better appetite when compared to controls .

Appetite was coded in three categories. The patients with fair and poor categories were grouped together for analysis. Statistically significant differences were observed in all the cycles. (Figure-1)

Vomiting:
We categorized the data into two groups i.e. vomiting present or absent. (Figure-2) MAK reduced the risk of vomiting with statistically significant difference in 3rd cycle of chemotherapy (p=0.002, RR 0.60; 95% confidence interval 0.42 to 0.85) PF=40.3, (95% confidence interval 15.1 to 58.1) and for 4th cycle of chemotherapy (p=0.01, RR 0.64; 95% confidence interval 0.45 to 0.91) PF=36.1, (95% confidence interval 9.1 to 55.1).

Karnofsky Performance Status:
KPS score assessed the overall state of health and physical performance. Patients were categorized in two groups i.e KPS < 70% or > 80% patients with deteriorating condition (KPS < 70% were more in controls as compared to MAK group. (Figure-3)

As chemotherapy progressed at the end of 5th cycle, highly significant statistical difference was observed. (p=0.005, RR 0.39; 95% confidence interval 0.20 to 0.78) PF=60.6 (95% confidence interval 22.1 to 80.1)

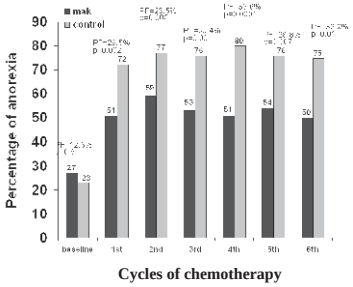


Fig 1 : Depicting Cumulative Incidence of Anorexia in the MAK and Control Groups in Different Cycles of Chemotherapy

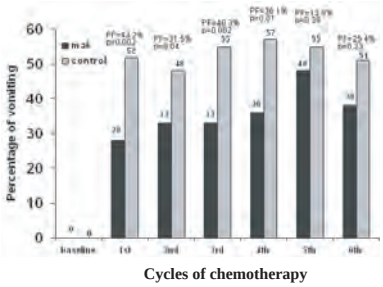


Fig 2 : Depicting Cumulative Incidence of vomiting in the MAK and Control Groups in Different Cycles of Chemotherapy

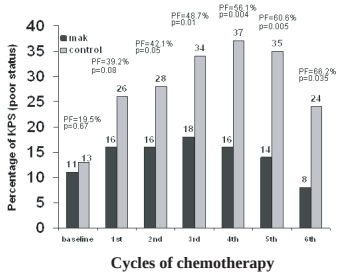


Fig 3 : Depicting Cumulative Incidence of K arnofsky performance status in t he M AK and Control Groups i n Different Cycles of Chemotherapy

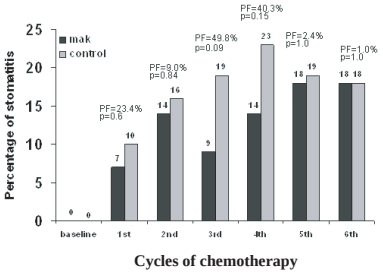


Fig 4 : Depicting Cumulative Incidence of Stomatitis in the MAK and Control Groups in Different Cycles of Chemotherapy

Weight:

Among women receiving neoadjuvant therapy with CAF the body weight was maintained in MAK group, mean difference in body weight (pre chemotherapy weight - post chemotherapy weight) was 0.81 kg (p=0.26, t=1.13) whereas women in control group experienced mean weight loss of 1.58kg, which on paired t test was statistically significant (p=0.01, t=2.33).

In case of CMF group there was an average increase in mean body weight in both group but the weight gain was more pronounced in the MAK group (1.68 kgs; 95% CI 2.9 to 0.37, t=2.59, p=0.01) compared to control group (1.28 kgs; 95% CI 2.54 to 0.026, t=2.05, p=0.04).

Thus, intake of MAK helped in maintenance of body weight through out the chemotherapy.

Stomatitis:

Stomatitis was recorded in 4 categories. The patients in 2,3 & 4 categories were grouped together for analysis.

At the end of 4th cycle, cumulative of stomatitis was less in the MAK group (14) as compared to controls (23) (PF=40.3%, p=0.15). (Figure-4)

Other side effects:

Diarrhoea:

The incidence of diarrhea was similar in both groups at baseline (table 1). After 3 cycles 76.5% patients had no diarrhea, 16.5% had > 2 days and 7.1% had diarrhea > 2 days. Similarly at the end of 3rd cycle in control group 13.4% patients reported diarrhea <2 days, 7.2% reported > 2 days and 1% patients required therapy to control diarrhea.

After completion of 6 cycles in MAK group 10.2% has diarrhoea <2 days, 2% had >2 days and in control group 12.5% had diarrhea <2 days and 7.1 reported diarrhoea >2 days.

Alopecia:

At the end of chemotherapy 38.8% and 32.1% patients from MAK and control groups reported minimal alopecia. Moderate alopecia were observed 28.6%, which was similar in both groups. Complete alopecia was observed in 20.4% and 26.8% in MAK and control group respectively, p=ns.

Tumour Response:
Tumour response was measured in patients receiving neo-adjuvant chemotherapy for locally advanced disease. In MAK group, out of 39, ten patients had complete response (CR) and sixteen patients had partial response (PR). Similarly in case of controls, out of 43 patients, ten had CR and 19 patients had PR. Six cases MAK and 4 cases in the control arm developed progressive disease.

Discussion:
In this study we tried to evaluate the effect of MAK as a chemo protective agent in patients with breast cancer.

In our study, there was significant amelioration in certain side effects. Patients receiving MAK had shown significantly better improvement in appetite as compared to controls, throughout chemotherapy.

The present study points out that MAK reduces the risk of vomiting as compared with controls significantly.

KPS is a measure of the physical activity status of patients.
Patients with KPS < 70% were more in control than in MAK group. At the end of chemotherapy 8% of patients in the MAK group had a KPS of < 70% compared to 23.6% in the control group. This indicates that MAK is helpful in enhancing the general performance status of patients.

Misra et. al. reported reduction in frequency of vomiting, diarrhea and improvement in general well being of patients taking MAK.[3] They observed a reduced risk of diarrhea and stomatitis. Women in CMF group gained weight more so in the MAK group. Among women receiving CAF there was a net loss of body weight of 1.5 kg in the control group. MAK administration in the CAF group helped in maintaining their body weight.

MAK has been found to have antioxidant and free radical scavenging properties in animals.[9] Free radicals and relative oxygen species have been shown to be related with the pathogenesis of cancer and other degenerative diseases. Ionizing radiation and chemotherapeutic agents also produce excess of free radicals, which eventually lead to damage of the tissues. Super oxide dismutase (SOD) is a naturally occurring enzyme in human cells, which buffers free radicals by dismutation. This enzyme is not adequate in presence of excess of free radicals.

MAK contains low molecular weight antioxidants. Niwa et. al. (1989) have demonstrated that lipid peroxide; free radical falls from abnormal to normal levels by supplementation of MAK. It has also been shown that MAK potentiated SOD enzyme induction capacity of human leukocytes.[10] MAK also inhibits the free radical mediated peroxidation of microsomal lipids in vitro.[11] Significant reduction in lipid peroxide was also observed by MAK in human beings.[3]

Acknowledgment:
We are grateful to Shri Anand Shrivastava (Chairman), Mr. S. M. Bhushan, Research Co-ordinator, Maharishi Ayurveda Products for funding and supporting the trial. We are also thankful to Mr. Jaiprakash for dispensing of MAK and in data entry.

Results:
There was a significant reduction in toxicities observed in MAK group throughout chemotherapy cycles : Poor performance status was prevented by concomitant administration of MAK along with chemotherapy. (Prevented Fraction (PF)=60.6% (95% confidence interval 22.1 to 80.1; p value =0.005). Vomiting was prevented by MAK {PF=40.3%, (95% confidence interval 15.1 to 58.1; p value =0.002)}.Similarly anorexia was reduced with PF=35.6%, (95% confidence interval 17.6 to 49.7, p value = 0.0001) in MAK group. No improvement occurred in stomatitis, diarrhea, alopecia and leucopenia. No overgrowth of tumours occurred in the group treated with Neoadjuvant chemotherapy receiving MAK.

Conclusion:
MAK may be used as a supplement along with chemotherapeutic drugs for reducing chemotherapy induced vomiting, anorexia and improving general well being of patients.

1. Title

Antioxidant Properties of Two Ayurvedic Herbal Preparations [MAK-4 and MAK-5]

Publication

Biochemical Archives, Vol. 10, pp. 25-31, 1994.

Authors

Stephen C. Bondy, Tina M. Hernandez, and Cara Mattia.

Conducted at

Department of Community and Environmental Medicine, University of California (Irvine), Irvine, CA 92717

Summary

Toluene is an organic solvent widely used in industry. Exposure to toluene can result in neuronal damage, as manifested by neurobehavioral and electrophysiological effects in humans and rats. Approximately six billion pounds of toluene are produced each year, therefore the potential for widespread occupational exposure is very high. In addition, toluene produces a euphoric effect which has led to its abuse. Toluene has been shown to induce excess oxidative activity within several organs, including the brain. In this investigation, ethanol and aqueous extracts of MAK-4 and MAK-5 were able to quench generation of reactive oxygen species (ROS) ($p<0.05$) within an isolated fraction of rat cerebral cortex enriched in mitochondria and nerve endings (synaptosomes). Based on these results, rats pretreated with MAK-5 showed a significant decrease in toluene-induced ROS in the cerebellar synaptosomal/mitochondrial preparations ($p<0.05$). Also, the alcoholic extract of MAK-5 significantly reduced toluene-induced ROS generation ($p<0.05$) in the kidney mitochondrial fraction.

See Antioxidant Research for more information on this study.

Fig. 3 Cerebellar ROS formation in toluene and MAK-5 treated rats

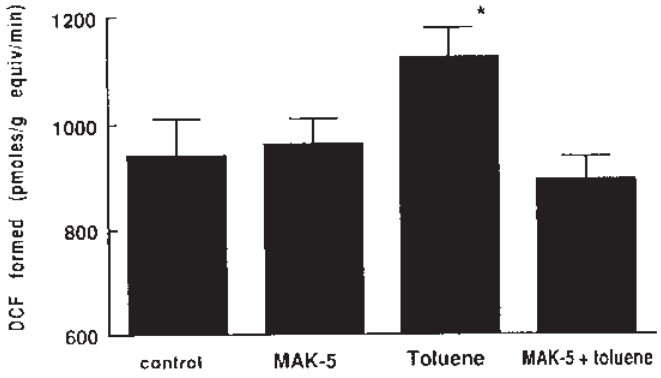


FIGURE 3

Cerebellar formation of reactive oxygen species in toluene- and MAK-5 treated rats Data are means ± SE derived from 6 animals/group. Experimental details in text. *: differs significantly from control value.

Study 1 **Research Highlights**

Rats pretreated with MAK-5 showed a significant decrease in toluene-induced reactive oxygen species (ROS) in cerebellar synaptosomal/mitochondrial preparations. Also, the alcoholic extract of MAK-5 significantly reduced toluene-induced ROS generation in the kidney mitochondrial fraction.

2. Title

In Vitro and In Vivo Inhibition of Microsomal Lipid Peroxidation by MA-631

Publication

Pharmacology, Biochemistry and Behavior, Vol. 48, No. 2, pp. 505-510, 1994.

Authors

Atef N. Hanna, Hari M. Sharma, Ellen M. Kauffman, and Howard A.I. Newman.

Conducted at

Department of Pathology, College of Medicine, The Ohio State University, Columbus, OH

Summary

MA-631 is an herbal mixture from the comprehensive system of natural health care known as Maharishi Ayur-Veda. The in vivo portion of this study on MA-631 involved feeding rats a 2% (w:w) MA-631-supplemented diet for three weeks, then challenging their system with an intraperitoneal injection of toluene. The results showed that the 2% MA-631-supplemented diet completely inhibited the in vivo microsomal lipid peroxidation induced by toluene in rat brain, kidney, liver, and heart ($p<0.05$).

See Antioxidant Research for more information on this study.

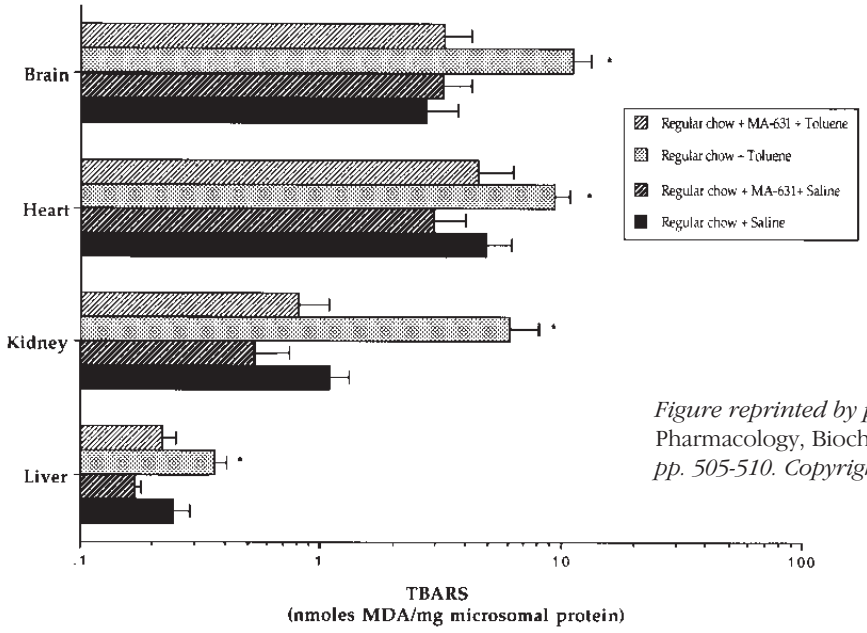


FIG. 3. Effect of in vivo pretreatment with MA-631 on toluene-induced microsomal lipid peroxidation. Animals were fed regular chow or regular chow supplemented with 2% MA-631 (w:w) for three weeks, then injected IP with toluene or a comparable volume of normal saline. Two hours after injection all animals were sacrificed and microsomal lipid peroxidation was assessed by measuring TBARS. Values are means ± SDs, $n = 6$. *Regular chow + toluene is significantly higher ($p < 0.05$) than regular chow supplemented with 2% (w : w) MA-631 + toluene.

Study 2 **Research Highlights**

An MA-631-supplemented diet pre-fed to rats for 3 weeks completely inhibited the in vivo microsomal lipid peroxidation induced by toluene in rat brain, kidney, liver, and heart.

3. Title

Effect of Herbal Mixture Student Rasayana on Lipoxygenase Activity and Lipid Peroxidation

Publication

Free Radical Biology and Medicine, Vol. 18, No. 4, pp. 687-697, 1995.

Authors

Hari M. Sharma, Atef N. Hanna, Ellen M. Kauffman, and Howard A.I. Newman.

Conducted at

Department of Pathology, College of Medicine, The Ohio State University, Columbus, OH

Summary

Student Rasayana (SR) is an herbal mixture derived from the comprehensive system of natural health care known as Maharishi Ayur-Veda. SR has been reported to increase intelligence in children. This study was undertaken to evaluate the hypothesis that SR improves brain functioning by protecting the brain from free radical damage and/or increasing lipoxygenase activity associated with long-term potentiation (a process associated with memory). The in vivo portion of the study involved feeding rats a 2% (w:w) SR-supplemented diet for three weeks, then challenging their system with an intraperitoneal injection of toluene. The results showed that SR completely inhibited in vivo toluene-induced microsomal lipid peroxidation in rat brain microsomes ($p<0.05$).

For more information on this study, see Antioxidant Research and Research on Anti-Aging, Neurophysiology and Intelligence.

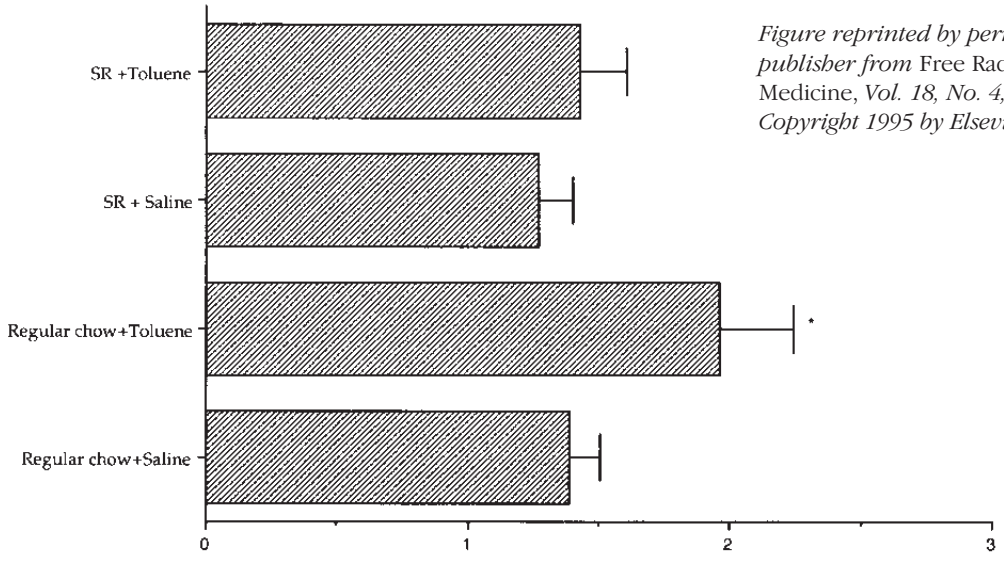


Fig. 5. Effect of in vivo pretreatment with SR on toluene-induced brain microsomal lipid peroxidation. Animals were fed regular chow or regular chow supplemented with 2% (w:w) SR for 3 weeks, then injected intraperitoneally with toluene or a comparable volume of normal saline. Two hours after injection, all animals were sacrificed, and microsomal lipid peroxidation was assessed by measuring TBARS. Values are mean ± SD, $n = 10$. *Regular chow + toluene is significantly higher ($p < 0.05$) than regular chow supplemented with 2% (w:w) SR + toluene.

Study 3 **Research Highlights**

A 2% Student Rasayana (SR)-supplemented diet pre-fed to rats for three weeks completely inhibited in vivo toluene-induced microsomal lipid peroxidation in rat brain microsomes.

1. Title

Inhibitory Effects of Maharishi-4 [MAK-4] and Maharishi-5 [MAK-5] on Microsomal Lipid Peroxidation

Publication

Pharmacology, Biochemistry and Behavior, Vol. 39, No. 3, pp. 649-652, 1991.

Authors

Chandradhar Dwivedi,* Hari M. Sharma,** Stacy Dobrowski,* and Ferzaan N. Engineer.*

Conducted at

* College of Pharmacy, South Dakota State University, Brookings, SD
**College of Medicine, The Ohio State University, Columbus, OH

Summary

The effects of Maharishi-4 (MAK-4) and Maharishi-5 (MAK-5) on microsomal lipid peroxidation were examined in vitro. Rat liver microsomes were incubated with an NADPH-generating system or with sodium ascorbate and an ADP-iron complex to stimulate enzymatic or nonenzymatic lipid peroxidation, respectively. Alcoholic or aqueous extracts of MAK-4 or MAK-5, when added to these incubation systems, inhibited hepatic microsomal lipid peroxidation in a concentration-dependent manner. The aqueous extract of MAK-4 was the most effective antiperoxidant in these systems. A 10% (w/v) aqueous extract of MAK-4 inhibited ascorbate or NADPH-induced lipid peroxidation by approximately 50% when added at volumes of 8 microliters and 3.5 microliters, respectively, to the incubation mixtures (total incubation volume, 2 mL). These findings suggest that MAK-4 and MAK-5, by virtue of their antioxidant properties, may be useful in the treatment of free radical-linked drug toxicities and disease states.

Study 1 **Research Highlights**

Alcoholic or aqueous extracts of MAK-4 or MAK-5, when added to rat liver microsomes incubated with a system to stimulate lipid peroxidation, inhibited hepatic microsomal lipid peroxidation in a concentration-dependent manner. These findings suggest that MAK-4 and MAK-5, by virtue of their antioxidant properties, may be useful in the treatment of free radical-linked drug toxicities and disease states.

2. Title

Effect of Maharishi 4 [MAK-4] and Maharishi 5 [MAK-5] on Inflammatory Mediators—With Special Reference to Their Free Radical Scavenging Effect

Publication

Indian Journal of Clinical Practice, Vol. 1, No. 8, pp. 23-27, January 1991.

Author

Yukie Niwa.

Conducted at

Niwa Institute for Immunology, Japan

Summary

Maharishi 4 (MAK-4) and Maharishi 5 (MAK-5) were investigated for their effects on human neutrophil chemotaxis, phagocytosis, reactive oxygen species (ROS) generation, and lymphocyte response to mitogens. The effect on ROS generated in a xanthine-xanthine oxidase system was also tested. Chemotaxis was significantly inhibited in the presence of MAK-4 and phagocytosis was slightly decreased in the presence of both

MAK-4 and MAK-5. MAK-4 and MAK-5 markedly decreased superoxide, hydrogen peroxide, and hydroxyl radicals, generated both in the neutrophil and xanthine-xanthine oxidase systems. These two herbal mixtures also significantly reduced lymphocyte blastogenesis stimulated by the mitogens phytohemagglutinin, concanavalin A, and pokeweed mitogen. This study suggests that the empirical effectiveness of these two natural products in a variety of diseases is due to their suppressive effect on inflammatory mediators, especially on potent ROS.

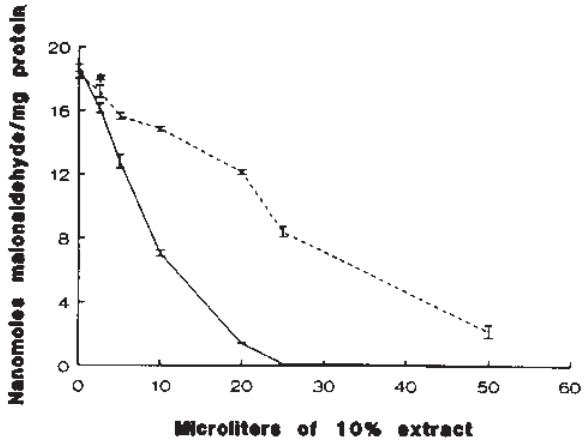


FIG. 1. Effect of M-4 (10% extract) on ascorbate-induced hepatic microsomal lipid peroxidation. The aqueous extract (—) or alcoholic extract (---) was added to the incubation mixture (total incubation volume = 2 ml) described in the Method section. Malonaldehyde values at each point represent the mean ± SD of 3–5 determinations. Values that are not significantly different ($p<0.05$) from the corresponding control value are marked with a * symbol.

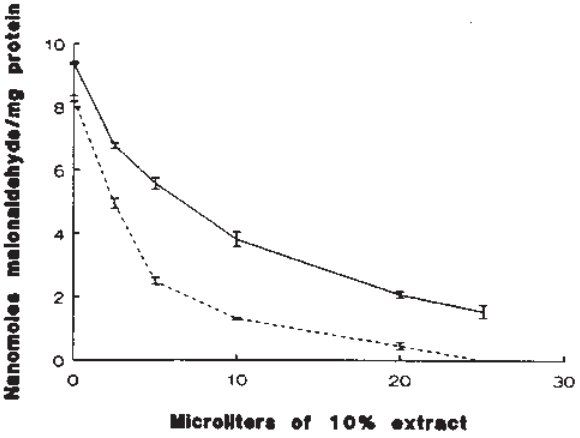


FIG. 4 Effect of M-5 (10% extract) on NADPH-stimulated hepatic microsomal lipid peroxidation. The aqueous extract (—) or alcoholic extract (---) was added to the incubation mixture (total incubation volume = 2 ml) described in the Method section. Malonaldehyde values at each point represent the mean ± SD of 3–5 determinations. Values that are not significantly different ($p<0.05$) from the corresponding control value are marked with a * symbol.

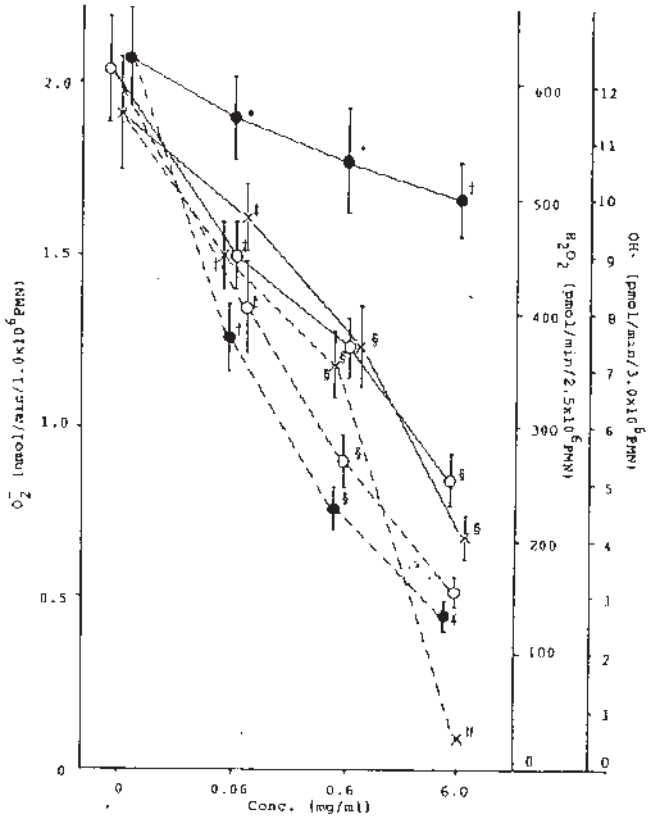


FIG. 2. Effect of MAK-5 on ROS generated by human neutrophils and in xanthine-xanthine oxidase system.
Closed circle (●) denotes O_2 (superoxide);
open circle (O) H_2O_2 (hydrogen peroxide);
and cross symbol (X) OH (hydroxy radical) levels.
Solid line (——) denotes each ROS generated by neurophils, and dashed line (------) in xanthine xanthine oxidase system. PMN denotes polymorphonuclear leukocytes.

*P < 0.05 vs. control, ‡P<0.01, § <0.001, ||P<0.0001.

Study 2 **Research Highlights**
The empirical effectiveness of MAK-4 and MAK-5 in a variety of diseases may be due to their suppressive effect on inflammatory mediators, especially on potent reactive oxygen species (ROS).

3. Title

Inhibition of Human Low-Density Lipoprotein Oxidation In Vitro by Maharishi Ayur-Veda Herbal Mixtures [MAK-4, MAK-5, MA-631, and Maharishi Coffee Substitute]

Publication

Pharmacology, Biochemistry and Behavior, Vol. 43, pp. 1175-1182, 1992.

Authors

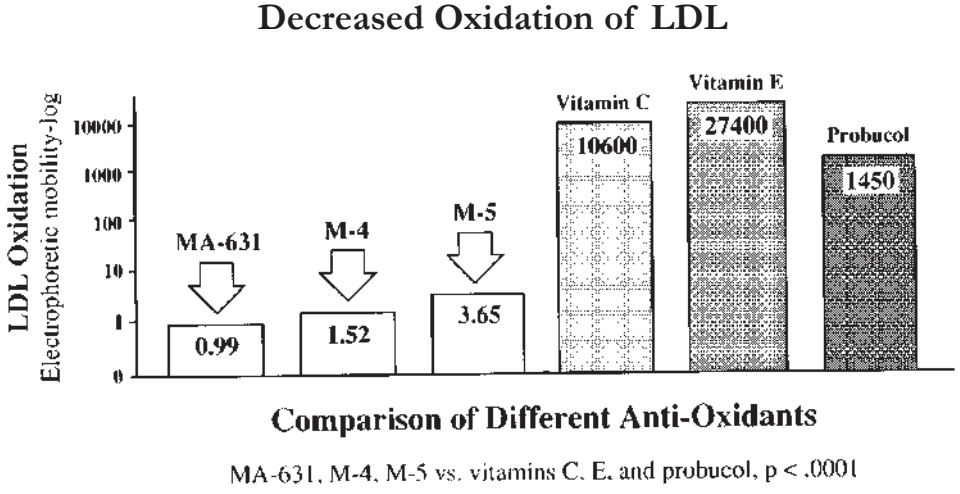
Hari M. Sharma, Atef N. Hanna, Ellen M. Kauffman, and Howard A.I. Newman.

Conducted at

Department of Pathology, College of Medicine, The Ohio State University, Columbus, OH 43210

Summary

This study examined the effect of the Maharishi Ayur-Veda herbal mixtures (MAHMs) MAK-4, MAK-5, MA-631, and Maharishi Coffee Substitute (MCS) on low-density lipoprotein (LDL) oxidation, and compared the potency of these mixtures to ascorbic acid (vitamin C), alpha-tocopherol (vitamin E), and the drug probucol. LDL was incubated in 95% air and 5% CO_2, with or without 3 micromolar Cu^{+2}, in the presence or absence of alcoholic or aqueous extracts of MAHMs, for 6 or 24 hours. In a separate experiment, LDL was incubated as above except the MAHM extracts were added at 0, 1.5, and 3.5 hours after incubation started, to assess their effect on the initiation and propagation of LDL oxidation. The results demonstrate that MAHMs caused concentration-dependent inhibition of LDL oxidation as assessed by thiobarbituric acid-reactive substances (TBARS) and electrophoretic mobility. Both the aqueous and alcoholic extracts of the MAHMs showed more antioxidant potency in preventing LDL oxidation than ascorbic acid, alpha-tocopherol, or probucol. The alcoholic extracts of the MAHMs were at least 1000 times more potent than ascorbic acid, alpha-tocopherol, and probucol after the 6-hour incubation. The alcoholic extracts of the MAHMs showed an even larger magnitude of difference after the 24-hour incubation. Also, the MAHMs inhibited both the initiation and propagation of cupric ion-catalyzed LDL oxidation.



Three Maharishi Ayur-Veda herbal preparations—MA-631, MAK-4 and MAK-5—were much more effective in preventing LDL oxidation than vitamin C and E, and the drug probucol (which are known to be powerful anti-oxidant). LDL oxidation plays a crucial role in the pathology of coronary heart disease. Antioxidant substances help to prevent heart disease by inhibiting oxidation of LDL and other fats.

(continued)

TABLE 1

COMPARISON OF IC_{50} (ng/ml) OF DIFFERENT ANTIOXIDANTS ON LDL OXIDATION AFTER 6-h INCUBATION

Agent	TBARS*	Electrophoretic Mobility*
M-4 aqueous	49.0 ± 7.37	48.4 ± 6.79
M-4 alcoholic	0.708 ± 0.222	1.03 ± 0.145
M-5 aqueous	163 ± 53.7	70.4 ± 14.7
M-5 alcoholic	0.132 ± 0.033	0.72 ± 0.31
MA-631 aqueous	10.2 ± 5.51	9.33 ± 1.69
MA-631 alcoholic	0.152 ± 0.055	1.20 ± 0.488
MCS aqueous	11.7 ± 2.16	–
MCS alcoholic	0.132 ± 0.103	0.967 ± 0.737
Ascorbic acid	$4.00 \pm 0.613 \times 10^3$	$10.5 \pm 1.49 \times 10^3$
α-Tocopherol	$19.6 \pm 3.90 \times 10^3$	$26.0 \pm 4.91 \times 10^3$
Probucol	$1.36 \pm 0.658 \times 10^3$	$2.02 \pm 0.089 \times 10^3$

LDL (0.2 mg) was incubated in 95% air and 5% CO_2, with or without 3 μM Cu^{+2}, in the presence or absence of antioxidant agents for 6 h. Values are mean ± SD (n = 3).

*M-4, M-5, MA-631, MCS vs. ascorbic acid, α-Tocopherol, and probucol are significantly different ($p < 0.0001$).

TABLE 2

COMPARISON OF IC_{50} (ng/ml) OF DIFFERENT ANTIOXIDANTS ON LDL OXIDATION AFTER 24-h INCUBATION

Agent	TBARS*	Electrophoretic Mobility*
M-4 aqueous	102 ± 11.2	124 ± 12.6
M-4 alcoholic	0.848 ± 0.387	1.52 ± 0.321
M-5 aqueous	158 ± 70.9	335 ± 55.7
M-5 alcoholic	0.235 ± 0.221	3.653 ± 0.103†
MA-631 aqueous	14.3 ± 5.15	37.3 ± 5.51
MA-631 alcoholic	0.163 ± 0.071	0.988 ± 0.164
MCS aqueous	37.5 ± 8.16	59.2 ± 9.84
MCS alcoholic	0.113 ± 0.028	0.398 ± 0.103
Ascorbic acid	$8.27 \pm 0.678 \times 10^3$	$10.6 \pm 1.70 \times 10^3$
α-Tocopherol	$23.2 \pm 0.924 \times 10^3$	$27.4 \pm 1.46 \times 10^3$
Probucol	453 ± 42.1	$1.45 \pm 0.576 \times 10^3$

Incubation conditions are the same as in Table 1 except incubation was carried out for 24 h. Values are mean ± SD (n = 3).

*M-4, M-5, MA-631, MCS vs. ascorbic acid, α-tocopherol, and probucol are significantly different ($p < 0.0001$).

†n = 2.

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Study 3 **Research Highlights**

Both aqueous and alcoholic extracts of MAK-4, MAK-5, MA-631 and Maharishi Coffee Substitute showed more antioxidant potency in preventing LDL oxidation than ascorbic acid, alpha-tocopherol, or probucol. The alcoholic extracts of MAK-4, MAK-5, and MA-631 were at least 1,000 times more potent than the comparison antioxidants.

4. Title

In Vitro and In Vivo Inhibition of Microsomal Lipid Peroxidation by MA-631

Publication

Pharmacology, Biochemistry and Behavior, Vol. 48, No. 2, pp. 505-510, 1994.

Authors

Atef N. Hanna, Hari M. Sharma, Ellen M. Kauffman, and Howard A. I. Newman.

Conducted at

Department of Pathology, College of Medicine, The Ohio State University, Columbus, OH 43210

Summary

Excess free radicals are linked to many diseases, including aging, atherosclerosis, and cancer. MA-631 (a complex herbal mixture) has been shown to inhibit human low-density lipoprotein (LDL) oxidation in vitro. In this study, further evaluation was undertaken on the in vivo and in vitro antioxidant activity of MA-631. Both the alcoholic and aqueous extracts of MA-631 inhibited enzymatic- and nonenzymatic-induced rat liver microsomal lipid peroxidation in a concentration-dependent manner ($p<0.05$). The thiobarbituric acid-reactive substances (TBARS) values (nmoles malondialdehyde (MDA)/mg microsomal protein) were 1.43 +/- 0.18 for microsomes alone (baseline for enzymatic system), 19.63 +/- 2.50 for microsomes + reduced nicotinamide adenine dinucleotide phosphate (NADPH) (oxidation without inhibitor), 9.89 +/- 1.41 for heated microsomes (baseline for nonenzymatic system), and 27.15 +/- 0.08 for microsomes + ascorbate (oxidation without inhibitor). The concentrations (microgram/2 mL) of MA-631 which produced 50% inhibition (IC_{50}) of enzymatic- and nonenzymatic-induced lipid peroxidation were 15.2 +/- 2.0 and 17.0 +/- 2.6, respectively, for the aqueous extract, and 4.3

+/- 0.8 and 6.4 +/- 1.2, respectively, for the alcoholic extract. These results imply that MA-631 may be useful in the prevention of free radical-linked diseases.

See Research on Reduction of Chemical Toxicity for more information on this study.

Study 4 **Research Highlights**
Both alcoholic and aqueous extracts of MA-631 inhibited rat liver microsomal lipid peroxidation in a concentration-dependent manner. The results suggest that MA-631 may be useful in the prevention of free-radical-linked diseases.

5. Title

Protective Effects of MAK-4 and MAK-5 on Adriamycin-Induced Microsomal Lipid Peroxidation and Mortality

Publication

Biochemical Archives, Vol. 8, pp. 267-272, 1992.

Authors

Ferzaan N. Engineer,* Hari M. Sharma,** and Chandradhar Dwivedi.*

Conducted at

* College of Pharmacy, South Dakota State University, Brookings, SD
**College of Medicine, The Ohio State University, Columbus, OH

Summary

The clinical usefulness of the chemotherapeutic agent Adriamycin is compromised by dose-dependent and potentially lethal cardiac toxic effects. The cardiotoxicity of Adriamycin may be linked with free radical-mediated peroxidation of microsomal lipids. This study examined the effects of MAK-4 and MAK-5, herbal food supplements, on Adriamycin-induced lipid peroxidation and toxicity. Rat liver microsomes were incubated with an NADPH-generating system to stimulate lipid peroxidation in the presence or absence of Adriamycin. Alcoholic or aqueous extracts of MAK-4 and MAK-5, when added to these incubation systems, inhibited hepatic microsomal lipid peroxidation in a concentration-dependent manner. The 10% ethanolic or aqueous extract of MAK-4 was a highly effective inhibitor of lipid peroxidation. The ethanolic extract (10%) of MAK-5 also inhibited lipid peroxidation. However, the 10% aqueous extract of MAK-5 did not exhibit antiperoxidant properties under these experimental conditions.

See Cancer Research for more information on this study.

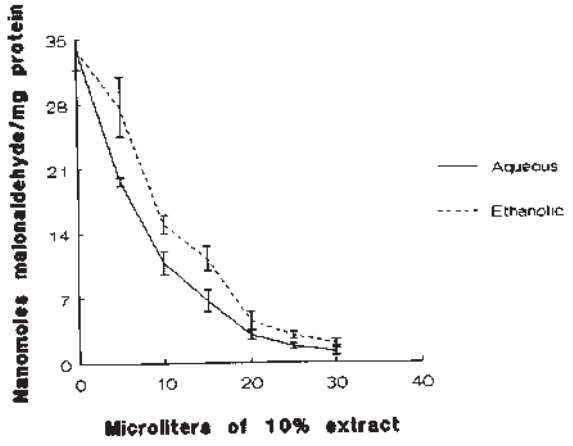

Figure 1
Effects of M-4 (10% extract) on Adriamycin-stimulated hepatic microsomal lipid peroxidation. Malonaldehyde values at each point represent the mean ± SD of 3-6 determinations. The value for control incubations in the absence of Adriamycin was 22.75±3.8 nanomoles malonaldehyde/mg protein.

Study 5 **Research Highlights**
Cardiotoxicity of the chemotherapeutic agent Adriamycin may be linked with free radical-mediated peroxidation of microsomal lipids. Alcoholic or aqueous extracts of MAK-4 and MAK-5, when added to lipid peroxidation incubation systems, inhibited hepatic microsomal lipid peroxidation in a concentration-dependent manner.

6. Title

In Vivo Effect of Herbal Mixture MAK-4 on Antioxidant Capacity of Brain Microsomes

Publication

Biochemical Archives, Vol. 12, pp. 181-186, 1996.

Authors

Hari M. Sharma, Jae Y. Lee, Ellen M. Kauffman, and Atef N. Hanna.

Conducted at

Department of Pathology, College of Medicine, The Ohio State University, Columbus, OH 43210

Summary

There is increasing evidence that free radicals are linked to neurological disorders and aging. The herbal mixture Maharishi Amrit Kalash-4 (MAK-4) has antioxidant properties, as assessed by inhibition of low-density lipoprotein oxidation in vivo and in vitro. This study examined the in vivo effect of MAK-4 on lipid peroxidation and antioxidant protection capacity of the brain of Watanabe Heritable Hyperlipidemic (WHHL) rabbits. A group of 5 rabbits (controls) were fed normal rabbit chow, and a group of 6 rabbits were fed normal chow supplemented with 6% MAK-4 (w:w) for 6 months. Brain microsomes were then prepared and incubated in the presence or absence of either an enzymatic or non-enzymatic system for inducing lipid peroxidation; in the absence of either system, air-induced lipid peroxidation was measured. Lipid peroxidation was assessed by measuring thiobarbituric acid-reactive substances (TBARS). The baseline level of TBARS (nmoles malondialdehyde/mg microsomal protein) was significantly lower ($p<0.05$) in the rabbits fed MAK-4 (1.18 +/- 0.07 vs. 1.51 +/- 0.25 for controls). Also, the MAK-4 group showed significantly lower TBARS ($p<0.05$) after air-, enzymatic-, and nonenzymatic-induced lipid peroxidation (1.29 +/- 0.21, 1.27 +/- 0.16, and 2.91 +/- 0.79, respectively), as compared to controls (1.92 +/- 0.45, 2.28 +/- 0.26, and 12.85 +/- 0.61, respectively). These results indicate MAK-4 may yield increased antioxidant protection in the brain, and may therefore be useful in preventing or treating free radical-induced neurological disorders.

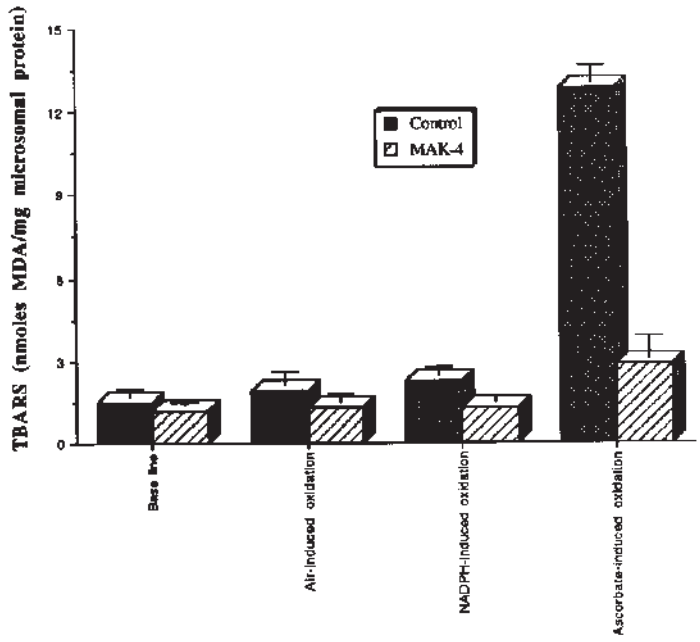

Figure 1

The effect of MAK-4 on resistance of brain microsomes to oxidation. WHHL rabbits were fed regular rabbit chow + 6% MAK-4 (MAK-4 group) or regular chow alone (control group) for 6 months. Brain microsomes were prepared by ultracentrifugation. The microsomes were incubated alone (air-induced oxidation), or with an NADPH-generating system, or with an ascorbate-Fe^{+3} system. The degree of oxidation was assessed by measuring TBARS before incubation (baseline) or after incubation with the various oxidants. Values are mean ± S.E.

Study 6 **Research Highlights**

As studied in Watanabe Heritable Hyperlipidemic rabbits, MAK-4 may yield increased antioxidant protection in the brain, and may therefore be useful in preventing or treating free radical-induced neurological disorders.

7. Title

Antioxidant Properties of Two Ayurvedic Herbal Preparations [MAK-4 and MAK-5]

Publication

Biochemical Archives, Vol. 10, pp. 25-31, 1994.

Authors

Stephen C. Bondy, Tina M. Hernandez, and Cara Mattia.

Conducted at

Department of Community and Environmental Medicine, University of California (Irvine), Irvine, CA 92717

Summary

Two herbal preparations (MAK-4 and MAK-5) constituted of mixtures of several plants have been used over a long period of time by practitioners of Ayurvedic medicine. In view of several reports on their health-related utility, this investigation was undertaken to study their properties in biological systems. Results of this study showed that ethanol and aqueous extracts of these preparations were able to quench generation of reactive oxygen species in vitro within an isolated cerebrocortical fraction enriched in mitochondria and nerve endings (synaptosomes). Both the ethanol and aqueous extracts of MAK-4 and MAK-5 exhibited potent antioxidant activity. The greatest effect was seen with the ethanol extracts of these herbal mixtures, and the most potent inhibition was found in ethanol-soluble materials derived from the MAK-5 product. The ability of MAK-5 extracts to modulate chemically-induced oxidative stress was also examined in intact animals. The excess production of reactive oxygen species observed within the cerebellar mitochondrial fraction after exposure of rats to toluene, was prevented by pretreatment with MAK-5. This effect was not apparent when the ethanol and aqueous extracts of the preparation were tested separately. However, the ethanol extract from MAK-5 alone was able to inhibit the toluene-induced elevation of oxidative species within a mitochondrial fraction derived from the kidney. The results suggest that these herbally-derived mixtures possess distinctive qualities which may be of utility in the design of preventive or therapeutic approaches relating to the mitigation of excess oxidative events. See Research on Reduction of Chemical Toxicity for more information on this study.

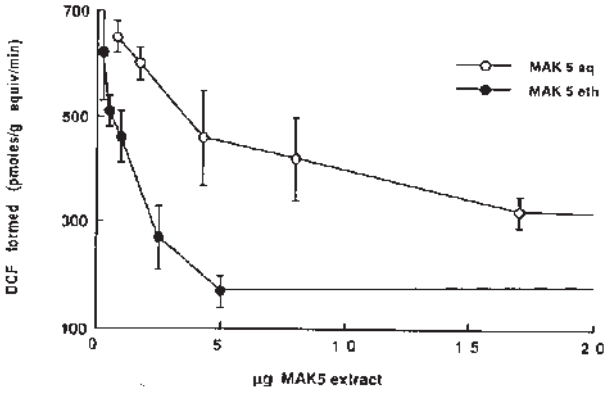

FIGURE 1

Effect of aqueous and ethanol extracts of MAK-5 on rates of synaptosomal oxygen radical formation. Data points are derived from 4-8 independent assays ± standard error

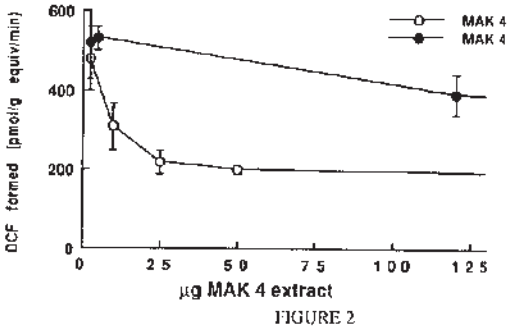

FIGURE 2

Effects of aqueous and ethanol extracts of MAK-4 on rates of synaptosomal oxygen formation. Data are derived from 4-9 individual determinations ± standard error.

Study 7 **Research Highlights**

Ethanol and aqueous extracts of MAK-4 and MAK-5 were able to quench generation of reactive oxygen species in vitro within an isolated cerebrocortical fraction enriched in mitochondria and nerve endings. Thus, these herbally-derived mixtures possess distinctive qualities, which may be of utility in the design of preventive or therapeutic approaches related to the mitigation of excess oxidative events.

8. Title

Effect of Herbal Mixtures MAK-4 and MAK-5 on Susceptibility of Human LDL to Oxidation

Publication

Complementary Medicine International, Vol. 3, No. 3, pp. 28-36, May/June 1996.

Authors

Atef N. Hanna, PhD,* Vidya Sundaram, MD,** James M. Falko, MD,** Ralph E. Stephens, PhD,* and Hari M. Sharma, MD, FRCPC.*

Conducted at

*Department of Pathology and **Department of Internal Medicine, College of Medicine, The Ohio State University, Columbus, OH 43210

Summary

Oxidation of low-density lipoprotein (LDL) plays a central role in the pathogenesis of atherosclerosis. This study investigated the in vivo antioxidant activity of MAK-4 and MAK-5 in a clinical setting, and investigated the in vitro antioxidant properties of MAK-4. Both the aqueous and alcoholic extracts of MAK-4 inhibited endothelial cell (EC)- and soybean lipoxygenase (SLP)-induced LDL oxidation in a concentration-dependent manner. The agent concentrations (microgram/mL) which inhibited 50% (IC_{50}) of EC- and SLP-induced LDL oxidation, respectively, were 150.0 +/- 10.0 and 488.3 +/- 41.9 for the aqueous extract, and 69.3 +/- 8.1 and 128.3 +/- 18.9 for the alcoholic extract. In vitro pretreatment of LDL with MAK-4 increased the resistance of LDL to Cu^{+2}-catalyzed LDL oxidation. Both the aqueous and alcoholic extracts inhibited free radical generation in a concentration-dependent manner. The IC_{50} was 16.35 +/- 4.27 for the aqueous extract, and 3.64 +/- 1.24 for the alcoholic extract; addition of both extracts showed a synergistic interaction. In hyperlipidemic patients, MAK-4 and MAK-5 increased resistance of LDL to oxidation by Cu^{+2} and EC. These results suggest that MAK-4 and MAK-5 protect LDL from oxidation and may be useful in the prevention and treatment of atherosclerosis.

See Cardiovascular Research for more information on this study.

Study 8 **Research Highlights**

MAK-4 and MAK-5 increased resistance of LDL to oxidation by Cu^{+2} and EC in hyperlipidemic patients. These results suggest that MAK-4 and MAK-5 protect LDL from oxidation and may be useful in the prevention and treatment of atherosclerosis.

9. Title

Effect of Herbal Mixture Student Rasayana on Lipoxygenase Activity and Lipid Peroxidation

Publication

Free Radical Biology and Medicine, Vol. 18, No. 4, pp. 687-697, 1995.

Authors

Hari M. Sharma, Atef N. Hanna, Ellen M. Kauffman, and Howard A.I. Newman.

Conducted at

Department of Pathology, College of Medicine, The Ohio State University, Columbus, OH

Summary

Brain cellular functions are affected by free radicals. Arachidonic acid and its 12-lipoxygenase metabolites have been proposed as important in enhancing long-term potentiation associated with learning. It has been reported that Student Rasayana (SR), an herbal mixture, improves brain functions. This study evaluated the antioxidant capacity of SR and its effect on lipoxygenase activity. Both the alcoholic and aqueous extracts of SR inhibited enzymatic- and nonenzymatic-induced microsomal lipid peroxidation in a concentration-dependent manner ($p<0.05$). The agent concentrations (microgram/mL) that produced 50% inhibition (IC_{50}) of enzymatic- and nonenzymatic-induced microsomal lipid peroxidation, respectively, were 99.1 +/- 3.9 and 1992.0 +/- 122.7 for the aqueous extract, and 17.7 +/- 0.9 and 646.7 +/- 79.7 for the alcoholic extract. The aqueous extract inhibited soyabean lipoxygenase (SLP)-induced LDL oxidation in a concentration-dependent manner (IC_{50}: 515.5 +/- 11.5) ($p<0.05$), whereas the alcoholic extract enhanced SLP-induced LDL oxidation. Simultaneous addition of the aqueous and alcoholic extracts inhibited SLP-induced LDL oxidation ($p<0.05$). The alcoholic extract (but not the aqueous extract) enhanced the ability of SLP to induce oxidation of linoleic acid. These results suggest SR improves brain functions through scavenging free radicals as well as increasing the second messenger for long-term potentiation.

See Research on Reduction of Chemical Toxicity and Research on Anti-Aging, Neurophysiology and Intelligence for more information on this study.

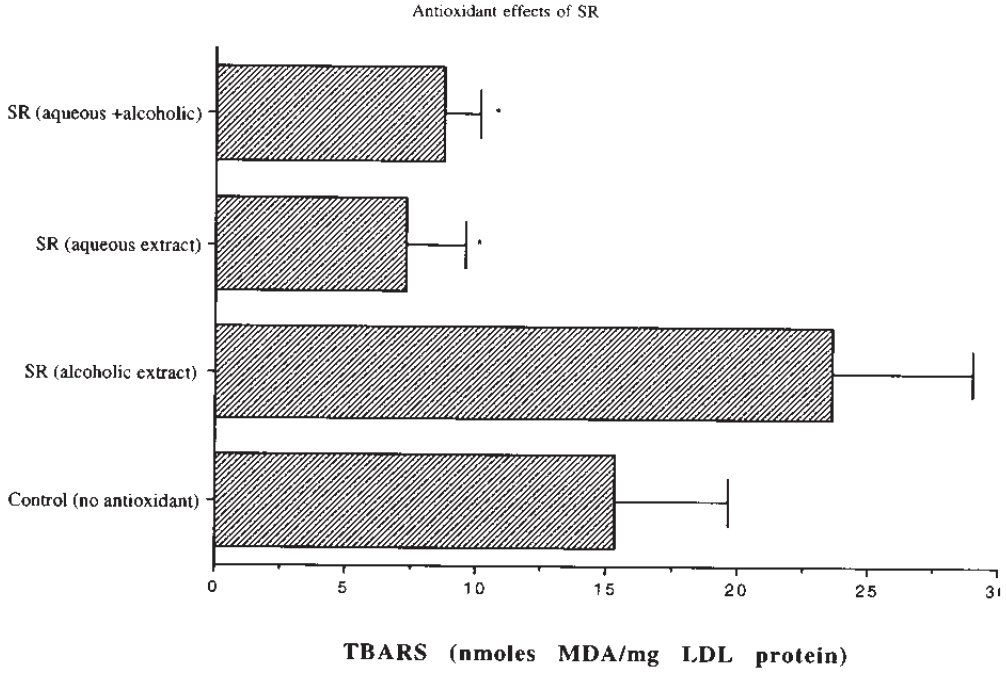

Fig. 1. Effect of simultaneous addition of alcoholic and aqueous extracts of SR on lipoxygenase-induced LDL oxidation. LDL was incubated with or without SLP and phospholipase A_2, in the presence or absence of the alcoholic extract (52 μg) and/or the aqueous extract (640 μg) of SR, at 37°C for 24 h. The degree of LDL oxidation was assessed by measuring TBARS. Values are mean ± *SD*, $n = 3$. *Significantly lower ($p < 0.05$) than the control or the incubation mixture containing only the alcoholic extract of SR.

Study 9 **Research Highlights**

Student Rasayana may improve brain functions through scavenging free radicals as well as increasing the second messenger for long-term potentiation.

10. Title

Inhibition of Low-Density Lipoprotein Oxidation by Oral Herbal Mixtures Maharishi Amrit Kalash-4 (MAK-4) and Maharishi Amrit Kalash-5 (MAK-5) in Hyperlipidemic Patients

Publication

The American Journal of the Medical Sciences, Vol. 314, No. 5, pp. 303-310, 1997.

Authors

Vidya Sundaram, M.D.,* Atef N. Hanna, Ph.D.,** Gary P. Lubow, M.D.,** Lata Koneru, M.D.,† James M. Falko, M.D.,* and Hari M. Sharma, M.D.**

Conducted at

*Department of Internal Medicine and **Department of Pathology, College of Medicine, The Ohio State University, Columbus, OH

†Department of Internal Medicine, Riverside Methodist Hospital, Columbus, OH.

Summary

Low-density lipoprotein (LDL) oxidation is central to the pathogenesis of atherosclerosis. This study evaluated the antioxidant activity of MAK-4 and MAK-5 in vivo. Ten hyperlipidemic patients prescribed stable hypolipidemic therapy were treated with MAK-4 and MAK-5 for 18 weeks. Plasma lipoprotein, plasma lipid peroxide, and LDL oxidation studies were performed every 6 weeks. Apolipoprotein A, apolipoprotein B, and lipoprotein (a) levels were measured at baseline and 18 weeks. After 12 weeks of treatment with MAK-4 and MAK-5, a time-dependent increase in the lag phase and delay in the propagation phase of oxidation of LDL by Cu^{+2} and endothelial cells was seen. Lag phases at baseline and after 6, 12, and 18 weeks of MAK-4 and MAK-5 ingestion were 6.66 hours ± 0.19 (mean ± standard error of mean), 6.77 hours ± 0.31, 7.22 hours ± 0.24, and 18.00 hours ± 0.73, respectively, for Cu^{+2}-catalyzed LDL oxidation. Lag phases were 14.89 hours ± 0.77, 13.33 hours ± 0.50, 20.22 hours ± 0.76, and 20.00 hours ± 0.79, respectively, for endothelial cell-induced LDL oxidation. The levels of plasma lipid peroxide did not change significantly. No significant changes were seen in the plasma lipoproteins and the levels of apolipoprotein A, apolipoprotein B, and lipoprotein (a). The results show that MAK-4 and MAK-5 inhibit LDL oxidation in patients with hyperlipidemia. Therefore, MAK-4 and MAK-5 may be useful in the prevention and treatment of atheroslerosis.

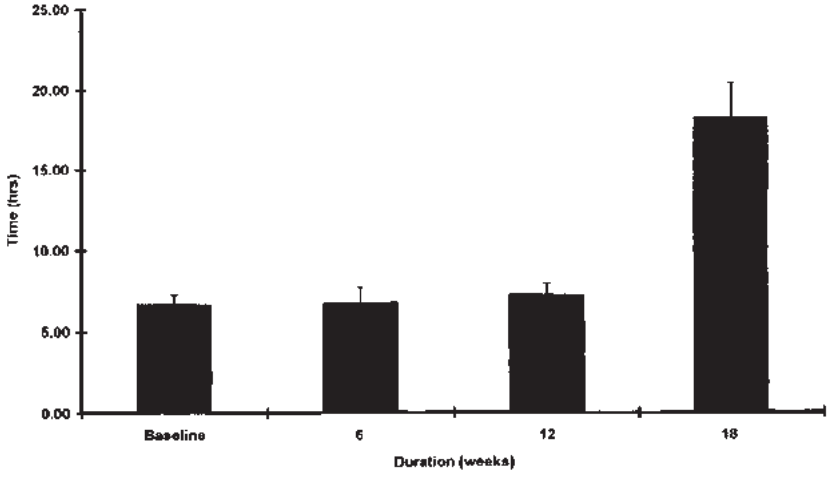

Figure 2. Lag phase (mean ± standard error of mean) of Cu^{+2}-induced low-density lipoprotein oxidation at baseline (0 weeks) and after 6, 12, and 18 weeks of treatment with MAK-4 and MAK-5. *P < 0.05

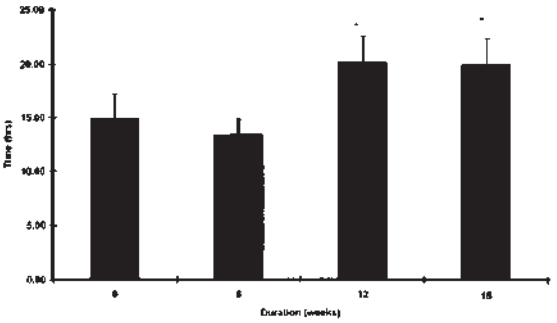

Figure 3. Lag phase (mean ± standard error of mean) of endothelial cell-induced low-density lipoprotein oxidation at baseline (0 weeks) and after 6, 12, and 18 weeks of treatment with MAK-4 and MAK-5. * $P < 0.05$

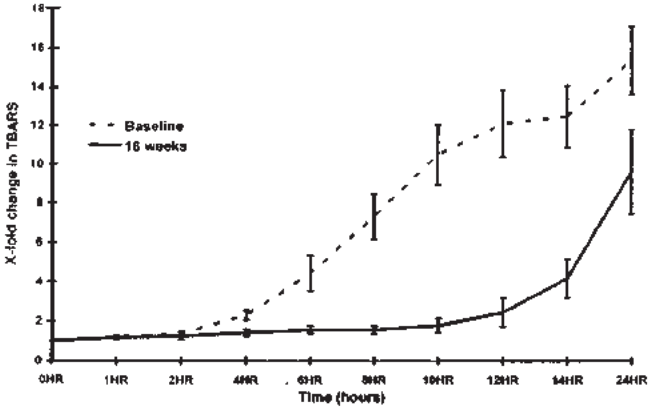

Figure 4. Plot depicting Cu^{+2}-induced low-density lipoprotein oxidation at baseline and after 18 weeks of treatment with MAK-4 and MAK-5. Y-axis represents x-fold change (mean ± standard error of mean) in thiobarbituric acid-reactive substances.

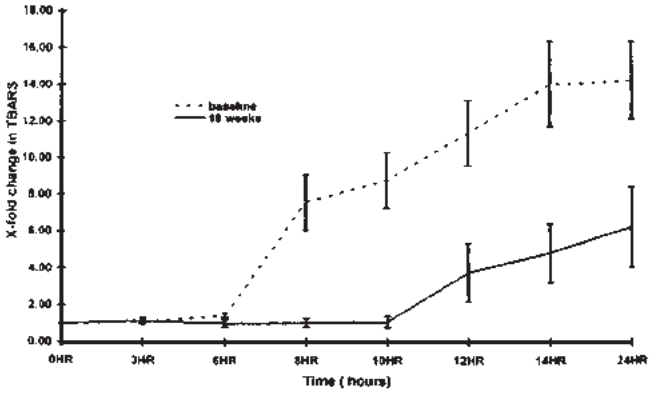

Figure 5. Plot depicting endothelial cell-induced low-density lipoprotein oxidation at baseline and after 18 weeks of treatment with MAK-4 and MAK-5. Y-axis represents x-fold change (mean ± standard error of mean) in thiobarbituric acid-reactive substances.

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Study 10 **Research Highlights**
Ten hyperlipidemic patients were treated with MAK-4 and MAK-5 for 18 weeks. After 12 weeks of treatment, a time-dependent increase in the lag phase and delay in the propagation phase of oxidation of LDL by Cu^{+2} and endothelial cells was seen. Therefore, MAK-4 and MAK-5 may be useful in the prevention and treatment of atherosclerosis.

11. Title

The Antioxidant and Antiatherogenic Effects of MAK-4 in WHHL Rabbits

Publication

Journal of Alternative and Complementary Medicine, Vol. 2, No. 4, pp. 463-478, 1996.

Authors

Jae Y. Lee, PhD, Atef N. Hanna, PhD, John A. Lott, PhD, and Hari M. Sharma, MD, FRCPC.

Conducted at

Department of Pathology, College of Medicine, The Ohio State University, Columbus, OH 43210

Summary

This study tested the effect of MAK-4 on the development of atheroma in WHHL rabbits. Eleven rabbits were divided into two groups: controls (n = 5) and a group fed 6% (w/w) MAK-4 (n = 6). Blood was drawn for biochemical analysis every two months and at necropsy, six months after the special diet was started. The aortas were preserved in formalin. The percentage area of aortic arch covered with visible plaque in the MAK-4 group (22.5 ± 4.2%, mean ± SE) was significantly reduced (p <0.01) compared to the control group (47.6 ± 6.8%, mean ± SE). The MAK-4 group showed a significant decrease (p <0.05) in lipid peroxide, and a significant increase (p <0.05) in glutathione peroxidase and resistance of LDL to endothelial cell-induced and cupric ion-catalyzed oxidation (4.5 h and 5 h lag phase, respectively, for the MAK-4 group; 0 h lag phase for both for the controls). These findings suggest MAK-4 reduces atheroma formation through its antioxidant activity. See Cardiovascular Research for more information on this study.

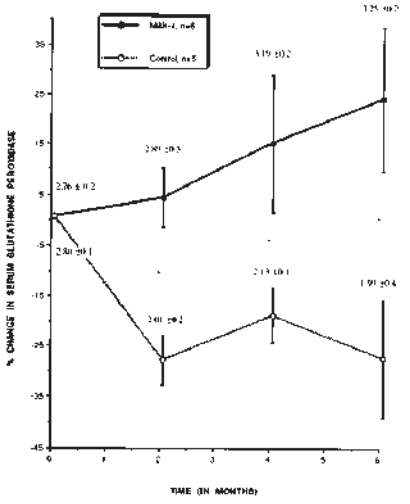

FIG. 3. Effect of MAK-4 on serum glutathione peroxidase activity in WHHL rabbits. Glutathione peroxidase is expressed as U/gm protein. Values are mean ± SE. *p < 0.05

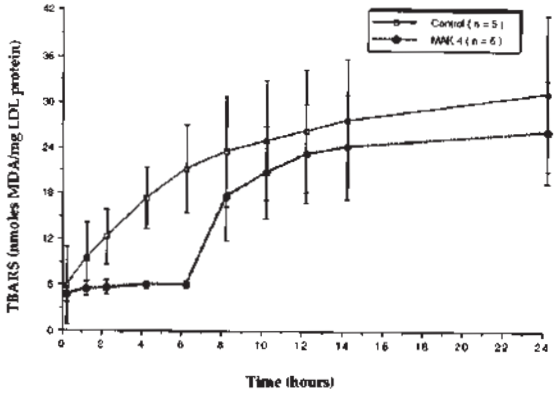

FIG. 4. Effect of MAK-4 on lag phase and propagation phase of cupric ion–catalyzed LDL oxidation at month 6, as assessed by measuring TBARS. LDL (0.2 mg) was incubated with or without 1 μM Cu^{+2} in a humidified environment of 95% air and 5% CO_2 at 37°C for various times. The degree of LDL oxidation was assessed by measuring TBARS. Values are mean ± SE. The concentration of TBARS at 4 h and 6 h in the MAK-4 group is significantly lower (p < 0.05) than the control group.

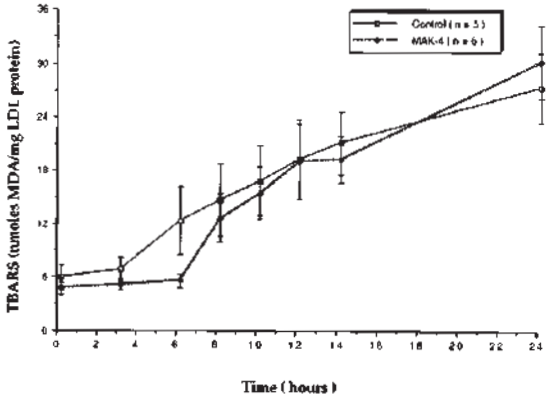

FIG. 5. Effect of MAK-4 on lag phase and propagation phase of endothelial cell–induced LDL oxidation at month 6. LDL (0.2 mg) was incubated with or without endothelial cells in a humidified environment of 95% air and 5% CO_2 at 37°C for various times. The degree of LDL oxidation was assessed by measuring TBARS. Values are mean ± SE.

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Study 11 **Research Highlights**

This study conducted with Watanabe Heritable Hyperlipidemic (WHHL) rabbits suggests that MAK-4 reduces atheroma formation through its antioxidant activity. (Atheroma refers to the fatty degeneration or thickening of the walls of the arteries in atherosclerosis.)

12. Title

In Vitro Inhibition of Microsomal Lipid Peroxidation by MA-631, Student Rasayana (SR), Ladies Rasayana (LR), and Maharishi Coffee Substitute (MCS)

Publication

The Pharmacologist, Vol. 34, No. 3, p. 184, 1992 (Abstract).

Authors

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Conducted at

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Summary

In this study, the effects of MA-631, SR, LR, and MCS on microsomal lipid peroxidation were examined in vitro. Rat liver microsomes were incubated with a sodium ascorbate and ADP-iron complex or with an NADPH-generating system to stimulate nonenzymatic or enzymatic lipid peroxidation, respectively. Aqueous or alcoholic extracts of MA-631, SR, LR, and MCS, when added to these incubation systems, inhibited hepatic microsomal lipid peroxidation in a dose-dependent manner. The alcoholic extracts were the most effective antiperoxidants in both systems. The alcoholic extract of MCS inhibited ascorbate- or NADPH-induced lipid peroxidation by 56% and 63%, with 12 micrograms and 22.5 micrograms, respectively. These findings suggest that these Maharishi Ayur-Veda food supplements may be useful in the treatment of free radical-induced injury due to their antiperoxidant properties.

Study 12 **Research Highlights**

In vitro aqueous and alcoholic extracts of MA-631, Student Rasayana, Ladies Rasayana, and Maharishi Coffee Substitute demonstrated potent antiperoxidant properties in a dose-dependent manner. Thus, these supplements may be useful in the treatment of free radical-induced injury due to their antiperoxidant properties.

13. Title

Maharishi Amrit Kalash [MAK-4 and MAK-5] Rejuvenates Ageing Central Nervous System's Antioxidant Defense System: An *In Vivo* Study

Publication

Pharmacological Research, Vol. 40, No. 6, pp 497-502, 1999.

Authors

Bhupinder Pal Singh Vohra,* Satya Prakash Sharma,* and Vinod Kumar Kansal.**

Conducted at

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Summary

The oxygen-free radical involvement in various deteriorative processes and in aging is unquestionably established. In the present study, age-related changes in antioxidant enzyme activity in the different regions of CNS of 10-month and 32-month-old guinea pigs were studied. Maharishi Amrit Kalash has shown promise in inhibiting the *in vitro* and *in vivo* lipid peroxidation. Therefore, in the present study the effect of MAK on the activity of antioxidant enzymes was checked. Our results indicate that the activity of superoxide dismutase and glutathione peroxidase, was found to be reduced $p < 0.05$ in all the regions of CNS studied. The activities of catalase declined significantly only in the cerebral cortex, hypothalamus and the cerebellum, whereas glutathione reductase activity declined in the cerebral cortex and hypothalamus. It is concluded that the age-related decline in the activities of antioxidant enzymes is region-specific as well as enzyme-specific. The endogenous lipid peroxide was found to be increased significantly $p < 0.05$ in the 32-month-old animals, whereas the lipid peroxidation after incubating the tissue homogenate in the air was found to be decreased $p < 0.05$ in the older animals. The results indicate that the accumulation of lipid peroxides takes place with age but the susceptibility of lipid peroxidation decreases in the older animals. The treatment of MAK 500 mg kg^{-1} body wt. for 2 months could augment the activities of antioxidant enzymes $p < 0.05$. The effect of MAK was more pronounced in older than younger animals. It is concluded that the MAK can be used in compensating the decline in the activities of antioxidant enzymes in CNS and thereby it reduces the risks of lipid peroxidation.

Table I
Effect of MAK on the activity of Cu / Zn-superoxide dismutase

Tissue	*Young animals (10 months)*		*Old animals (32 months)*	
	Control	*Treated*	*Control*	*Treated*
Cerebral cortex	26.57 ± 1.02	36.67 ± 3.46*	13.24 ± 2.56**	25.14 ± 1.43*
Hypothalamus	26.56 ± 1.54	40.04 ± 1.56*	13.14 ± 2.37**	24.72 ± 2.96*
Rest of the cerebrum	28.10 ± 1.53	30.98 ± 1.10	18.10 ± 1.10**	24.25 ± 1.09*
Brain-stem	32.52 ± 1.80	41.91 ± 2.37*	16.48 ± 2.65**	30.89 ± 1.13*
Cerebellum	30.93 ± 1.44	40.46 ± 1.51*	15.67 ± 2.37**	24.21 ± 1.47*
Spinal cord	35.41 ± 1.56	41.14 ± 1.20*	19.39 ± 1.40**	30.06 ± 2.12*

Notes. The activity of enzyme is defined as the amount of enzyme required to inhibit 50% reduction of NBT. Values in the table represent enzyme units per milligram of protein. Data are mean ± SEM of five animals. * Values are significantly different from the controls within the same age group $P < 0.05$; ** values are significantly different from young controls $P < 0.05$.

Table II
Effect of MAK on the activity of Mn-superoxide dismutase

Tissue	*Young animals (10 months)*		*Old animals (32 months)*	
	Control	*Treated*	*Control*	*Treated*
Cerebral cortex	18.05 ± 1.38	21.57 ± 1.75	11.76 ± 1.02**	20.41 ± 0.95*
Hypothalamus	19.82 ± 0.95	23.20 ± 1.30	10.59 ± 1.35**	18.26 ± 1.45*
Rest of the cerebrum	21.05 ± 2.67	29.85 ± 1.56*	11.28 ± 1.24**	20.05 ± 1.74*
Brain-stem	22.94 ± 0.76	29.87 ± 1.56*	14.79 ± 1.24**	23.24 ± 1.74*
Cerebellum	23.59 ± 0.79	30.84 ± 1.61*	17.06 ± 1.16**	23.61 ± 1.37*
Spinal cord	24.29 ± 2.37	30.25 ± 2.77	16.94 ± 1.28**	24.49 ± 2.37*

Notes. The activity of enzyme is defined as the amount of enzyme required to inhibit 50% reduction of NBT. Values in the table represent enzyme units mg^{-1} protein. Data are mean ± SEM of five animals. * Values are significantly different from the controls within the same age group $P < 0.05$; ** values are significantly different from young controls $P < 0.05$.

Table III
Effect of MAK on the activity of catalase

Tissue	*Young animals (10 months)*		*Old animals (32 months)*	
	Control	*Treated*	*Control*	*Treated*
Cerebral cortex	42.32 ± 1.54	44.31 ± 1.22	19.54 ± 2.33**	30.74 ± 1.28*
Hypothalamus	36.29 ± 1.63	47.80 ± 1.16*	21.14 ± 1.90**	22.99 ± 1.35
Rest of the cerebrum	61.46 ± 4.54	63.89 ± 2.58	62.37 ± 3.10	68.10 ± 2.97
Brain-stem	46.89 ± 3.74	51.07 ± 1.76	40.82 ± 1.78	46.60 ± 1.78
Cerebellum	79.44 ± 2.00	95.41 ± 3.03*	51.17 ± 3.96**	51.19 ± 3.19
Spinal cord	34.10 ± 2.20	42.66 ± 2.14*	28.60 ± 4.36	34.80 ± 2.27*

Notes. The activity of enzyme is expressed as micromoles of H_2O_2 decomposed per minute per milligram protein. Data are mean ± SEM of five animals. * Values are significantly different from the controls within the same age group $P < 0.05$; ** values are significantly different from young controls $P < 0.05$.

Table IV
Effect of MAK on the activity of glutathione peroxidase

Tissue	*Young animals (10 months)*		*Old animals (32 months)*	
	Control	*Treated*	*Control*	*Treated*
Cerebral cortex	37.78 ± 1.36	43.99 ± 1.50*	21.54 ± 1.39**	32.07 ± 1.87*
Hypothalamus	41.15 ± 2.53	50.46 ± 1.31*	23.87 ± 2.19**	40.25 ± 2.69*
Rest of the cerebrum	38.84 ± 2.85	45.77 ± 2.27	20.77 ± 1.61**	36.14 ± 2.54*
Brain-stem	37.75 ± 1.80	46.19 ± 3.26*	25.61 ± 1.93**	38.48 ± 1.74*
Cerebellum	45.12 ± 1.01	51.17 ± 3.29	27.65 ± 1.61**	43.94 ± 2.94*
Spinal cord	51.29 ± 2.47	59.95 ± 2.30*	30.95 ± 1.64**	49.68 ± 2.39*

Notes. The activity of enzyme is expressed as nanomoles of NADPH oxidised per minute per milligram of protein. Data are mean ± SEM of five animals. * Values are significantly different from the controls within the same age group $P < 0.05$; ** values are significantly different from young controls $P < 0.05$.

Table V
Effect of MAK on the activity of glutathione reductase

Tissue	*Young animals (10 months)*		*Old animals (32 months)*	
	Control	*Treated*	*Control*	*Treated*
Cerebral cortex	0.22 ± 0.02	0.28 ± 0.01*	0.18 ± 0.01**	0.21 ± 0.01*
Hypothalamus	0.28 ± 0.02	0.35 ± 0.03*	0.19 ± 0.02**	0.29 ± 0.03*
Rest of the cerebrum	0.26 ± 0.01	0.35 ± 0.02*	0.25 ± 0.02	0.35 ± 0.01*
Brain-stem	0.24 ± 0.01	0.32 ± 0.04*	0.23 ± 0.02	0.30 ± 0.03*
Cerebellum	0.27 ± 0.01	0.34 ± 0.02*	0.26 ± 0.02	0.33 ± 0.02*
Spinal cord	0.32 ± 0.01	0.39 ± 0.03*	0.31 ± 0.02	0.37 ± 0.02*

Notes. The activity of enzyme is expressed as micromoles of GSH formed per minute per milligram of protein. Data are mean ± SEM of five animals. * Values are significantly different from the controls within the same age group $P < 0.05$; ** values are significantly different from young controls $P < 0.05$.

Table VI
Effect of MAK on the level of endogenous TARS production

Tissue	*Young animals (10 months)*		*Old animals (32 months)*	
	Control	*Treated*	*Control*	*Treated*
Cerebral cortex	41.86 ± 1.27	32.10 ± 1.18*	82.12 ± 1.31**	42.77 ± 1.07*
Hypothalamus	32.37 ± 1.00	26.40 ± 0.79*	87.93 ± 1.37**	37.78 ± 1.17*
Rest of the cerebrum	76.89 ± 1.39	57.08 ± 1.11*	122.55 ± 1.43**	70.95 ± 1.57*
Brain-stem	43.81 ± 1.07	19.02 ± 0.78*	82.12 ± 1.59**	24.47 ± 1.71*
Cerebellum	27.68 ± 1.76	18.43 ± 0.99*	50.57 ± 1.01	29.41 ± 0.78*
Spinal cord	41.82 ± 1.08	26.70 ± 1.00*	81.40 ± 1.17**	42.17 ± 0.97*

Notes. The values are nanomoles of TARS per milligram of protein. Data are mean ± SEM of five animals. * Values are significantly different from the controls within the same age group $P < 0.05$; ** values are significantly different from young controls $P < 0.05$.

Study 13 **Research Highlights**
As demonstrated in guinea pigs, the treatment of MAK 500 mg/kg body wt for two months could augment the activities of antioxidant enzymes. Therefore, MAK could be used in compensating the decline in the activities of antioxidant enzymes in the CNS, thereby reducing the risks of lipid peroxidation.

14. Title

Effect of Maharishi Amrit Kalash, an Ayurvedic Herbal Mixture, on Lipid Peroxidation and Neuronal Lipofuscin Accumulation in Ageing Guinea Pig Brain

Publication

Indian Journal of Experimental Biology, Vol. 39, No. 4, pp. 355-359, 2001.

Authors

B.P. Vohra, S.P. Sharma, V.K. Kansal, and S.K. Gupta.

Conducted at

Laboratory of Nutritional Histopathology, Kurukshetra University, India

Summary

The effects of Ayurvedic herbal mixture Maharishi Amrit Kalash (MAK) were studied on brain lipid peroxidation, oxygen consumption, and lipofuscin accumulation in 10-month-old and 32-month-old guinea pigs. Brain regions studied were cerebral cortex, hypothalamus, cerebellum and spinal cord. Parameters assessed were lipid peroxidation, oxygen consumption, and lipofuscin accumulation. The endogenous lipid peroxide was found to be increased significantly ($P < 0.05$) in the 32-month-old animals. Neuronal lipofuscin accumulation in the neurons of cerebral motor cortex, cerebellum and cervical spinal cord was increased ($P < 0.05$) in the older animals. Oxygen consumption was found to be decreased significantly ($P < 0.05$) in the 32-month-old guinea pigs. Treatment with MAK at a dose of 500 mg/kg body weight daily for two months reduced the lipid peroxidation and lipofuscin pigment accumulation significantly in brain regions, and it also helped in restoring the normal oxygen consumption in the older animals. This indicates antioxidant properties of MAK.

Study 14 **Research Highlights**

Treating guinea pigs with MAK at a dose of 500 mg/kg body weight daily for two months reduced lipid peroxidation in brain regions and helped restore normal oxygen consumption in older animals. This indicates antioxidant properties of MAK.

15. Title

The Antioxidant Activity of Maharishi Amrit Kalash (MAK-4 and MAK-5), Estrogen and Vitamin C

Presented at

Scientific Conference on Atherosclerosis, Thrombosis, and Proliferation, American Heart Association, Orlando, FL, February 23-26, 1994.

Authors

Hari M. Sharma, Atef N. Hanna, Lynda C. Titterington, Gary P. Lubow, and Ralph E. Stephens.

Conducted at

The Ohio State University, Columbus, OH

Summary

MAK-4 and MAK-5 inhibit Cu^{+2}-catalyzed LDL oxidation and liver microsomal lipid peroxidation. In this study, we examined the ability of antioxidants to inhibit endothelial cell (EC)- and Soybean lipoxygenase (SLP)-induced LDL oxidation, and total antioxidant capacity to absorb peroxyl free radicals. Both aqueous and alcoholic extracts of MAK-4 and MAK-5 inhibited the EC-induced LDL oxidation in a concentration-dependent manner. The concentrations (ug/2mL) that produce 50% inhibition (IC_{50}) for aqueous extracts of MAK-4 and MAK-5 were 100.4 ± 6.2, 180.6 ± 17.9, and alcoholic extracts of MAK-4 and MAK-5, 57.5 ± 15.2, 7.10 ± 2.26, respectively, for TBARS. MAK-4 and MAK-5 caused prolongation of the lag phase and delay of the propagation phase of EC-LDL oxidation. Both aqueous and alcoholic extracts of MAK-4 inhibited the SLP-induced LDL oxidation in a concentration-dependent manner [IC_{50} were 840.6 ± 196.6 and 246.4 ± 32.5, respectively]. The aqueous extract of MAK-5 inhibited SLP-induced LDL oxidation in a concentration-dependent manner [IC_{50} was 503.0 ± 139.4] and Vit. C inhibited up to 35% at a concentration of 200 uM, whereas estradiol and estrone were ineffective up to 20 uM. Vit. C, MAK-4 and MAK-5 showed a concentration-dependent potency in absorbing peroxyl radicals. These results suggest that MAK-4 and MAK-5 possess antioxidant activity and might be beneficial in atherosclerosis.

Study 15 **Research Highlights**
Both aqueous and alcoholic extracts of MAK-4 and MAK-5 inhibited endothelial cell-induced LDL oxidation in a concentration-dependent manner. Thus, it is suggested that MAK-4 and MAK-5 possess antioxidant activity and might be beneficial in atherosclerosis.

16. Title

Anti-Aging Effect of a Natural Product, Maharishi Amrit Kalash (MAK)

Presented at

Joint Meeting of the International Union of Biochemists – Symposium No. 200, Satellite Meeting of the Oxygen Society, and the International Society for Free Radical Research, Berkeley, CA, January 26-27, 1990.

Authors

J.Z. Fields,* R.H. Schneider,** L. Wichlinski,* and J. Hagen.*

Conducted at

* Department of Pharmacology, Hines V.A. – Loyola University Medical Center, Maywood, IL
**Department of Physiology, Maharishi International University, Fairfield, IA

Summary

Aging is a concept that is not clearly defined. Is it the genetically coded final stage in development or the random accumulation of errors? Operationally, aging is seen as a process that increases susceptibility to disease and dysfunction. Interventions to retard or reverse this process would decrease disease, improve human function, and thereby increase quality of life and at least mean survival time.

Ayurvedic medicine, the traditional medicine of India, holds that Maharishi Amrit Kalash (MAK) has substantial anti-aging properties. Accordingly, we studied the effects of this novel herbal preparation, MAK, on aging and related parameters. MAK is a combination of 26 plants (Maharishi Ayurveda Products International, Stoneham, Massachusetts).

Fifty-eight C57BL/6 mice (males) started on dietary MAK supplements at 25 mo, and kept on them for up to 8 weeks, showed significantly ($p<0.05$) more activity (locomotion, +85%), more coordination (roto-rod, +23%) and lower heart weight (-30%).

For mice (n=58) started at 18 mo, 80% of MAK mice were alive at 23 mo vs. 48% for controls ($p<0.05$). In these survivors, body weights for controls (41.5 g) and for MAK mice (38.3 g) were not significantly different.

MAK also increased acute survival 7 days after injection of a cytotoxic drug mitomycin-c at 3.25 mg/kg: 100% of MAK (Fisher female) rats (9 of 9) were alive compared to 33% (2 out of 6) for controls ($p<0.05$).

The finding of H. Sharma (Physiol. Biochem. Behav., in press) that MAK prevents cancer also suggests an anti-aging effect. The anti-aging mechanism(s) may include scavenging of reactive oxygen metabolites (ROM) by low molecular weight anti-oxidants. Using aqueous extracts, we found that MAK was as competent as superoxide dismutase (100% inhibition) and as potent, mg for mg, at scavenging one oxygen free radical, superoxide anions, produced by human neutrophils (PMN) (reduction of ferricytochrome-c assay). In vitro, at similar MAK concentrations, hypochlorous acid (HOCl) was also scavenged (iodometric assay). HOCl is another PMN-generated ROM and may be even more directly involved in tissue injury.

The maximum anti-aging effects of MAK, the full effects in man, and the active ingredients of MAK and their mechanisms remain to be determined.

Study 16 **Research Highlights**
MAK supplementation to mice at 18 mo and continuing to 23 mo showed increased survival rates as compared with controls. Mice started on dietary MAK supplements at 25 mo and continuing for 8 weeks showed significantly more activity, more coordination and lower heart weight. MAK also significantly increased acute survival of rats 7 days after injection of a cytotoxic drug.

17. Title
Superoxide Scavenging of Two Natural Products, Maharishi-4 [MAK-4] and Maharishi-5 [MAK-5]

Publication
Federation of American Societies for Experimental Biology Journal, Vol. 5, No. 5, p. A1284, 1991 (Abstract).

Authors
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Summary

Maharishi Ayurveda, a recent restoration of the traditional health care system of India, upholds an herbal fruit concentrate (M-4) and an herbal tablet (M-5) as rasayanas—food supplements that promote physiological balance, health, and immunity. The superoxide scavenging properties of M-4, M-5, and ascorbic acid were investigated with superoxide radicals generated during the catalytic activity of xanthine oxidase. M-4 and M-5 (10 mg/ml prior to centrifugation) inhibited the reduction of nitroblue tetrazolium (NBT) 98% and 96%, respectively. 50% inhibition of NBT reduction was obtained with 0.04 mg/ml M-4 and 0.15 mg/ml M-5. Ascorbic acid inhibition of superoxide radical reduction of NBT reached 88% at 1 mM, but declined to 42% at a concentration of 10 mM. The rate of uric acid production monitored at 290 nm demonstrated negligible inhibition of xanthine oxidase by M-4, M-5, or ascorbic acid. The results contribute to an understanding of previously reported antineoplastic, antioxidant, and anti-aging properties of M-4 and M-5, and warrant consideration in the light of present preventive, nutritional, and chemotherapeutic approaches to health, antioxidant defense, and carcinogenesis.

Study 17 **Research Highlights**
M-4 and M-5 (10 mg/ml prior to centrifugation) inhibited the reduction of nitroblue tetrazolium 98% and 96%, respectively. The results contribute to an understanding of previously reported antineoplastic, antioxidant and anti-aging properties of M-4 and M-5.

18. Title
Oxygen Free Radical (OFR) Scavenging Effects of an Anti-Carcinogenic Natural Product, Maharishi Amrit Kalash

Publication
The Pharmacologist, Vol. 32, No. 3, p. 155, 1990 (Abstract).

Authors
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Summary

Recently H. Sharma et al (Pharm Bioch Behav, 35:767-773, 1990) showed that MAK, an herbal mixture derived from 15 different plants, prevents and even reverses chemically induced breast tumors in rats. Although the chemical constituents are not yet known, we hypothesized that MAK might contain one or more scavengers of OFR. Aqueous extracts of MAK (5g + 10 ml H_20), or superoxide dismutase (SOD), or vehicle were added at various dilutions to suspensions of [1] human neutrophils (PMN; 1 x 10^6 cells) prior to stimulation (by phorbol myristate acetate) or [2] xanthine/xanthine oxidase. Superoxide (SO) was monitored via reduction of ferricytochrome C followed at 550 nm. Like SOD, MAK was able to completely scavenge SO and MAK did not compromise the viability (trypan blue exclusion) or respiration (O_2 utilization) of PMNs. Thus, the anti-oxidant properties of MAK may contribute to its anti-carcinogenic properties.

Study 18 **Research Highlights**
Aqueous extracts of MAK added at various dilutions to suspensions of human neutrophils (PMNs) were able to completely scavenge superoxide and did not compromise the viability or respiration of PMNs. Thus, the anti-oxidant properties of MAK may contribute to its anti-carcinogenic properties.

19. Title
Anti-Aging and Oxygen Free Radical (OFR) Scavenging Effects of an Anti-Carcinogenic Natural Product, Maharishi Amrit Kalash [MAK-4 and MAK-5]

Publication
Federation of American Societies for Experimental Biology Journal, Vol. 5, No. 6, p. A1735, 1991 (Abstract).

Authors
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Dept. of Physiology, Maharishi International University, Fairfield, IA

Summary

MAK is an herbal preparation available as a food supplement. It is being taken for its anticipated health-promoting and anti-aging benefits. MAK refers to the combination of two natural products: M4 a paste, and M5 a tablet. Combined MAK is comprised of plants or plant parts from 24 different herbs. Sharma et al (Pharmacol Biochem Behav, 35:767-773, 1990) showed that MAK prevents and even reverses chemically induced breast tumors in rats. We showed (JZ Fields et al, The Pharmacologist, 32:155, 1990) that aqueous extracts of MAK scavenged both OFR (superoxide) and non-radical oxidants (hypochlorous acid) in suspensions of human neutrophils without compromising the viability of the cells. In mice (C57BL/6 male, n=29/group) fed 6% MAK in the diet starting at 18 months of age, 80% of MAK mice were alive at 23 mo vs. 48% for controls ($p < 0.05$). Body weights for control (41.5 g) and MAK mice (38.3 g) were not significantly different. In fruitflies (male, wild type, Drosophila melanogaster, n=100/group) fed 12% MAK from hatching to expiration, mean life span was significantly increased (+70%). The anti-oxidant properties and anti-carcinogenic properties of MAK may contribute to its anti-aging properties.

Study 19 **Research Highlights**
Studies have been conducted in animals and in vitro demonstrating the antioxidant properties and anti-carcinogenic properties of MAK, which may contribute to its anti-aging properties.

20. Title
Anti-Oxidant and Antiplatelet Properties of Maharishi Amrit Kalash [MAK-4] in Hypercholesterolemic Rabbits

Publication
Ninth International Symposium on Atherosclerosis, Rosemont, IL, October 6-11, 1991, p. 188 (Abstract).

Authors
Rao V. Panganamala, Ph.D. and Hari M. Sharma, M.D., FRCP(C).

Conducted at
The Ohio State University, College of Medicine, Columbus, OH, USA

Summary

Platelet aggregation and oxidized lipids are considered important mediators of vascular injury leading to atherosclerosis. M-4, an herbal food supplement (MAPI Inc., Lancaster, MA) has been shown to be effective in preventing generation of reactive oxygen species in-vitro (IJCP 1:23-27, 1991). The experiments were carried out to evaluate the effectiveness of M-4 in preventing platelet aggregation and oxidation of lipids in hypercholesterolemic rabbits. Two groups of six rabbits (pair matched) were given a 1% cholesterol diet. The experimental group in addition was given 0.4% M-4 in the diet. At the end of the experiment (7 weeks) total cholesterol, plasma and hepatic TBARS and platelet aggregation induced by ADP & collagen were compared between the two groups. The results are:

	Control	Experimental
Total cholesterol (mg/dl)	1511	1003
Plasma TBARS (nmoles/ml)	5.38 ± 0.5	1.9 ± 0.3
Hepatic TBARS (nmoles/g tissue)	148 ± 16	83 ± 11

Platelet Aggregation	% Transmittance			
	Collagen (ug/ml)		ADP (x 10^{-3})	
	4.4	2.2	4.4	2.2
Control (n = 5)	48.6	30.0	34.0	21.0
Experimental (n = 4)	26.0	3.0	10.0	3.75

Results show that M-4 supplementation reduces plasma and hepatic lipid peroxidation and platelet aggregation induced by collagen and ADP in hypercholesterolemic rabbits.

Study 20 **Research Highlights**
M-4 supplementation reduced plasma and hepatic lipid peroxidation and platelet aggregation induced by collagen and ADP in hypercholesterolemic rabbits.

21. Title
Lipid Peroxide in Ischemic Heart Disease (IHD): Inhibition by Maharishi Amrit Kalash (MAK-4 and MAK-5) Herbal Mixtures

Publication
Federation of the American Societies for Experimental Biology Journal, Vol. 14, No. 4, p. A121, 2000 (Abstract).

Authors
J. Dogra and A. Bhargava (SPON: H. Sharma).

Conducted at
Central Government Health Scheme and Okay Research Centre, Jaipur, India 302017

Summary

As oxidation of low-density lipoprotein plays a significant role in atherogenesis, an improvement in the antioxidant status should lead to a protective effect. We initiated this trial to study the in vivo effects of MAK-4 and MAK-5 (herbal mixtures containing polyphenols, bioflavonoids, tocopherol, ascorbic acid, and carotenoids) on lipid peroxide in addition to its clinical efficacy. Eighty patients with proven IHD were enrolled in our study. Lipid peroxide studies were done initially and at one year in MAK-supplemented and control groups. The control group consisted of 40 IHD patients minus MAK. Drugs like antioxidant vitamin E and lipid-lowering agents were withdrawn in both groups. Clinical parameters of drug response were assessed. MAK-4 paste was prescribed in a dose of 10 g daily in 2 divided doses followed by MAK-5 tablet, for 1 year as 'add-on' regimen. Thirty-four patients reported a significant decrease in the mean anginal frequency per month from 5.50 (+3.20) to 2.15 (+2.00) and improvement in the treadmill test was reported in 8 cases at 1 year. Echocardiography studies reported improvement in ejection fraction in 7 cases. Plasma lipid peroxide concentration of patients with IHD was 7.24 nmoles MDA/ml (mean), which was reduced to 4.97 nmoles MDA/ml (mean) after 1 year of MAK 'add-on' trial. However, no significant reduction was noted in the control group. We conclude that MAK significantly lowers lipid peroxide, which has been implicated in atherogenesis and significantly lowers the incidence of myocardial ischemia.

Study 21 **Research Highlights**
Plasma lipid peroxide concentration of patients with Ischemic Heart Disease was reduced from 7.24 nmoles MDA/ml (mean) to 4.97 nmoles (mean) after 1 year of MAK supplementation, while no significant reduction was noted in the control group. Thus, MAK significantly lowers lipid peroxide, which has been implicated in atherogenesis and significantly lowers the incidence of myocardial ischemia.

1. Title

Effect of Herbal Mixtures MAK-4 and MAK-5 on Susceptibility of Human LDL to Oxidation

Publication

Complementary Medicine International, Vol. 3, No. 3, pp. 28-36, May/June 1996.

Authors

Atef N. Hanna, PhD,* Vidya Sundaram, MD,** James M. Falko, MD,** Ralph E. Stephens, PhD,* and Hari M. Sharma, MD, FRCPC.*

Conducted at

*Department of Pathology and **Department of Internal Medicine, College of Medicine, The Ohio State University, Columbus, OH 43210

Summary

Oxidation of low-density lipoprotein (LDL) plays a central role in the pathogenesis of atherosclerosis. This study investigated the in vivo antioxidant activity of MAK-4 and MAK-5 in a clinical setting, and investigated the in vitro antioxidant properties of MAK-4. Both the aqueous and alcoholic extracts of MAK-4 inhibited endothelial cell (EC)- and soybean lipoxygenase (SLP)-induced LDL oxidation in a concentration-dependent manner. The agent concentrations (microgram/mL) which inhibited 50% (IC_{50}) of EC- and SLP-induced LDL oxidation, respectively, were 150.0 +/- 10.0 and 488.3 +/- 41.9 for the aqueous extract, and 69.3 +/- 8.1 and 128.3 +/- 18.9 for the alcoholic extract. In vitro pretreatment of LDL with MAK-4 increased the resistance of LDL to Cu^{+2}-catalyzed LDL oxidation. Both the aqueous and alcoholic extracts inhibited

Figure 1a.

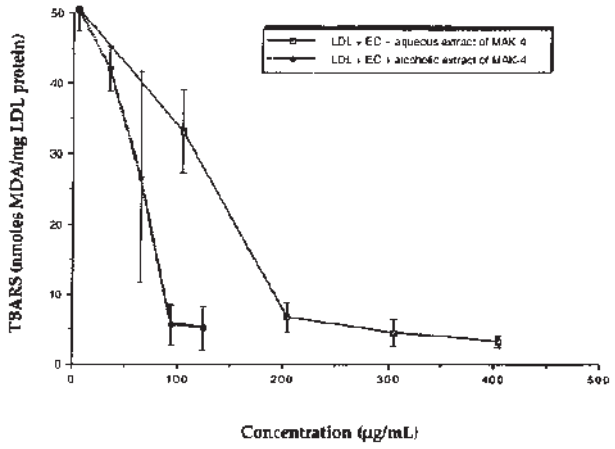
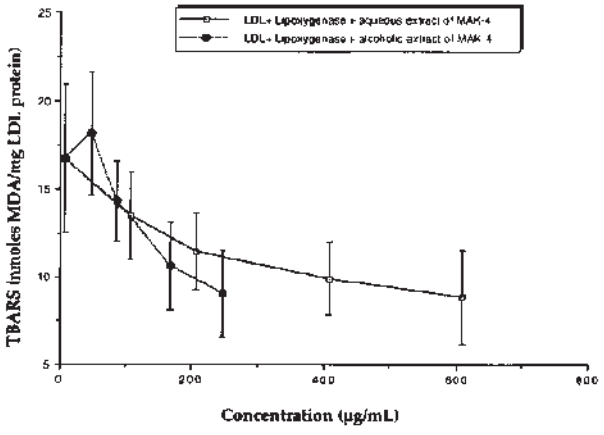


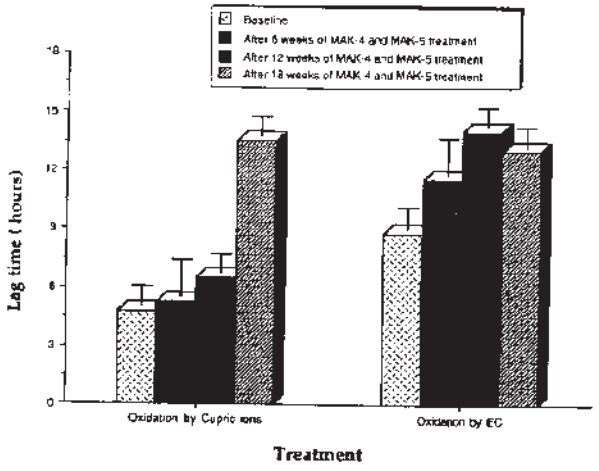
Figure 1b.



The effect of the aqueous and alcoholic extracts of MAK-4 on endothelial cell (EC)- induced LDL oxidation (Figure 1a.) and soybean lipoxygenase (SLP)-induced LDL oxidation (Figure 1b.). LDL (200 µg LDL protein) was incubated with or without EC or 20 mg/mL of SLP, in the presence or absence of various concentrations of the aqueous or alcoholic extracts of MAK-4, in a humidified environment of 95 percent air and 5 percent CO_2, at 37°C. for 24 hours. The degree of LDL oxidation was assessed by measuring thiobarbituric acid- reactive substances (TBARS). All values are expressed as mean ± SD, n=three subjects.

free radical generation in a concentration-dependent manner. The IC_{50} was 16.35 +/- 4.27 for the aqueous extract, and 3.64 +/- 1.24 for the alcoholic extract; addition of both extracts showed a synergistic interaction. In hyperlipidemic patients, MAK-4 and MAK-5 increased resistance of LDL to oxidation by Cu^{+2} and EC. These results suggest that MAK-4 and MAK-5 protect LDL from oxidation and may be useful in the prevention and treatment of atherosclerosis.

Figure 4.



Effect of treatment of hyperlipidemic patients with MAK-4 and MAK-5 on the susceptibility to Cu^{+2}- or endothelial cell (EC)-induced LDL oxidation, as assessed by measuring the lag time of the oxidative process. LDL was isolated from hyperlipidemic patients before, and six, 12, and 18 weeks after treatment with MAK-4 and MAK-5. Isolated LDL was incubated with two mmol/L Cu^{+2} at 37°C., in an atmosphere of humidified 95 percent air and 5 percent CO_2. Samples were taken at zero, one, two, three, four, six, eight, 10, 12, 14, and 24 hours, and stored with 0.1 mmol/L EDTA at -80°C. The same method was used to test resistance to EC-induced LDL oxidation, except samples were taken at zero, three, six, eight, 10, 12, 14, and 24 hours. The degree of LDL oxidation was assessed by measuring TBARS. All values are expressed as mean ± SD, n=four subjects.

Study 1 **Research Highlights**
MAK-4 and MAK-5 increased resistance of LDL to oxidation by Cu^{+2} and EC in hyperlipidemic patients. These results suggest that MAK-4 and MAK-5 protect LDL from oxidation and may be useful in the prevention and treatment of atherosclerosis.

2. Title

Inhibition of Low-Density Lipoprotein Oxidation by Oral Herbal Mixtures Maharishi Amrit Kalash-4 (MAK-4) and Maharishi Amrit Kalash-5 (MAK-5) in Hyperlipidemic Patients

Publication

The American Journal of the Medical Sciences, Vol. 314, No. 5, pp. 303-310, 1997.

Authors

Vidya Sundaram, M.D.,* Atef N. Hanna, Ph.D.,** Gary P. Lubow, M.D.,** Lata Koneru, M.D.,† James M. Falko, M.D.,* and Hari M. Sharma, M.D.**

Conducted at

*Department of Internal Medicine and **Department of Pathology, College of Medicine, The Ohio State University, Columbus, OH
†Department of Internal Medicine, Riverside Methodist Hospital, Columbus, OH.

Summary

Low-density lipoprotein (LDL) oxidation is central to the pathogenesis of atherosclerosis. This study evaluated the antioxidant activity of MAK-4 and MAK-5 in vivo. Ten hyperlipidemic patients prescribed stable hypolipidemic therapy were treated with MAK-4 and MAK-5 for 18 weeks. Plasma lipoprotein, plasma lipid peroxide, and LDL oxidation studies were performed every 6 weeks. Apolipoprotein A, apolipoprotein B, and lipoprotein (a) levels were measured at baseline and 18 weeks. After 12 weeks of treatment with MAK-4 and MAK-5, a time-dependent increase in the lag phase and delay in the propagation phase of oxidation of LDL by Cu^{+2} and endothelial cells was seen. Lag phases at baseline and after 6, 12, and 18 weeks of MAK-4 and MAK-5 ingestion were 6.66 hours ± 0.19 (mean ± standard error of mean), 6.77 hours ± 0.31, 7.22 hours ± 0.24, and 18.00 hours ± 0.73, respectively, for Cu^{+2}-catalyzed LDL oxidation. Lag phases were 14.89 hours ± 0.77, 13.33 hours ± 0.50, 20.22 hours ± 0.76, and 20.00 hours ± 0.79, respectively, for endothelial cell-induced LDL oxidation. The levels of plasma lipid peroxide did not change significantly. No significant changes were seen in the plasma lipoproteins and the levels of apolipoprotein A, apolipoprotein B, and lipoprotein (a). The results show that MAK-4 and MAK-5 inhibit LDL oxidation in patients with hyperlipidemia. Therefore, MAK-4 and MAK-5 may be useful in the prevention and treatment of atheroslerosis.

See Antioxidant Research for more information on this study.

Study 2 **Research Highlights**

Ten hyperlipidemic patients were treated with MAK-4 and MAK-5 for 18 weeks. After 12 weeks of treatment with MAK-4 and MAK-5, a time-dependent increase in the lag phase and delay in the propagation phase of oxidation of LDL by Cu^{+2} and endothelial cells was seen. Therefore, MAK-4 and MAK-5 may be useful in the prevention and treatment of atherosclerosis.

3. Title

The Antioxidant and Antiatherogenic Effects of MAK-4 in WHHL Rabbits

Publication

Journal of Alternative and Complementary Medicine, Vol. 2, No. 4, pp. 463-478, 1996.

Authors

Jae Y. Lee, PhD, Atef N. Hanna, PhD, John A. Lott, PhD, and Hari M. Sharma, MD, FRCPC.

Conducted at

Department of Pathology, College of Medicine, The Ohio State University, Columbus, OH 43210

Summary

This study tested the effect of MAK-4 on the development of atheroma in WHHL rabbits. Eleven rabbits were divided into two groups: controls (n = 5) and a group fed 6% (w/w) MAK-4 (n = 6). Blood was drawn for biochemical analysis every two months and at necropsy, six months after the special diet was started. The aortas were preserved in formalin. The percentage area of aortic arch covered with visible plaque in the MAK-4 group (22.5 ± 4.2%, mean ± SE) was significantly reduced (p <0.01) compared to the control group (47.6 ± 6.8%, mean ± SE). The MAK-4 group showed a significant decrease (p <0.05) in lipid peroxide, and a significant increase (p <0.05) in glutathione peroxidase and resistance of LDL to endothelial cell-induced and cupric ion-catalyzed oxidation (4.5 h and 5 h lag phase, respectively, for the MAK-4 group; 0 h lag phase for both for the controls). These findings suggest MAK-4 reduces atheroma formation through its antioxidant activity.

See Antioxidant Research for more information on this study.

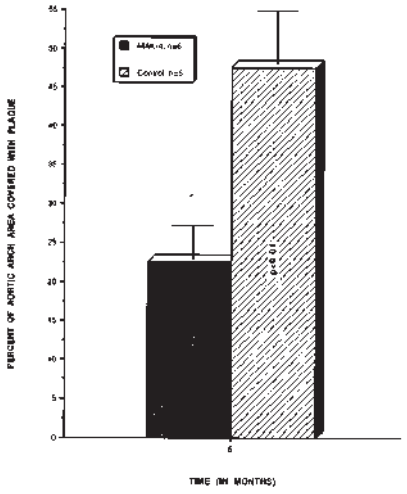


Fig. 8. Effects of MAK-4 on plaque formation on aortic arch in WHHL rabbits (22.5±4.2% and 47.6±6.8% for MAK-4 group and control group, respectively; values are mean ± SE). *p<0.01

Study 3 **Research Highlights**
As compared with a control group, WHHL rabbits treated with MAK-4 for 6 months showed a significant reduction in visible plaque in the aortic arch and a significant increase in resistance of LDL to induced oxidation. It is suggested that MAK-4 reduces atheroma formation through its antioxidant activity.

4. Title

Inhibition of Human Low-Density Lipoprotein Oxidation In Vitro by Maharishi Ayur-Veda Herbal Mixtures [MAK-4, MAK-5, MA-631, and Maharishi Coffee Substitute]

Publication

Pharmacology, Biochemistry and Behavior, Vol. 43, pp. 1175-1182, 1992.

Authors

Hari M. Sharma, Atef N. Hanna, Ellen M. Kauffman, and Howard A.I. Newman.

Conducted at

Department of Pathology, College of Medicine, The Ohio State University, Columbus, OH 43210

Summary

In this study on the in vitro inhibition of human LDL oxidation, the rasayanas (health-promoting herbal mixtures) MAK-4, MAK-5, MA-631, and Maharishi Coffee Substitute, were compared to the antioxidants vitamin C, vitamin E, and probucol (an antioxidant drug). All four rasayanas showed more than a 1000-fold greater inhibition of cupric ion-catalyzed LDL oxidation, as compared to vitamin C, vitamin E, and probucol ($p<0.0001$).

For more information on this study, see Antioxidant Research.

Study 4 **Research Highlights**
MAK-4, MAK-5, MA-631, and Maharishi Coffee Substitute showed more than a 1000-fold greater inhibition of cupric ion-catalyzed LDL oxidation, as compared to vitamin C, vitamin E, and probucol.

5. Title

Maharishi Amrit Kalash (MAK-5) Prevents Human Platelet Aggregation

Publication

Clinica and Terapia Cardiovascolare, Vol. 8, No. 3, pp. 227-230, 1989.

Authors

H.M. Sharma,* Y. Feng,** and R.V. Panganamala.**

Conducted at

*Department of Pathology and **Department of Physiological Chemistry, College of Medicine, The Ohio State University, Columbus, OH

Summary

MAK-5 belongs to a group of substances which are known as "rasayanas." The purpose of rasayanas is two-fold: prevention of disease and retardation or reversal of the aging process, which results from optimization of physiological balance (homeostasis). This investigation was conducted to study the effect of MAK-5 on human platelet aggregation. Platelet aggregation can be induced by free radicals, catecholamines, and vascular linings injured by oxidized lipids. This in vitro experiment showed that MAK-5 reduces platelet aggregation in platelet-rich plasma obtained from normal, healthy subjects. This prevention of aggregation was seen with the following inducers of platelet aggregation: catecholamines, which are released during stress; collagen, which is exposed when vascular endothelium is injured; arachidonic acid, which is released from injured cell membranes; and ADP, which is released from injured red blood cells and platelets. Since platelet aggregation is considered an important aspect of the initiation and progression of atherosclerosis, the ability of MAK-5 to reduce platelet aggregation may help in the prevention of atherosclerosis.

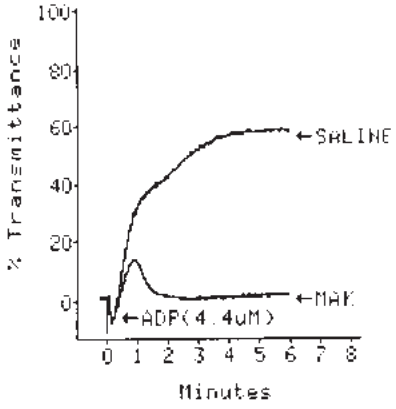


Fig. 1 - Effect of MAK on epinephrine induced platelet aggregation. This shows blockage of second phase of epinephrine induced aggregation.

		% Aggregation		
Agonist	Dose	Control	MAK	Significance
Collagen	0.28 ug/ml	56.6 ± 4.1*	0	$p < 0.001$
ADP	11 uM	49.4 ± 6.6*	22.4 ± 7.2	$p < 0.05$

* ± SEM
Number of subjects = 9

Table 3 - Inhibition of platelet aggregation by MAK in whole blood.

Study 5 **Research Highlights**

This in vitro experiment showed that MAK-5 reduces platelet aggregation in platelet-rich plasma obtained from normal, healthy subjects. Since platelet aggregation is considered an important aspect of the initiation and progression of atherosclerosis, the ability of MAK-5 to reduce platelet aggregation may help in the prevention of atherosclerosis.

6. Title

Indigenous Free Radical Scavenger MAK-4 and MAK-5 in Angina Pectoris. Is it Only a Placebo?

Publication

Journal of the Association of Physicians of India, Vol. 42, No. 6, pp. 466-467, 1994.

Authors

J. Dogra,* N. Grover,* P. Kumar,* and N. Aneja.**

Conducted at

* Department of Medicine, C.G.H.S., Jaipur, India

**SMS Medical College, Jaipur, India

Summary

Thirty patients were evaluated to study the effect of Maharishi Amrit Kalash (MAK-4 and MAK-5) on angina pectoris. The mean angina frequency per month was 8.87. Twelve lead ECG, computerized TMT and echo studies were done initially, at 6 months, and after 2 years in all cases. Ten grams of MAK-4 paste was given daily in two divided doses, each followed by a MAK-5 tablet, for six months. Vasodilator and antihypertensive drugs were continued on ethical grounds. Twenty-four patients (80%) of the total 30 reported a significant improvement after 6 months of therapy. The mean angina frequency per month improved from 8.87 to 3.03 ($p<0.001$). All patients reported a sense of well-being. Five of 11 hypertensive patients reported a fall in systolic blood pressure. The lipid profile showed a rise in high-density lipoprotein (HDL) which was statistically insignificant. Improved exercise tolerance was observed in 10 cases (33.33%) after 6 months of therapy and this effect was sustained even at 2 years. ECG and echo studies were inconclusive. No side effects or drug interactions were seen. The beneficial effects observed may be the result of the free radical-scavenging property of MAK-4 and MAK-5 on reactive oxygen species (ROS), or an inhibitory effect on lipid peroxidation, or inhibition of platelet aggregation, or all of these in synergism.

TABLE 1. Showing Changes in anginal status after MAK-4 and MAK-5 (n= 30).

Chest pain	Mean (± SD) at base line	Mean (± SD) at 6 months	Mean (± SD) at 2 years
Frequency* per month	8.87 (± 7.18)	3.03 (± 3.74)	3.57 (± 3.96)
Duration (in mins)	2.70 (± 4.50)	1.89 (± 4.30)	2.02 (± 4.21)
Severity**	3.1 (± 1.4)	2.4 (± 1.3)	2.45 (± 1.4)
Sub-lingual tablets consumed per month*	17.37 (± 12.59)	5.8 (± 5.79)	7.33 (± 6.96)

* Applying X^2 test $p < 0.001$.

** Scale of 1 to 7 (1 indicating least severe)

Study 6 **Research Highlights**

Eighty percent of patients reported improvement in angina pectoris after 6 months of MAK-4 and MAK-5 therapy, with the mean angina frequency improving from 8.87 to 3.03 ($p<0.001$). The positive effects may be the result of the free radical-scavenging property of MAK-4 and MAK-5 on reactive oxygen species, or an inhibitory effect on lipid peroxidation, or inhibition of platelet aggregation, or all of these in synergism.

7. Title

Effect of Maharishi AK-4 [MAK-4] on H_2O_2-induced Oxidative Stress in Isolated Rat Hearts

Publication

Journal of Ethnopharmacology, Vol. 56, pp. 215-222, 1997.

Authors

William J. Cullen,* Scott A. Dulchavsky,* Thomas P.A. Devasagayam,* B.V. Venkataraman,** Saradindu Dutta.†

Conducted at

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**Department of Pharmacology, St. John's Medical College, Bangalore – 560 034, India

† Department of Pharmacology, Wayne State University School of Medicine, 540 E. Canfield Avenue, Detroit, MI 48201, USA

Summary

Oxidative damage to crucial biomolecules due to excess generation of reactive oxygen species has been implicated as a major cause of organ damage, and hence compounds capable of negating such damage have potential benefits. Using hydrogen peroxide (H_2O_2) as a model pro-oxidant to induce oxidative stress, we have examined the ability of the natural food supplement Maharishi Amrit Kalash (MAK-4) to decrease oxidative damage in potassium-arrested isolated rat hearts. The protocol was that hearts isolated from male Sprague-Dawley rats were retrograde-perfused with Krebs-Henseleit (K-H) solution for 30 min for equilibration. After this period, the hearts were subjected to cardioplegia with high potassium (26-30 mM), followed by reperfusion with K-H solution in the presence or absence of 200 uM H_2O_2. As expected, H_2O_2 treatment following cardioplegia induced a high degree of oxidative stress as assessed by release of lactate dehydrogenase (LDH, a marker of plasma membrane damage) and total glutathione (GSH + GSSG). H_2O_2 also impaired the ability of the heart to regain developed tension during the testing period. However, addition of MAK-4 in the perfusate containing H_2O_2 decreased oxidative stress in terms of release of LDH and glutathione. In parallel with these biochemical studies, in a few experiments the cardiac function was assessed by measuring developed contractile tension. These preliminary studies also showed that in the presence of MAK-4, the H_2O_2 -treated hearts were able to regain better-developed tension. Further in vitro studies to examine the possible mechanisms of MAK-4 action reveal that this formulation contains H_2O_2 binding activity, which resulted in the decreased availability of H_2O_2 itself. Our studies hence reveal that the ayurvedic food supplement MAK-4 may have potential benefits in reducing oxidative stress.

(See charts on next page.)

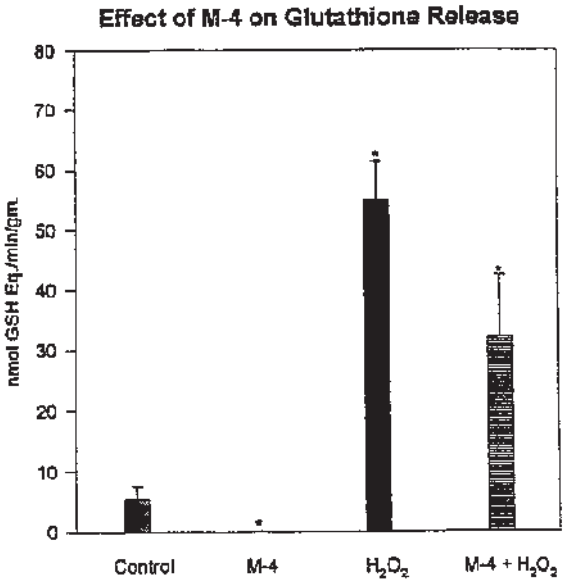

Fig. 1. Glutathione (GSH + GSSG) release into effluent samples collected at 89- to 90-min time interval from vehicle (control), MAK-4 (0.1%), 200 μM H_2O_2 and MAK-4 (0.1%) + 200 μM H_2O_2 treated isolated rat hearts. Hearts were equilibrated for 30 min, exposed to cardioplegia with high potassium (26–30 mM) for the next 45 min and reperfused with K–H for the last 30 min. Values represent mean ± SE ($n = 4$).

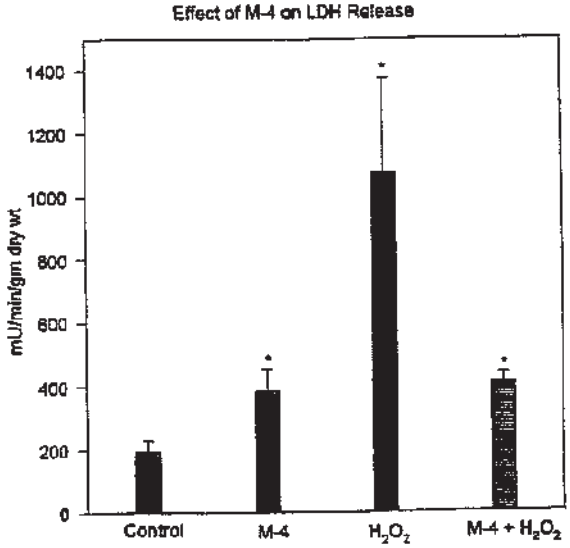

Fig. 2. Lactate dehydrogenase (LDH) release into effluent samples collected as described in Fig. 1. Values represent mean ± SE ($n = 4$).

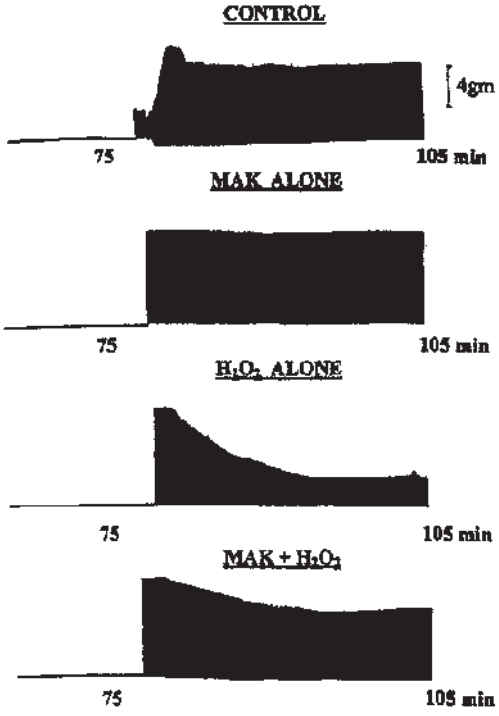

Fig. 3. Representative contractile records showing the recovery of cardioplegic, isolated rat hearts exposed to Krebs-Henseleit solution containing the following agents: (a) vehicle (control); (b) MAK-4 (0.1%); (c) 200 μM H_2O_2; (d) MAK-4 (0.1%) + 200 μM H_2O_2.

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Study 7 **Research Highlights**

Researchers demonstrated the ability of MAK-4 to successfully decrease oxidative stress induced by H_2O_2 in an in vitro model. It was subsequently found that MAK-4 contains H_2O_2 binding activity. Thus MAK-4 may have potential benefits in reducing oxidative stress.

8. Title

Anti-Oxidant and Antiplatelet Properties of Maharishi Amrit Kalash [MAK-4] in Hypercholesterolemic Rabbits

Publication

Ninth International Symposium on Atherosclerosis, Rosemont, IL, October 6-11, 1991, p. 188 (Abstract).

Authors

Rao V. Panganamala, Ph.D. and Hari M. Sharma, M.D., FRCP(C).

Conducted at

The Ohio State University, College of Medicine, Columbus, OH, USA

Summary

Platelet aggregation and oxidized lipids are considered important mediators of vascular injury leading to atherosclerosis. M-4, an herbal food supplement (MAPI Inc., Lancaster, MA) has been shown to be effective in preventing generation of reactive oxygen species in-vitro (IJCP 1:23-27, 1991). The experiments were carried out to evaluate the effectiveness of M-4 in preventing platelet aggregation and oxidation of lipids in hypercholesterolemic rabbits. Two groups of six rabbits (pair matched) were given a 1% cholesterol diet. The experimental group in addition was given 0.4% M-4 in the diet. At the end of the experiment (7 weeks), total cholesterol, plasma and hepatic TBARS, and platelet aggregation induced by ADP & collagen were compared between the two groups. The results are:

	Control	Experimental
Total cholesterol (mg/dl)	1511	1003
Plasma TBARS (nmoles/ml)	5.38 ± 0.5	1.9 ± 0.3
Hepatic TBARS (nmoles/g tissue)	148 ± 16	83 ± 11

Platelet Aggregation	% Transmittance			
	Collagen (ug/ml)		ADP (x 10^{-3})	
	4.4	2.2	4.4	2.2
Control (n = 5)	48.6	30.0	34.0	21.0
Experimental (n = 4)	26.0	3.0	10.0	3.75

Results show that M-4 supplementation reduces plasma and hepatic lipid peroxidation, as well as platelet aggregation induced by collagen and ADP, in hypercholesterolemic rabbits.

Study 8 **Research Highlights**

Hypercholesterolemic rabbits supplemented with M-4 for 7 weeks showed a reduction in plasma and hepatic lipid peroxidation, as well as platelet aggregation induced by collagen and ADP.

9. Title

Lipid Peroxide in Ischemic Heart Disease (IHD): Inhibition by Maharishi Amrit Kalash (MAK-4 and MAK-5) Herbal Mixtures

Publication

Federation of the American Societies for Experimental Biology Journal, Vol. 14, No. 4, p. A121, 2000 (Abstract).

Authors

J. Dogra and A. Bhargava (SPON: H. Sharma).

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Central Government Health Scheme and Okay Research Centre, Jaipur, India 302017

Summary

As oxidation of low-density lipoprotein plays a significant role in atherogenesis, an improvement in the antioxidant status should lead to a protective effect. We initiated this trial to study the in vivo effects of MAK-4 and MAK-5 (herbal mixtures containing polyphenols, bioflavonoids, tocopherol, ascorbic acid, and carotenoids) on lipid peroxide in addition to its clinical efficacy. Eighty patients with proven IHD were enrolled in our study. Lipid peroxide studies were done initially and at one year in MAK-supplemented and control groups. The control group consisted of 40 IHD patients minus MAK. Drugs like antioxidant vitamin E and lipid-lowering agents were withdrawn in both groups. Clinical parameters of drug response were assessed. MAK-4 paste was prescribed in a dose of 10 g daily in 2 divided doses followed by MAK-5 tablet, for 1 year as 'add-on' regimen. Thirty-four patients reported a significant decrease in the mean anginal frequency per month from 5.50 (+3.20) to 2.15 (+2.00) and improvement in the treadmill test was reported in 8 cases at 1 year. Echocardiography studies reported improvement in ejection fraction in 7 cases. Plasma lipid peroxide concentration of patients with IHD was 7.24 nmoles MDA/ml (mean), which was reduced to 4.97 nmoles MDA/ml (mean) after 1 year of MAK 'add-on' trial. However, no significant reduction was noted in the control group. We conclude that MAK significantly lowers lipid peroxide, which has been implicated in atherogenesis and significantly lowers the incidence of myocardial ischemia.

Study 9 **Research Highlights**

Plasma lipid peroxide concentration of patients with Ischemic Heart Disease was reduced from 7.24 nmoles MDA/ml (mean) to 4.97 nmoles (mean) after 1 year of MAK supplementation, while no significant reduction was noted in the control group. Thus, MAK significantly lowers lipid peroxide, which has been implicated in atherogenesis and significantly lowers the incidence of myocardial ischemia.

10. Title

In-Vitro Inhibition of Microsomal Lipid Peroxidation by MA-631, Student and Ladies Rasayana (SR and LR) and Maharishi Coffee Substitute (MCS)

Publication

The Pharmacologist, Vol. 34, No. 3, p. 184, 1992 (Abstract).

Authors

H.M. Sharma, A. Hanna, E.M. Kauffman, and H.A.I. Newman (SPON: D. Feller).

Conducted at

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Summary

MCS, MA-631, M-4, and M-5 have been shown to inhibit in-vitro human LDL oxidation. In the present study, the effects of MA-631, SR, LR and MCS on microsomal lipid peroxidation were examined in vitro. Rat liver microsomes were incubated with a sodium ascorbate and ADP-iron complex or with an NADPH generating system to stimulate non-enzymatic or enzymatic lipid peroxidation respectively. Aqueous or alcoholic extracts of MA-631, SR, LR and MCS, when added to these incubation systems, inhibited hepatic microsomal lipid peroxidation in a dose dependent manner. The alcoholic extracts were the most effective antiperoxidants in both systems. Alcoholic extract of MCS inhibited ascorbate or NADPH-induced lipid peroxidation by 56% and 63% with 12 ugm and 22.5 ugm, respectively. These findings suggest that these Maharishi Ayurveda food supplements may be useful in the treatment of free radical induced injury due to their antiperoxidant properties.

Study 10 **Research Highlights**

In vitro aqueous and alcoholic extracts of MA-631, Student Rasayana, Ladies Rasayana, and Maharishi Coffee Substitute demonstrated potent antiperoxidant properties in a dose-dependent manner. Thus, these supplements may be useful in the treatment of free radical-induced injury due to their antiperoxidant properties.

11. Title

Open Randomized Clinical Trial Comparing Herbal Compound MA 1596 with Lovastatin in Hyperlipidemic Patients

Publication:

1. Association of Physicians of India (APICON), held on 11th - 15th January 2003.
2. Asian Network of Research on Antidiabetic Plants (ANRAP), held on 16th - 18th January, 2004.

Principal Investigator:

Dr. Anoop Misra*, Professor, Department of Medicine, A. I. I. M. S., New Delhi, INDIA

Co-Investigators:

Dr. R. M. Pandey**, Prof. & Head, Department of Biostatistics, A. I. I. M. S., New Delhi, INDIA
Dr. Randeep Guleria*, Professor, Department of Medicine, A. I. I. M. S., New Delhi, INDIA
Dr. Anurag Srivastava*, Professor, Department of Surgery, A. I. I. M. S., New Delhi, INDIA

Background & Objectives:

Hyperlipidemia is major risk factor for cardiovascular diseases. The currently available drugs for use in hypelipidemia, though effective have adverse effects. Therefore there is need to evaluate herbal formulations for the treatment of hyperlipidemia.

MA-1596 is a polyherbal compound made up of fourteen herbs like Curcuma longa, Commiphora mukul, Zingiber officinalis, Terminalia chebula etc.

The present study was undertaken to evaluate the effect of MA-1596 as compared to Lovastatin (an HMG-CoA reductase inhibitor) in patients with primary hyperlipidemia.

The objective of our study was to examine efficacy and tolerability of herbal compound Lipomap (MA-1596) on patients with hyperlipidemia.

Methodology

Study Procedures:

This was an open randomized clinical trial. The trial duration was of 12 weeks preceded by a placebo run in period of 4 weeks. All patients with primary hyperlipidemia were enrolled after following inclusion criteria. Patients received one month of placebo, diet and exercise advise and were subsequently randomized to receive either Lovastatin or MA-1596 for 3 months. Lipid profile was performed at each visit & biochemical investigations were performed at baseline and at the completion of study.

Trial Methodology:

(a) Trial Medication: MA-1596 or Lovastatin.

(b) Dosage: MA-1596 -500mg (2 B.D.) & Lovastatin 10 mg (1 B.D.)

(c) Number of Patients: A total of 50 patients with primary hyperlipidemia were studied from medicine OPD according to the inclusion and exclusion criteria.

Results:

Analysis of data was done by using strata 8.0. Total numbers of 50 patients were enrolled for the study. Out of which 26 and 24 patients were in MA-1596 & Lovastatin groups respectively. Mean age in both groups MA-1596 & Lovastatin were observed similar i.e. 43.97+ 9.8 & 44.64+ 9.8 respectively.

Table 1 : Intergroup comparison

	VARIABLES (mg %)	MA-1596 (n1)	LOVASTATIN (n2)	p-VALUE
AT BASELINE	TC	239±38.9	251.4±11.7	0.4
(n=50)	TG	183.3±78.2	186.8±33.1	0.8
(n1=26,n2=24)	LDL-c	161.9±48	172.2±68.8	0.5
	HDL-c	41.3±4.7	41.8±6.61	0.7
POST THERAPY	TC	229.8±42.2	188±33.1	**0.004**
(N=33)	TG	158±71.2	170.6±52.6	0.5
(n1=19,n2=14)	LDL-c	155.2±44	111.8±36.2	**0.004**
	HDL-c	43±3.99	42.9±4.39	0.9

Table 2 : Intragroup comparison

Table 2A : MA-1596 (n=19)

VARIABLES (mg%)	PRE-THERAPY median (range)	POST-THERAPY median (range)	p-VALUE
TC	237.5(180-356)	220(171-314)	0.09
TG	161(80-400)	137(92-321)	0.01
LDL-c	161(71.6-297.8)	151(93.6-252.2)	0.1

Table 2B : Lovastatin (n=14)

VARIABLES (mg%)	PRE-THERAPY median (range)	POST-THERAPY median (range)	p-VALUE
TC	246(150-350)	186.5(142-247)	0.002
TG	179(62-334)	163(89-295)	0.3
LDL-c	172.6(66-295.6)	107(52-175.6)	0.004
HDL-c	42(30-56)	42(38-50)	0.05

Summary:

Thirty-three out of 50 patients have completed the study. Fourteen patients were on Lovastatin and 19 patients received MA-1596. Mean TC, TG, LDL, & HDL-c levels were similar in both groups at baseline.

After 12 weeks, on inter group comparison greater reduction in TC (p=0.004) and LDL-c (p=0.004) was observed in the Lovastatin group as compared to MA-1596. On intra group comparison MA-1596 reduced TG(p=0.01) significantly and also increased HDL-c levels (p=0.06), which is very close to significance. Lovastatin decreased TC (p=0.002) and LDL-c (0.004). No significant effect was observed in triglyceride levels in Lovastatin group. There was no change observed in liver and renal function test in both groups after treatment.

Major Conclusion:
On observation, MA-1596 has shown significant reduction in triglyceride levels and no adverse effects were reported in patients receiving MA-1596. Further study is required with larger sample size to evaluate the potential of this drug in dyslipidemia.

Outcome of study:
In this study MA-1596 has shown beneficial effect in triglycerides and HDLc levels in dyslipidemic patients.

1. Title

Hypoglycemic, Hypolipidemic and General Beneficial Effects of an Herbal Mixture MA-471

Publication

Alternative Therapies in Clinical Practice, Vol. 3, No. 5, pp. 26-31, September/October 1996.

Authors

Amulya R. Sircar, MD,* Ramesh C. Ahuja, MD,* Shankar M. Natu, PhD,* Birendra Roy, MBBS,* and Hari M. Sharma, MD, FRCPC.**

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Summary

An herbal mixture used for thousands of years in India for treatment of diabetes was evaluated for its efficacy and safety in patients with non-insulin-dependent diabetes mellitus (NIDDM). This herbal mixture, MA-471 (Glucomap™), was developed by Maharishi Ayur-Veda Products (Noida, India) and showed very good results in preliminary trials. In the present pilot study, a clinical trial was conducted in which patients were divided into three groups: Group A (15 cases) were patients who had never taken an anti-diabetic drug and were uncontrolled by diet and exercise; Group B (30 cases) were patients controlled by an oral hypoglycemic agent (OHA); and Group C (15 cases) were patients uncontrolled by the maximum dose of an OHA. All patients were started on MA-471 tablets after initial evaluation and blood collection, and were called for follow-up every two weeks for blood collection and observation of the improvement or deterioration of various symptoms. The mean fasting and postprandial blood glucose, and hemoglobin A1C showed a significant decrease from the initial values in all three groups of patients. "Good" and "acceptable" control was achieved in 68.3% of the patients. MA-471 seemed to be more effective in patients who had diabetes of less than five years duration. MA-471 also resulted in a significant fall in serum total cholesterol and triglycerides, and resulted in marked improvement in polyuria, fatigue, and constipation. This pilot study shows the herbal mixture MA-471 has significant hypoglycemic and hypolipidemic properties, and also improves the quality of life of NIDDM patients.

(See charts on next two pages.)

Table 1. Fasting and postprandial blood glucose and hemoglobin A_1C before and after MA-471.*

Group			Initial	After MA-471 3 months	6 months	9 months
A		n	15	15	15	13
	Fast. glucose		9.28(± 1.22)	7.28 (± 1.11)	6.77 (± 0.95)	6.82 (± 0.82)
		p value		< 0.001	< 0.001	< 0.001
	PP glucose		16.10 (± 1.57)	12.82 (± 1.28)	12.35 (± 1.11)	12.16 (± 1.06)
		p value		< 0.001	< 0.001	< 0.001
	HBA_1C		10.3 (± 2.8)	8.5 (± 1.49)	7.1 (± 1.5)	7.3 (± 1.47)
		p value		<0.05	< 0.01	< 0.05
B		n	30	30	30	25
	Fast. Glucose		6.43 (± 1.14)	5.90 (± 1.35)	5.54 (± 1.22)	5.70 (± 1.28)
		p value				
	PP glucose		9.55 (± 1.07)	9.10 (± 1.02)	9.37 (± 1.24)	9.45 (± 1.36)
		p value				
	HBA_1C		7.0 (± 1.97)	7.1 (± 2.1)	7.8 (± 1.87)	7.6 (± 2.8)
		p value				
C		n	15	15	15	12
	Fast. glucose		8.34 (± 1.21)	6.14 (± 1.07)	6.01 (± 0.95)	5.66 (± 0.79)
		p value		< 0.001	< 0.001	< 0.001
	PP glucose		13.73 (± 1.24)	10.33 (± 1.0)	9.51 (± 1.01)	9.42 (± 0.75)
		p value		< 0.001	< 0.001	< 0.001
	HBA_1C		10.1 (± 2.5)	8.0 (± 1.7)	7.3 (± 1.8)	6.4 (± 1.5)
		p value			< 0.01	< 0.05
TOTAL		n	60	60	60	50
	Fast. glucose		7.13 (± 1.27)	5.93 (± 1.01)	5.75 (± 0.98)	5.76 (± 1.02)
		p value		< 0.001	< 0.001	< 0.001
	PP glucose		13.07 (± 1.39)	9.91 (± 1.18)	9.54 (± 0.90)	9.67 (± 0.87)
		p value		< 0.001	< 0.001	< 0.001
	HBA_1C		9.13 (± 2.9)	7.53 (± 1.8)	6.73 (± 1.7)	6.93 (± 1.8)
		p value		< 0.01	< 0.001	< 0.01

* Values are mean ± SD. Glucose units are mmol/dL and hemoglobin A_1C unit is percent. P values were derived by comparison with initial value. Fast. glucose = fasting glucose; PP glucose = Postprandial glucose; HBA_1C = hemoglobin A_1C.

Table 5. Comparative effect of MA-471 and oral hypoglycemic agents (OHA) on some common symptoms of diabetes

	Initial	After MA-471			Initial	After OHA		
Presenting complaint	**n**	**Same**	**Improved**	**Worse**	**n**	**Same**	**Improved**	**Worse**
Polyuria	25	5	18	2	27	10	13	4
Polydipsia	13	3	6	4	11	5	4	2
Mouth dryness	12	8	4	-	15	10	3	2
Weakness	41	19	21	1	39	24	10	5
Fatigue	39	15	23	1	42	23	12	7
Joint pain	33	21	10	2	34	24	10	-
Muscle pain	28	16	11	1	26	18	6	2
Giddiness	33	16	15	2	30	20	10	-
Nausea	3	2	1	-	2	2	-	-
Anorexia	26	13	10	3	22	14	8	-
Constipation	15	7	8	-	16	8	6	2
Abdominal pain	6	5	1	-	4	4	-	-
Palpitation	18	11	7	-	20	9	9	2
Paresthesia	23	19	3	1	26	20	3	3
Numbness	30	23	5	2	29	24	4	1
Pruritis	2	1	1	-	1	1	-	-
Anxiety	13	9	4	-	13	9	2	2
Insomnia	19	13	6	-	17	12	5	-
Headache	2	2	-	-	1	1	-	-
Skin rash	4	1	3	-	2	1	-	1
Impotence	15	10	5	-	13	13	-	-

Study 1 **Research Highlights**
Supplementation of Non-Insulin Dependent Diabetes Mellitus (NIDDM) patients with MA-471 resulted in "good" or "acceptable" control in over 68% of patients. MA-471 supplementation also resulted in a significant fall in serum total cholesterol and triglycerides, and resulted in marked improvement in polyuria, fatigue, and constipation. MA-471 seemed to be more effective in patients who had diabetes for less than five years.

2. Title

Double blind randomized placebo controlled Clinical Trial of herbal compound Glucomap (MA-471) on metabolic profile in Type II DM patients.

Publication:

1. ANRAP (4th Asian Network of Research on Anti - diabetic plants), International Seminar, '2003'.
2. DIAMOND APICON (Annual Conference of Association of Physicians of India) '2005'

Principal Investigator:
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Professor, Department of Medicine, A.I.I.M.S., New Delhi, INDIA

Co-Investigators:

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Prof. & Head, Department of Biostatistics, A.I.I.M.S., New Delhi, INDIA

Dr. Randeep Guleria
Professor, Department of Medicine, A.I.I.M.S., New Delhi, INDIA

Background and Objectives:

Type-2 diabetes (Type II DM) is a growing menace worldwide. Drug therapy of Type II DM may be limited by adverse drug reactions, requiring alternative therapies. Herbal medicines are supposed to have benefits with fewer side effects. So there is a need to evaluate these herbs scientifically. Glucomap (MA-471) is a polyherbal compound.

The objective of our study was to examine efficacy and tolerability of herbal compound Glucomap (MA-471) on metabolic profile in Type II DM patients.

Trial Methodology:

(a) Trial Medication:

Glucomap (MA-471) or Placebo

(b) Dosage:

500mg tablets, 2 tablets twice a day.

(c) Number of Patients:

A total of 100 patients with diabetes mellitus were studied from medicine OPD and Diabetes Research Clinic according to the inclusion and exclusion criteria.

Result:

Analysis of data was done using stata 7. A total number of 100 patients were enrolled for the study. Eighty-two patients have completed the study. Number of males & females were 42 & 58 respectively. At the baseline mean age, fasting & post-prandial blood glucose levels, HbA1c levels were comparable in both groups. (Table 1)

At the time of termination of study Glucomap (MA-471) has shown significant reduction in fasting blood glucose levels & in Glycosylated haemoglobin levels ($p = 0.02$ & $p = 0.008$ respectively. (Table 2).

Table 1 : Inter Group Comparison at baseline

Mean age (years) :
Glucomap (MA-471) : 46.02+12.4
Placebo : 48.6±8.9

	Pre t/t Mean (±SD)		
Parameters	Group A (MA-471) n=42	Group B (Placebo) n=58	p - Value
FBG*** (mg%)	153.4 (±21.4)	150.6 (±20.8)	0.52
PPBG*** (mg%)	214.6 (±41.6)	199.2 (±41.5)	0.08
HbA1c*** (%)	8.5 (±0.8)	8.3 (±0.5)	0.14

*Ns

Table 2 : Intra Group comparison of pre & post t/t Blood Glucose levels

Parameters	Group Gp-A (MA-471) Gp-B (Placebo)	Pretreatment mean (±SD) n=82 Gp-A=42 Gp-B=40	Posttreatment mean (±SD)	p - Value
FBG***	A	152.8 (±20.4)	142.8 (±25.1)	**0.02***
	B	150.2 (± 21.9)	139.9 (±35.3)	0.07
PPBG*** (Mg%)	A	211.8 (±41.8)	196.7 (±41.4)	0.07
	B	195.3 (±40.3)	186.3 (±51.5)	0.20
HbA1c***	A	8.5 (±0.9)	8.1 (±0.6)	**0.008***
	B	8.2 (±0.5)	8.1 (±0.5)	0.11

*Significant
**n=Number of Patients
***FBG=Fasting blood glucose
***PPBG=Post prandial blood glucose
***HbA1c=Glycosylated haemoglobin

Major Conclusions:

On observation, Glucomap (MA-471) has shown significant reduction in fasting blood glucose levels & in glycosylated haemoglobin levels and no adverse effects were reported in patients receiving Glucomap (MA-471). Further study is required with larger sample size to evaluate the anti-hyperglycemic potential of the drug.

3. Title

To Evaluate Effect of Glucomap In Type II Diabetes Mellitus.

Principal Investigator: Dr. M. K. Gupta*, Dr. Chitra Gupta***

Co-Investigator: Dr. Ayesha Gupta**

Publication:
Ayurveda Mahasammelan Patrika, Page No. 6- June- 2012

Background & Objective:

To evaluate the effect of an indigenous herbal product GLUCOMAP from "Maharishi Ayurveda Products Pvt. Ltd.", India on blood sugar in type II Diabetes.
The present study was designed to evaluate efficacy and side effects if any of this product on blood sugar and other co-morbid conditions. We also studied effects of this drug especially on kidney, liver and other vital parameters.

Material & Methods:

We studied total number of 52 patients of type II Diabetes aged from 22 yrs to 72 yrs of both sexes either newly diagnosed type II Diabetics or who were not controlled with their conventional treatments.

This study continued for six months duration with three mandatory visits by each included patient: one at the time of registration, second visit after one to two months and third visit after six months. We took all basic parameters of all individuals including weight, height, blood pressure and performed blood sugar, HbA1c, Lipid profile, KFT, LFT, CBC, Urine routine & microscopic first at the time of registration and then after six months. During second visit, after one or two months we only performed routine physical examination and blood sugar and urine analysis. Those cases who did not feel well with medicine were further investigated at this time. We also did initial & final ultrasound of abdomen to evaluate Liver, Kidney, etc. at the time of registration and after six months.

Inclusion & Exclusion Criteria:

We included newly diagnosed type II Diabetics, Type II Diabetics not controlled with conventional [2] OHAs and type II diabetics not controlled with two doses of pre mixed insulin injections. We excluded pregnant females and females intending to get pregnant during study period. We also excluded all those who had serum creatnine > 1.5 mg and all those who had SGPT & SGOT > two times of UNL. We also excluded cases of proved ischemic heart disease.

* Senior Consultant, Shri Ram Medical Centre
** Resident Doctor & Research Co-ordinator
*** Senior Consultant, Shri Ram Medical Centre

Result :

We assessed 52 diabetics (M/F 33/19, age average 41 yrs)

Table 1 shows age and sex distribution of cases.

Age Group	Male	Female	Total No.
20-30	04 0	0	4
31-40	08 0	3	11
41-50	08 0	8	16
51-60	05 0	6	11
61-70	06 0	2	08
71-80	02 0	0	2
Total	**33**	**19**	**52**

of 52 cases 3 dropped out and 2 were withdrawn from study because of no effect on blood sugar.

Blood Sugar Level & HbA1c :

Parameter	At the time of registration	After One Month	After Six Months
Fasting	138+\-12	128+\-9	110+\-12
Post Parandial	213+\-9	200+\-8	180+\-16
HbA1c	8.2+\-1.2	Not done	7.2+\-1

Various groups on the basis of severity of diabetes :

	A Newly diagnosed Diabetics	B OHAs Failure Cases	C Not controlled with twice a day premixed insulin
No. of cases registered	16	26	10
No. of cases completed the study	14	24	09

We used Glucomap 500mg tablets provided by Maharishi Ayurveda Products Pvt. Ltd. for the study. We initiated with 500 mg twice a day after breakfast & dinner and built up the dose of up to 2 gms a day in divided doses.

Effect on Lipid Profile & Weight :

	Weight	Cholesterol	HDL	TG
At Registration	71+\-8	216+\-8	41+\-3	226+\-12
1st Month	70+9	--	--	--
6th Month	72.2+\-7	210+\-9	44+\-3	200+\-16

Effect on Liver & Kidney Functions :

	SGPT	SGOT	Creatinine	Uric Acid
Starting	26+\-9	22+\-8	1.2+\-4	4.8+\-3
1st Month	--	--	--	--
6th Month	29+\-6	20+\-3	1.1+\-4	4+\-2.5

Observations:
We observed that Glucomap (a combination of herbs) is a safe anti-diabetic product with mild to moderate anti-diabetic action. We did not observe any significant hypoglycemia in any of the cases. This drug significantly reduces both fasting and post parandial blood sugar and HbA1c by 1% average. This drug is not associated with any significant GI side effect or water retention etc.

We also observed that Glucomap worked in all three sub groups of diabetic cases, in newly diagnosed cases, OHAs failure cases and also in poorly controlled diabetics on premix insulin.
However its effect was much significant in newly diagnosed type II diabetics and marginal in insulin dependent type II diabetics.

Conclusion:
Our six months study in 52 cases of type II diabetics concluded that Glucomap is safe, anti-diabetic drug. This drug shows its effect even with insulin therapy, it is lipid neutral and has no effect on renal or liver functions.

It brings down HbA1c on an average by 1%. Its effect is more marked in newly diagnosed type II diabetics and mild cases already receiving insulin.
We also concluded that this drug is weight neutral. Interesting thing we observed was about its significant effect on triglyceride especially all those who had triglyceride 250mg and BMI 27.

Acknowledgement:
The authors are grateful to Sh. Anand Shrivastava, Chairman & Managing Director of Maharishi Ayurveda Products Pvt. Ltd., A-14 Mathura Road, New Delhi - 110 044 for the liberal supply of free medicine and grants for conducting the various laboratory tests for the assessment of inclusion criteria and final results and Sh. S. M. Bhushan, Director, Research & Development for the technical support and references both from Modern and Ayurvedic texts.

1. Title

Dose-Dependent Activation of Immune Function in Mice by Ingestion of Maharishi Amrit Kalash-5 (MAK-5)

Publication

Environmental Health and Preventive Medicine, Vol. 2, No. 1, pp. 35-39, 1997.

Authors

Ryoichi Inaba*, Haruo Sugiura*, Hirotoshi Iwata* and Takuji Tanaka**.

Conducted at

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**First Department of Pathology, Gifu University School of Medicine, Gifu, Japan.

Summary

This study evaluated the dose-effects of ingestion of Maharishi Amrit Kalash-5 (MAK-5), an Ayurvedic food supplement, on the immune function in 10-week female inbred BALB/c mice. Superoxide anion (O^2) production of peritoneal macrophages and the response of spleen cells to concanavalin A (Con A) were examined in mice given MAK-5 by gastric intubation of an aqueous emulsion at the doses of 10, 50, 100 and 200 mg/kg once a day for 20 days. Glucose consumption of peritoneal macrophages in the MAK-5-treated mice at all doses after 24 hours of incubation, and only at the dose of 200 mg/kg after 48 hours of

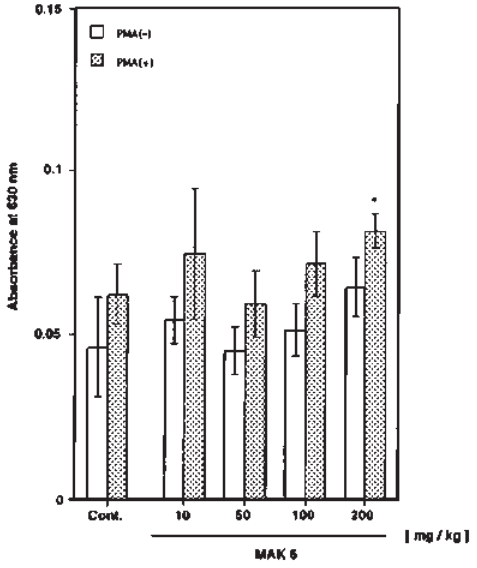

Fig. 2 Effects of Maharishi Amrit Kalash 5 (MAK 5) on superoxide anion (O_2^-) production of peritoneal macrophages in mice. Each value represents the mean±SE of triplicate determinations. *p<0.05, compared with the controls. Cont., Control.

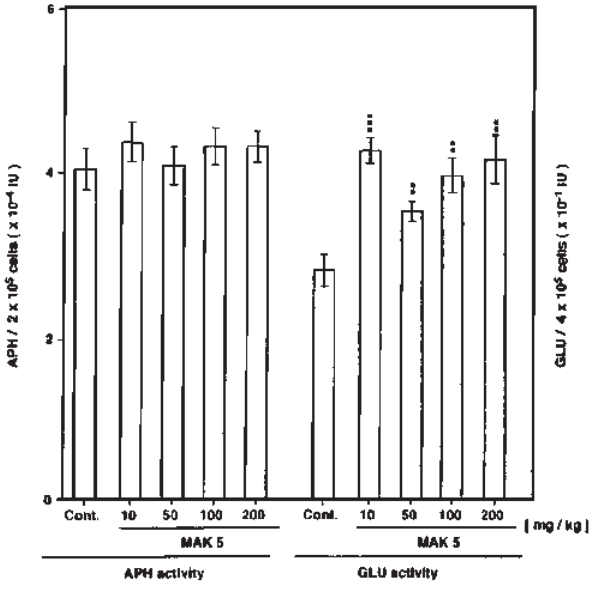

Fig. 3 Effects of Maharishi Amrit Kalash 5 (MAK 5) on acid phosphatase (APH) and β-glucuronidase (GLU) activities of peritoneal macrophages in mice. Each value represents the mean±SE of triplicate determinations. **p<0.01, ***p<0.001, compared with the controls. Cont., Control.

incubation were significantly higher than those in the control group. O^{2-}-production of peritoneal macrophages in the presence of stimulator was significantly higher in the MAK-5-treated group at the dose of 200 mg/kg than in the control group. Activities of ß-glucuronidase and lactate dehydrogenase in the peritoneal macrophages were significantly increased in the MAK-5-treated mice at all doses. MAK-5 did not enhance spontaneous splenic lymphocyte proliferation at any dose in mice. Stimulation indices in the MAK 5-treated groups at the doses of 50, 100 and 200 mg/kg were significantly higher than that of the control group. These results indicate that gastric intubation of MAK-5 once a day at the dose of 50 mg/kg enhances not only macrophage function but also lymphocyte responsiveness in mice.

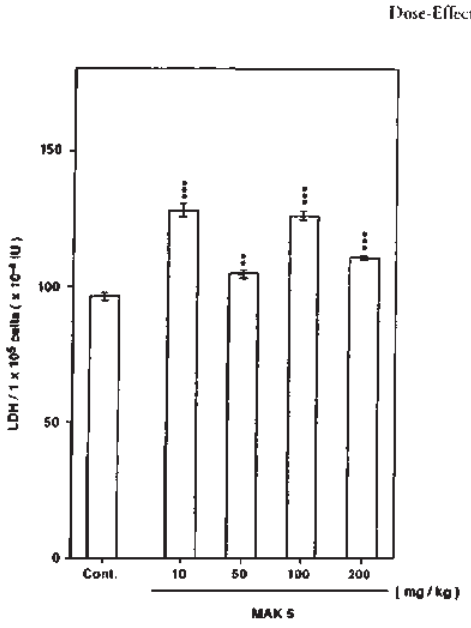

Fig. 4 Effects of Maharishi Amrit Kalash 5 (MAK 5) on lactate dehydrogenase (LDH) activities of peritoneal macrophages in mice. Each value represents the mean±SE of triplicate determinations. ** p<0.01, ***p<0.001, compared with the controls. Cont., Control.

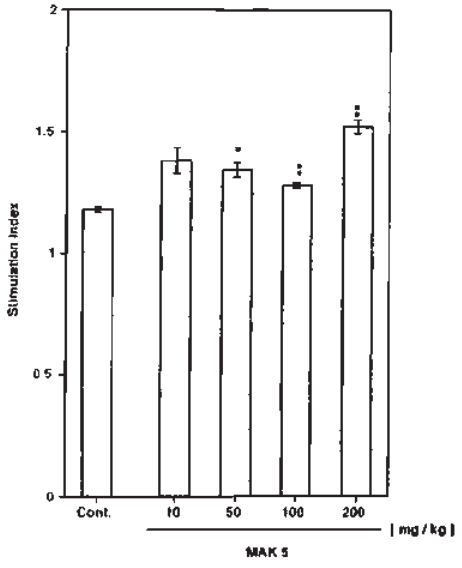

Fig. 5 Effects of Maharishi Amrit Kalash 5 (MAK 5) on proliferation of splenocytes induced by Con A in mice. Each value represents the mean±SE of 4 mice. *p<0.05, **p<0.01, compared with the controls. Cont., Control.

Study 1 **Research Highlights**
As demonstrated in mice, gastric intubation of MAK-5 once a day at the dose of 50 mg/kg enhanced not only macrophage function but also lymphocyte responsiveness.

2. Title

Immunomodulatory Effects of Maharishi Amrit Kalash 4 and 5 [MAK-4 and MAK-5] in Mice

Publication

Japan Journal of Hygiene, Vol. 50, No. 4, pp. 901-905, 1995.

Authors

Ryoichi Inaba, Haruo Sugiura, and Hirotoshi Iwata.

Conducted at

Gifu University School of Medicine, Department of Hygiene, Gifu 500, Japan

Summary

To evaluate the immunomodulatory effects of two kinds of Ayurvedic food supplements (Maharishi Amrit Kalash 4 and Maharishi Amrit Kalash 5, MAK-4 and MAK-5), superoxide anion production of peritoneal macrophages and the response of spleen cells to concanavalin A (Con A) were examined in mice given an aqueous emulsion of MAK-4 and MAK-5 p.o. at doses of 50 and 100 mg/kg for 10 days. Superoxide anion production of peritoneal macrophages in the MAK-5 (50 mg/kg)-treated group was significantly higher than that in the control group. The indices of stimulation of spleen cells by Con A were significantly (3 to 4 times) higher in groups treated with MAK-4 and MAK-5 at all doses than in the control group. These results indicate that MAK-4 enhances lymphocyte responsiveness and MAK-5 enhances not only lymphocyte responsiveness, but also macrophage function. It is also suggested in this study that MAK-4 and MAK-5 have mitogenic effects on lymphocytes.

Study 2 **Research Highlights**

As demonstrated in mice, MAK-4 enhances lymphocyte responsiveness, and MAK-5 enhances not only lymphocyte responsiveness, but also macrophage function. It also is suggested that MAK-4 and MAK-5 have mitogenic effects on lymphocytes.

Table 2 Effects of M-4 and M-5 on proliferation of splenocytes induced by Con A in mice.

Group	N	Absorbance (570 nm) Con A (−)	Con A (+)
Control	4	0.045 ±0.001	0.249 ±0.021
M-4			
50 mg/kg	4	0.088** ±0.004	0.800** ±0.019
100 mg/kg	4	0.075** ±0.001	0.744** ±0.015
M-5			
50 mg/kg	4	0.084** ±0.003	0.740** ±0.011
100 mg/kg	4	0.095** ±0.004	0.950** ±0.019

Each value represents the mean ±SE.
Significantly different from control at **$p<0.01$.
M-4, Maharishi Amrit Kalash 4; M-5, Maharishi Amrit Kalash 5. N, Number of mice used.

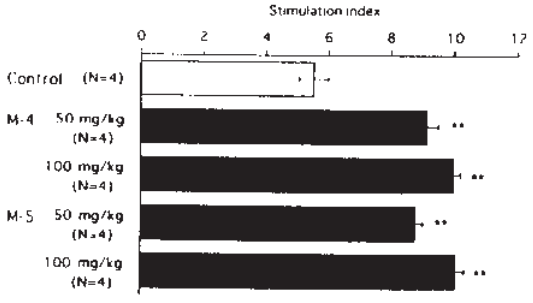

Fig. 2 Effects of M-4 and M-5 on proliferation of splenocytes induced by Con A in mice.
Each column and horizontal bar represents the mean ± SE.
Significantly different from control at ** $p<0.01$.
M-4, Maharishi Amrit Kalash 4; M-5, Maharishi Amrit Kalash 5. N, Number of mice used.

3. Title

Immunomodulation by Maharishi Amrit Kalash [MAK-4] in Mice

Publication

Journal of Applied Nutrition, Vol. 48, Nos. 1 and 2, pp. 10-21, 1996.

Authors

Ryoichi Inaba, PhD,* Haruo Sugiura, PhD,* Hirotoshi Iwata, PhD,* Hiroshi Mori, PhD,** and Takuji Tanaka, PhD.†

Conducted at

* Department of Hygiene, Gifu University School of Medicine, Gifu, Japan
**Department of Microbiology, Gifu Pharmaceutical University, Gifu, Japan
† First Department of Pathology, Gifu University School of Medicine, Gifu, Japan

Summary

The effects of ingestion of Maharishi Amrit Kalash-4 (MAK-4), one of the Ayurvedic food supplements, on immune function were evaluated in male A/He mice aged 7 weeks. Production of nitric oxide (NO) by peritoneal macrophages and proliferation of spleen cells stimulated by mitogens was examined in mice given MAK-4 by gastric intubation at the doses of 10, 50, and 100 mg/kg once a day for 20 days.

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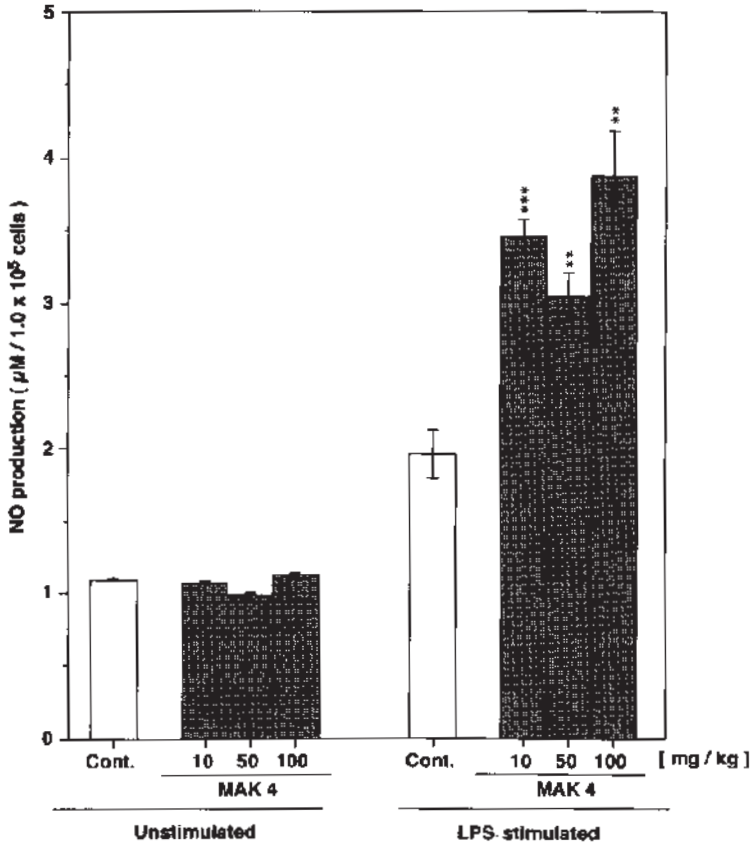
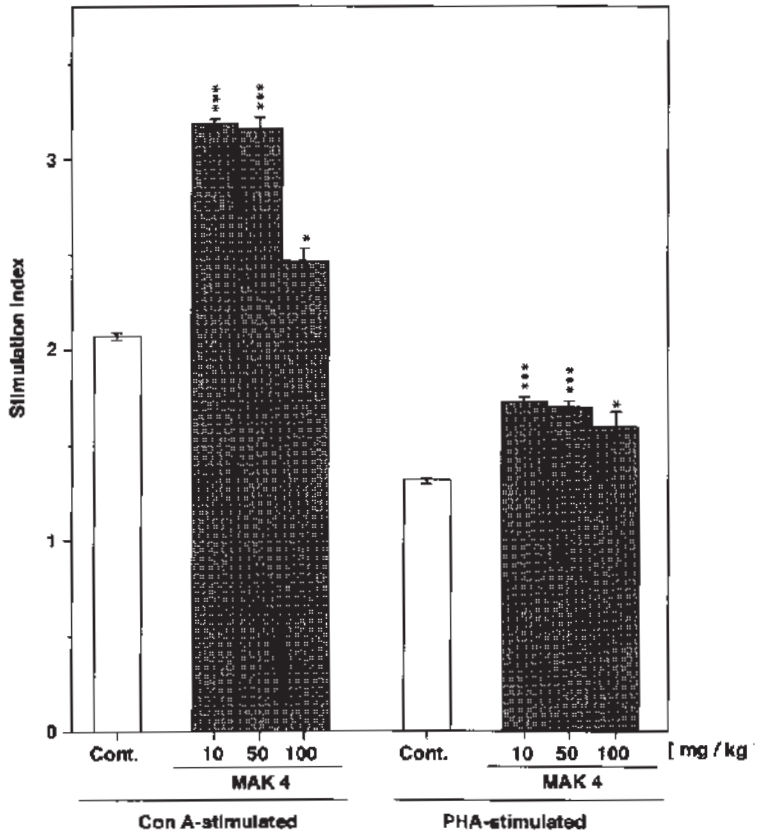
Figure 4 Effects of Maharishi Amrit Kalash 4 (MAK 4) on nitric oxide (NO) production by peritoneal macrophages cultured for 24 hours in mice.



Each value represents the mean ± SE of triplicate determinations. * $p<0.05$, * * $p<0.01$, * * * $p<0.001$, compared with the control group (Cont.). LPS, lipopolysaccharide.

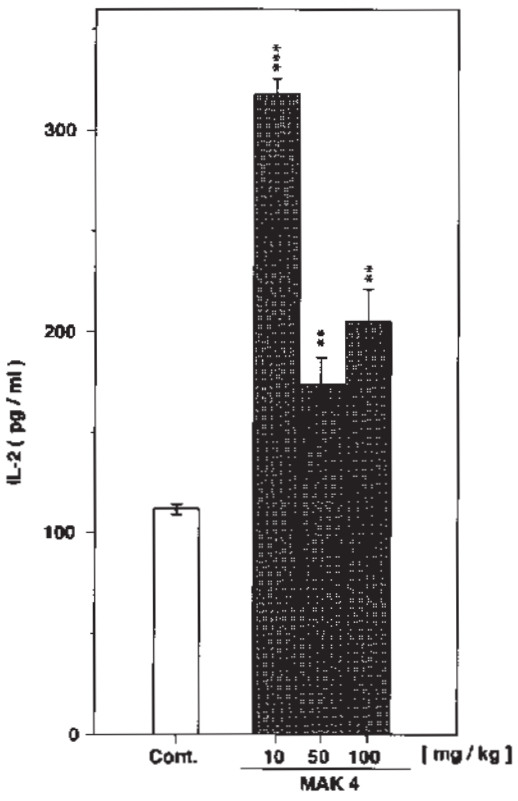
Glucose consumption of peritoneal macrophages during incubation up to 72 hours at all doses of MAK-4 was significantly higher in the MAK-4 treated mice than in the control group ($p < 0.05$). Activities of lactate dehydrogenase in the peritoneal macrophages were significantly increased in the MAK-4 treated mice at all doses ($p < 0.01$). Macrophage production of NO stimulated by lipopolysaccharide in the MAK-4 treated mice at all doses was significantly increased ($p < 0.01$). Stimulation indices both by concanavalin A (Con A) and phytohaemagglutinin in the MAK-4 treated groups at all doses were significantly higher than those of the control group ($p < 0.05$). Splenocyte production of interleukin-2 (IL-2) stimulated by Con A in the MAK-4 treated mice at all doses was significantly increased ($p<0.01$). MAK-4 treated mice at the dose of 10 mg/kg had the highest IL-2 production by splenocytes. MAK-4 at any of the doses used did not enhance spontaneous NO production, spontaneous splenic lymphocyte proliferation, or spontaneous IL-2 production by splenocytes. These results indicate that gastric intubation of MAK-4 once a day at a dose of 10 mg/kg or more enhances not only macrophage function but also lymphocyte responsiveness in mice.

Figure 5 Effects of Maharishi Amrit Kalash 4 (MAK 4) on concanavalin A (Con A) - and phytohaemagglutinin (PHA) - stimulated splenocytes proliferative responses in mice.



Each value represents the mean ± SE of 4 mice. * $p<0.05$, * * $p<0.01$, * * * $p<0.001$, compared with the control group (Cont.).

Figure 6 Effects of Maharishi Amrit Kalash 4 (MAK 4) on concanavalin A (Con A) – stimulated splenocyte production of interleukin-2 (IL-2) in mice.



Each value represents the mean ± SE of mice. * * $p<0.01$, * * * $p<0.001$, compare with the control group (Cont.).

Study 3 **Research Highlights**
MAK-4 once a day at a dose of 10 mg/kg or more enhances not only macrophage function but also lymphocyte responsiveness in mice.

4. Title

Enhanced Lymphoproliferative Response, Macrophage-Mediated Tumor Cell Killing and Nitric Oxide Production After Ingestion of an Ayurvedic Drug [MAK-5].

Publication

Biochemical Archives, Vol. 9, pp. 365-374, 1993.

Authors

Kottarappat N. Dileepan, Sapna T. Varghese, Jordan C. Page, and Daniel J. Stechschulte.

Conducted at

Division of Allergy, Clinical Immunology and Rheumatology, Department of Medicine, University of Kansas Medical Center, Kansas City, KS 66160

Summary

The Ayurvedic system of medicine utilizes a variety of herbal food supplements to enhance the body's resistance to infection and disease. Maharishi Amrit Kalash Ambrosia (MAK-5) is one such commercially available food supplement. In order to evaluate its potential immunomodulatory actions, we studied the effect of ingestion of MAK-5 on lymphoproliferative response, macrophage-mediated tumor cell killing, and the production of nitric oxide (NO) by macrophages. C57BL/6J mice were fed either a standard diet or that supplemented with 0.3% MAK-5, for a period of six weeks. After this time, splenic lymphocytes and peritoneal macrophages were isolated. The lymphoproliferative response was measured by [^{3}H] thymidine uptake after activation of the lymphocytes with phytohemagglutinin (PHA) or anti-CD3 antibodies. Tumor cell killing by lipopolysaccharide (LPS)- or interferon (IFN)-activated macrophages was studied by an 18-hour [^{51}Cr] release assay using P815 murine mastocytoma cells as targets. Production of NO was assayed by measuring the nitrite contents in the 24-hour culture supernatants of macrophage monolayers activated with IFN or a combination of LPS and IFN. In comparison to controls, lymphocytes from mice fed the MAK-5-supplemented diet exhibited significantly higher proliferative responses to PHA and anti-CD3 at all concentrations tested. The spontaneous rate of lymphocyte proliferation, measured in the absence of activators, was not enhanced by the MAK-5 diet. Peritoneal macrophages from mice maintained on the MAK-5-supplemented diet demonstrated enhanced tumor cell killing when activated with LPS, IFN, or LPS plus IFN. The production of NO by LPS- or IFN-activated macrophages from MAK-5 treated mice was significantly higher than those from controls. Neither the cytotoxicity nor the production of NO by unactivated macrophages was altered by MAK-5 supplementation. These results indicate that MAK-5 contains ingredients that can induce in vivo priming of both T-cells and macrophages for enhanced functions.

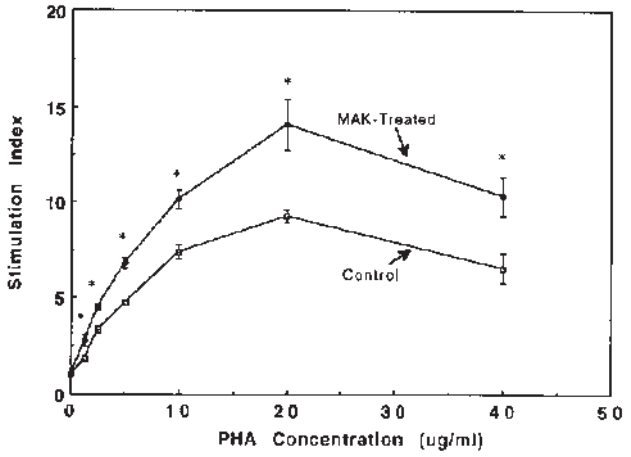


Figure 1. **Effect of MAK treatment on PHA-induced splenic lymphocyte proliferation.** The lymphoproliferative response to PHA was determined by the in vitro [^{3}H]-thymidine uptake assay as described. Stimulation index is the ratio of PHA-induced [^{3}H]-thymidine uptake to the unstimulated basal uptake. Each value given is the mean ± SEM of quadruplicate determinations. The results presented here are from a typical experiment using pooled splenic lymphocytes. A similar effect of MAK on PHA-induced lymphocyte proliferation has been noted in another experiment with a different batch of MAK. *This indicates statistically significant at least at $p<0.05$.

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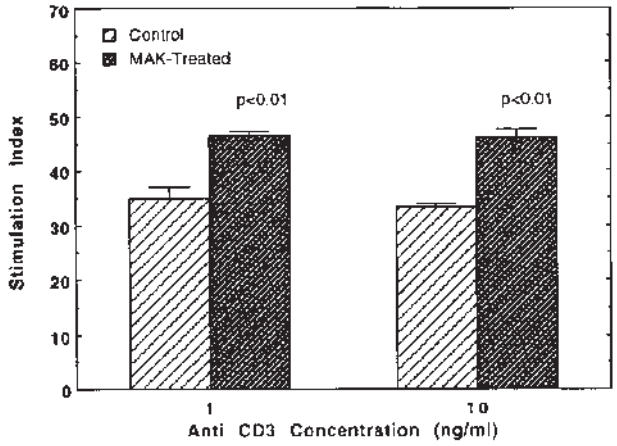

Figure 2. Effect of MAK treatment on anti CD3-induced splenic lymphocyte proliferation. The lymphoproliferative response to anti-CD3 was determined by the in vitro ^{3}H-thymidine uptake assay as described. Stimulation index is the ratio of anti-CD3-induced ^{3}H-thymidine uptake to the unstimulated basal uptake. Each value given is the mean ± SEM of quadruplicate determinations.

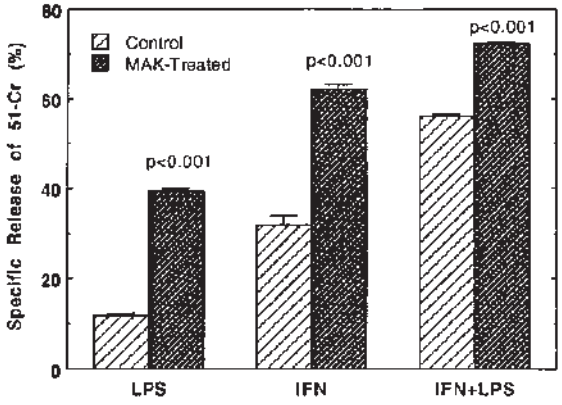

Figure 3. Effect of MAK treatment on macrophage-mediated tumor cell killing. Macrophage-mediated tumor cell killing was assayed by monitoring the release of ^{51}Cr from radiolabeled P815 mastocytoma cells (tumor targets) in an 18 hour co-culture. Concentrations of the activators used were: LPS, 1 μg/ml; IFN$_\gamma$, 100 units/ml. Each value given is mean ± SEM of triplicate determinations.

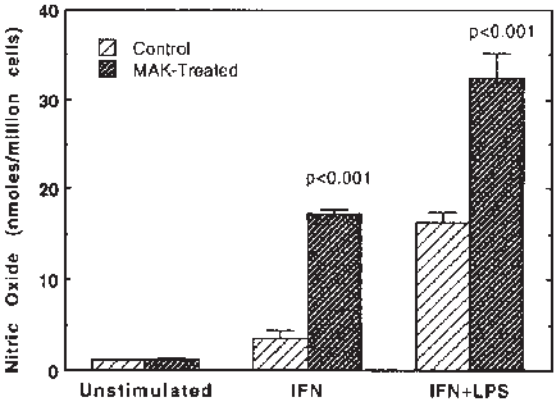

Figure 4. Effect of MAK treatment on nitric oxide production by macrophages. Production of nitric oxide by macrophages was assayed by monitoring nitrite content in the culture supernatants after 24 hour culture. Concentrations of the activators used were: LPS, 1 μg/ml; IFN$_\gamma$, 100 units/ml. Each value given is mean ± SEM of quadruplicate determinations.

Study 4 **Research Highlights**

As tested in splenic lymphocytes and peritoneal macrophages isolated from mice fed MAK-5 for six weeks, MAK-5 seems to contain ingredients that can induce in vivo priming of both T-cells and macrophages for enhanced functions.

5. Title

Priming of Splenic Lymphocytes After Ingestion of an Ayurvedic Herbal Food Supplement [MAK-5]: Evidence for an Immunomodulatory Effect

Publication

Biochemical Archives, Vol. 6, pp. 267-274, 1990.

Authors

Kottarappat N. Dileepan,* Vimal Patel,** Hari M. Sharma,† and Daniel J. Stechschulte.*

Conducted at

* Division of Allergy, Clinical Immunology and Rheumatology, Department of Medicine, University of Kansas Medical Center, Kansas City, KS 66103

**Department of Pathology, Indiana University School of Medicine, Indianapolis, IN 46223

† Department of Pathology, Ohio State University College of Medicine, Columbus, OH 43210

Summary

The in vivo immunomodulatory effects of an Ayurvedic food supplement (Maharishi Amrit Kalash Ambrosia, MAK-5) were studied in rats gavaged with this preparation at a dose of 50 mg/day for 10 or 20 days. After these regimens, mitogen-induced lymphocyte proliferation, macrophage superoxide anion production, and phagocytosis were assayed. In vitro lymphoproliferative responses to various mitogens were markedly enhanced by MAK-5 ingestion. MAK-5-mediated increases in stimulation indices ranged from 32-88% for varying concentrations of phytohemagglutinin (PHA). MAK-5 treatment did not affect spontaneous lymphocyte proliferation. The lymphoproliferative response induced by MAK-5 ingestion was significant even in animals treated for 10 days and persisted for at least 15 days after discontinuation of MAK-5. Macrophage superoxide anion generation and phagocytosis were unaltered as a result of MAK-5 treatment. These data indicate that ingestion of this food supplement enhances lymphocyte responsiveness to mitogens without affecting spontaneous proliferation.

Study 5 **Research Highlights**

As evaluated in mice, MAK-5 enhances lymphocyte responsiveness to mitogens without affecting spontaneous proliferation.

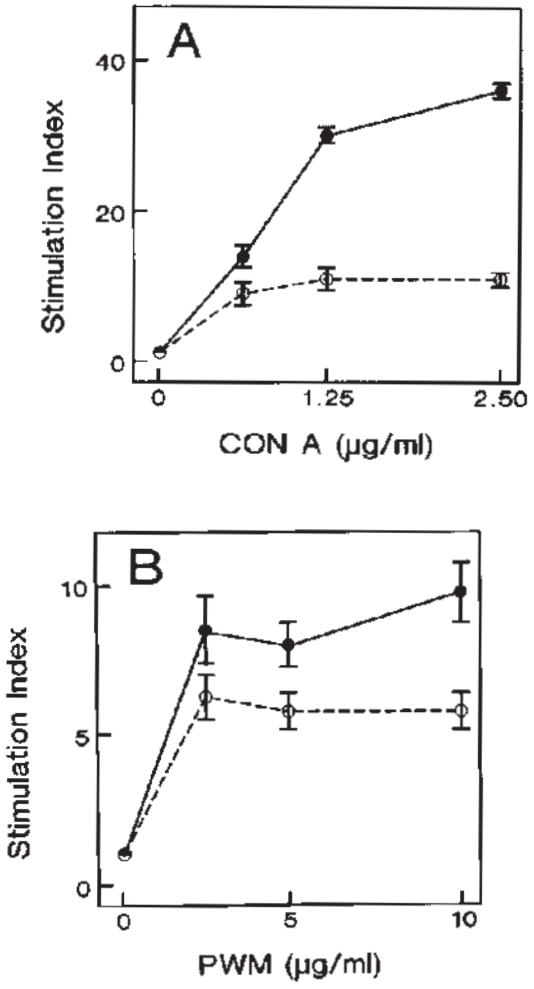

Figure 1

Proliferative response of splenic lymphocytes from control (o–o) and MAK-treated (•–•) rats to Con A (Panel A) and pokeweed mitogen (Panel B).

Research on Anti-Ageing, Neurophysiology and Intelligence

1. Title

The Effect of the Maharishi Student Rasayana Food Supplement on Non-Verbal Intelligence

Publication

Personality and Individual Differences, Vol. 15, No. 5, pp. 599-602, 1993.

Authors

Sanford I. Nidich,* Paul Morehead,* Randi J. Nidich,* David Sands,** and Hari Sharma.†

Conducted at

* Department of Science of Creative Intelligence and Education, and
**Department of Physiological and Biological Sciences, Maharishi International University, Fairfield, IA 52556
† The Ohio State University, College of Medicine, Columbus, OH

Summary

Research shows that IQ is a strong predictor of student academic performance. Previous studies have found that increasing the intake of vitamins and minerals improves non-verbal intelligence. The purpose of this study was to measure the effect of an herbal food supplement, Maharishi Ayur-Veda Student Rasayana (MA-SR), on non-verbal intelligence. The 5-month study consisted of 34 third-grade students who were randomly assigned to either an experimental group or a placebo group. The MA-SR group exhibited a 9.83 point increase in IQ compared to 4.88 points for the placebo group. Analysis of the data indicated that a significant proportion of students in the MA-SR group (78%) compared to that of the placebo group (50%) showed an improvement in IQ which exceeded that of the test-retest effect. Additional statistical analysis further indicated that taking MA-SR improves IQ.

Table 3. Mean changes in IQ for matched MA-SR and placebo groups ($N = 28$)

		Pretest		Posttest		Change	
Groups	N	M	SD	M	SD	M	SD
Rasayana	14	118.57	8.03	125.86	9.95	7.29*	6.01
Placebo	14	121.64	7.65	123.36	11.05	1.71**	11.41

*$F(1,13) = 20.573$, $P < 0.001$, repeated measures on MA-SR group pretest posttest scores; **$F(1,13) = 0.213$, $P = 0.328$, NS, repeated measures on placebo pretest posttest scores

2. Study 1 **Research Highlights**

A significant portion (78%) of third-grade students taking Maharishi Student Rasayana (MA-SR) Food Supplement showed an improvement in IQ that exceeded that of the test-retest effect, as compared to the placebo group. Additional statistical analysis further indicated that taking MA-SR improves IQ.

Title

Effect of Herbal Mixture Student Rasayana on Lipoxygenase Activity and Lipid Peroxidation

Publication

Free Radical Biology and Medicine, Vol. 18, No. 4, pp. 687-697, 1995.

Authors

Hari M. Sharma, Atef N. Hanna, Ellen M. Kauffman, and Howard A.I. Newman.

Conducted at

Department of Pathology, College of Medicine, The Ohio State University, Columbus, OH

Summary

There is evidence that suggests a relationship among free radicals, brain injury, and brain functionality. The scavenging of free radicals as a possible mechanism for the improvement in intelligence by Student Rasayana (SR) was explored in this study on the effect of SR on lipid peroxidation and lipoxygenase activity. SR inhibited enzymatic- and nonenzymatic-induced rat liver microsomal lipid peroxidation in a concentration-dependent manner ($p<0.05$). SR also inhibited soyabean lipoxygenase-induced LDL oxidation in vitro ($p<0.05$). In vivo, SR inhibited toluene-induced rat brain microsomal lipid peroxidation ($p<0.05$). An interesting finding in this study is that an alcoholic extract of SR increased in vitro a metabolite of arachidonic acid which enhances long-term potentiation, a process associated with learning. Thus, SR may protect brain functions and increase intelligence through scavenging of free radicals and/or increasing certain metabolites of arachidonic acid.

For more information on this study, see Research on Reduction of Chemical Toxicity and Antioxidant Research.

Study 2 **Research Highlights**
An alcoholic extract of Student Rasayana (SR) increased a metabolite of arachidonic acid, which enhances long-term potentiation, a process associated with learning. Thus, SR may protect brain functions and increase intelligence through scavenging of free radicals and/or increasing certain metabolites of arachidonic acid.

3. Title
In Vivo Effect of Herbal Mixture MAK-4 on Antioxidant Capacity of Brain Microsomes

Publication
Biochemical Archives, Vol. 12, pp. 181-186, 1996.

Authors
Hari M. Sharma, Jae Y. Lee, Ellen M. Kauffman, and Atef N. Hanna.

Conducted at
Department of Pathology, College of Medicine, The Ohio State University, Columbus, OH 43210

Summary

There is increasing evidence that free radicals are linked to neurological disorders and aging. This study examined the in vivo effect of MAK-4 on lipid peroxidation and antioxidant protection capacity of the brain of Watanabe Heritable Hyperlipidemic (WHHL) rabbits. Brain microsomes of rabbits fed MAK-4 showed significantly lower levels of lipid peroxidation than those of control rabbits fed normal chow. These results indicate MAK-4 may yield increased antioxidant protection in the brain, and may therefore be useful in preventing or treating free radical-induced neurological disorders.

For details of this study, see Antioxidant Research.

Study 3 **Research Highlights**
Research with Watanabe Heritable Hyperlipidemic rabbits suggests that MAK-4 may yield increased antioxidant protection in the brain, and may therefore be useful in preventing or treating free radical-induced neurological disorders.

4. Title

Antioxidant Properties of Two Ayurvedic Herbal Preparations [MAK-4 and MAK-5]

Publication

Biochemical Archives, Vol. 10, pp. 25-31, 1994.

Authors

Stephen C. Bondy, Tina M. Hernandez, and Cara Mattia.

Conducted at

Department of Community and Environmental Medicine, University of California (Irvine), Irvine, CA 92717

Summary

This study investigated the antioxidant effects of MAK-4 and MAK-5 in the rat brain in vitro and in vivo. In vitro, ethanol and aqueous extracts of MAK-4 and MAK-5 were able to quench generation of reactive oxygen species within an isolated fraction of rat cerebral cortex enriched in mitochondria and nerve endings (synaptosomes). In vivo, the excess production of reactive oxygen species observed within the cerebellar mitochondrial fraction after exposure of rats to toluene, was prevented by pretreatment with MAK-5.

For more information on this study, see Research on Reduction of Chemical Toxicity and Antioxidant Research.

Study 4 **Research Highlights**

In vivo and in vitro studies showed that MAK-4 and MAK-5 were able to quench the excess generation of reactive oxygen species in rat brains.

5. Title

Effect of Maharishi Amrit Kalash [MAK-5] on Brain Opioid Receptors and Neuropeptides

Publication

The Journal of Research and Education in Indian Medicine, Vol. 10, No. 1, pp. 1-8, 1991.

Authors

Hari M. Sharma,* Silva Hanissian,** Anil K. Rattan,** Stephen L. Stern,† and Gopi A. Tejwani.**

Conducted at

*Department of Pathology, **Department of Pharmacology, and †Division of Psychiatry, College of Medicine, The Ohio State University, Columbus, OH 43210

Summary

MAK-5 was tested for its effects on opioid receptors in the brain, and on neuropeptides. In vitro tests using animal brain tissue showed that MAK-5 inhibited the binding of mu, kappa, and delta opioid receptors. Opioid peptides binding to these receptors are known to trigger changes in analgesia, behavior, appetite, endocrine and autonomic functions, and modulation of the immune system. Levels of Substance P, a neurotransmitter involved in pain pathways and

Table 2 Effect of MAK on Plasma Neuropeptides and Cortisol in Human Subjects.

	Before MAK*	After MAK*
Prolactin (ng/ml)	4.2 ± 0.50 (8)	4.0 ± 0.46 (8)
Substance P (pg/ml)	255.8 ± 70.0 (5)	36.0 ± 9.7** (7)
VIP (pg/ml)	43.5 ± 13.1 (8)	42.5 ± 12.5 (8)
Somatostatin (pg/ml)	34.0 ± 2.7 (8)	31.0 ± 0.0 (8)
Cortisol (μg/dl)	12.4 ± 1.6 (8)	12.3 ± 1.2 (8)

* Values are Mean ± SEM and number of observations are in parentheses.

** Value is significantly different from the value before MAK ingestion.

pulmonary and gastrointestinal inflammation, showed a significant decrease in human subjects using MAK-5 for three months. Levels decreased from 255.8 pg/ml to 36.0 pg/ml over the 3-month period ($p<0.01$). This suggests MAK-5 may be helpful in relieving pain, as well as pulmonary and gastrointestinal inflammation.

Study 5 **Research Highlights**
In vitro tests using animal brain tissue and human studies measuring neurotransmitter levels associated with pain, suggest that MAK-5 may be helpful in relieving pain, as well as pulmonary and gastrointestinal inflammation.

6. Title
Influence of a Maharishi Ayur-Vedic Herbal Preparation [MAK-5] on Age-Related Visual Discrimination

Publication
International Journal of Psychosomatics, Vol. 37, Nos. 1-4, pp. 25-29, 1990.

Authors
P. Gelderloos, SScD, H.H.B. Ahlstrom, MS, D.W. Orme-Johnson, PhD, D.K. Robinson, MS, R.K. Wallace, PhD, and J.L. Glaser, MD.

Conducted at
Maharishi University of Management, Fairfield, IA

Summary
An ancient system of natural medicine—Maharishi Ayur-Veda—prescribes certain herbal formulas to enhance cognitive functioning, prevent illness, and alleviate the detrimental effects of the aging process. A double-blind study was conducted to test the effect of an Ayurvedic herbal preparation, Maharishi Amrit Kalash (MAK-5), on an age-related alertness task. Forty-eight men over 35 years of age were randomly assigned to receive MAK-5 tablets or a closely matched placebo twice daily for six weeks. A visual discrimination task consisted of the identification of the exact location of a stimulus "v" within an array of "x" symbols in tachistoscopic presentations. The MAK-5 group improved significantly more in their performance of this task after three and six weeks of treatment relative to the placebo group. Performance was highly correlated with age, and because successful performance apparently requires an unrestricted flow of homogeneous attention as well as focalized concentration, it is concluded that MAK-5 may enhance attentional capacity or alertness, and thus reverse some of the detrimental cognitive effects of aging.

Study 6 **Research Highlights**
A group of men over 35 years of age and supplemented with MAK-5 twice daily for six weeks, showed a significant improvement in a visual discrimination task as compared with a placebo group. Performance was highly correlated with age. MAK-5 may enhance attentional capacity or alertness, and thus reverse some of the detrimental cognitive effects of aging.

7. Title

Anti-Aging Effect of a Natural Product, Maharishi Amrit Kalash (MAK)

Presented at

Joint Meeting of the International Union of Biochemists – Symposium No. 200, Satellite Meeting of the Oxygen Society, and the International Society for Free Radical Research, Berkeley, CA, January 26-27, 1990.

Authors

J.Z. Fields,* R.H. Schneider,** L. Wichlinski,* and J. Hagen.*

Conducted at

* Department of Pharmacology, Hines V.A. – Loyola University Medical Center, Maywood, IL

** Department of Physiology, Maharishi International University, Fairfield, IA

Summary

Aging is a concept that is not clearly defined. Is it the genetically coded final stage in development or the random accumulation of errors? Operationally, aging is seen as a process that increases susceptibility to disease and dysfunction. Interventions to retard or reverse this process would decrease disease, improve human function, and thereby increase quality of life and at least mean survival time.

Ayurvedic medicine, the traditional medicine of India, holds that Maharishi Amrit Kalash (MAK) has substantial anti-aging properties. Accordingly, we studied the effects of this novel herbal preparation, MAK, on aging and related parameters. MAK is a combination of 26 plants (Maharishi Ayurveda Products International, Stoneham, Massachusetts).

Fifty-eight C57BL/6 mice (males) started on dietary MAK supplements at 25 mo, and kept on them for up to 8 weeks, showed significantly ($p < 0.05$) more activity (locomotion, +85%), more coordination (roto-rod, +23%) and lower heart weight (-30%).

For mice ($n = 58$) started at 18 mo, 80% of MAK mice were alive at 23 mo vs. 48% for controls ($p < 0.05$). In these survivors, body weights for controls (41.5 g) and for MAK mice (38.3 g) were not significantly different.

MAK also increased acute survival 7 days after injection of a cytotoxic drug mitomycin-c at 3.25 mg/kg: 100% of MAK (Fisher female) rats (9 of 9) were alive compared to 33% (2 out of 6) for controls ($p < 0.05$).

The finding of H. Sharma (Physiol. Biochem. Behav., in press) that MAK prevents cancer also suggests an anti-aging effect. The anti-aging mechanism(s) may include scavenging of reactive oxygen metabolites (ROM) by low molecular weight anti-oxidants. Using aqueous extracts, we found that MAK was as competent as superoxide dismutase (100% inhibition) and as potent, mg for mg, at scavenging one oxygen free radical, superoxide anions, produced by human neutrophils (PMN) (reduction of ferricytochrome-c assay). In vitro, at similar MAK concentrations, hypochlorous acid (HOCl) was also scavenged (iodometric assay). HOCl is another PMN-generated ROM and may be even more directly involved in tissue injury.

The maximum anti-aging effects of MAK, the full effects in man, and the active ingredients of MAK and their mechanisms remain to be determined.

Study 7 **Research Highlights**

MAK supplementation to mice at 18 mo and continuing to 23 mo showed increased survival rates as compared with controls. Mice started on dietary MAK supplements at 25 mo and continuing for 8 weeks showed significantly more activity, more coordination and lower heart weight. MAK also significantly increased acute survival of rats 7 days after injection of a cytotoxic drug.

8. Title

Maharishi Amrit Kalash [MAK-4 and MAK-5] Rejuvenates Ageing Central Nervous System's Antioxidant Defense System: An *In Vivo* Study

Publication

Pharmacological Research, Vol. 40, No. 6, pp 497-502, 1999.

Authors

Bhupinder Pal Singh Vohra,* Satya Prakash Sharma,* and Vinod Kumar Kansal.**

Conducted at

* Laboratory of Nutritional Histopathology and Ageing, Department of Zoology, Kurukshetra University, Kurukshetra—136 119, Haryana, India

**Animal Biochemistry Division, National Dairy Research Institute, Karnal, Haryana, India

Summary

The oxygen-free radical involvement in various deteriorative processes and in aging is unquestionably established. In the present study, age-related changes in antioxidant enzyme activity in the different regions of CNS of 10-month and 32-month-old guinea pigs were studied. Maharishi Amrit Kalash has shown promise in inhibiting the in vitro and in vivo lipid peroxidation. Therefore, in the present study the effect of MAK on the activity of antioxidant enzymes was checked. Our results indicate that the activity of superoxide dismutase and glutathione peroxidase, was found to be reduced $p<0.05$ in all the regions of CNS studied. The activities of catalase declined significantly only in the cerebral cortex, hypothalamus and the cerebellum, whereas glutathione reductase activity declined in the cerebral cortex and hypothalamus. It is concluded that the age-related decline in the activities of antioxidant enzymes is region-specific as well as enzyme-specific. The endogenous lipid peroxide was found to be increased significantly $p<0.05$ in the 32-month old animals, whereas the lipid peroxidation after incubating the tissue homogenate in the air was found to be decreased $p<0.05$ in the older animals. The results indicate that the accumulation of lipid peroxides takes place with age, but the susceptibility of lipid peroxidation decreases in the older animals. The treatment of MAK 500 mg kg^{-1} body wt for 2 months could augment the activities of antioxidant enzymes $p<0.05$. The effect of MAK was more pronounced in older than younger animals. It is concluded that the MAK can be used in compensating the decline in the activities of antioxidant enzymes in CNS, and thereby it reduces the risks of lipid peroxidation.

For more information on this study, see Antioxidant Research.

Study 8 **Research Highlights**

As demonstrated in guinea pigs, the treatment of MAK 500 mg/kg body wt for two months could augment the activities of antioxidant enzymes. Therefore, MAK could be used in compensating the decline in the activities of antioxidant enzymes in the CNS, thereby reducing the risks of lipid peroxidation.

9. Title

Effect of Maharishi Amrit Kalash, an Ayurvedic Herbal Mixture, on Lipid Peroxidation and Neuronal Lipofuscin Accumulation in Ageing Guinea Pig Brain

Publication

Indian Journal of Experimental Biology, Vol. 39, No. 4, pp. 355-359, 2001.

Authors

B.P. Vohra, S.P. Sharma, V.K. Kansal, and S.K. Gupta.

Conducted at

Laboratory of Nutritional Histopathology, Kurukshetra University, India

Summary

The effects of Ayurvedic herbal mixture Maharishi Amrit Kalash (MAK) were studied on brain lipid peroxidation, oxygen consumption, and lipofuscin accumulation in 10-month-old and 32-month-old guinea pigs. Brain regions studied were cerebral cortex, hypothalamus, cerebellum and spinal cord. Parameters assessed were lipid peroxidation, oxygen consumption, and lipofuscin accumulation. The endogenous lipid peroxide was found to be increased significantly ($p<0.05$) in the 32-month-old animals. Neuronal lipofuscin accumulation in the neurons of cerebral motor cortex, cerebellum and cervical spinal cord was increased ($p<0.05$) in the older animals. Oxygen consumption was found to be decreased significantly ($p<0.05$) in the 32-month-old guinea pigs. Treatment with MAK at a dose of 500 mg/kg body weight daily for two months reduced the lipid peroxidation and lipofuscin pigment accumulation significantly in brain regions, and it also helped in restoring the normal oxygen consumption in the older animals. This indicates antioxidant properties of MAK.

Study 9 **Research Highlights**

Treating guinea pigs with MAK at a dose of 500 mg/kg body weight daily for two months reduced lipid peroxidation in brain regions and helped restore normal oxygen consumption in older animals. This indicates antioxidant properties of MAK.

10. Title

Anti-Aging and Oxygen Free Radical (OFR) Scavenging Effects of an Anti-Carcinogenic Natural Product, Maharishi Amrit Kalash [MAK-4 and MAK-5]

Publication

Federation of American Societies for Experimental Biology Journal, Vol. 5, No. 6, p. A1735, 1991 (Abstract).

Authors

J.Z. Fields, E. Eftekhari, J.F. Hagen, L.J. Wichlinski, and R.H. Schneider (SPON: A.H. Friedman).

Conducted at

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Summary

MAK is an herbal preparation available as a food supplement. It is being taken for its anticipated health-promoting and anti-aging benefits. MAK refers to the combination of two natural products: M4 a paste, and M5 a tablet. Combined, MAK is comprised of plants or plant parts from 24 different herbs. Sharma et al. (Pharmacol Biochem Behav, 35:767–773, 1990) showed that MAK prevents and even reverses chemically induced breast tumors in rats. We showed (JZ Fields et al, The Pharmacologist, 32:155, 1990) that aqueous extracts of MAK scavenged both OFR (superoxide) and non-radical oxidants (hypochlorous acid) in suspensions of human neutrophils without compromising the viability of the cells. In mice (C57BL/6 male, $n = 29$/group) fed 6% MAK in the diet starting at 18 months of age, 80% of MAK mice were alive at 23 mo vs. 48% for controls ($p < 0.05$). Body weights for control (41.5 g) and MAK mice (38.3 g) were not significantly different. In fruitflies (male, wild type, Drosophila melanogaster, $n = 100$/group) fed 12% MAK from hatching to expiration, mean life span was significantly increased (+70%). The antioxidant properties and anti-carcinogenic properties of MAK may contribute to its anti-aging properties.

Study 10 **Research Highlights**

Studies have been conducted in animals and in vitro demonstrating the antioxidant properties and anti-carcinogenic properties of MAK, which may contribute to its anti-aging properties.

1. Title

Nutritional Insights From Maharishi Ayur-Veda

Publication

Journal of Applied Nutrition, Vol. 48, Nos. 1 and 2, pp. 34-41, 1996.

Author

Hari M. Sharma, MD, FRCPC.

Conducted at

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Summary

Major changes are needed in the health care arena to solve the current health care crisis. With the growing emphasis on prevention of disease, nutritional science can be a major part of these changes. However, a new paradigm is needed to address individual metabolic differences and seasonal variations in dietary needs. Maharishi Ayur-Veda (MAV), a comprehensive system of natural health care, provides this paradigm. MAV addresses differences in individual physiological functioning (Prakriti) and imbalances in the physiology (Vikriti). MAV considers taste and quality to be central features in the classification of foods, and seasonal factors as crucial in determining nutritional needs. MAV also advises use of certain herbal nutritional supplements to maintain optimum health. These supplements are rich in antioxidants and have been researched extensively for their health-promotion and disease-prevention properties. This new paradigm may enable nutritional science to play a major role in producing a renewed, healthy society.

Study 1 **Research Highlights**

A new paradigm is needed to address individual metabolic differences and seasonal variations in dietary needs. Maharishi Ayurveda addresses differences in individual physiological functioning and imbalances in the physiology and considers taste and quality to be central features in the classification of foods.

1. Title

The Maharishi Ayur-Veda Treatment of Ten Chronic Diseases—A Pilot Study

Publication

Netherlands Magazine of Integrated Science, Vol. 5, No. 35, pp. 586-594, 1989.

Author

G.W.H.M. Janssen, MD.

Conducted at

Maharishi Ayur-Veda Health Centre, Laag Soeren, The Netherlands

Summary

From September 1987 to January 1988, a preliminary research study was conducted in the Maharishi Ayur-Veda Health Centre at Laag Soeren on the effectiveness of the Maharishi Ayur-Veda treatments of the following diseases:

- rheumatoid arthritis
- bronchial asthma
- chronic bronchitis
- eczema
- psoriasis
- hypertension
- chronic constipation
- headache
- chronic sinusitis
- non-insulin-dependent diabetes mellitus

A total of 126 patients completed the treatment, which consisted of the following: diet program, Maharishi Ayur-Veda herbal preparations, and regulations for the daily routine. The patients could also make use of the following treatment procedures: physiological purification therapy, neuromuscular integration therapy, marma therapy, and the Transcendental Meditation technique for the development of consciousness.

Of the 126 patients, 100 (79%) experienced an improvement, 17 (14%) showed no change, and 9 (7%) experienced a worsening of their condition. The majority of the ten clinical conditions showed a significant or strongly significant improvement: rheumatoid arthritis ($p=0.04$), bronchial asthma ($p=0.09$), eczema ($p=0.03$), hypertension (diastolic blood pressure, $p=0.07$), chronic constipation ($p=0.0001$), headache ($p<0.0001$), and chronic sinusitis ($p=0.01$).

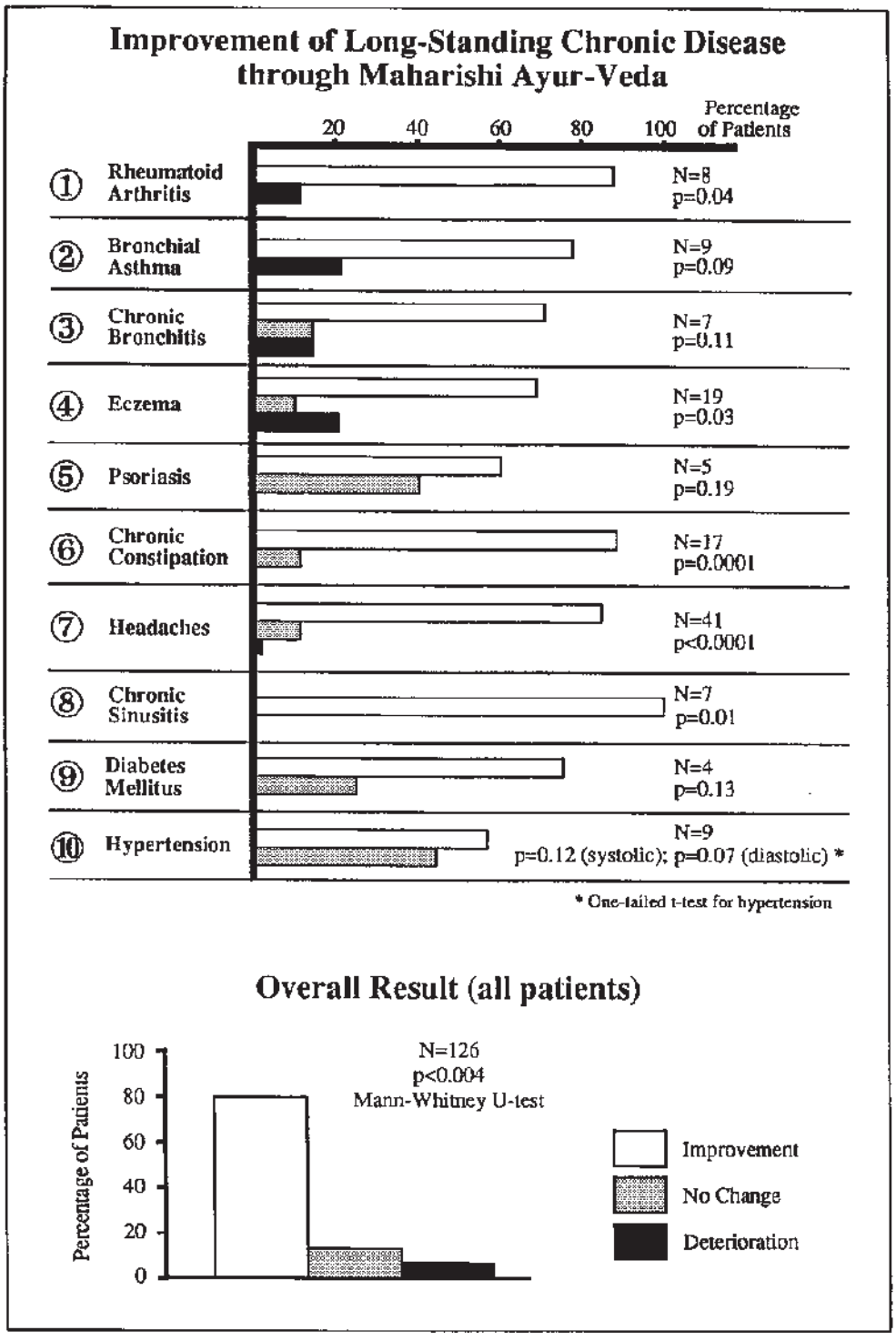
The following diseases showed a result in the predicted direction: chronic bronchitis ($p=0.11$), psoriasis ($p=0.19$), diabetes mellitus ($p=0.13$), and hypertension (systolic blood pressure, $p=0.12$).

Ten subjects could be declared cured during the research period. Of the 35 participants who had medication prescribed by their family doctor or specialist, 14 (40%) could reduce their dose or could even stop the medication. The Maharishi Ayur-Veda preparations were tolerated well by 95% of the patients.

On the basis of this research, it can be concluded that within a relatively short time the Maharishi Ayur-Veda treatment is able to bring about a substantial improvement in seven of the ten above-mentioned diseases, even if these have already existed for many years. It has been found that this form of therapy can be combined with other forms of treatment without any problem.

Considering the great number of patients suffering from chronic diseases and the results of treatment of these diseases with western medicine so far, and considering the effectiveness, lack of harmful side effects, and relatively low cost of Maharishi Ayur-Veda treatments, it is clear on the basis of the results of this study that the direct application of Maharishi Ayur-Veda is justifiable and desirable, and that further research into this treatment modality deserves the highest priority.

FIGURE 1



Study 1 **Research Highlights**
Research conducted with 126 patients with chronic diseases, revealed that Maharishi Ayurvedic treatment (consisting of diet, herbal formulas, and daily routines) was able to bring about a substantial improvement in seven of ten chronic diseases, even in cases where the disease had existed for many years.

2. Title

Efficacy of herbal formulation 'Amlant' compared to H2-receptor antagonists in treating patients with non-ulcer dyspepsia: An open randomized trial.

Publication:
Indian Journal of Gastroenterology, Volume 22 Supplement 1, November 2003

Principal investigator:
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Co-investigator:
Dr.Vineet Ahuja, Dr.Abha Saxena, P C Kashyap, et. al.
Deptt. of Gastroenterology,
All India Institute of Medical Sciences, New Delhi.

Background

Non Ulcer Dyspepsia (NUD) is defined as presence of chronic dyspeptic symptoms in the absence of definite structural disease. Herbal medicine is becoming increasingly popular for treatment of chronic benign disorders like NUD.

Aim

To compare the clinical efficacy and tolerability of herbal compound "Amlant" with H2-receptor antagonist, ranitidine in patients with non ulcer dyspepsia.

Non-ulcer dyspepsia (NUD), also known as functional dyspepsia or dyspepsia of unknown cause refers to a complex of symptoms characterized by epigastric pain, early satiety, postprandial bloating, nausea with occasional regurgitation, and vomiting. These upper gastrointestinal symptoms are not associated with any demonstrable structural abnormality by standard diagnostic investigations (radiological, endoscopic and histological). Dyspepsia is a fairly common complaint within the general population and is largely self managed as a majority of the patients experience symptoms for a short duration with mild severity. Empirical therapy is commonly employed to treat this condition without prior diagnostic procedures. Herbal medicine is becoming increasing popular for treatment of benign conditions such as functional dyspepsia.

We evaluated the efficacy of Amlant which is a novel combination of herbal formulations with known gastro protective effects in comparison to Ranitidine in patients with non ulcer dyspepsia.

Materials and Methods

This was a prospective open randomized controlled trial comparing the efficacy of herbal compound 'Amlant' (Maharishi Ayurveda Products Pvt. Ltd., New Delhi, India) with Ranitidine. The patients were included in the trial if upper gastrointestinal endoscopy confirmed non ulcer dyspepsia and the patients had at least 6 months of persistent or recurrent symptoms of dyspepsia. Each patient had normal abdominal sonography and normal blood counts and blood chemistry analysis. Patients were excluded from the study if they had been on acid suppressive therapy for the past two weeks and pregnant ladies.The following investigations were carried out on all patients complete blood count,erythrocyte sedimentation rate, coagulation profile, urine analysis, stool for ova/parasites, serum electrolytes, random blood sugar, hepatic function panel, serum amylase, right upper quadrant ultrasound and upper GI endoscopy.

The study was approved by institutional ethics committee. An informed consent was taken from each patient prior to commencement of therapy.

Treatment Schedule
All patients who fulfilled the above criteria were enrolled in the study. Composite dyspepsia score was calculated taking into account the following symptoms: epigastric pain, belching/burping, heartburn and bloating. Each symptom was scored from 1 to 5 with a maximum final score of 20 and minimum of 4. Patients were randomly allocated to the two treatment groups Amlant 1000 mg BID or Ranitidine 150 mg BID for 6 weeks. Each patient was followed up at 2, 4 and 6 weeks interval. After the completion of 6-weeks follow up all patients were assessed for the clinical efficacy of the drugs. The physician evaluating the symptom profile was blinded to the treatment arm.

Statistical Analysis
The data were analyzed for differences between the two treatment groups. Frequencies were calculated for all variables and continuous data was provided as mean and standard deviation. Comparisons for the two groups were done for changes from base line values of total score as well as individual scores for epigastric pain, belching/burping, heartburn and bloating.

18 individuals of the initial 173 patients enrolled in the study experienced adverse effects during the course of therapy. Among patients experiencing adverse effects 6 were treated with Amlant and 12 were treated with Ranitidine.

Discussion
Non-Ulcer dyspepsia is a common diagnosis seen in 30-50% of the patients presenting to outpatient clinic. Conventional treatment for non ulcer dyspepsia includes prokinetic agents and H2 receptor antagonists. The available treatments relieve symptoms in only a proportion of patients. The treatment of this chronic and relapsing condition may require long term drug therapy and wide fluctuations in drug efficacy.

In our study the efficacy and tolerability of a novel herbal compound - Amlant was compared to Ranitidine. The anti dyspeptic mechanism of action of Amlant is due to the synergistic action of the polycomponents of the herbs like P. longum, P.nigrum and Z. officinale, Glycyrrhiza glabra reduces the acid secretion in the stomach. E. officinale and C. rotundus have anti-oxidative properties.

In our study, patients in both the groups had similar clinical response to therapy. Minor adverse events were noted with both drugs. This trial suggested that use of Amlant as well as Ranitidine resulted in a significant reduction in composite symptom score over the six week treatment period. This suggested that Amlant is as effective as the conventional treatment with Ranitidine.

The safety profile of herbal medicinal products is encouraging. The drawbacks of this study are that we have not evaluated the H.pylori status of the patients. However, at present there is no conclusive evidence that eradication of H.pylori results in improvement of symptom profile.

In conclusion this randomized trial suggests that Amlant is as efficacious as conventional therapy with Ranitidine in patients with non ulcer dyspepsia.

Acknowledgements:
We acknowledge the support of Mr. Anand Shrivastava, C&MD, Mr. S. M. Bhushan, Research Co-ordinator, Maharishi Ayurveda Products Pvt. Ltd. for providing the research grant to support this trial.

Table : Adverse effects in patients treated with Ranitidine & Amlant

	Ranitidine (n=87)	**Amlant (n=86)**
Loss of appetite	1 (1.1%)	0
Constipation	0	1 (1.2%)
Abdominal pain	3 (3.4%)	1 (1.2%)
Loose stools	2 (2.3%)	0
Eye pain	1 (1.1%)	0
Bloating	1 (1.1%)	1 (1.2%)
Pruritus	1 (1.1%)	0
Abdominal pain /Loose stools	1 (1.1%)	1 (1.2%)
Weakness / hypersomnia	1 (1.1%)	0
Abdominal bloating	1 (1.1%)	1 (1.2%)
Mouth ulcers	0	1 (0.9%)

1. Title

Effect of the Herbal Mixture MAK-4 on Organ Functions in Watanabe Heritable Hyperlipidemic (WHHL) Rabbits

Publication

Biochemical Archives, Vol. 13, pp. 285-296, 1997.

Authors

Jae Y. Lee, John A. Lott, Ellen M. Kauffman, and Hari M. Sharma.

Conducted at

Department of Pathology, College of Medicine, The Ohio State University, Columbus, OH 43210

Summary

This study assessed the organ-protective effects of MAK-4 which was fed to Watanabe Heritable Hyperlipidemic (WHHL) rabbits. The control group (n = 5) was fed normal rabbit chow and the experimental group (n = 6) was fed 6% (w/w) MAK-4-supplemented chow, for 6 months. Blood specimens were drawn from the ear vein at the start of the experiment before MAK-4 was given, and after 2, 4, and 6 months of MAK-4 ingestion. Twenty-four-hour urines were collected between the 25th and 26th week. Various biochemical parameters were assessed, including tests for liver function, kidney function, pancreatic function, enzymes, and other tests for tissue damage. Results showed that albumin, fibrinogen, and total protein were significantly higher ($p < 0.05$) in the MAK-4 group compared to the control group. Gamma glutamyl transferase, creatine kinase, creatine kinase-MM isoenzyme, and lipid peroxide were significantly decreased in the MAK-4-treated group as compared to the controls. Creatinine, urine inorganic phosphorus, urine uric acid, urine amylase, and urine glucose were significantly lower ($p < 0.05$) in the MAK-4 group compared to the control group. Glutathione peroxidase activity, mean corpuscular hemoglobin concentration, and superoxide dismutase were significantly increased ($p < 0.05$) in the MAK-4 group compared to the controls. These findings suggest prevention of

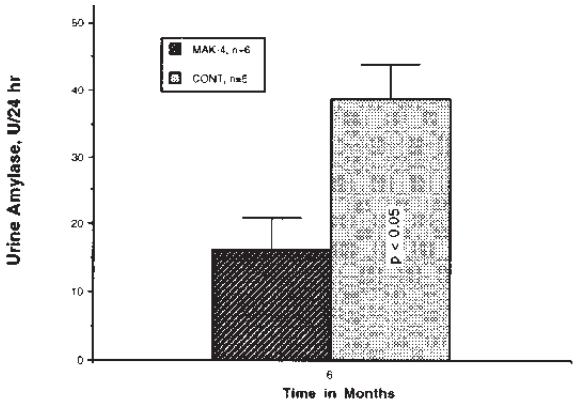

Figure 2: Effect of 6% MAK-4 supplemented diet on urine amylase in Watanabe Heritable Hyperlipidemic rabbits after 6 months. CONT: control group. Values are mean ± SE.

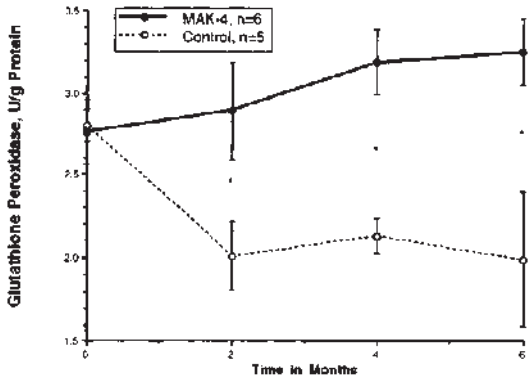

Figure 3: Effect of 6% MAK-4 supplemented diet on glutathione peroxidase in Watanabe Heritable Hyperlipidemic rabbits during a 6 month study period. Values are mean ± SE. *p<0.05.

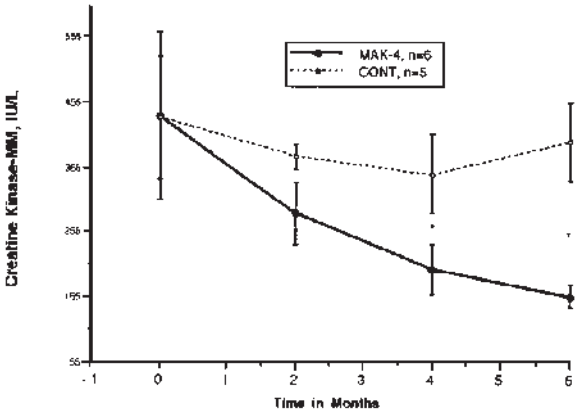

Figure 4: Effect of 6% MAK-4 supplemented diet on creatine kinase in Watanabe Heritable Hyperlipidemic rabbits during a 6 month study period. CONT: control group. Values are mean ± SE. p<0.05.

organ damage in the MAK-4-supplemented rabbits. The mechanism of action may be prevention of lipid and protein oxidation by MAK-4.

Study 1 **Research Highlights**
Wanatabe Heritable Hyperlipidemic rabbits fed MAK-4 for 6 months showed significantly increased glutathione peroxidase activity, mean corpuscular hemoglobin concentration and superoxide dismutase, as compared with the control group. These findings suggest prevention of organ damage in the MAK-4 supplemented rabbits, which may be due to prevention of lipid and protein oxidation by MAK-4.

2. Title
Subjective Survey, Blood Chemistry and Complete Blood Profile of Subjects Taking Maharishi Amrit Kalash (MAK)

Publication
Federation of the American Societies for Experimental Biology Journal, Vol. 5, No. 5, p. A1317, 1991 (Abstract).

Authors
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Summary

Psychophysiological changes are reported in subjects regularly taking MAK (MAPI, Inc., Lancaster, MA), an herbal food supplement demonstrating antineoplastic, antioxidant and anti-aging activities in animal and in in-vitro studies. Six hundred fifty-nine subjects (age 41±9, taking MAK 22±11 mos) reported substantial benefits in 19 psychophysiological indices, e.g., increased resistance to illness 87%; happiness 84%; energy 78%; tranquility 83%; mental clarity and emotional balance 80%. Remaining subjects noted no change or condition worsened, ≤ 1%. A substantial percentage of previous sufferers (46 on medical treatment) reported benefits on 21 illnesses, e.g. colds 94% improved or eliminated, n=209; PMS 84%, 120; constipation 87%, 245; hay fever 81%, 118; headaches 78%, 148; fatigue 88%, 249; asthma 82%, 28; cancer 90%, 10; rheumatoid arthritis 73%, 22; autoimmunity 100%, 10. Only 3% (n=22) reported minor complaints, e.g. bad taste; sugar rush; upset stomach; and diarrhea. Blood chemistry (24 values) and complete blood profile in 82 separate volunteers showed no abnormal findings associated with MAK intake. Substantial benefits indicate that MAK may be valuable as a preventive agent, a therapeutic adjunct and a safe candidate for clinical trials.

Study 2 **Research Highlights**
Data from 659 human subjects showed that regularly taking MAK carried substantial benefits in 19 psychophysiological indices and on 21 illnesses, with no abnormal effects, as evaluated by blood chemistry and complete blood profiles. Therefore, MAK may be valuable as a preventive agent, a therapeutic adjunct and a safe candidate for clinical trials.

1. Title

Clinical Trial on Raktda in Anaemia (Pandu Roga)

Principal Investigator:
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Hon. - Lecturer in Ayurved College, Solapur - 413 001 (M. S.)

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Yogiraj' Krushi Nagar, Civil Lines Solapur - 413 003 (M. S.)

Anaemia is one of the common diseases which occurs in all walk of life and in all seasons. Raktalpta is one of the main causative factors hence it can be named as PANDU-VARNA (PALLOR). Nails and skin are general clinical sights to diagnose this. Medical Science (Western) accepted that the R.B.C.'s when are less in numbers in blood the phenomenon is known as ANAEMIA. The term RAKTALPATA can be considered qualitative and quantitative deficiency of RBCs in blood.

Pitta dosha is main causative factor of all this because alkalinity is not maintained in the gut properly, or - will be better maintained hence Vit-K is not released and bile salts are not released. In Ayurveda we can say Raktalpata is due to the poshaka rasa which converts into rakta dhatu is not formed properly.

It is a very common disease occurring in all ages, and without any sex discrimination. India being a developing country nearly 65% people are below poverty line. So the proper diet, proper Jivansatva, proper ahar is not regular. It is not only the poverty line but even people who do have sound economical condition also get affected with this disease because they do not follow the dietetic principles. We doctors generally come across some problem with pregnant as well as lactating woman (mothers). Due to this we commonly find a number of Pandu Rugnas (Aneamic patients) in day to day practice. If these patients don't get proper treatment they may get involved in stress on "SWASTHASYA SWASTHYA RAKSHANAM" i.e PREVENTION IS BETTER THAN CURE. It is stated by GREAT ACHARYA CHARAK very clearly if PANDU ROGI (ANAEMIC PERSON) takes Pitta Prakopaka Ahar (SPICY, OILY, CHILLY DIET, VISITS CHAT BHANDAR) he may be prone to get KAMALA (JAUNDICE).

So proper care i.e. Treatment should be taken to avoid further complications.

I selected RAKTDA tablets to see the effect on Pandu Roga. RAKTDA contains naturally prepared Iron & other metals, drugs which act to maintain normalcy of Gastrointestinal mucosa to raise permeability of Iron i.e. with Ayurvedic Antacid for quick assured absorption by cells, tissues and in high percentage.

METHOD AND MATERIALS

I) **SELECTION OF PATIENTS -** All patients were O.P.D. Patients and detailed history, clinical examination and relevant observations were recorded in specially prepared proforma.

II) **DIAGNOSIS -** Diagnosis was made on the basis of haemoglobin percentage which is nearly 70 and also of signs and symptoms mentioned in Charak-Samhita.

III) **DIET -** Routine diet was advised as chapati or bhakri (roti) dal and vegetables were permitted, rather insisted.

IV) **INVESTIGATIONS -** All the patients were investigated for pathological analysis before and after the treatment like Hb% E.S.R., TLC, DLC, Urine, Stool etc.

V) **NUMBER OF PATIENTS -** Total 47 (Forty Seven) patients were studied for treatment. Results were as follows :

TABLE - I

SEX	No. of Patients	(%)
MALE	17	36.17%
FEMALE	30	63.82%

TABLE - II

AGE	No. of Patients	(%)
1-20 Yrs.	02	04.25%
20-30	12	25.53%
30-40	27	57.44%
40-50	05	10.63%
50 & Above	01	02.12%

TABLE - III

SYMPTOMS	BEFORE	AFTER
VAIYARNYA (Faintness on skin)	22 (46.80%)	09(19.14%)
ALPARAKTATA (Low Hb%)	47 (100%)	04(08.51%)
NIDRALU (Narcolepsy)	25 (53.19%)	05 (10.83%)
PINDIKOD WEDAN (Pain in Legs)	40 (85.10%)	06 (12.76%)
SHRAMA (Tiredness)	47 (100%)	02 (04.20%)
BHRAMA (Giddiness) (Absent mindedness)	29 (61.70%)	04 (08.51%)
AGNIMANDYA (Anorexia)	45 (95.74%)	03 (06.38%)
AKSHIKOTA SHOTHA (Swelling)	39 (82.97%)	02 (04.25%)

TABLE IV

IMPROVEMENT	NO. OF PATIENTS
COMPLETE IMPROVEMENT	09 (19.14%)
MARKED IMPROVEMENT	28 (59.57%)
MODERATE IMPROVEMENT	07 (14.89%)
SLIGHT IMPROVEMENT	02 (04.25%)
NO IMPROVEMENT	01 (02.12%)

TABLE V

EFFECT OF RAKTDA ON PATIENTS		
No. of Patients	Before (Mean Hb%) Treatment	After (Mean Hb%) Treatment
47	07.16	11.136

Conclusion

From this study the drug RAKTDA has shown maximum results on PANDU ROGA (ANAEMIA). During this treatment not a single patient complained of reactions like NAUSEA, VOMITING, LOOSE MOTION OR STOMACH UPSET, as drugs used in RAKTDA are harmless and act as heamopoietic agents by increasing rasadhatu due to natural characteristic property of easy assimilability.

Sufficient rasadhatu after digestion with rasagni converts into poshaka and poshya rasa. Poshaka rasa further converts to Rakta in presence of raktagni (as drugs do stimulate RAKTAGNI too) act as HEAMOPOIETIC by increasing agni and Rasadhatu. It can be taken as general tonic by everybody irrespective of age and sex.

Thanks to Maharishi Ayurveda for such wonderful drug which serves for better future of mankind.

2. Title

Trial Report : Raktda For Iron Defficiency Anaemia

Author

Vd. Sanjay Chhajed

M. D. (Ayurved) Jamnagar - Gold Medalist

Consultant, Ayurvedic Physician - Baba Ramdev Institute for Ayurvedic Panchkarma Treatment & Research, Aurangabad, **Specialist in** Panchkarma & Rasayana, Gandhi Nagar, Aurangabad

Aim & Objective

To evaluate the clinical efficacy of Raktda.

Parameter used

Haemoglobin percentage in g / dl.

Drug

Raktda Tablets, a product of Maharishi Ayurveda Corporation Ltd. (now Maharishi Ayurveda Products Pvt. Ltd.), New Delhi.

Trials carried out at

Baba Ramdev Institute for Ayurvediya Panchkarma Treatment and Research, Aurangabad.

Dosage

2 tablets BD x 10 days, followed by 1 tablet BD x 20 days.

Material and Method

16 patients of clinical biochemical evidence of Anaemia were selected randomly irrespective of the age, sex, economical status and origin of anaemia. For the trial they were given the drug according to the prescribed dose without addition of any other medication and were investigated before and after the treatment for haemoglobin from capillary blood.

Observations

Total 5 males and 11 females were included in the study belonging to age group 2 to 42 years. (Maximum of which were from 30 to 40 years of age.) 4 male patients were suffering from sickle cell anaemia & 3 females were suffering from menorrhagia, all others were of iron deficiency anaemia. The overall results are as follows : 3 patients left the treatment in between.

Mean increase in Hb% = 1.91 ; SD = 0.72 ; SE = 0.93 ; t=9.90 p> = 0.001

List of Patients in Raktda Trial

SN	Age	Sex	Hb% (g/dl) Before Treatment	Hb% (g/dl) After Treatment
01	30	F	10.0	12.0
02	42	F	10.5	12.5
03	37	F	8.5	10.8
04	25	F	8.5	11.0
05	06	M	6.0	8.0
06	02	M	10.0	10.5
07	04	M	8.0	10.0
08	38	M	10.5	10.5
09	37	M	10.0	12.0
10	35	M	9.8	11.8
11	30	F	11.0	12.5
12	40	F	8.0	10.0
13	21	F	9.2	12.0

Inference
The probability above 0.001 is suggestive of the efficacy of the drug, is highly significant in increasing Haemoglobin and hence can be used as a safe Haematinic irrespective of the origin of the anaemia in either sex at any age.

I am interested in carrying out a full series of sickle cell anaemia and thalassaemia with Raktda.

3. Title
A Pilot Study on Pirant Oil and Tablets

Investigator:
Dr. Sunil Sharma, MBBS, M.S. (Ortho), Chetganj Chauraha, Varanasi.

No. of Patients Treated:
50

Symptoms in which used:
Non-traumatic & traumatic, acute and chronic orthopedic patients.

Observations / Comments
1. "Showed very good analgesic effect even when used alone."
2. "Showed super-additive analgesic effect when used with systemic NSAIDs / Pirant tablets."
3. "Pirant Oil can be used as very good & safe local analgesic in nearly all types of orthopaedic problems avoiding gastritis and other ill effects of systemic NSAIDs."
4. "It can be used for prolong periods."
5. "Patient compliance is excellent."

Conditions in which used:
Chronic Knee Pain · L 4-5 Spondylosis · Osteodystrophy · Ankylosing arthropathy · Rheumatoid polyarthritis · Post traumatic pain (RPD Calf) · Lumbar spondylosis · Osteomalacia · OA Knee · Degenerative tenovaginitis · Gout ·Tennis elbow · Ch. LBA with Sciatic neuralgia · Osteoporosis / Para articular osteoporosis · Multiple joint pain · Coccydynia · Pain rib cage · Old knee Arthralgia.

Research on Primordial Sound

1. Title

Effect of Different Sounds on Growth of Human Cancer Cell Lines In Vitro

Publication

Alternative Therapies in Clinical Practice, Vol. 3, No. 4, pp. 25-32, 1996.

Authors

Hari M. Sharma, MD, FRCPC, Ellen M. Kauffman, MT, HTL (ASCP), and Ralph E. Stephens, PhD.

Conducted at

Department of Pathology, College of Medicine, The Ohio State University, Columbus, OH

Summary

Sound has an effect on plants and on the human physiology. Cells vibrate dynamically and may transmit information via harmonic wave motions. This study compared the effects of "primordial sounds" (Sama Veda, from the Maharishi Ayur-Veda system of natural health care), or hard rock music (AC/DC, "Back in Black"), and no sound on the growth of cells in culture. Five human tumor cell lines (lung, colon, brain, breast, and skin) and one normal cell line (fibroblasts) were tested in triplicate for each of an average of four experiments. The recordings of Sama Veda and "Back in Black" were normalized to maintain the same maximum amplitudes, with no significant effect on the results. Primordial sound significantly decreased the average growth across cell lines ($p=0.005$, ANOVA). In the presence of hard rock music, growth of cells was significantly increased ($p=0.03$), but the effect was not consistent. We conclude that sound has an effect on the growth of neoplastic and normal human cells in vitro.

Table 1. Sound-induced changes in cell growth

No sound vs. Primordial sound			
Tissue/organ	**Classification**	**Cell line**	**percent change**
Brain	Malignant glioma	U251-MG	- 25.3
Breast	Adenocarcinoma	MCF7	- 16.9
Colon	Adenocarcinoma	HT29	- 19.9
Lung	Carcinoma	A549	- 22.4
Skin	Malignant melanoma	RPMI7951	- 12.4
Skin	Normal fibroblasts	NHDF	- 13.9
No sound vs. Hard rock music			
Tissue/organ	**Classification**	**Cell line**	**percent change**
Brain	Malignant glioma	U251-MG	+ 22.1
Breast	Adenocarcinoma	MCF7	+ 26.9
Colon	Adenocarcinoma	HT29	+ 14.1
Lung	Carcinoma	A549	+ 6.1
Skin	Malignant melanoma	RPMI 7951	(Only one experiment)
Skin	Normal fibroblasts	NHDF	+ 10.2

Primordial sound (Sama Veda) decreased average growth across cell lines ($p = 0.005$, ANOVA) as compared to no music, after controlling in our statistical model for cell line and day of experiment. In the presence of hard rock music (AC/DC, "Back in Black") growth of cells was increased ($p = 0.03$, ANOVA) compared to no music after controlling for cell line and day of experiment, but the effect was not consistent.

Study 1 **Research Highlights**

In the presence of primordial sounds, average growth across five human tumor cell lines and one normal cell line (fibroblasts) decreased. In the presence of hard rock music, growth of tumor cells significantly increased, but the effect was not consistent. Thus, sound has an effect on the growth of neoplastic and normal human cells in vitro.

Research on the Maharishi Rejuvenation[SM] Program

1. Title

Improvement in Cardiovascular Risk Factors Through Panchakarma[§] Purification Procedures

Publication

The Journal of Research and Education in Indian Medicine, Vol. 12, No. 4, pp. 3-13, 1993.

Authors

Hari M. Sharma,* Sanford I. Nidich,** David Sands,† and D. Edwards Smith.†

Conducted at

* Department of Pathology, College of Medicine, The Ohio State University, Columbus, OH

**Department of Science of Creative Intelligence and †Laboratory for Preventive Medicine, Department of Physiological and Biological Sciences, Maharishi International University, Fairfield, IA

Summary

Maharishi Ayur-Veda uses Maharishi Panchakarma[§] (PK) for eliminating impurities, purifying and balancing the physiology, and clearing the channels. PK consists of oleation (use of clarified butter), virechana (purgation), abhyanga (medicated whole-body massage), shirodhara (flow of medicated oil on forehead), swedena (herbalized fomentation), nasya (nasal administration of herbs), and basti (herbalized enemas). PK was given for 3-5 days to 31 subjects (15 male and 16 female), with a mean age of 40.6 years. Fasting blood samples were tested for biochemical parameters before (visits A and B), during (visit C), 1 week following (visit D), and 2.9 months following (visit E) PK. Vasoactive intestinal peptide (VIP), a coronary vasodilator, rose a significant 80% by 2.9 months after PK. Total cholesterol fell acutely in all subjects and HDL cholesterol rose 7.5% ($p=0.015$) after 2.9 months if original values were <15 mg/dL. Lipid peroxide, a measure of free radical damage, rose during PK, then fell to lower levels at 2.9 months. Pulse and diastolic blood pressure were reduced after PK. State anxiety measures improved significantly. These results indicate that PK is useful in improving cardiovascular risk factors.

Vasoactive Intestinal Peptide : The initial value of **VIP** (n=31) was pg/mL in all but 5 subjects. It remained essentially unchanged at visits A through D but then rose a dramatic 80% from A to E, p=0.003, and 84% from B to E, p=0.004, using a paired, two-tailed t-test **(Figure.1)**.

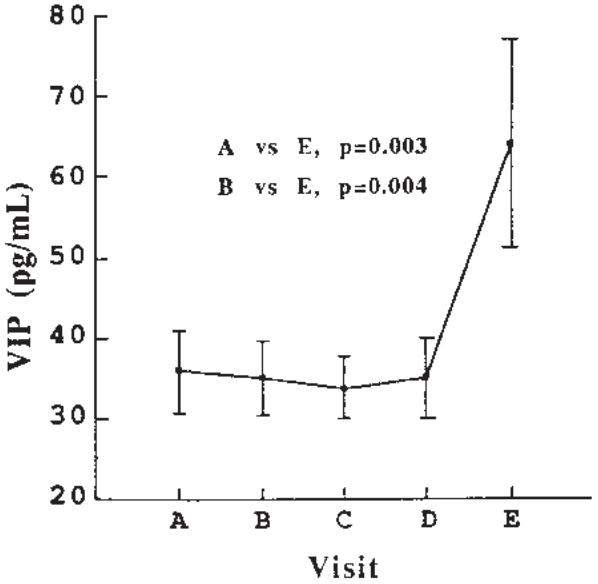

Figure. 1 Vasoactive intestinal peptide (VIP) in pg/mL for all subjects Means and Standard Error of the Mean (SEM) for each visit.

§ Maharishi Panchakarma is another name for the Maharishi Rejuvenation[SM] Program

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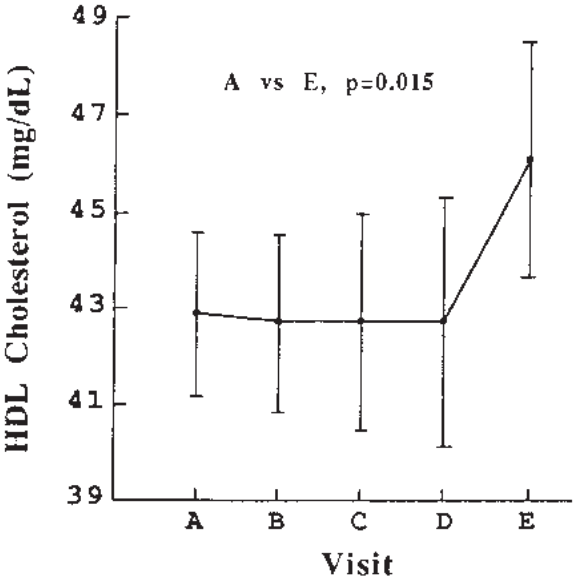

Figure. 3 HDL cholesterol in mg/dL for those subjects (n=13) whose initial values at A were <50 mg/dL. Means and SEM for visit.

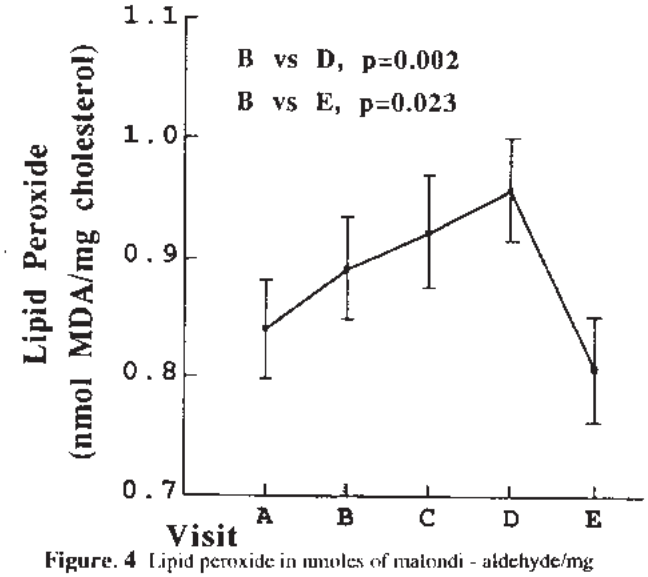

Figure. 4 Lipid peroxide in nmoles of malondi - aldehyde/mg cholesterol for all subjects (n=27). Means and SEM for each visit.

Table 2 : Means, Standard Deviations, and Change Score on State Anxiety for PK and Control Groups.

GROUP		PRE TEST (VISIT A)		POST TEST (VISIT B)		ADJUSTED CHANGE
	N	M	SD	M	SD	M
PK	27	29.778	7.827	26.111	7.013	-3.934*
Control	28	30.750	8.847	31.679	8.857	+1.186

M=mean , N= sample size, SD = standard deviation. *$p < 0.025$

Study 1 **Research Highlights**
Maharishi Panchakarma (PK) administered to human subjects for 3 to 5 days showed usefulness in improving cardiovascular risk factors.

2. Title
Influence of Maharishi Ayur-Veda Purification Treatment on Physiological and Psychological Health

Publication
Erfahrungsheilkunde—Acta Medica Empirica (German medical journal), Vol. 11, pp. 720-729, 1988.

Author
Rainer Waldschutz.

Conducted at
Albert-Ludwigs University, Freiburg, Germany

Summary

Maharishi Panchakarma§, one of the many aspects of Maharishi Ayur-Veda, aims at purifying and balancing the physiology. This therapy includes herbalized oil massage (abhyanga), herbalized steam treatment (swedana), pouring of herbalized oil on the forehead (shirodhara), medicated enemas (basti), laxative treatment (virechana), and other forms of treatment. This study was conducted to assess the effects of Maharishi Panchakarma in the areas of physiology and psychology. Total cholesterol, triglycerides, creatinine, urea, uric acid, and glucose were measured before and immediately after a two-week treatment period on up to 93 patients. Psychological evaluation was made using the Freiburger Personality Inventory (FPI), which was administered to 106 subjects before, immediately after, and 6-8 weeks after treatment. Results showed reductions in total cholesterol from 203.5 mg/dL to 179.5 mg/dL (n=82, $p<0.001$), and in urea from 23.9 mg/dL to 20.4 mg/dL (n=70, $p<0.01$). Uric acid, triglycerides, creatinine, and glucose did not show significant changes. Over the two-week treatment period, significant changes on 6 of the 12 FPI scales were observed, including reductions in bodily complaints, irritability, bodily strain, psychological inhibition, and openness, as well as greater emotional stability. Psychological testing six to eight weeks after treatment showed evidence of sustained benefits for mental health and well-being. No significant changes were observed in physiological or psychological parameters in 10 control subjects, except for a temporary increase in aggression. These findings support the results of previous research on Maharishi Panchakarma indicating its effectiveness in improving physiological and psychological health.

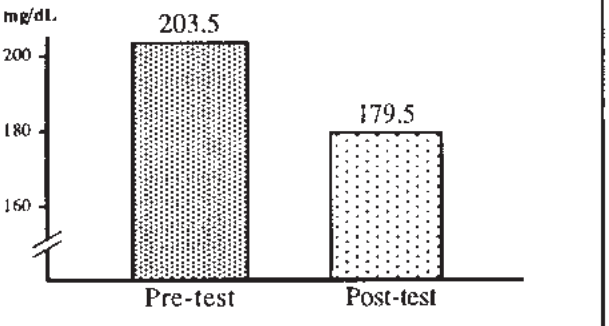

Figure 1: Change in Total Cholesterol
Total cholesterol was measured in 82 subjects at the time of Pre- and Post-test. The average change was 10.5% (203.5 mg/dL at Pre-test and 179.5 mg/dL at Post-test).

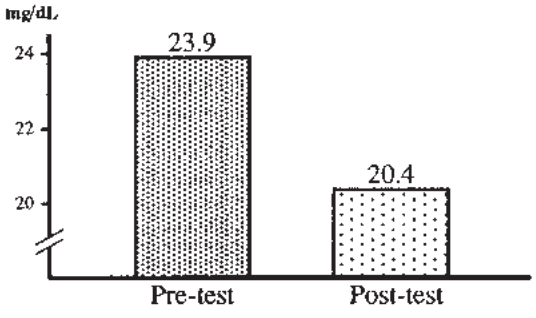

Figure 2: Change in Urea
Urea was measured in 70 subjects at the time of Pre- and Post-test. The average change was 11% (23.9 mg/dL at Pre-test and 20.4 mg/dL at Post-test).

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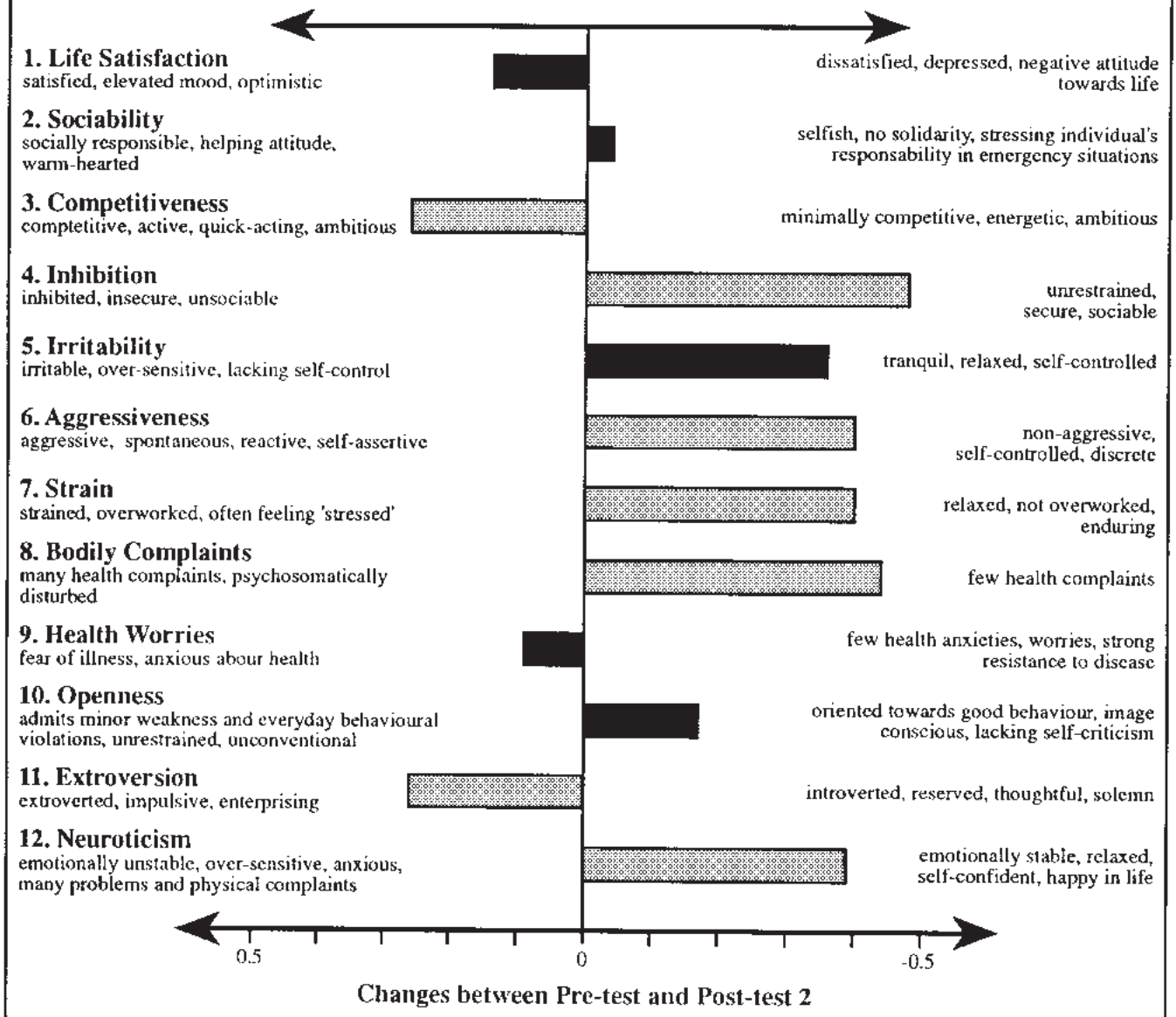
Figure 3: Psychological Changes as Measured by the Freiburger Personality Inventory



The Freiburger Personality Inventory was used in 106 experimental subjects at Pre-test, Post-test 1 and Post-test 2. The changes between Pre-test and Post-test 2 are shown above. Significant changes are shown in bright color and non-significant changes in dark color.

Study 2 **Research Highlights**
The findings of this study, conducted with human subjects, support the results of previous research on Maharishi Panchakarma, indicating its effectiveness in improving physiological and psychological health.

3. Title

Health Promotion With a Traditional System of Natural Health Care: Maharishi Ayur-Veda

Publication

Journal of Social Behavior and Personality, Vol. 5, No. 3, pp. 1-27, 1990.

Authors

Robert H. Schneider,* Kenneth L. Cavanaugh,** H.S. Kasture,† Stuart Rothenberg,†† Richard Averbach,†† Donald Robinson,* and Robert Keith Wallace.*

Conducted at

* Department of Physiological and Biological Sciences, Maharishi International University, Fairfield, IA 52556

**Department of Management and Public Affairs, Maharishi International University, Fairfield, IA 52556

† MAH Government Ayurveda Hospital, Ahmedabad, Gujarat, India

††Institute for Ayurvedic Studies, Maharishi International University, Fairfield, IA 52556

Summary

This study investigated the Maharishi Ayur-Veda Panchakarma§ program and its effects on self-reported mental and physical health. This program includes a set of physiological therapies that are recommended on a periodic basis for enhancement of physiological homeostasis and promotion of mental and physical health. In a first pilot study, 142 subjects were surveyed after a 1-2 week Maharishi Ayur-Veda Panchakarma program for changes in health symptoms compared to 60 control subjects who participated in a didactic class for the same period of time. In the second follow-up study, 62 consecutive subjects were tested before and after a similar Maharishi Ayur-Veda Panchakarma program with the Profile of Mood States (POMS) and compared to 71 controls participating in a didactic class. The results for the pilot study showed that the experimental subjects reported significantly greater improvements in well-being, energy-vitality, strength-stamina, appetite and digestive patterns, previous complaints generally, and rejuvenation and youthfulness than control subjects ($p=0.05$ to <0.00001). Sleep patterns changed nonsignificantly. In the second study, the experimental subjects decreased significantly more than controls on overall distress ($p=0.003$). On the POMS subscales, anxiety, depression, and fatigue decreased, and vigor increased significantly more for the experimental group than the controls ($p=0.03$ to 0.003). Confusion decreased marginally ($p=0.06$) and anger decreased nonsignificantly. These preliminary findings suggest that the Maharishi Ayur-Veda Panchakarma program is associated with improvements in mental and physical health symptoms, at least in selected subjects. This traditional program of natural health care may help to address current public health demands for efficacious and practical health-promotion and disease-prevention programs.

§ Maharishi Panchakarma is another name for the Maharishi Rejuvenation[SM] Program

Study 3 **Research Highlights**

Preliminary research shows that the Maharishi Ayurveda Panchakarma program is associated with improvements in mental and physical health symptoms, at least in selected human subjects. Thus, this program may help to address current public health demands for efficacious and practical health-promotion and disease-prevention programs.

4. Title

Selective Growth Inhibition of a Human Malignant Melanoma Cell Line by Sesame Oil In Vitro

Publication

Prostaglandins, Leukotrienes and Essential Fatty Acids, Vol. 46, pp. 145-150, 1992.

Authors

D. Edwards Smith and J.W. Salerno.

Conducted at

Laboratory for Preventive Medicine, Department of Physiological and Biological Sciences, Maharishi International University, Fairfield, IA 52556

Summary

Ayurveda, an ancient and comprehensive system of natural medicine, recommends regular topical application to the skin of sesame oil, above all other oils, as a health-promoting procedure. We examined the effect of sesame oil and several other vegetable oils and their major component fatty acids on the proliferation rate of human normal and malignant melanocytes growing at similar rates in serum-free media. We found that sesame and safflower oils, both of which contain large amounts of linoleate in triglyceride form, selectively inhibited malignant melanoma growth over normal melanocytes, whereas coconut, olive, and mineral oils, which contain little or no linoleate as triglyceride, did not. These oils were tested at a range of 10-300 microgram/mL. We found that of the fatty acids tested, only linoleic acid was selectively inhibitory, while palmitic and oleic were not. These fatty acids were tested in the range of 3-100 microgram/mL. These results suggest that certain vegetable oils rich in linoleic acid, such as sesame oil recommended for topical use by Ayurveda, may contain selective antineoplastic properties which are similar to those demonstrated for essential polyunsaturated fatty acids and their metabolites. This suggests that whole vegetable oils may have potential clinical usefulness.

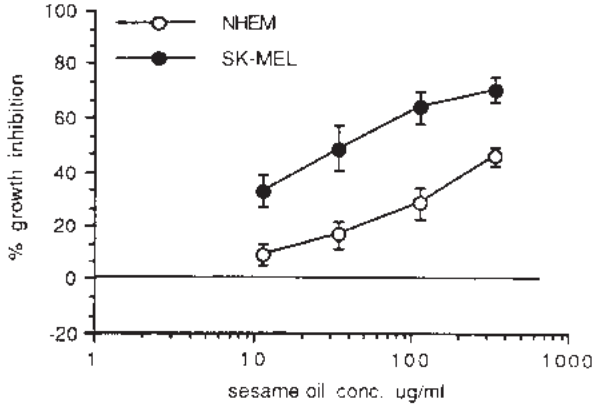


Fig. 2 Growth inhibiting effect of whole undigested sesame oil on the (SK-MEL •) human malignant melanoma and (NHEM ○) normal human epidermal melanocytes. Dosage range was 10, 30, 100 and 300 μg/ml plotted on logarithmic scale. All cells seeded at 1×10^3 per cm^2 (or 4×10^4 per well) in 12-well TC plates. Each well contained 2 ml MGM (melanocyte growth medium — no serum). Sesame oil added on day 2 and all cells harvested and counted together on day 5. Average growth (fold increase) over 5 days was 2.6 for NHEM and 2.2 for SK-MEL. Each point represents the mean and SEM of 12 experiments. $F(1, 11) = 13$, $p = 0.004$

Study 4 **Research Highlights**

In vitro research results suggest that certain vegetable oils rich in linoleic acid, such as sesame oil recommended for topical use in Ayurveda, may contain selective antineoplastic properties that are similar to those demonstrated for essential polyunsaturated fatty acids and their metabolites.

5. Title

The Use of Sesame Oil and Other Vegetable Oils in the Inhibition of Human Colon Cancer Growth In Vitro

Publication

Anticancer Research, Vol. 11, pp. 209-216, 1991.

Authors

John W. Salerno and D. Edwards Smith.

Conducted at

Department of Physiological and Biological Sciences, Maharishi International University, Fairfield, IA 52556

Summary

Sesame contains large quantities of the essential polyunsaturated fatty acid (PUFA), linoleic acid, in the form of triglycerides. The antineoplastic properties of many PUFAs such as linoleic acid and their metabolites are known. This study tested the hypothesis that natural vegetable oils, such as sesame oil and its component linoleic acid, when added to human colon adenocarcinoma cells growing in tissue culture, would inhibit their growth and that normal colon cells would not be similarly affected. Three human colon cancer cell lines and one normal human colon cell line were exposed to the following: (1) pure linoleic acid; (2) lipase-digested sesame oil; (3) undigested sesame oil; (4) five additional common vegetable oils; (5) mineral oil. Linoleic acid inhibited the in vitro growth of all three malignant human colon adenocarcinoma cell lines. The normal colon cell line showed dramatically less inhibition of growth. Lipase-digested sesame oil (LDSO) and undigested sesame oil (UDSO) produced greater inhibition of growth of all three malignant colon cell lines than of the normal colon cells. Five other common vegetable oils containing various amounts of PUFAs, such as corn, soybean, safflower, olive, and coconut oils, all in their lipase-digested form, were found to dramatically inhibit the growth of the HT-29 malignant human colon cell line. Undigested olive and safflower oils also inhibited the HT-29 cells, although not as markedly as the lipase-digested oils. Mineral oil did not inhibit the growth of HT-29 cells. Both lauric and palmitic acid, which are saturated fatty acids found in abundance in coconut oil, inhibited the HT-29 cells more strongly than linoleic acid, while oleic acid did not inhibit. These results indicate that many vegetable oils, including sesame, contain in vitro antineoplastic properties; this finding warrants further investigation both in vitro and in vivo to assess their possible chemotherapeutic potential.

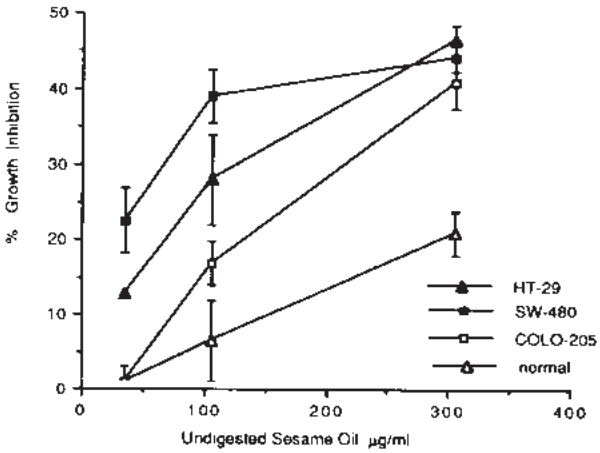


Figure 3. *Growth inhibiting effect of whole undigested sesame oil at doses of 30, 100, 300 µg·ml on the growth rate of three human colon adenocarcinoma and one normal human colon cell line. Each point represents the mean and SEM of four experiments.*

Study 5 **Research Highlights**

In vitro research with human colon cancer cell lines indicates that many natural vegetable oils, including sesame, contain in vitro antineoplastic properties. Further in vivo and in vitro investigation is warranted in order to assess oils' possible chemotherapeutic potential.

Study 6

Alternative Therapies in Health and Medicine 2002 Sep-Oct;8(5):40-51

Lipophil-mediated reduction of toxicants in humans: an evaluation of an ayurvedic detoxification procedure.

Herron RE, Fagan JB.

CONTEXT: Lipophilic toxicants have been associated with hormonedisruption, immune system suppression, reproductive disorders, several types of cancer, and other diseases. Due to environmental persistence and bioaccumulation, body burdens of certain toxicants, such as dichlorodiphenyldichloroethylene (DDE) and polychlorinated biphenyls (PCBs), appear to be a health risk despite the toxicants' having been banned for decades.

OBJECTIVE: To determine whether a safe, standardized, Ayurvedic detoxification procedure can mobilize lipid-soluble toxicants and stimulate their excretion.
DESIGN: Cross-sectional and longitudinal evaluations.

SETTING: Southeastern Iowa.

PARTICIPANTS: In the cross-sectional study, 48 participants who had undertaken lipophil-mediated detoxification were compared with 40 control subjects. In the prospective, longitudinal evaluation, serum levels were measured in 15 subjects before and after they underwent the detoxification procedure. These 15 subjects served as their own controls.

INTERVENTION(S): Ayurvedic lipophil-mediated detoxification procedure.

MAIN OUTCOME MEASURE: Gas chromatographic analysis of 17 serum toxicant levels (9 PCB congeners and 8 pesticides or metabolites) on a lipid-adjusted and wet-weight basis (ng/g) as parts per billion.

RESULTS: In the cross-sectional study, gas chromatographic analysis of 9 PCB congeners and 8 pesticides revealed that serum PCB levels were significantly lower in the detoxification subjects than in controls. Trans-nonachlor (TNC), p,p'-dichlorodiphenyldichloroethylene (p,p'-DDE), oxychlordane, and hexachlorobenzene (HCB) levels were also markedly lower in the detoxification group. All subjects had undetectable levels of p,p'-DDT, lindane, and a-hexachlorocyclohexane (a-HCH). Beta- hexachlorocyclohexane (beta-HCH) levels were significantly higher in detoxification subjects than in controls. In the longitudinal evaluation, after treatment, mean levels of PCBs (46%) and beta-HCH (58%) declined significantly in the subjects.

CONCLUSIONS: The higher beta-HCH levels in the subjects in the longitudinal study appear to be an anomaly related to diet. The results of the 2 studies generally suggest that lipophil- mediated detoxification may be effective in reducing body burdens of fat-soluble toxicants. As numerous people worldwide are at risk from high body burdens of such lipid-soluble agents, further studies to evaluate this procedure appear warranted.

PMID: 12233802 [PubMed - indexed for MEDLINE]

1. Title

A Randomized Controlled Trial of Stress Reduction for Hypertension in Older African Americans

Publication

Hypertension, Vol. 26, pp. 820-827, 1995.

Authors

Robert H. Schneider,* Frank Staggers,** Charles N. Alexander,† William Sheppard,** Maxwell Rainforth,† Kofi Kondwani,† Sandra Smith,** and Carolyn Gaylord King.†

Conducted at

* Center for Health and Aging Studies, Department of Physiological and Biological Sciences, Maharishi University of Management, Fairfield, IA

**The Hypertension and Stress Management Research Clinic, West Oakland Health Center, Oakland, CA

† Department of Psychology, Maharishi University of Management, Fairfield, IA

Summary

This study investigated the short-term efficacy and feasibility of two stress education approaches to the treatment of mild hypertension in older African Americans. This was a randomized, controlled, single-blind trial with 3 months of follow-up in a primary care, inner-city health center. Of 213 African American men and women screened, 127 individuals (aged 55 to 85 years with initial diastolic pressure of 90 to 109 mm Hg, systolic pressure of $\leq$189 mm Hg, and final baseline blood pressure of $\leq$179/104 mm Hg) were selected. Of these, 16 did not complete follow-up blood pressure measurements. Mental and physical stress-reduction approaches (Transcendental Meditation and progressive muscle relaxation) were compared with a lifestyle modification education control program and with each other. The primary outcome measures were changes in clinic diastolic and systolic pressures from baseline to final follow-up, measured by blinded observers. The secondary measures were linear blood pressure trends, changes in home blood pressure, and intervention compliance. Adjusted for significant baseline differences and compared with control, Transcendental Meditation reduced systolic pressure by 10.7 mm Hg ($p<0.0003$) and diastolic pressure by 6.4 mm Hg ($p<0.00005$). Progressive muscle relaxation lowered systolic pressure by 4.7 mm Hg ($p=0.054$) and diastolic pressure by 3.3 mm Hg ($p<0.02$). The reductions in the Transcendental Meditation group were significantly greater than in the progressive muscle relaxation group for both systolic blood pressure ($p=0.02$) and diastolic blood pressure ($p=0.03$). Linear trend analysis confirmed these patterns. Compliance was high in both stress-reduction groups. Home systolic but not diastolic pressure changes were similar to clinic changes. Selected mental and physical stress-reduction techniques demonstrated efficacy in reducing mild hypertension in this sample of older African Americans. Of the two techniques, Transcendental Meditation was approximately twice as effective as

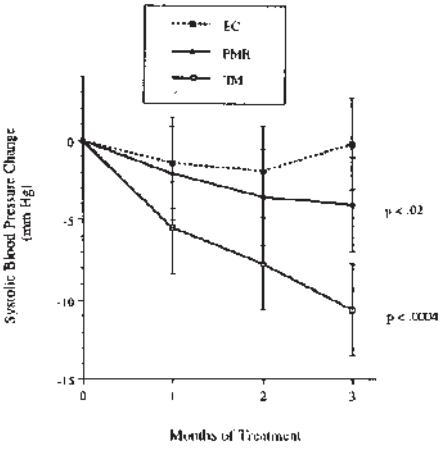


FIG. 1. Line graph shows mean changes in clinic systolic pressure over 3 months (follow-up minus baseline) with SEM. Probability values are for repeated measures ANCOVA comparing each experimental group (TM and PMR) with control (EC). TM indicates Transcendental Meditation (n=36); PMR, progressive muscle relaxation (n=33); and EC, lifestyle modification education control (n=35).

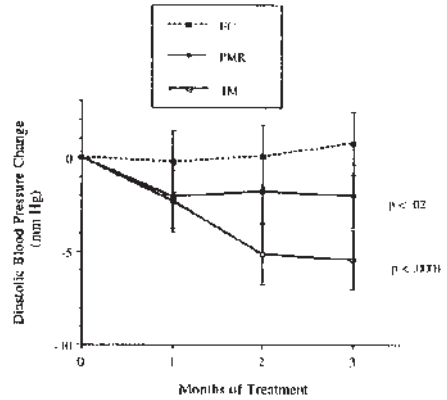


FIG. 2. Line graph shows mean changes in clinic diastolic pressure over 3 months (follow-up minus baseline) with SEM. Probability values are for repeated-measures ANCOVA comparing each experimental group (TM and PMR) with control (EC). TM indicates Transcendental Meditation (n=36); PMR, progressive muscle relaxation (n=33); and EC, lifestyle modification education control (n=35).

progressive muscle relaxation. Long-term effects and generalizability to other populations require further evaluation.

Study 1 **Research Highlights**
The effects of Transcendental Meditation and progressive muscle relaxation were compared in African-American men and women with elevated blood pressure. Of the two techniques, Transcendental Meditation was approximately twice as effective as progressive muscle relaxation in reducing both systolic and diastolic blood pressure.

2. Title
Cost-Effective Hypertension Management: Comparison of Drug Therapies With an Alternative Program

Publication
The American Journal of Managed Care, Vol. 2, pp. 427-437, 1996.

Authors
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Summary
The competitive nature of managed care organizations demands that providers seek cost-effective ways to maintain the health of their clients. As an approach to reducing cardiovascular morbidity and mortality, antihypertensive medication is costly, has adverse side effects, and has questionable value in reducing coronary heart disease. This report evaluates a behavioral stress-reduction method as an option to pharmaceutical treatment. Randomized studies indicate that the Transcendental Meditation® (TM) technique reduces mild hypertension (the predominant form of hypertension) as effectively as do drug therapies. A cost-effectiveness comparison in 1996 dollars was conducted among five standard antihypertensive medications and the TM technique over a simulated 20-year treatment period. According to present value analysis of treatment payments, the TM technique had the lowest present value cost, and thus appeared to be the most attractive alternative. The estimated average cost of antihypertensive drug treatment ranged from $375 per year for hydrochlorothiazide to $1,051 per year for propranolol hydrochloride, whereas the estimated average cost of treatment with the TM technique was $286 per year. When combined with results of controlled trials documenting the effectiveness of the TM technique in reducing high blood pressure, decreasing morbidity and mortality, and improving the quality of life, the present comparison suggests that this nonpharmacologic procedure may be safely used as a cost-effective treatment of hypertension in the managed care setting.

Study 2 **Research Highlights**
In a cost-effectiveness comparison, the estimated average cost of antihypertensive drug treatment ranged from $375 per year for hydrochlorothiazide to $1,051 per year for propranolol hydrochloride, whereas the estimated average cost of treatment with the Transcendental Meditation technique was $286 per year.

3. Title

Usefulness of the Transcendental Meditation Program in the Treatment of Patients With Coronary Artery Disease

Publication

The American Journal of Cardiology, Vol. 77, pp. 867-870, 1996.

Authors

John W. Zamarra, MD, Robert H. Schneider, MD, Italo Besseghini, MD, Donald K. Robinson, MS, and John W. Salerno, PhD.

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Summary

This investigation was designed as a pilot study to test the hypothesis that stress reduction intervention with the Transcendental Meditation (TM) program would reduce exercise-induced myocardial ischemia in patients with known coronary artery disease. Twenty-one patients with documented coronary artery disease were prospectively studied. After baseline symptom-limited exercise tolerance testing, subjects were assigned to practice the TM technique or allocated to a wait-list control group. Single blind testing was repeated after an average 7.6 months of follow-up. Results showed that the patients who learned TM demonstrated significantly greater exercise tolerance, higher maximal workload, delayed onset of ST-segment depression, and decreases in double product at each exercise interval, compared with the control group. The reliability of the test data for assessing changes in exercise performance was supported by the relatively high reproducibility of the symptom-limited exercise tolerance test measures at baseline. The results suggest that practice of the Transcendental Meditation program is useful in reducing exercise-induced myocardial ischemia in patients with coronary artery disease and may be considered beneficial for the prevention and treatment of coronary artery disease.

Study 3 **Research Highlights**

Human study results suggest that the Transcendental Meditation program is useful in reducing exercise-induced myocardial ischemia in patients with coronary artery disease and may be considered beneficial for the prevention and treatment of coronary artery disease.

4. Title

The Impact of the Transcendental Meditation Program on Government Payments to Physicians in Quebec: An Update

Publication

American Journal of Health Promotion, Vol. 14, No. 5, pp. 284-291, 2000.

Authors

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Summary

This study expands upon a previous study conducted by the authors to analyze whether practice of the Transcendental Meditation (TM) technique affected government payments to physicians in Quebec, Canada. The present study includes data on an additional 741 practitioners of the TM technique (for a total of 1418 TM subjects) and a comparison subject for each TM practitioner, and extends the time period three additional years. This retrospective, longitudinal study compared data on government payments to physicians for treating 1418 health insurance enrollees in Quebec who practiced TM and 1418 comparison subjects who did not practice TM. Data for pre-intervention and post-intervention periods over a time period of 14 years was analyzed. The TM subjects had practiced TM for an average of 6.7 years and participated in the study by filling out a questionnaire. They were considered a convenience sample since they were self-selected, the number of questionnaires distributed was not known, and the number of possible respondents was not known. The comparison group for this study was randomly selected by the Quebec health insurance agency, matching each TM subject with a comparison subject having the same age, gender, and region in which they lived. The total number of study subjects was 2836, including 1408 men and 1428 women, with an average age of 38 years. The subjects' annual physician expenses for the years 1981-1994 were adjusted for inflation and analyzed in constant 1992 Canadian dollars. For the preintervention period (before subjects started the TM technique), the yearly rate of increase in payments to physicians was not significantly different between the TM and comparison groups. For the post-intervention period (after the subjects started TM), the yearly payments to physicians for the comparison group increased to levels that were higher than the preintervention levels for this group, increasing up to 11.73% annually over a six-year period. In the TM group however, the yearly payments decreased 1% to 2% annually in the post-intervention period, resulting in a significant mean annual difference of 13.78% ($p=0.0017$), compared to the non-TM group. These data suggest that practice of the TM technique reduced payments to physicians between 5% and 13% per year over a six-year period, compared to the control group. This type of reduction in medical expenditures could result in billions of dollars saved by governments and private health insurance companies in nations experiencing rapidly rising health care costs.

Study 4 **Research Highlights**

This retrospective, longitudinal study compared data on Canadian government payments to physicians for treating health insurance enrollees who practiced Transcendental Meditation (TM) with comparison subjects who did not practice TM. The data suggest that practice of the TM technique reduced payments to physicians between 5% and 13% per year over a six-year period, compared with the control group.

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Trials of Maharishi Ayurveda for cardiovascular disease: A pooled analysis of outcome studies with carotid intima-media thickness

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Abstract

Objective: To investigate a multimodality, natural medicine systems approach—Maharishi Ayurveda (MAV)—for prevention or reversal of atherosclerotic cardiovascular disease (ASCVD).

Design: Pooled analysis of data from existing trials that used MAV to reduce carotid artery intima-media thickness (CIMT).

Settings: Two large medical centers in the U.S. Midwest.

Subjects: Thirty-four elderly patients with or at high risk for ASCVD.

Interventions: Four components of MAV: Transcendental Meditation™, Ayurvedic diet, Ayurvedic exercise, and Ayurvedic herbal food supplements.

Primary outcome measure: CIMT, a surrogate measure of ASCVD, was determined by B-mode ultrasonography.

Results: After 9–12 months of intervention, CIMT declined in the MAV group (change in CIMT = –0.15 ± 0.22 mm; 95% CI = –0.22 to 0.01 mm) and increased in the usual care group (change in CIMT = + 0.02 ± 0.06 mm; 95% CI = –0.02 to 0.04). This difference between groups of –0.17 mm was significant [$F(1,29) = 14.1$, $p << .01$]. In the MAV group, those individuals showing the largest reductions in CIMT with treatment also had the highest risk factor levels at the start. Baseline data from this subgroup indicated the presence of hypertension, (systolic blood pressure (SBP) = 141 ± 11 mmHg, diastolic blood pressure (DBP) = 80 ± 12 mmHg, means ± SD). They also had elevated waist circumference (91 ± 8 cm), and dyslipidemia (triglyceride-to-HDL-cholesterol ratio = 4.8 ± 2.9). Each individual in this "high-CIMT-change" group, 80% of whom were women, improved notably in one or more risk factors with the MAV intervention.

Conclusions: The pooled results of these two trials suggest that MAV multimodality intervention programs, including the Transcendental Meditation technique and heart-healthy Ayurvedic diet, exercise, and herbal food supplements, may be effective in the regression of ASCVD, especially in patients at high risk for cardiovascular disease.

Key Words

- Ayurveda
- Maharishi Ayurveda
- Transcendental Meditation
- Meditation
- Natural medicine
- Herbal supplements
- Carotid IMT
- Cardiovascular disease
- Atherosclerosis
- Hypertension
- Dyslipidemia

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* The indicated sequence is a simplified version of complex and parallel physiological interactions

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Hypertension
Journal of the American Heart Association

American Heart Association

AHA Scientific Statement

Beyond Medications and Diet: Alternative Approaches to Lowering Blood Pressure

A Scientific Statement From the American Heart Association

Robert D. Brook, MD, Chair; Lawrence J. Appel, MD, MPH, FAHA, Co-Chair; Melvyn Rubenfire, MD, FAHA; Gbenga Ogedegbe, MD, MPH; John D. Bisognano, MD, PhD; William J. Elliott, MD, PhD, FAHA; Flavio D. Fuchs, MD, PhD; Joel W. Hughes, PhD; Daniel T. Lackland, DrPH, MSPH, FAHA; Beth A. Staffileno, PhD, FAHA; Raymond R. Townsend, MD, FAHA; Sanjay Rajagopalan, MD; on behalf of the American Heart Association Professional Education Committee of the Council for High Blood Pressure Research, Council on Cardiovascular and Stroke Nursing, Council on Epidemiology and Prevention, and Council on Nutrition, Physical Activity and Metabolism

Hypertension. published online April 22, 2013

The online version of this article, along with updated information and services, is located at: http://hyper.ahajournals.org/content/early/2013/04/22/HYP.0b013e318293645f

Brook RD et al., Beyond Medications and Diet: Alternative Approaches to Lowering Blood Pressure. A Scientific Statement from the American Heart Association. Hypertension, 61:00, 2013.

Highlights from the Scientific Statement:

According to the American Heart Association, the Transcendental Meditation technique is the only meditation practice that has been shown to lower blood pressure. According to the AHA, "Because of many negative studies or mixed results and a paucity of available trials, all other meditation techniques (including MBSR) received a 'Class III, no benefit, Level of Evidence C' recommendation. Thus, other meditation techniques are not recommended in clinical practice to lower BP at this time."

The AHA scientific statement also reported the finding that lower blood pressure through Transcendental Meditation practice is associated with substantially reduced rates of death, heart attack and stroke.

The AHA scientific statement concludes that alternative treatments that include the Transcendental Meditation technique are recommended for consideration in treatment plans for all individuals with blood pressure > 120/80 mm Hg.

The report also recognized that Transcendental Meditation is generally considered safe and without harmful side effects. As an additional advantage, the statement noted that many of the reviewed alternative therapies, such as meditation, may provide a range of health or psychological benefits beyond BP lowering or cardiovascular risk reduction.

Current Hypertension Reviews, 2012, Vol. 8, No. 3.

Prevention and Treatment of Cardiovascular Disease in Adolescents and Adults through the Transcendental Meditation® Program: A Research Review Update

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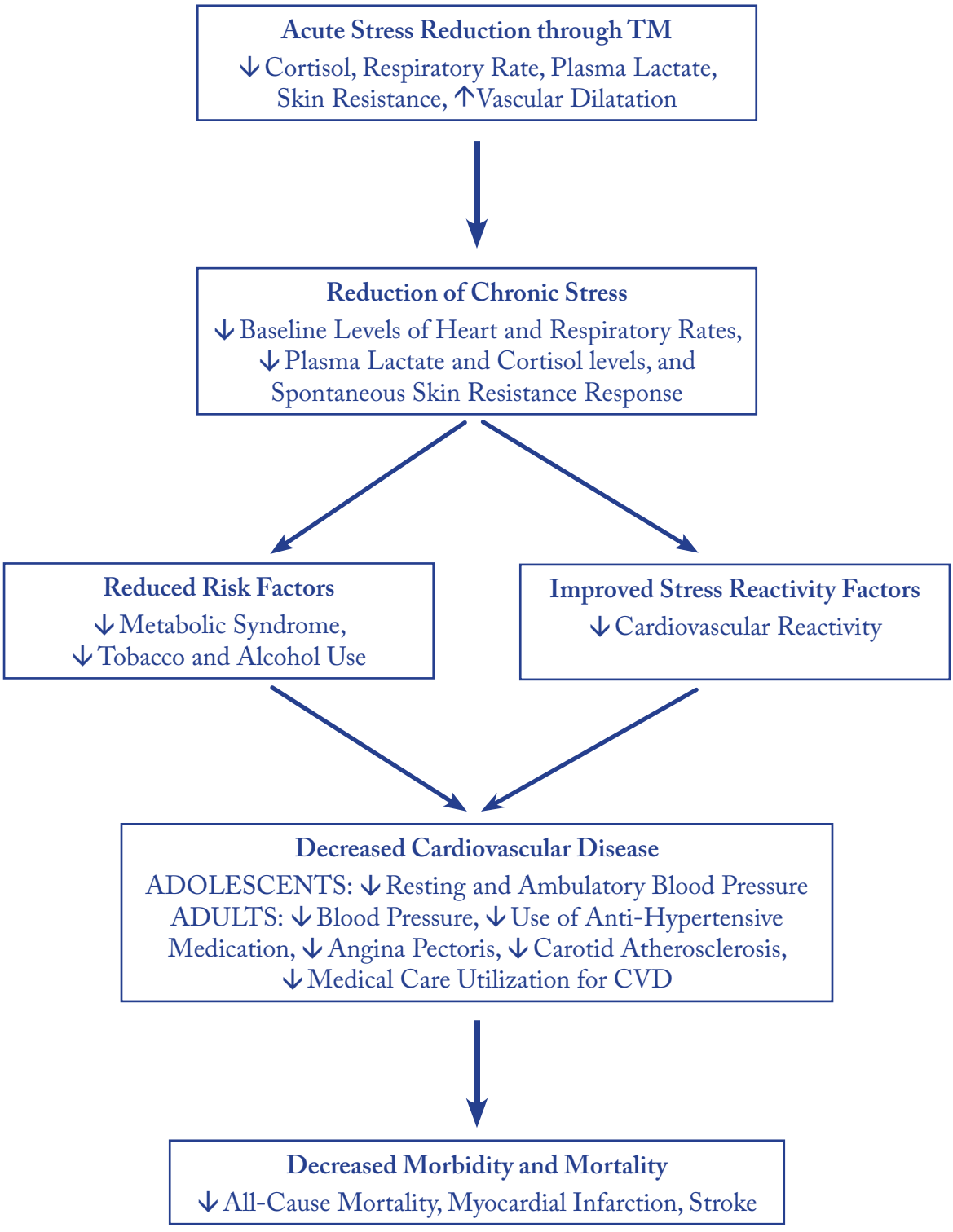
Abstract: The pathogenesis and progression of cardiovascular diseases are thought to be exacerbated by stress. Basic research indicates that the Transcendental Meditation® technique produces acute and longitudinal reductions in sympathetic tone and stress reactivity. In adolescents at risk for hypertension, the technique has been found to reduce resting and ambulatory blood pressure, left ventricular mass, cardiovascular reactivity, and to improve school behavior. Research on adults with mild or moderate essential hypertension has reported decreased blood pressure and reduced use of anti-hypertensive medication. The technique has also been reported to decrease symptoms of angina pectoris and carotid atherosclerosis, to reduce cardiovascular risk factors, including alcohol and tobacco use, to markedly reduce medical care utilization for cardiovascular diseases, and to significantly decrease cardiovascular and all-cause morbidity and mortality. These findings have important implications for inclusion of the Transcendental Meditation program in efforts to prevent and treat cardiovascular diseases and their clinical consequences.

Treatment and prevention of CVD through stress reduction (see figure next page). A model of the Transcendental Meditation® (TM) program's effects on hypertension and CVD as reviewed in this paper is presented. Chronic environmental and psychosocial stresses, and genetic predisposition, contribute to an increase in acute stress-induced sympathetic nervous system (SNS) arousal, resulting in increased neurohormonal activity and hypothalamic-pituitary-adrenocortical axis dysregulation. Such changes result in greater blood pressure (BP) responsivity to the stress, vasoconstriction and increased BP levels. Reduction of acute and chronic stress via TM practice reduces SNS activity resulting in reduced BP reactivity to acute stress. Over time, due to decreased CV reactivity to acute events, there is reduced load upon the heart, resulting in decreased BP levels, thereby helping to prevent essential hypertension (EH) and CVD.

Treatment and Prevention of Cardiovascular Disease (CVD) Through Stress Reduction



This model (credit Vernon A. Barnes) shows how regular practice of the Transcendental Meditation Program may reduce chronic stress, which in turn reduces CVD risk factors and improves stress reactivity, thereby decreasing cardiovascular disease, and consequential morbidity and mortality.

Circulation: Cardiovascular Quality and Outcomes

Circulation: Cardiovascular Quality and Outcomes. 2012; 5: 750-758
Published online before print November 13, 2012, doi: 10.1161/CIRCOUTCOMES.112.967406

Original Article

Stress Reduction in the Secondary Prevention of Cardiovascular Disease

Randomized, Controlled Trial of Transcendental Meditation and Health Education in Blacks

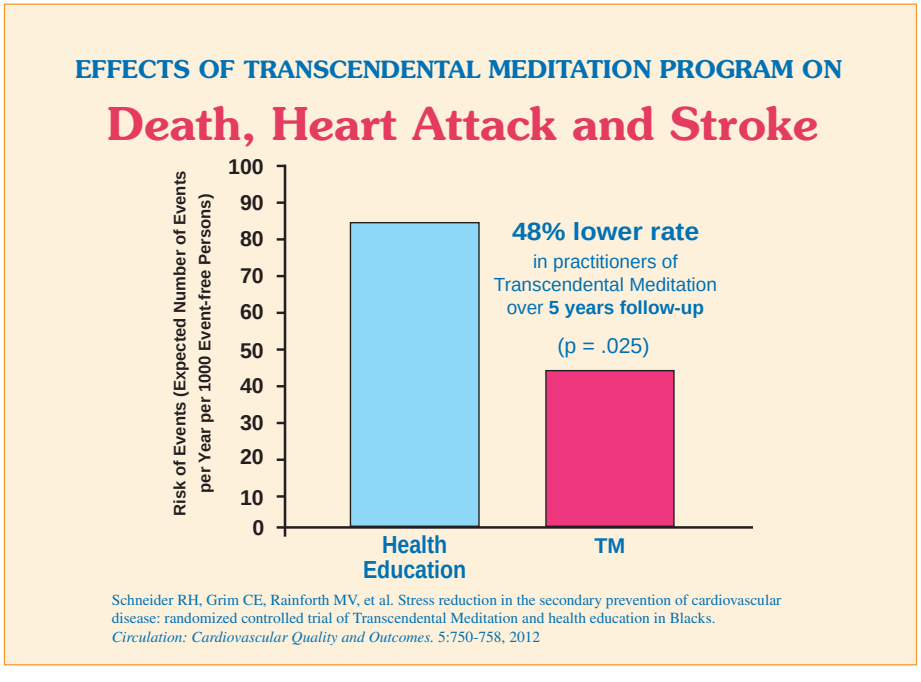
Robert H. Schneider, MD, FACC, Clarence E. Grim, MD, Maxwell V. Rainforth, PhD, Theodore Kotchen, MD, Sanford I. Nidich, EdD, Carolyn Gaylord-King, PhD, John W. Salerno, PhD, Jane Morley Kotchen, MD, MPH and Charles N. Alexander, PhD†

Abstract

Background—Blacks have disproportionately high rates of cardiovascular disease. Psychosocial stress may contribute to this disparity. Previous trials on stress reduction with the Transcendental Meditation (TM) program have reported improvements in cardiovascular disease risk factors, surrogate end points, and mortality in blacks and other populations.

Methods and Results—This was a randomized, controlled trial of 201 black men and women with coronary heart disease who were randomized to the TM program or health education. The primary end point was the composite of all-cause mortality, myocardial infarction, or stroke. Secondary end points included the composite of cardiovascular mortality, revascularizations, and cardiovascular hospitalizations; blood pressure; psychosocial stress factors; and lifestyle behaviors. During an average follow-up of 5.4 years, there was a 48% risk reduction in the primary end point in the TM group (hazard ratio, 0.52; 95% confidence interval, 0.29–0.92; P=0.025). The TM group also showed a 24% risk reduction in the secondary end point (hazard ratio, 0.76; 95% confidence interval, 0.51–0.1.13; P=0.17). There were reductions of 4.9 mmHg in systolic blood pressure (95% confidence interval −8.3 to −1.5 mmHg; P=0.01) and anger expression (P<0.05 for all scales). Adherence was associated with survival.

Conclusions—A selected mind–body intervention, the TM program, significantly reduced risk for mortality, myocardial infarction, and stroke in coronary heart disease patients. These changes were associated with lower blood pressure and psychosocial stress factors. Therefore, this practice may be clinically useful in the secondary prevention of cardiovascular disease.



Additional research on Transcendental Meditation:

The following five volumes contain more than 500 research studies conducted on the Transcendental Meditation and TM-Sidhi techniques during the past 25 years:

1. Orme-Johnson DW, Farrow JT (eds). Scientific Research on the Transcendental Meditation Program: Collected Papers, Volume 1. Rheinweiler, Germany: MERU Press, 1977.

2. Chalmers RA, Clements G, Schenkluhn H, Weinless M (eds). Scientific Research on Maharishi's Transcendental Meditation and TM-Sidhi Program: Collected Papers, Volume 2. Vlodrop, The Netherlands: MVU Press, 1989.

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Note: The most recent research on Transcendental Meditation can be viewed at www.tm.org.

http://www.davidlynchfoundation.org/research.html
http://www.tm.org/research-on-meditation