

The Medicinal Value of Rhino Horn – a quest for the truth

Introduction

World Rhino Day was September 22nd 2011 – and from Australia to Zimbabwe, the message was loud and clear: Rhino horn is NOT medicine! In the UK, the Vietnamese Embassy was presented with a message it could not ignore for World Rhino Day: ‘rhino horn is not medicine. It does not cure anything. You might as well chew your own toe-nails. People would do just as well to chew their own nails, eat their own hair or better still, eat someone else’s nails, to get the same effect’. The same message can be found on many other conservation organisations websites.

Where does the information come from to substantiate these statements?

It has become almost universal to make reference to two studies. The first is that of the pharmaceutical giant Hoffmann-LaRoche who tested white rhino horn in 1980 on behalf of the World Wildlife Fund. The only results of the tests that can be found are in a short paper on rhino conservation published in 1983 where it is stated:

“[spokesman of WWF:] Tests also showed that rhino horn, which, like fingernails is made of agglutinated hair, has no analgesic, anti-inflammatory, anti-spasmodic nor diuretic properties, and no bactericidal effect could be found against suppuration and intestinal bacteria” Anonymous, 1983. Scientific tests fail to show rhino horn effective as medicine. *Environmentalist* 3 (2): 153.

It appears that either no detailed report was ever produced or that the possibly single copy is untraceable - as confirmed by the company, WWF and IUCN. It is therefore not possible for the study to undergo academic scrutiny or for the methodology to be challenged.

The second study often quoted is that of the Zoological Society of London (ZSL) who, it is said, undertook further testing in 2005. Dr Raj Amin of ZSL is shown in a National Geographic video sitting in a laboratory wearing a lab coat as he refers to the medicinal properties of rhino horn. He says “there is no evidence at all that any constituents of rhino horn has any medical property. Medically it is the same as actually chewing your nails” Moments later he says “we are looking at the constituents of rhino horn”. Despite the unfortunate inference that may be taken from the film, no tests on the medicinal properties of rhino horn have been undertaken by ZSL- as confirmed by the organisation.

The editor of the Rhino Resource Center Dr Kees Rookmaaker wrote that it “is recommended not to quote as the source of these findings either the tests of Hoffmann-LaRoche of 1980 (as the actual results have never been properly published) or tests at ZSL (as these have never been undertaken)”. This proposal seems to have had little effect to date.

Another study was undertaken by the Chinese University of Hong Kong in 1990 with their findings published as ‘Ethnopharmacology of Rhinoceros Horn. I: Antipyretic Effects of Rhinoceros Horn and Other Animal Horns’. Although fever-induced rats showed temporary lowering of temperature after being injected with an extremely high concentration of rhino horn extract, there was no antipyretic effect at the dosage levels comparable to what would be prescribed to a human patient. However, this simplifies exactly what the research states in the paper and there was a second part to the study which receives no mention. This is discussed later.

There appears to be no supporting scientific evidence given for the claim that rhino horn is ‘medically the same as chewing your fingernails’ but it is a nice soundbite.

The claims made that rhino horn has no medicinal qualities seem to be based on rather flimsy evidence but that does not mean to say they are wrong. The question then is, are there any scientific results that might suggest that rhino horn has some medicinal value?

i) The chemical constituents

Chemically, rhinoceros horn contains keratin, amino acids, guanidine derivatives, sterols, amine (ethanolamine), acidic peptide and sugar- and phosphorus-containing substances. (Inagaki and Oida, 1970; Yuan, 1987). Rhinoceros horn also contains many trace and metallic elements, including a high amount of calcium (Anonymous, 1975; Zhang et al., 1984).

Keratin is also found in fingernails and human hair but is not necessarily of the same constitution. Richard J Block (1939) compared the Composition of Keratins – the amino acid composition of hair, wool, horn and other eukeratins

Extract of table of results

Chemical	Human Hair	Fingernails	Rhino Horn	Note re rhino horn
Nitrogen	15.4	14.9	15.6	
Sulphur	5.0	3.8	2.3	
Histidine	0.6	0.5	0.6	
Lysine	2.5	2.6	2.6	
Argenine	8.0	8.5	8.2	
Cystine	15.5	12.0	8.7	Relatively low
Tyrosine	3.0	3.0	8.6	Very high
Tryptophane	0.7	1.1	1.7	
Phenylalanine	2.6	2.5	5.0	Relatively high
Glycine	4.3	-	7.4	

The results show that whilst rhino horn is made of keratin, as with human hair and fingernails, it is incorrect to presume the chemical composition is identical in all three cases. This may have implications as to the medicinal properties of each so it is misleading to state, as is often found in the literature, that chewing fingernails will have the same medicinal effect as taking rhino horn medicine.

Despite what some may have you believe, TCM is a researched science with several specialist facilities in universities and medical schools. There is a book - Traditional Chinese medicines: molecular structures, natural sources and applications 2nd ed Zhou, J., Xie, G & Yan, X Published by Ashgate Publishing Ltd, UK &USA 2003 - that gives details of the

chemical compound that has been found to be responsible for the medicinal value in each TCM ingredient.

The second edition of this book contains information on 9,127 chemicals isolated from 3,922 natural sources. The Chemical Compound associated with rhino horn is given as:

2897 Ethanolamine: Synonyms: 2-Aminoethanol; Monoethanolamine CAS Registry Number <141-43-5> C₂H₇NO Molecular weight (61.08). bp 171 deg; structure H₂N\OH

TCM Source XI JIAO (*Chinese name for rhino horn*).

T3141 XI JIAO; Rhinoceros Horn. Origin: Rhinoceros unicornis L; Rhinoceros sondaicus desmarest; Rhinoceros sumatrensis (Fischer) (Rhinocerotidae). Part: Horn. Effects: to cool blood, clear heat, resolve toxin, settle fright. Indications: blood ejection, spontaneous external bleeding, acute febrile disease, epidemic febrile diseases. Components: 2897

The Reference given is number 6 from the Jiangsu New Medical College, Chinese Medical Dictionary, Shanghai Science and Technology Press, Shanghai 1979 (in Chinese).

Note: Ethanolamine is a primary amine and primary alcohol, the second most abundant head group for phospholipids. It is also used in messenger molecules. As the brand ETHAMOLIN, Ethanolamine oleate is a human medicine to stop re-bleeding in oesophageal varices, caused by liver disease, that have recently bled.

Research, Proof of Effects

Dr Paul But Pui-hay, director of the Medicinal Material Research Centre at the Chinese University of Hong Kong was asked to study the antipyretic (fever reducing) effects of rhino horn. Several pharmacological studies on the antipyretic properties of rhinoceros horn had produced contradictory conclusions (Huang et al., 1959; Ogata et al. 1960; Yuan, 1987). The contradictory results could have been due to differences in routes of administration, types of preparation and dosage levels.

The team considered that a model of hyperthermia induced by *E. coli* may not be the best bioassay system for the assessment of the antipyretic effect of rhinoceros horn since the method involved a bacterial toxin and also the duration of hyperthermia induced was rather short. They thought that to evaluate the reputed antipyretic effect of rhinoceros horn, it may have been better to try another pyrogen such as one that causes inflammation and a longer duration of hyperthermia and to study higher dosage levels. They opted to use higher dosage levels, and to induce hyperthermia in their study rats through injections of turpentine.

The study was in two parts. In the first, the group looked at the effects of rhino horn, and saiga antelope, water buffalo and cattle horns, which some clinical studies had reported to also have antipyretic action. Then, because rhino horn is rarely prescribed in isolation, they focused on the combined effects of horn and herbs. From 31 preparations with rhino horn that were manufactured in China in the 1980s, they chose one known as the Qingying Decoction, a blend of horn and eight herbs that was often employed in treating heat stroke, encephalitis B, bacterial endocarditis and other inflammatory diseases. They ran these tests with both rhino and buffalo horns.

The results broadly tallied with the claims of Chinese herbalists: rhino and other horns could indeed lower feverish temperatures, buffalo horn could be a viable substitute for rhino, and the horn and herb combinations were more efficacious than horn alone. At high dosages - equivalent to over 100 times the normal human dosage of rhino horn - all four horns demonstrated antipyretic action. When the team reduced dosages by 80 percent, only rhino and saiga antelope horns produced significant temperature drops. This roughly fitted the assertions of some herbalists that, when buffalo horn is substituted for rhino, around ten times as much should be used.

The effects of rhino and saiga antelope horns were apparently similar, yet in practice rhino horn is regarded as superior in cooling blood and counteracting toxins, while saiga horn is favoured for cooling liver and quenching wind. Also - in a result some conservationists have taken as showing rhino horn is unnecessary - the Qingying Decoction herbs alone produced similar temperature drops to herbs with horn. Dr But cautions these results may have arisen from the way the experiments were conducted. "The reduction of fever in Chinese medicine has many facets - it's more profound than just reducing the temperature," he says. "In our particular assay model, inducing a fever through chemicals, it appeared a combination of herbs with or without horn may produce the same effect".

Qingying Decoction, a classic compound prescription composed of rhinoceros horn and eight herbs showed significant antipyretic action at dosages equivalent to 6.5 g/ml of rhinoceros horn extract. Comparable action was obtained by Qingying Decoction prepared with water buffalo horn. It is suggested that water buffalo horn can be used as a substitute for rhinoceros horn in treating hyperthermia especially when prepared with other herbal materials according to the principles of compound prescriptions of Chinese medicine.

The rationale of prescribing a compound prescription over the use of a single drug is that the items in a compound prescription may (i) cover a multitude of physiologic targets to restore holistic balance in the body; (ii) interact with one another to enhance the potency of the main drugs, or synergistically to magnify their total activities, or to minimize or neutralise the toxicity and side effects of some of the items; and (iii) avoid the potential lopsided effects of a large dose of a single drug.

At the low dosage levels, when the individual extracts of neither horn nor herbs could induce a drop in rectal temperature in rats with hyperthermia, the combined horn-herbs extracts of either rhinoceros or water buffalo horns demonstrated significant antipyretic actions. This result is highly significant in two directions. First, it clearly indicates that water buffalo horn can be used as a substitute for rhinoceros horn when prescribed in combination with other herbal materials. Second, it lends support to the rationale for the therapeutic use of compound prescriptions.

The enhancing or synergistic functions of multi-items appear to characterize Qingying Decoction. The various herbs in the prescription are known to have antibacterial, sedative, cardiogenic, diuretic and immuno-potentiating effects (Chang and But, 1986, 1987).

The low efficacy of rhino horn extracts to reduce temperature in febrile animals could in part be explained by the differences in concepts of the pathology of fever between Western medicine and TCM. The major difference is that in TCM febrile diseases can manifest without an increase in body temperature (Hsu *et al.*, 1986; Xu, 1994). In contrast, febrile diseases are associated with an increase in body temperature in Western medicine (Moltz, 1993).

"When people criticise Chinese people for using medicines, they should do so according to laboratory research, rather than without foundation. Although we use plants or wild animals, not drugs, we are treating diseases and protecting people's health, just like western medicine".

A more recent study involving an investigation of plant species as alternatives to the use of products obtained from endangered animal species (bear bile, rhino horn and tiger bone) was carried out by Middlesex University (UK) in collaboration with the Jodrell Laboratory, Royal Botanic Gardens, Kew (UK). With financial support from the UK government Department for Environment Food and Rural Affairs (DEFRA) and the International Fund for Animal Welfare (IFAW) Charitable Trust, the report was published in 2006 (and is freely available on the internet).

Based on both traditional use and scientific evidence for pharmacological actions, single herbs and TCM 'prescriptions' (combinations of herbs) were selected for investigation as alternatives to the use of rhino horn in Traditional Chinese Medicine.

The area chosen for investigation was the treatment of conditions associated with inflammatory processes for which rhino horn medicine was traditionally used. Nine single herbs and six prescriptions were selected as potential alternatives to rhino horn. The inflammatory response is a complex cascade of events, often triggered by infection (commonly by bacteria) and is one of the body's defence mechanisms in fighting disease. The inflammatory response forms one of the underlying pathologies of arthritis, fever, liver diseases, cancer and cardiovascular diseases.

Certain Traditional Chinese Medicine prescriptions, both with and without rhino horn, showed anti-bacterial and anti-inflammatory properties in this study but with further work required to ascertain the contribution of the horn extracts to any activity shown by the prescriptions.

One problem faced in researching the efficacy of rhino horn in TCM is that much of the information is contained in Chinese journals where only summaries are available and often in broken English. Two such reports repeated verbatim as examples follow below (note Xi jiao is rhino horn):-

China Journal of Chinese Materia Medica 2009-12

Effects of Xijiao Dihuang decoction on the expressions of Bcl-2, caspase-3, TNF- α and IL-6 after acute intracerebral hemorrhage in rats

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Objective: To study the effects of Xijiao dihuang decoction on the expressions of Bcl-2 and caspase-3 protein positive cells in brain tissue, TNF- α and IL-6 in blood after acute intracerebral hemorrhage in rat.

Method: The experimental ICH model was established by injection of non-heparinized autologous arterial blood into the right basal ganglia. Immunohistochemistry and radioimmunity methods were used to detect expressions of Bcl-2 and caspase-3 protein positive cells in brain tissue, TNF- α and IL-6 in blood.

Result: After ICH, caspase-3 protein positive cells in brain tissue, TNF- α and IL-6 in blood increased obviously in the model group. Caspase-3 protein positive cells, TNF- α and IL-6 were significantly reduced by treatment with Xijiao Dihuang decoction. On the contrary, Bcl-2 protein positive cells in brain tissue increased markedly.

Conclusion: Xijiao Dihuang decoction can protect nerve cell by reducing the expression of caspase-3, TNF- α and IL-6, increasing the expression of Bcl-2 after ICH in hemorrhagic brain damage

The efficacy study of Xijiao Dihuang decoction on rabbit's retinal blood vessel affected by Gentamicin

OBJECTIVE To study the protection of Xijiao Dihuang decoction on gentamicin affected Rabbit's retinal blood vessels, then identify the therapeutic effects of this Chinese medicinal herbs on this kind of and other similar diseases, such as retinal vasculitis.

METHODS Five hundred micrograms gentamicin was injected into rabbits' vitreous body, and then the rabbits were treated with Xijiao Dihuang decoction, dexamethasone or saline. All the eyes were measured with ocular fundus photography, fluorescein angiography, retinal vascular digestion, histopathologic finding, electron microscopy, histochemical changes after 7 and 14 days of treatment.

RESULTS The moderate dosage of Xijiao Dihuang decoction had significant effect on retina and vessels affected by gentamicin, which could lighten the hemorrhage of retina, reduce the inflammatory reaction, depress the expression of intercellular adhesion molecular-1 (ICAM-1), the effective treatment was very stable even after long time. The small and big dosage of Xijiao Dihuang decoction could only lighten the hemorrhage of retina. Dexamethasone had obvious effect at the first 7 days. But after longer treatment, it aggravated the inflammatory reactions.

CONCLUSIONS As a classical formula herb, Xijiao Dihuang decoction could decrease the hemorrhage and inflammatory reaction of the rabbits' retina and blood vessels induced by gentamicin, having no obvious side-effect. It would be of great value in clinical practice about the similar diseases especially on retinal vasculitis.

A most recently published study of the medicinal efficacy of rhino horn is that of Liu *et al* 2011 who undertook an analysis of the active components of rhinoceros, water buffalo and yak horns using two dimensional electrophoresis and ethnopharmacological evaluation. The results were published in *the Journal of Separation Science*, volume 34, pages 354–362

The study noted that, in order to reduce the dependence on rhino horn in Chinese medicine, researchers have started to look for other horns that could substitute for it. Different animal horns have been investigated to determine their inorganic elements, amino acids constituents, and pharmacological properties in recent decades. As a result, water buffalo horn and yak horn were shown to be similar to rhino horn in all the aspects described above. Water buffalo horn is currently widely used in China due to its abundant resources, low price, and eutherapeutic effects. Water buffalo horn was used as a substitute for rhino horn in clinical applications and produced satisfactory therapeutic efficacy, which was documented in the Chinese Pharmacopoeia in the 2010 Edition.

In this study, ethnopharmacological experiments were used to evaluate and verify the traditional efficacies of horns. Two-dimensional electrophoresis (2-DE) was used to analyze

the protein components in horns, as a result, 14 common protein spots in rhinoceros horn, water buffalo horn, and yak horn electrophoresis gels were found by image analysis.

Based on the documented efficacy, ethnopharmacological experiments including antipyretic activity, spontaneous activity, and procoagulant activity test were used to evaluate and verify the biological efficacies of the three animal horns.

The antipyretic study results showed that the rectal temperatures in rabbits were significantly increased after injection of *E. coli* endotoxin, and oral administration with rhinoceros horn, water buffalo horn, and yak horn powder caused significant lowering of body temperature, respectively.

Oral administration with rhinoceros horn, water buffalo horn, and yak horn powder showed significant activity on decreasing mice voluntary movements.

Oral administration with rhinoceros horn, water buffalo horn, and yak horn powder could significantly decrease coagulation time.

These studies confirmed the antipyretic, sedative, and procoagulant efficacy of the three kinds of horn thereby verifying their traditional effects.

There are other studies mentioned in the references of these works and other literature but they are mostly in Chinese or Japanese.

Another source of confusion has arisen over the “Statement opposing the use of rhino horn in medicines by the American College of Traditional Chinese Medicine and Council of Colleges of Acupuncture and Oriental Medicine 2011”. In it it says:

“According to TCM theories, rhino horns were used to treat typhoid fever, convulsions, macula, carbuncle and other disorders, which was the traditional use over thousands of years. However, some individuals and organizations with little understanding of the essence and modern development of TCM misinterpret and exaggerate the medicinal properties of rhino horns”.

Rather than suggest rhino horn has no medicinal properties as has been suggested, it confirms that it does have medicinal properties but these have been exaggerated. The statement also says:

“The overwhelming (increase in) demand derives from a non-traditional and unproven use – as a cure for cancer. There is *no evidence* that rhino horn is an effective cure for cancer and this is *not documented in TCM nor is it approved by the clinical research in traditional Chinese medicine*”.

That rhino horn medicine is a cure for cancer has never been a claim by TCM practitioners but is based on a rumour that came from Vietnam. In fact an undercover reporter tested several Vietnamese TCM pharmacies on this and their reaction was a unanimous rejection of the claim.

The fact is the Chinese banned the use of rhino horn in TCM in 1993 and TCM practitioners have shown a high regard for conserving endangered species. Even before the ban there is

evidence of this for example here is an extract from the 1986 book Chinese Herbal Medicine: Compiled and translated by Dan Bensky and Andrew Gamble Eastlands Press, Seattle 1986 ISBN 0-939616-03-3

“HERBS THAT COOL THE BLOOD

Cornu Rhinoceri – either the African species *Rhinoceros sinus Burchell* and *R. bicornis* L; or the Asian ones, *R. Unicornis* L., *R. Sondaicus* Desmarest, and *R. Sumatrensis* Cuvier

Properties: bitter, salty, cold Channels entered: heart, liver, stomach

Of the substances in this category, Cornu Rhinoceri (Xi Jiao) is the most effective in clearing Heart Fire and cooling the Blood. It is a primary substance for high fever and delirium, coma and convulsions as well as bleeding from Heat entering at the Nutritive or Blood levels of disease. However, it is rare and expensive, and unless absolutely necessary, Cornu Bubali (Shui Niu Jiao) can be substituted”.

Starting with the 2010 edition, Chinese Pharmacopoeia no longer includes any medicine whose ingredients are derived from endangered wild animals, and removes references to tiger bone, rhinoceros horn, and bear bile.

To conclude, many renowned rhino conservation organisations need to ensure what they state as fact can be supported by evidence. World Rhino Day 2011 set out to highlight “efforts to debunk the myths and diminish the demand for rhino horn”. However the foundation of this strategy is most probably false – that rhino horn has no medicinal value – and so the strategy will likely fail.

Is this important? Yes for if strategies to reduce the demand for rhino horn are to be successful, they must be based on the facts as to why there is a demand for the horn.

Perhaps the key fact is that conservationists actually have no data on the annual uptake of rhino horn and for what uses. Recent evidence suggests that it is being used more as a status symbol in Asia and not in TCM. How much horn is actually being stockpiled by speculators? Until the information is known, and with the South African government reportedly financing a research project there is some activity in this area, it is impossible to know what the best approach is to reduce demand but it certainly is not telling TCM users to eat their fingernails or hair.

Dr Felix Patton

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