

Full Length Research Paper

Further consideration of Asian medicinal plants in treating common chronic diseases in the West

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Ethnopharmacological knowledge is viewed as an increasingly relevant and important source for development of new medicinal products. Historically plants have been the basis of many medicines and are a major resource for human health care. This project critically examined the science-based medical evidence supporting use of traditional Asian medicinal plants for curative, preventive or palliative functions relevant to important chronic ailments in Western countries (eg. cardiovascular disease, cancer, diabetes, arthritis, dementia, asthma). Around 400 medicinal plant species were reviewed through 3,500 scientific references. There were more species associated with anticancer effects than any other chronic disease, suggesting that if Asian medicinal species are to make new impacts on Western health there is a strong chance that this will be as anticancer agents. However, conclusive positive results from randomised, double blind, placebo-controlled experiments with humans were only available for a limited number of crops. Garlic (*Allium sativum*), turmeric (*Curcuma longa*), green tea (*Camellia sinensis*), ginseng (*Panax ginseng*), *Astragalus membranaceus* and *Ginkgo biloba* are important Chinese medicinal plants with strong support from medical efficacy trials. Other species backed by good data include *Apocynum venetum*, *Codonopsis pilosula*, *Fallopia multiflora*, *Huperzia serrata*, *Lycium barbarum*, *Lycium chinense*, *Stephania tetrandra* and *Trichosanthes kirilowii*.

Key words: Ethnopharmacology, plant, chronic disease.

INTRODUCTION

Plants have been a source of medicine and a major resource for health care since ancient times, with some traditional herbal medicines in use for more than 2,000 years. The modern pharmaceutical industry is paying more attention to plants as scientists re-discover that plant life is an almost infinite resource for medicine development. One fourth of modern medicines available on prescription today owe their origins of raw material to higher plants of tropical forests (Samy et al., 2005). Out of these, 74% are derived from plants that have some related use in traditional herbal medicine (Samy et al., 2005). Increasing emphasis on the use of medicinal plants in searching for new drugs is undoubtedly a productive strategy (Liu and Yaniv, 2005).

Phytochemicals that improve human health may be consumed as fresh plant products like fruits and vegetables, or at the other extreme as highly value-

added processed forms (eg. extracts / powders / pills). Where plant materials are concerned, it can be difficult to draw a sharp distinction between 'nutraceuticals', 'herbal medicines', 'functional foods' and 'drugs', as they all can contain bioactive ingredients. However, they have in common the potential to enhance human health further than the simple supply of fuel for metabolic processes.

Many foods consumed in Asia have been traditionally used to cure specific human ailments and the philosophy behind Chinese medicine often reflects this usage. However, in the West where the potential value of functional foods (and herbal medicines) has only recently captured the imagination, these links to traditional uses remain largely unexplored.

Natural products and mainly plants (greater than 80%) are the basis of traditional Chinese medicine (Lee et al.,

2005). Chinese medicines have been developed to treat all important diseases. Approximately 5,000 plant species used in traditional Chinese medicine are believed to have therapeutic qualities (Lee et al., 2005). Around 500 plants are commonly prescribed by doctors of Chinese medicine and these can be available in raw and processed or concentrated form (Lee et al., 2005). About 140 new drugs have originated directly or indirectly from Chinese medicinal plants by means of modern scientific methods, confirming that these plants are an important resource (Liu and Yaniv, 2005).

Chronic diseases are a major health problem in all developed countries, accounting for a high proportion of deaths, disability and illness and are increasingly prevalent because Western people are living to older ages (AIHW). By their very definition, chronic diseases are those involving a long course in their development or their symptoms. Yet many of these diseases are preventable or their onset can be delayed by relatively simple measures. Most chronic diseases do not resolve spontaneously and are generally not cured completely. Some can be immediately life threatening, such as heart attack and stroke, others is often serious including various cancers, depression and diabetes. However, they all tend to persist in an individual through life but are not always the cause of death. In addition to illness, pain and disability, chronic diseases are also a significant economic burden, both on those who suffer from them and for the wider community. In Australia, the top ten causes of disease burden are chronic diseases (AIHW). These include coronary heart disease, stroke, cancer, dementia, diabetes, asthma and osteoarthritis.

To date, the majority of plant materials used in traditional Chinese medicine has not been clinically evaluated in randomised, double-blind studies and consequently Western medicine has not generally accepted the efficacy of Chinese treatments (Craker and Giblette, 2002). Even as recently as 1998, data about the safety and efficacy of Eastern medicinal herbs tended to be many years old, limited to *in vitro* or animal studies or only available in non-English language journals (O'Hara et al., 1998). However, many Chinese medicines are now undergoing evaluation on a biochemical basis with high quality 'evidence-based' scientific trials on plant materials currently undertaken in both the East and West.

This literature review critically examined the evidence-based health benefits to consumers of plant products used in traditional Chinese medicine, and where relevant, plants from other Asian folk medicines. The focus has been on plant products with the potential to bring preventive, palliative and curative benefits to sufferers of common chronic diseases in the West. Up-to-date medical verification has been summarised so

that identification and development of new products aimed at Western markets can be facilitated.

METHODOLOGY

Species review - boundaries of the investigation

The study targeted Asian medicinal plant species (and their derived products) that have been documented to possess curative, preventive or palliative functions relevant to important chronic ailments in the West: cardiovascular disease, cancer, diabetes, arthritis, dementia and asthma.

There was a predominant focus on plants used in Chinese medicine and on plants with their genetic origins in Asia, however, plants used in non-Chinese folk medicine were included when relevant. Often these were from countries that are near neighbours to China where plant species frequently range over the geographic borders of the region. Additional species typically derived from Indian, Japanese, Myanmar and Malaysian folk medicine. In particular, 'Ayurveda', the ancient Indian medical science, employs many phytochemical based treatments.

For each pertinent plant (see Thomson, 2007), a summary profile was developed that generally included: botanical and common / vernacular names, traditional ailments addressed, biochemical basis for efficacy (active compounds), scientific verification of disease control and healing (evidence of the plant product's effects).

It should be noted that while medicinal plants are often tagged 'herbs' or 'herbals' these descriptions simply refer to the fact that the materials are plant-based in origin. These terms do not necessarily mean that the species is a herbaceous (that is a non-woody) higher plant. In fact, many of the plants used in Chinese and other Asian folk medicines derive from shrub or tree species.

The search

Chinese medicinal plants are often prepared as 'medicines' which are mixtures of more than one plant (Blumenthal, 1999). The literature review focussed on research which investigated the separate efficacy of each target species, and in so doing has generally avoided the issue of which component(s) in a concocted medicine are responsible for effects, or if all the herbs in the formula are essential. The focus was on data from trials of single plants and their derivatives (monopreparations).

For this report, all the screened literature pertaining to human health effects was science-based and published in either recognised science and medical journals, or review textbooks by experts in the field. No website information for efficacy data was used unless it represented papers from on-line scientific journals. Product efficacy claims made by website promoters and purveyors were not considered, and leaflet literature popularly used to promote retailed 'health' products was similarly discounted.

Particular care was taken to verify the correct genus and species names for investigated plants. These scientific names were verified for accuracy on the germplasm resources information network (GRIN). The GRIN website is <http://www.ars-grin.gov>.

Scientific and medical data were primarily (but not exclusively) sourced from the PubMed electronic database (which also covers relevant Chinese journals) from inception to May 2006. PubMed website - <http://www.ncbi.nlm.nih.gov/entrez/query.fcgi>.

Table 1. Percentage of reviewed Chinese and non-Chinese Asian medicinal plant species with some form of positive scientific evaluation linked to countering chronic Western diseases.

Medical activity	Percentage of reviewed species
Anticancer	41
Antiinflammatory	22
Cardiovascular protective	20
Antioxidant	12
Antidiabetic	11
Hypotensive	10
Neuroprotective	9
Antihyperlipidaemia	7
Antiarthritic (predominantly rheumatoid)	5
Hepatoprotective	3
Nitric oxide inhibitor	3
Antiasthma	3

Note- These terms were the predominant ones used in pertinent pieces of scientific literature. The interrelationships between eg. antioxidation and nitric oxide inhibition are recognised; as are the close linkages between eg. antiinflammatory and antiarthritic actions, and eg. antioxidant and anticancer effects etc.

Typically, the extraction of data was based on abstracts alone. Given the vast bulk of material, which required evaluation, multiple assessments of summarised abstract material were considered a superior yield of overview information than detailed focus on a lesser number of full papers.

What constitutes good evidence?

In theory, the most trustworthy evidence for herbal efficacy/ causality should come from trials on humans but the experimental design of trials still dictates the reliability of derived data. Human trials can take various forms: observational studies (also called epidemiological or population studies); controlled studies using an untreated group; single-blind studies; double-blind comparative trials; and randomised, double blind, placebo-controlled (RDBPC) experiments.

RDBPC experiments are the best in terms of scientific design and rigour, and guarantee the most dependable results. Their drawback can be considerable expense in both establishment and on-going evaluation to meet stringent requirements of experimental plans and statistical analysis. While RDBPC trials with humans are considered the most appropriate to prove causality, many claims are made on lesser research. Often 'health' products available commercially over-the-counter have not undergone evaluation in RDBPC trials, and may not have been evaluated scientifically in any type of human trial to substantiate effects.

Some support for efficacy of botanical products can be derived from animal (usually mammal) trials where the testing takes place in live (that is '*in vivo*'), anatomically complete individuals. However, because animals may process herbal products differently from humans, results are not necessarily reliable. Less reliable again is testing that uses human cell-lines (sometimes tissues) derived from humans and grown under controlled conditions in culture (that is '*in vitro*'). However, such studies are often only regarded as spurs for further research; they do not prove that a treatment is effective in real life. *In vitro* trials based on animal cell-lines and tissues can provide data but are at the limit of what can be regarded as medically provide data but are at the

limit of what can be regarded as medically useful.

It is not always essential for a particular plant species to be directly investigated for it to obtain some support for causality. Often the positive benefits of consumption of particular plant chemical compounds have been proven. Many of these compounds tend to occur within distinct plant families, so that when a phytochemical is newly shown to occur in a previously uninvestigated species, 'linked' or 'unsubstantiated' claims are made as to possible efficacy.

RESULTS

The study directly reviewed and documented information on over 400 Asian medicinal plant species with links to targeted chronic diseases (Thomson, 2007). Ninety-eight percent of these were higher plants (angiosperms and gymnosperms). Over 3,500 scientific reference items were considered and over 1,000 of these were directly referenced and documented in species summaries that can be found at <https://rirdc.infoservices.com.au/items/06-128>.

Of the 400, there were more species (around 165) associated with anticancer effects than any other chronic disease (Table 1). Species with antiinflammatory and cardiovascular protective properties were also well represented (Table 1).

It was also determined that not all plant species used in Chinese medicine are indigenous to China and traditional usage of a particular species may differ from the modern usage. Modern Chinese medicine may also use plant species that were not traditionally utilised. Western medicine sometimes uses plants from traditional Chinese medicine but not necessarily for a purpose in

in common with the Chinese use.

The curative powers ascribed to particular plant species appear to have contracted in recent times as more evidence-based evaluation for efficacy reduces the incidence of broad-spectrum claims and panaceas. However, lists have also added more modern pandemic ailments like heart disease, obesity, elevated cholesterol levels, high blood pressure and diabetes.

A vast array of plant types are used in Chinese medicine but overall numbers tend to be increased by nomenclature duplicities surrounding the use of synonyms, varieties/cultivars/selections and regional variants/ genotypes. A large proportion of the species had name synonyms and there were points of confusion regarding the appropriate spelling of names.

DISCUSSION

A 2005 review found that less than 30% of papers in traditional Chinese medicine journals had employed randomised controlled trials (Li et al., 2005). The present study also established that there is a general lack of recent and rigorous human efficacy testing. Conclusive positive human results from RDBPC trials are only available for a handful of the plants examined. Less than 20% of the 400+ species considered had undergone some type of 'scientific' evaluation on humans. However, many of these species are the subject of active research and future results from long-term studies could quickly establish their medicinal credentials. To date, at least 6% have yielded phytochemicals used in commercial drugs relating to chronic ailments.

Some important types of information were particularly scarce in the literature, such as results of negative trials, drug interactions, toxic reactions and effects in special populations. In some cases, good evidence about short-term side effects was available from well-controlled human trials. However, information about the effects of long-term use was often based on case reports rather than prospective studies; a situation unchanged since 1998 (O'Hara et al., 1998).

The efficacy data generated for many species are based on extracts rather than whole fruit or vegetables. There often remains the question of how much fresh material must be ingested to supply sufficient levels of phytochemical for generation of biochemical changes in the human body. Cooking plant products can also affect the availability of actives in different ways, sometimes positively and at other times detrimentally. Here the importance of human experimentation is critical and for the vast majority of species that are not current commercial mainstream crops, these issues often need resolution. Concentration of bioactive compounds can also vary with growing conditions and of course genotype or

or cultivar. Sometimes increase in healthy vegetative plant growth is inversely related to levels of phytochemicals.

Table 2 lists those species evaluated to have the best scientific support for their use in countering chronic disease. Many could be readily incorporated into Western diets and some are already established as international foodstuffs (eg. garlic, green tea, turmeric, ginger). For example, the dried leaves of *Apocynum venetum*, *Lycium barbarum* and *Lycium chinense* can be brewed as decoctions (or teas). *Lycium barbarum* berries can be eaten fresh or dried and provide functional levels of active phytochemicals in this form. Fresh leaves and young shoots of *Lycium barbarum* and *Lycium chinense* can be cooked or consumed raw in salads. Bitter melon (*Momordica charantia*) is palatable following appropriate preparation and cooking.

There is a need to monitor prospective species that are currently attracting considerable research with good results. The publication of results from a single well-planned, human trial can be enough to launch these species into the medical spotlight. Options to watch include - *Actaea heracleifolia* (cardiovascular), *Albizia lebbek* (asthma, dementia), *Alpinia oxyphylla* (dementia, cancer), *Anemarrhena asphodeloides* (diabetes, cancer, cardiovascular), *Angelica keiskei* (cancer, cardiovascular), *Cinnamomum verum* (antioxidant, diabetes), *Cnidium monnieri* (cancer), *Commiphora wightii* (arthritis, cholesterol), *Coriolus versicolor* (cancer), *Corydalis yanhusuo* (cardiovascular), *Cuscuta chinensis* (immune response, cancer), *Eucommia ulmoides* (cardiovascular, cancer, diabetes), *Gleditsia sinensis* (cancer), *Gymnema sylvestre* (diabetes), *Ligusticum sinense* (cardiovascular), *Polygala tenuifolia* (dementia), *Rabdosia rubescens* (cancer), *Sinomenium acutum* (arthritis, inflammation), *Spatholobus suberectus* (inflammation, bone), *Tinospora cordifolia* (diabetes, cancer, immune response), *Uncaria rhyrachophylla* (cardiovascular, dementia), *Uncaria sinensis* (antioxidant, dementia), *Ziziphus jujuba* (dementia). Definitive positive results from future human trials would establish these plants as bona fide medicinals.

The potential for new neuroprotective (antidementia) plant products to be further developed and have an impact on human health is another exciting possibility. Dementia affects one in four Australians over the age of 60 (AIHW). Leaf extracts from *Ginkgo biloba* certainly appear to counter memory loss and improve cognition but the prospect of identifying a new fruit or vegetable that could be consumed fresh (or with minimal home processing) and have ginkgo's same powers is compelling. There is an increasing research trend to seek herbal remedies for neuroprotection and many studies using animals have been recently completed.

Cardiovascular uses and in particular compounds for

Table 2. Chinese and non-Chinese Asian medicinal plant species with the best scientific support for use in countering chronic Western diseases.

Species	Common names	Usage
<i>Allium sativum</i>	TA SUAN, garlic	Cholesterol, cancer
<i>Apocynum venetum</i>	LUOBUMA, dogbane	Antioxidant, hypertension, cholesterol
<i>Astragalus membranaceus</i>	HUANG QI, astragalus, membranous milk-vetch	Cardiovascular, cancer
<i>Camellia sinensis</i>	LU CHA, green tea	Cancer
<i>Camptotheca acuminata</i>	XI ZHU, camptotheca	Cancer
<i>Codonopsis pilosula</i>	DANG SHEN, bellflower, Asiabell	Dementia
<i>Curcuma longa</i>	YU JIN, turmeric	Inflammation, arthritis
<i>Fallopia multiflora</i>	HE SHOU WU, Chinese knotweed, fleece flower, polygonum, fo ti	Dementia, cholesterol
<i>Ginkgo biloba</i>	BAI GUO (seeds), YEN XING (leaves), ginkgo, maidenhair tree	Cognition, cardiovascular
<i>Huperzia serrata</i>	toothed club moss, toge-shiba	Dementia
<i>Lycium barbarum</i>	GOU QI ZI (fruit), DI GU PI (root bark), Barbary wolfberry, matrimony vine	Cardiovascular, cholesterol, diabetes, cancer
<i>Lycium chinense</i>	GOU QI ZI (fruit), DI GU PI (root bark), Chinese boxthorn, Chinese wolfberry	Liver function
<i>Momordica charantia</i>	bitter melon, bitter gourd, balsam pear, karela	Diabetes
<i>Monascus purpureus</i>	red yeast	Cholesterol
<i>Panax ginseng</i>	REN SHEN, ginseng	Cognition, cancer
<i>Stephania tetrandra</i>	FANG JI, stephania	Cardiovascular, arthritis
<i>Trichosanthes kirilowii</i>	TIAN HUA FEN, GUA LOU, Chinese snake gourd, Chinese cucumber	Cancer, inflammation, cardiovascular, osteoarthritis
<i>Zingiber officinale</i>	SHENG JIANG (fresh), GAN JIANG (dried), ginger	Arthritis

hypertension (high blood pressure) have a long and relatively rigorous history of investigation and plant products have provided benefits. Antiasthma and antidiabetic activities in plants and their derivatives have also undergone considerable analysis but with lesser success and there are believed to be only a handful of species that have been proven functional in these respects. Over the past decade, there has been considerable interest in the isolation of potent antioxidant compounds to treat diseases involving oxidative stress (eg. cancer and aspects of cardiovascular disease). A high proportion of plant extracts exhibit some level of antioxidant activity and therefore current prospecting aims only to identify extracts with the highest levels of activity. Modern research has a large focus on anticancer properties of plants and some successes are evident. Forty-one percent of the Asian medicinal plant species documented in the review (Thomson, 2007) were associated with anticancer effects (Table 1). Given this high level of activity, if Asian and in particular Chinese medicinal species are to make new impacts on human health, there is a strong chance that this will be as anticancer agents.

There is a general awareness of the need to increase dietary fruit and vegetables for health benefits. However, for maximum benefits it is essential that there is a focus on those plant products with superior and proven

medicinal qualities. Many 'Asian' plant-based foods like ginger, turmeric, green tea and ginkgo are not currently large components of Western diets. There is a tendency for existing commercial agricultural/horticultural industries to justify and promote the health properties of plant species they currently produce, however, this should not mask and prejudice opportunities for other new species that can provide potentially superior health benefits. The expansion of Western diets to include some plants traditionally used in Asian medicine could bring about beneficial health outcomes.

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