

A Review of Scientific Literature on the Health Benefits of Velvet Antler

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I. Introduction

For more than two millennia deer and deer parts have been a source of medicine in the Orient. The velvet antler industry is growing in North America but its main market has been in Asian countries. The industry is attempting to penetrate the North American market place. To this end, there is a need to provide scientifically verified evidence on the health benefits of antler velvet that the Chinese have advocated for centuries. This report attempts to bridge the gap between Oriental and Western medicine philosophy and the benefits of velvet antler products to human health. Some benefits, such as general well-being may not be quantifiable using Western science's methods for objectively quantifying and reproducing "truths". To understand the use of antler velvet in its entire context, it is important to read the section explaining the differences in medical philosophy as well as the information pertaining to the *Materia Medica* as it explains the traditional usage of deer horn products. This will explain why certain scientific studies have been conducted and will illustrate the areas in which more scientific scrutiny is required.

The second part of this review attempts to assist the velvet antler industry in identifying scientifically proven benefits and properties of velvet antler products. Therefore, a search was conducted for published scientific studies that appear in peer reviewed scientific journals. The peer review process brings some assurance that the methods employed and results are scientifically sound. However, arguments abound about what makes good science. Scientific studies that were not published in scientific journals, testimonials and anecdotes were not considered for this report. There were three reasons for this. First, the time frame for the project did not allow for thorough gathering, investigation and reporting of anecdotal information. However, many will argue that anecdotal information is valid with new treatments. Anecdotal information also provides impetus for new scientific studies. Second, it is important for the industry and researchers to know what exists and where research needs to be conducted. Third, proponents in the industry had stated that they would like to expand marketing efforts in North America but felt they needed scientific evidence for a science-based society.

Unfortunately, some industry contacts were not willing to share information on sources of scientific peer reviewed literature. Time, language barriers and inability to pay for leads and assistance were some barriers encountered in the search. Privately funded studies that claimed health benefits were discovered but were unavailable due to proprietary rights. However, had they been made available, they would not have been included because they had not been peer reviewed. Every attempt was made to find articles through several databases. A lot of sources on animal husbandry and physiology, growth and composition of antlers were found.

The journals summarized in this review provide a good understanding of some of velvet antler's health benefits and the properties or mechanisms that provide those benefits. As noted in the section on marketing antler velvet, North Americans are buying it as a remedy for arthritis and osteoporosis. However, no studies on velvet antler's ability to ameliorate arthritis symptoms or osteoporosis were found. Two reasons may account for

this. The first is that science has not caught up with people's clinical understanding of the product. The second reason is that some studies are privately funded and therefore may not be available in the public realm. However, other health benefit factors that were identified may have a positive effect on symptoms such as anti-inflammatory properties and effect on osteal growth.

The summarized studies provide a good indication of the healing benefits of velvet antler. Chinese medicine does not advocate the indiscriminate usage of any remedy and it is very specific on the ailments velvet antler may be used for. Therefore, before using velvet antler for a specific condition, it is important to understand its effect on other bodily systems and other drug interactions. For example, if a person is using a sedative, it may have sedative-enhancing effects similar to that identified with hexobarbitol, which may not be beneficial. It appears that, in general, velvet antler has several identified health promoting effects.

Some words of caution, about using the cited studies are necessary. As many studies are done on animal subjects rather than humans, it is important to remember that humans are not rats and mice. Consequently, there may be differences in human versus animal results. All scientific evidence may not be good evidence. Generally, older studies (pre1980) may not be scientifically sound. An attempt was made to include studies since 1980. However, a small group of earlier studies have been included because they may provide some benefit for future research.

II. Chinese Medicine and Western Medicine – Different Perspectives on Health and Well-being and the Use of Antler Velvet

There are several good books and articles explaining the differences in philosophy and practice of Western and Chinese medicine. These are referenced at the end of this section. Appreciating medical practices whether they be from China or the West, requires an understanding of the societies and cultures in which people live, become ill and attempt to deal with their illnesses (Kleinman et al, 1975). What follows provides a brief explanation of the differences between the two systems.

Some Chinese medical practices, such as acupuncture, have become more popular and accepted in Western society. This is evident from the number of schools for acupuncture which have appeared. Acupuncture is accepted by some insurance companies as valid medical treatment. Scientific studies on the medical effects of acupuncture have been able to confirm the Chinese understandings of its medical use. This does not mean there has been a wholesale acceptance of any or all Chinese medical practices by allopathic (Western) medicine. Chinese medicine continues to be viewed with great skepticism by many while being highly revered by others. However, it is wrong to assume that Western medicine has a monopoly on truth and all else is superstition or that because Chinese medicine is more spiritual, holistic and ancient it is superior to Western medicine (Kaptchuk, 1983).

Western medicine is based on scientific principles which search for objective, reproducible truths. It is concerned with the human body (somatic), seeks out the causes of certain phenomena (causal-analytic) and it regards the search for causality as the only scientifically valid mode of inquiry (Porkert, 1988). Recent innovations in Western medicine are derived solely from the application of the four fundamental principles of scientific method:

1) the empirical principle, in which observation precedes hypothesis, hypothesis precedes experiment and experiment in turn is followed by reproducible observation;

2) the quantitative principle, based on the belief in the measurability of real processes and consequently the need for precise measurements;

3) the mechanical principle, expressed in the search for regularity among causal relationships and the formal abstraction of these relationships; and

4) the principle of progress which rests on the understanding of the incompleteness of present knowledge and the accompanying belief in the need for research (Unschuld, 1985).

The scientific method, by its analytic nature, has produced a medical system which is highly specialized and technical in nature (Sivin, 1987). It searches for a precise cause for a specific disease (Kaptchuk, 2000) and is mainly concerned with isolable disease categories or agents of disease which it zeroes in on, isolates and tries to change, control or destroy (Kaptchuk, 1983). Above all, it is most effective for acute, life-threatening disorders such as trauma and infection (Sivin, 1987).

The scientific medical system has dissatisfied some people because it does not have solutions to problems which appear to be more general in nature, disease causing agents are not easily identifiable and curative measures have undesired side effects or do not produce desired results. Western medicine does not appear to treat the person as a whole but chooses to categorize and focus on specific biochemical processes. Others want a more general, preventative approach which emphasizes keeping the body in balance or harmony which reduces the likelihood of illness. The dissatisfaction with Western medicine can be found in its evolution which Sivin sums up:

As the great capacity to cure acute diseases and overcome dangerous trauma evolved, the roles of doctors and patient evolved to fit the new institutions designed to maximize this capacity. The balance tipped away from general practice toward specialization, away from the home and the family doctor's office toward the hospital and the multi-doctor clinic. The patient's biochemistry and physiology became more crucial than his feelings which were apt to get in the way of decisions made by the therapist on technical grounds (Sivin, 1987).

The general dissatisfaction felt by some people should not invalidate the many benefits Western medicine has given to the world such as prevention of life threatening diseases through immunization, medicines, technological aids such as dialysis machines, treatment of trauma, advances in diagnosis and the treatment of disorders.

For the Western thinker to understand the basic philosophy of Chinese medicine, a brief explanation of its evolution is required. Chinese medicine, unlike Western medicine, did not evolve from the analytical study of anatomy. Chinese society venerated their ancestors and the study of anatomy was considered a desecration of the dead. Surgery was considered an infringement upon the sacredness of the body (Veith, 1973). As a result, the Chinese developed a naturalistic philosophy which compared human physiology to the universe. The comparative approach was based on careful observation and created a system of treatment which offered diagnosis and treatment without infringing on the sacredness of the body.

The essence of early Chinese medical thinking was that medical science did not exist by itself. The art of healing was part of a philosophy and religion which advocated oneness with nature and the universe. Chinese traditional thinking conceives of man as composed of the same elements as the universe and as functioning along the same principles as the macrocosm. During Creation, it was Tao, the Way, that caused the original state of chaos to divide into two forces, the Yin and the Yang. After creation was completed, Tao guided the functions of everything in the universe while Yin and Yang, in their ebb and flow of opposition and attraction to each other, maintained proper balance and harmony. Man, who was created with the universe and in its image, owed his health and his life to the harmony of the natural forces. If this harmony was upset, the result was disease and death. It was up to man to shape his fate by compliance with Tao, thus keeping proper balance of Yin and Yang, the two opposing forces. Through this philosophy, the ancient Chinese arrived at two extremely important conclusions: first, that disease is rarely localized, but generally affects the entire human being; and secondly that disease is often derived from the infringement of a moral law (Veith, 1973).

Chinese traditional medicine developed a set of remedies whose use was guided by the theories about the functioning of the body and its relationship to the world around it. It encompasses the use of herbs and drugs, acupuncture, massage techniques, chiropractic, breathing and physical exercise, use of compresses and fuming or steaming therapies (Yanchi, Vol.1, 1988). The Chinese naturalistic philosophy embraces the concepts of Yin and Yang the function circles or meridians. Yin and yang result from one point which contains two parts. Females have more Yin than males and males have more Yang than females but each has some of both. Yin is associated with the moon, the back, down and cold. Yang is associated with the sun, the front, up and heat. Disease is caused by the imbalance or disharmony between these two.

It was through its naturalistic philosophy that Chinese medicine came to treat each individual specifically rather than classifying diseases and administering a general treatment for a disease. The Chinese physician directs attention to the complete physiological and psychological individual. Chinese medicine wants to know how a symptom fits into a patient's entire bodily pattern. The symptom is only one part of a complete bodily imbalance that can be seen in other aspects of a patient's life and behaviour (Kaptchuk, 1983).

In spite of the advent of Western practices, the Chinese have never completely ceased to employ their own art of healing mainly because it continued to fit into their specific philosophy of life but also because frequently it was good medicine (Risse, 1973). After the Chinese Revolution in 1949, some of China's new leaders wished to accept modern medicine while others wanted to discard the practical and theoretical usefulness in the traditional medicine. The result was thousands of experiments and clinical studies during the 1950s which upheld the principles of Chinese medicine demonstrated that it works clinically (Kaptchuk, 1983). For social, economic and medical reasons benefiting the population, there have been attempts to blend Western and Chinese medicine practices. There has been recognition that each has something good to offer. However, until the philosophical and theoretical problems are well understood, there will not be a comfortable relationship between the two methods (Porkert, 1988).

Each system has its inherent strengths and weaknesses. They have the potential to compliment each other because of their different services and approaches to healing. Evidence can be found illustrating that in certain situations both Western and traditional Chinese medicine is effective. A Western doctor will successfully prescribe the same course of treatment to a group of patients with the same identified disease. The Chinese medicine practitioner, on the other hand, will administer a different treatment to each person after taking into consideration all other manifestations of imbalance (physiological, emotional, and psychological). Both Western and Chinese treatments were successful although their approaches and philosophies differed greatly. Therefore, the two different systems, despite their differing perceptions can affect and often heal human beings regardless of their cultural affiliation (Kaptchuk, 2000).

North American medical philosophy, being Western, is causal/analytical and seeks to treat a specific disease with a specific treatment. Therefore, there is great skepticism when traditional medicine from another culture is introduced. There are concerns over safety, purity and dosage. There are greater concerns that people are self-diagnosing and self-medicating. Problems with self-diagnosis include incorrect diagnosis resulting in drastic consequences from a disease or ailment which could have been easily treated in its early stages. It is remarkable that Chinese medicine practitioners, like allopathic doctors also do not advocate self-diagnosis. Before a Chinese practitioner prescribes a nutraceutical or life style change, all factors regarding a person's state of health are considered. It is possible to have side effects which we do not understand when using a treatment in a cause and effect manner when it was designed bring balance to a specific disruption in the bodily system.

When contemplating the use of velvet antler, the following points must be considered:

- 1) Taking antler velvet has some proven health benefits. Evidence for this exists from scientific testing and through centuries of empirical use in China. There is Western scientific evidence to substantiate some of the claims made by users of Chinese practitioners.

2) When taking supplements or nutraceuticals without the guidance of an allopathic doctor or practitioner of oriental medicine, do not use them beyond recommended dosages and be very aware of how your body feels before and after using the supplements. Continue annual medical examinations and contact a physician for persisting or unexplained ailments.

3) The Chinese do not use antler velvet indiscriminately or as a food supplement. It, like all Chinese herbs and medical treatments, is used after careful consideration of all symptoms (physiological, psychological, and spiritual). The Chinese generally do not prescribe it to the young except to weak and sickly child as it is considered to be adding energy or fire to the body. It is used by the “elderly” who lack the vital energy. Overuse may, in the words of one Chinese practitioner, cause imbalance in the system which may not be beneficial by causing the system to “burn out”. Anything taken in quantities beyond what the body needs for proper function, may have detrimental effects.

Although a person may have a treatable symptom as described in the usage of velvet antler in the Chinese Materia Medica, it does not automatically mean that velvet antler is the appropriate prescription. For example, it must be determined if the symptom is due to a yin deficiency or a yang excess and in what channel or meridian the imbalance is occurring. Taking a prescription without proper diagnosis may create further imbalances and problems.

4) Velvet antler use is popular in modern society because people work too hard and Yin needs Yang support for extra energy and heat. This is also why antler is becoming more popular with athletes. They use it for strength and it is believed that strength comes from deer blood. However, not all preparations of antler velvet will pass anti-doping tests. Those, in combination with other ingredients, are less likely to pass and the ingredients causing the problems have not been identified (Ping, Chinese Olympic Anti-Doping Commission, conversation, 2000).

Notes from the Rare Chinese Materia Medica and the Chinese Materia Medica

The following is a compilation of information on the use of pilose (velvet) antler from the Rare Chinese Materia Medica and the Chinese Materia Medica. A brief explanation of some concepts and terminology has been included.

The Chinese word for pilose antler (*Gornu Cervi pantotrichum*) is *Lurong*. Pilose means hairy or velvety. Both Matria Medica books refer to the use of antler from sika (*Cervus nippon Temminck*) and red deer *Cervus elaphus Linnaeus*). The Rare Chinese Materia Medica also contains a description of counterfeits made from bone glue or other animal bones and wrapped in fur.

The medicine has a sweet and salty flavor, is warm in property and acts on the liver and kidney channels. Its actions and indications are:

1. Reinforcing or replenishing the *kidney-yang*. Insufficiency of the kidney-yang are manifested as aversion/intolerance to cold, coldness in the extremities, impotence, premature ejaculation, sterility due to cold uterus, frequent urination, soreness of the loins and knees, dizziness, tinnitus, listlessness, mental fatigue, etc. It can be used alone or in combination with other herbs such as ginseng.

2. Tonifying the vital essence, blood and strengthening the bones and muscles. It is used for weakness of muscle and bones, maldevelopment of children, delayed walking and dentition and infantile metopism. The Chinese Materia Medica states that for these symptoms, pilose antler is used to treat the deficiency of both kidney and liver functions. It is often used in combination with other herbs and roots.

3. It is used for the treatment of insufficiency of essence of the *chong* and *ren* channels and whose deficiency and coldness produces metrorrhagia and metrostaxis. It is also used for the treatment of profuse leucorrhea which is due to the in consolidation of the *dai* channel.

4. It has the effects of warming and tonifying yang, thereby promoting pus drainage in the treatment of a deep-rooted carbuncle of yin nature or protracted ulcerations without healing. Therefore, it is efficacious in the treatment of protracted skin and external diseases.

Precautions:

This drug should be given to patients in small dosage at the beginning rather than in large dosages so as to avoid side-effects manifested as dizziness and conjunctival congestion or symptoms of impairment of yin. This drug is warm in property, so it should not be used in cases of hyperactivity of yang due to deficiency of yin, excess heat in the blood system, excessive stomach fire, accumulation of phlegm and heat in the lung, exopathic and epidemic febrile diseases.

Notes from the Korean Book of Medicine, 1983

The character of deer horn is that it is warm, it has a sweet taste and it affects the heart, liver and kidney systems. Its main effects are to:

- 1) make blood thereby complementing heat energy;
- 2) create stamina and blood thereby complementing cold energy;
- 3) treat the weaknesses and defection of the kidney system;
- 4) treat men who have weakness and shortage of stamina;
- 5) treat women who have massive menstrual bleeding; and
- 6) make strong muscle and healthy bone marrow.

Deer horn complements heat energy. If you have weak heat energy congenitally, then your physiological mechanism is weakened as is the immune system. For this, deer horn supplies heat energy, nutritional elements, vitality and stamina. Deer horn from Mongol, Siberia (far northern region) is the best because deer can survive when they have proper heat energy in a tough, cold environment. Male deer has strong heat energy and most of that energy goes to the horn as well as stamina and blood.

The main pharmacological effect of deer horn is to strengthen the heat energy of the kidney and liver systems. It activates the physiological function of the liver and kidney. It is able to treat diseases that have resulted from the congenital weakness of the heart and kidney systems.

The kidney system is in charge of essential fluid and bone marrow. Activation of the kidney system improves the production of new platelets and bone marrow. It can improve the activity of body fluid (including blood and hormones). It stimulates and improves the central nervous system. It improves the ability of feedback control.

Care must be exercised in the use of deer horn with children or the person who has a lot of heat in the heart and upper body (chest to head) to avoid excess heat in these areas.

In many cases, deer horn is good for women. It works in the case of shortage of blood and spontaneous abortion and difficulties in pregnancy caused by the dysfunction of hormonal secretions.

Deer horn is good for diseases caused by over-fatigue.

A Brief Explanation of the Information in the Chinese Materia Medica

For a complete understanding of the concepts used in Chinese medicine, consult the sources listed in the references. If you wish to use antler velvet for any of these ailments, please consult with a qualified practitioner. An explanation of the functions of the Kidney channel will clarify the context in which antler velvet is prescribed in Chinese medicine.

Kidney-yang:

While the heart, liver, spleen, lung and kidney share the same names in both the Chinese and Western medicine, the concept of an organ in Chinese medicine is not the same as for western science. In Chinese medicine, each organ is a system which includes other tissues, sense organs, and pathways which interconnect these parts to form the channel system. The kidney is connected by channels to three body orifices: the ears, the genitals and the anus. Hearing depends on kidney qi (life force) as does reproduction. The kidney system promotes the discharge of urine and elimination of wastes through the anus (Yanchi, Vol.1, 1988).

The kidneys, like all organs, have a yin and yang aspect. Yin is the kidney's storing activity which is called either Jing or Water. The kidneys rule water through their Yang aspect, the Life Gate of Fire. This Fire transforms water and all circulation of water in the body depends on the vaporizing power of the kidneys (Kaptchuk, 2000). The kidney is purported to store genuine yin and yang or vital essence which is the material basis of life. Essence is the source of reproduction, development and maturation. Therefore, reproductive problems such as sterility or impotence and developmental disorders like retarded growth and sexual maturation are seen as dysfunctions of the kidney's storing of

essence (Kaptchuk, 2000). The kidney function is regarded as a source of the body's resistance and endurance, of physical, emotional and spiritual tenacity. It's makeup largely determines whether a person can withstand physical exertions, mental anguish, nervous strain and stressful circumstances or if extreme cold or heat can be endured (Porkert, 1988).

Other functions controlled by the Kidney system are:

- a) the production of marrow. The vital essence stored by the kidney forms bone marrow;
- b) regulation of water in the body. The kidney regulates water circulation by its ability to transport clear fluid upward, to discharge turbid fluid downward and to reabsorb fluids in large quantities;
- c) helps coordinate respiration. Although respiration is controlled by the lung, it is coordinated by the kidney during inhalation by directing the qi downward; and
- d) storage of determination. When kidney qi is abundant, an individual will demonstrate determination as it produces rich essence and marrow resulting in good memory, vigor, wisdom and well-developed skills. However, when kidney qi is weak, symptoms such as poor memory, low spirits, a lack of aspiration and premature senility may appear. (Yanchi, Vol.1, 1988).

Definitions

Chong Channel: it is known as “the sea of blood”. It controls the qi and blood for the entire body. It originates in the uterus or genital organs. (Yanchi, Vol.1, 1988)

Dai Channel: Dai means belt. It is seen as a belt binding the yin and yang channels. (Yanchi, Vol.1, 1988)

Ren Channel: Ren means responsibility. This Channel is responsible for all the yin channels. Ren also connotes nourishing. It is said to govern the development of the fetus and therefore in women originates in the uterus where the fetus is nourished. (Yanchi, Vol.1, 1988)

Metrorrhagia: uterine bleeding, usually variable amount, occurring at completely irregular but frequent intervals, the period of flow sometimes being prolonged. (Dorland's, 1994)

Metrostaxis: a slight but persistent escape of blood from the uterus (Dorland's, 1994)

Conjunctival: pertaining to the conjunctiva which is the delicate membrane that lines the eyelids and covers the exposed surface of the sclera (Dorland's, 1994)

Febrile: pertaining to or characterized by fever (Dorland's, 1994)

Exopathogen: Exo: a prefix meaning outside or outward
 Pathogen: any disease producing organism

Exopathy: a disease originating in some cause lying outside the organism. (Dorland's, 1994)

Metopism: the persistence of the frontal suture [the usually transient line of junction between the right and left halves of the frontal bone (forehead)] (Dorland's, 1994) Therefore, **infantile metopism** occurs when the line or split between the halves of the frontal bone have not grown together within a reasonable time period.

Leucorrhoea: A discharge of a white, yellowish, or greenish, viscid mucus, resulting from inflammation or irritation of the membrane lining the genital organs of the female. (The On-Line Medical Dictionary) <http://www.graylab.ac.uk/cgi-bin/omd>

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III. Velvet Antler Literature Review

The following is a summary of scientific literature that supports the health effects of velvet antler. Some studies stated the deer species from which the antler preparations were made and others did not. Due to copyright law, copies of the scientific studies cannot be reproduced for this review. The summaries provide basic information about experiment results. Summaries cited are fully referenced. A glossary of terms follows this section to assist the reader with some terms and concepts. For the reader's convenience, words defined in the glossary have been put in bold the first time they are used.

Some words of caution, about using the cited studies are necessary. As many studies are done on animal subjects rather than humans, it is important to remember that humans are not rats and mice. Consequently, there may be differences in human versus animal results. All scientific evidence may not be good evidence. Generally, older studies (pre1980) may not be scientifically sound. An attempt was made to include studies since 1980. However, a small group of earlier studies have been included because they may provide some benefit for future research. It is important to note that although there are many reported benefits, velvet antler has some attributes reported in the following summaries which may not be beneficial to people because of their medical status.

1. ANTI-AGING PROPERTIES

1.1 MONOAMINE OXIDASE ACTIVITY

Monoamines are neurotransmitters in an animal's nervous system. During oxidation, monoamines are converted by **monoamine oxidase** (MAO). This oxidation causes a decrease in the amount of monoamines and MAO and causes damage in nervous system. There are two types of MAO: MAO-A and MAO-B. Increased MAO activity shows an aging effect in animals. MAO-B activity increases with age and is responsible for some senile diseases.

Chen, X., Jia, Y. and Wang, B. X. 1992. Inhibitory effect of the extract of pilose antler on monoamine oxidase of aged mice. Chung Kuo Chung Yao Tsa Chih. 17(2): 107-110.

This experiment measured the effect of a water extract of pilose antler on monoamine oxidase activity and monoamine contents of young (one month old) and old (18 months old) mice. The extract was from *Cervus nippon Temminck var. mantchuricus Swinhoe*.

To measure the effects of the extract on MAO activity in the brain of mice *in vitro*, MAO was prepared from the brain tissues of young mice. The results show that the extract significantly inhibited the activity of MAO-B but not MAO-A. The inhibitory function for MAO-B increased as the concentration of the extract increased.

To measure the effect of the extract on MAO activity in the brain and liver tissues of young and aged mice, the extract was orally administered once a day for 10 days. One hour after the last administration, brain and liver tissue samples were examined. Compared to the younger mice, the older mice had distinctly higher levels of MAO-B and low levels of MAO-A. The extract was shown to inhibit MAO-B activity in the brain and liver tissues but had no effect on the MAO-A activity. The effect was more significant in the older mice than in the young mice. Inhibitory effects increased as concentration increased.

The effect of the extract (1.0g/kg) on monoamine contents (5-HT, NE and DA) was also measured. Generally, older mice not only have a significantly higher level of MAO activity but also lower levels of monoamines. Lower doses of extract had no effect on monoamine contents for both young and aged mice. Higher doses significantly increased monoamine contents in the brain tissue of aged mice. The effect on the monoamines in the brain tissue of young mice was not significant.

Additional experiments suggest that the extract caused competitive inhibition for MAO-B and mixed inhibition for MAO-A. However, the mechanism for the inhibition was not identified.

Chen, X., Wang, B.X. and Wu, Y.D. 1990. Inhibitory effect of total lipids of pilose antler on monoamine oxidase activity. Chinese Traditional and Herbal Drugs. 21: 501-504.

This study used water extract of pilose antler to examine the effect on liver and brain MAO activity in mice. The experimental methods and the results were similar to the previous experiment. The results show that a higher concentration of antler extract increases monoamine (5-HT, NE and DA) contents in aged mice. MAO activity decreases with increase in time and the antler extract had competitive inhibition on MAO-B and a mixed inhibition on MAO-A.

Wang, B.X., Zhou, X.H., Qi, S. B., Kaneko, S., Hattori, M., Tsuneo, N. and Nomura, Y. 1988. Effects of repeated administration deer antler extract on biochemical changes related to aging in senescence-accelerated mice. Chem. Pharm. Bull. 36(7): 2587-2592.

This study examined the influence of repeated administration of a water extract of unossified pilose antler from *Cervus nippon Temminck var. manchuricus Swinhoe* (Rokujo) on some biochemical parameters that change with age. The preparation was administered to **senescence-accelerated** male mice, **senile prone (SAM-P) and senile resistant (SAM-R)**. Rokujo effects SAM-P more markedly than SAM-R.

In terms of general behaviour, SAM-P at age 11-12 months displayed physical symptoms of senescence such as loss of spontaneous activity, hair and skin disorders and periophthalmic lesions. The SAM-R group displayed fewer signs. There was no marked improvement in the appearance of either group in comparison with the control group.

Plasma testosterone was measured because many endocrine secretory functions tend to decline with aging. The plasma testosterone levels in SAM-P were half of the SAM-R group. Levels for both groups increased with repeated oral administration of the extract but the increase was significant only for the SAM-P group. The effect was also dependent on dose.

The effect of the extract on malondialdehyde, a product of **lipid peroxidation**, was measured on the liver and brain tissue of senile-prone and senile resistant mice. More malondialdehyde-like substances were found in the liver of senile prone animals. A marked difference in brain tissue was not observed between the two groups. The extract did not affect the tissues of senile resistant mice but showed a marked decrease in the brain and liver tissues of senile prone mice.

The treatment did not change the wet weight of desiccated whole liver. However, it produced an increase in liver protein content in the senile prone mice.

Superoxide dismutase (SOD) is a free radical scavenger. Its activity was measured in liver. SOD activities were lower in the saline-treated group of senile prone mice than in

the senile resistant mice. In the senile prone group, the decreased SOD activities recovered significantly towards the normal senile resistant levels after treatment with the extract. The increased activity of SOD will decrease free radical activity i.e. oxidizing degradation of biochemical substances.

Wang, B.X., Zhou, X.H., Qi, S. B., Kaneko, S., Hattori, M., Tsuneo, N. and Nomura, Y. 1988. Stimulating effect of deer antler extract on protein synthesis in senescence-accelerated mice *in vivo*. Chem. Pharm. Bull. 36(7): 2593-2598.

The results from the study summarized previously (Wang et al, 1988) which showed increased liver protein synthesis may explain the restorative effects resulting from the clinical application of Rokujo. To test this, this study investigated the effects of Rokujo on the metabolism of protein, messenger ribonucleic acid (RNA) and deoxyribonucleic acid (DNA) in senescence-accelerated mice using **radioactive isotopes**. The serum protein content in senescence accelerated prone mice was significantly increased after treatment with the extract for 20 days at a rate of 200 and 300mg/kg/d. Values were 41% and 49% respectively above control values.

Protein, RNA and DNA synthesis in organs showed that the incorporation rates of [¹⁴C]Leu were physiologically higher than the other tissues and increased as the dose increased. These increases paralleled the increases in [¹⁴C]uridine incorporation into RNA but not with [³H]thymidine incorporation. There were no significant changes in values for the brain and heart.

Although a brief exposure to the extract did not directly affect **polymerase** activity, the activity of RNA polymerase II in solubilized liver nuclei was markedly accelerated thereby suggesting that this increased activity is responsible for the increase in protein synthesis.

1.2 THE ACTIVE INHIBITORY COMPOUND FOR MONOAMINE OXIDASE B

Wang, B.X., Zhou, X.H., Yang, X. W., Kaneko, S., Hattori, M., Tsuneo, N. and Nomura, Y. 1988. Identification of the inhibitor for monoamine oxidase B in the extract from deer antler (Rokujo). Journal of Medical and Pharmaceutical Society for WAKAN-YAKU. 5:116-122.

Wang et al (1988) conducted further studies with Rokujo to identify the active compound that is inhibiting the MAO-B activity. The sliced pilose antler was extracted six times with different reagents. The six different extractions were examined on mouse liver (MAO-B source). The **butanol** and **diethylether** extracts suppressed MAO-B activity. But the butanol extract showed more potency against MAO-B activity. This extract was found to be a complex of several other compounds. One of them, **hypoxanthine**, shows the same suppressing characteristics against MAO-B as the extract itself does. On the

other hand, the diethylether extract has cholesterol as its main component. So it was suggested that the main anti-aging compound in Rokujo is hypoxanthine.

2. ANTI-FUNGAL ACTIVITY

Park, H. S., Jhon, G. J. and Choi, W. 1998. Deer antler extract selectively suppresses hyphal growth in dimorphic fungus, *Candida albicans*. J. Microbiol. Biotechnol. 8(3): 291-294.

The fungus ***Candida albicans*** is one of the normal human flora. But it shows opportunistic infections in **immunocompromised** patients. The anti-fungal activity of antler was tested in relation to the suppression of the pathogenicity of *Candida albicans*. Whole antler extract (*Cervus nippon*) was prepared into two sub-extracts the soluble parts (subfraction A) and insoluble parts (subfraction B). The effectiveness of the two extracts was tested on the **hyphal** and yeast forms of the fungus. The hyphal form is the pathogenic form. The extracts in their high concentrations suppressed hyphal activity significantly but had no effect on the yeast form or the non-pathogenic form. It was suggested that antler extract could be used as an anti-fungal agent for immunocompromised patients without causing any side effects.

Park, H.S., Jhon, G.J. and Choi, W. 1998. Hyphal growth inhibition by deer antler extracts mimics the effect of chitin synthase deletion in *Candida albicans*. J. Microbiol. Biotechnol. 8(4): 422-425.

To identify the means by which deer antler extract inhibits hyphal activity, the enzyme activities of **chitin synthases** were examined. **Chitin** appears to be crucial in *Candida* morphogenesis and in its transition to the hyphae form. The effect of antler extract on the enzyme chitin synthase was examined as it synthesizes chitin in the growing hyphae cell wall. In *C. albicans* there are three chitin synthases named CACHs1, CACHs2 and CACHs3. CACHs1 is believed to promote the crucial step in hyphal transition. All three synthases were inhibited by the extract and CACHs1 was the most sensitive. These results correlate with previous results about deer horn's ability to cause hyphal suppression probably through direct inhibition of chitin synthases.

3. ANTI-INFLAMMATORY ACTIVITY

Shin, K.H., Lee, E.B., Kim, J.H., Chung, M. S. and Cho, S.Y. 1989. Pharmacological studies on the powdered whole part of unossified antler. Korean J. Pharmacogn. 20(3): 180-187.

Powdered antler did not have a significant effect of decreasing the effects of induced edema in male rats. Powdered antler was administered orally to male rats twice a day for three days. 30 minutes after the final dosage a 0.1ml of 1% carageenan solution was injected subcutaneously in to the centre of the left rear foot. The rate of edema was

measured. A hydrocortisone injection showed a significant anti-inflammatory effect. The powdered antler exhibited no effect.

Zhang, Z.Q., Wang, Y., Zhang, H., Zhang, W. Zhang Y., Wang, B.X. 1994. Anti-inflammatory effects of pilose antler peptide. Acta Pharmalogica Sinica. 15(5): 282-284.

Pilose antler **peptide** (PAP MW 7200; amino acid residue 68) was isolated from the antler of *Cervus nippon Temmick*. It was shown to produce inhibitions towards acute and chronic inflammations in a dose-dependent manner. In adrenalectomized rats, PAP showed an anti-inflammatory action on carageenan-induced hind paw swelling. It was shown to reduce ascorbic acid and cholesterol contents and also to reduce serum hydrocortisone levels. Dexamethasone treatments did not affect ascorbic acid and cholesterol contents. Therefore, the anti-inflammatory effects of PAP do not totally depend on the pituitary-adrenal system.

3.1 PURIFICATION OF ANTI-INFLAMMATORY COMPOUND

Zhao, Q.C., Kiyohara, H., Nagai, T. and Yamada, H. 1992. Structure of the complement-activating proteoglycan from the pilose antler of *Cervus nippon Temminck*. Carbohydrate Research. 230: 361-372.

The pilose antler of *Cervus nippon Temminck* is reported to possess **anti-complementary** activity. **Complement activation** in our serum results in an inflammatory response. Zhao et al (1992) conducted the experiment to purify the active component that produces the anti-inflammatory effect. The antler extract was fractionated with several purification processes. A high molecular weight component labeled DWA-2, showed anti-complementary activity. This component consists mainly of **glycosaminoglycan** and **chondroitin sulfate** A- and C- like substances. It is suggested that these components of DWA-2 might be responsible for showing anti-complementary activity.

4. ANTI-NARCOTIC ADDICTION ACTIVITY

Kim, H. S and Lim, H.K. 1999. Inhibitory effects of velvet antler water extract on morphine-induced conditioned place preference and DA receptor supersensitivity in mice. Journal of Ethnopharmacology. 66: 25-31.

Morphine is an addictive drug that can cause **conditioned place preference** (CPP) and postsynaptic **dopamine** (DA) receptor supersensitivity as a result of repeated administration. The results indicate that velvet antler may be a useful treatment as in the prevention and therapy from the adverse effects of morphine.

Velvet antler water extract from *Cervus elaphus* was shown to inhibit morphine induced conditioned place preference in mice. Postsynaptic dopamine supersensitivity which had developed as a result of morphine treatment, was inhibited by the extract. Groups pretreated with 50 and 100 mg/kg of velvet antler extract showed no conditioned place preference but the group pretreated with 200 mg/kg showed a significant inhibition of morphine-induced conditioned place preference. Morphine was administered at 5 mg/kg.

The **ambulatory** activity induced by apomorphine was enhanced after a treatment with morphine. Compared to the morphine control group, the groups pretreated with 100 and 200 mg/kg of extract showed significant inhibitions in morphine induced ambulatory activity whereas the group pretreated with 50 mg/kg did not.

Cage climbing, an **apomorphine**-induced (2 mg/kg apomorphine) striatal dopaminergic behaviour, was not inhibited by a single dosage of extract. Therefore, in terms of cage-climbing behaviour, the extract has negligible antidopaminergic activity at post synaptic dopamine receptors. Postsynaptic dopamine receptor supersensitivity did not develop as apomorphine-induced ambulatory activity was not inhibited with the pretreatment with 50, 100 or 200 mg/kg of extract when compared to the control group.

Kim, K.W., Lim, H. K and Park, W.K. 1999. Antinarcotic effect of the velvet antler water extract on morphine in mice. Journal of Ethnopharmacology. 66: 41-49.

Morphine is an **analgesic** which after repeated administration, results in analgesic tolerance and physical dependence. The effects of velvet antler water extract from *Cervus elaphus*, on analgesia showed that pretreatment with the extract at 50, 100 and 200 mg/kg did not antagonize morphine-induced analgesia. **Analgesic tolerance** was demonstrated after the repeated administration of morphine (10 mg/kg) once a day for 6 days. Significant inhibition of morphine-induced analgesic tolerance was shown in groups pretreated with 100 and 200 mg/kg doses of the extract of about 3 times and 5 times respectively.

Morphine treatment shows increased ambulatory activity (hyperactivity). Compared to the control group, groups pretreated with 50, 100 and 200 mg/kg of extract did not show significant inhibition of ambulatory activity.

Velvet antler water extract was shown to have inhibitory effects on the development of dopamine receptor supersensitivity in morphine-induced reverse tolerant mice. Groups pretreated with 100 and 200 mg/kg of the extract showed significant inhibition of enhanced ambulatory activity caused by apomorphine by 40% and 41% respectively while a treatment of 50 mg/kg did not show significant effects.

The authors cite literature which shows that keratin inhibits analgesic tolerance to and dependence on morphine. Velvet antler is rich in **keratin**. Therefore, it is postulated that the effects of velvet antler water extract may be associated with keratin as it increases the **glutathione** level for detoxification.

5. ANTI-ULCER ACTIVITY

Wang, B.X., Liu, A.J., Cheng, X.J., Wang, Q.G., Wei, G.R., Cui, J.C. 1985. Anti-ulcer activity of the polysaccharides isolated from pilose antler. Acta Pharmaceutica Sinica. 20(5): 321-325.

This study found that **polysaccharides** isolated from pilose antler (PPA) have significant anti-ulcer activity when administered orally at doses of 500 and 250 mg/kg. It was found to be effective on stress-restraint ulcers, acetic acid ulcers and **pyloric ligation** ulcers. However, it was ineffective in **indomethacin** induced ulcers. PPA was found to decrease the gastric acid and pepsin activity in gastric juice. In the gastric juice in rats treated with **pentagastrin**, PPA inhibited the increase in gastric acid and raised the level of **PGE₂**. PPA showed no effect on gastric acid or level of PGE₂ levels in rats treated with **pilocarpin** and **histamine** or in rats treated with aspirin. As the polysaccharides may decrease gastric acid secretion, it may have the effect of protecting the gastric mucous membrane from injury.

6. CARDIOVASCULAR EFFECTS

Clifford, D. H., Lee, M. O., Kim, C.Y. and Lee, D.C. 1979. Can an extract of deer antlers alter cardiovascular dynamics? American Journal of Chinese Medicine. 7(4): 345-350.

This study was conducted to determine if an ethanol extract from Korean deer antler would modify cardiovascular function. Dogs under light **halothane** anesthesia were used to evaluate the effects. Eleven cardiovascular functions were measured: cardiac output, stroke volume, heart rate, mean arterial pressure, pulse pressure, central venous pressure, total peripheral resistance, pH, PaCO₂, PaO₂ and base deficit. Stroke volume was consistently elevated during the period of observation and significantly elevated at two time intervals. Other values were not altered significantly. Stroke volume is the amount of the blood pumped out of the ventricle with its single contraction. In this model, antler extract does not appear to have a great acute effect on the cardiovascular system.

Huang, S. L., Kakiuchi, N., Hattori, M. and Namba, T. 1991. A new monitoring system of cultured myocardial cell motion effects of pilose antler extract and cardioactive agent on spontaneous beating of myocardial cell sheets. Chem. Pharm. Bull. 39(2): 382-387.

The effect of a water extract of antler from *Cervus nippon Temminck* var. *mantchuricus Swinhoe*, was measured with a new monitoring system of myocardial cell motion using a microcomputer-driven image analyzing method. In the standard medium, the extract at concentrations of 0.01 – 0.1 mg/ml showed no significant effect on the beating rate and the beating amplitude. The extract and its fractions increased the beating amplitude significantly in the low Ca²⁺ (calcium ion) medium but decreased the beating rate. The extract and its fractions were **inotropic** (increase in strength) rather than **chronotropic**

(increase in rate) when the spontaneous beating of the myocardial cell sheet was suppressed under low Ca^{2+} ion conditions.

Tsujibo, H., Miyake, Y., Maruyama, K. and Inamori, Y. 1987. Hypotensive compounds isolated from alcohol extract of unossified horn of *Cervus elaphus* L var. *xanthopygus* (Rokujo) 1. Isolation of lysophosphatidyl choline as a hypotensive principle and structure activity study of related compounds. Chem. Pharm. Bull. 35: 654.

The alcohol extract of Rokujo is known as Pantocrin in Russia. A reported pharmacological activity of Pantocrin is its **hypotensive** activity. The purpose of this study was to isolate the active compound causing this effect using the antler of *Cervus elaphus* L. var. *xanthopygus*. Two hypotensive compounds were isolated and one of them was showing similar physicochemical actions as **lysophosphatidyl choline**. This compound was found to consist of eight **fatty acids** with palmitic acid being the dominating component.

The study measured the effects of the various lysophosphatidyl cholines (LPCs) on the blood pressure in anesthetized spontaneously **hypertensive** rats. Hypotensive activity was observed at dose levels higher than 1.0mg/kg. Activity increased strongly with increasing dosage of LPC. A transient hypotensive effect was produced by LPC and blood pressure recovered to the original level within one minute. Pronounced hypotension in **normotensive** rats was also observed.

In examining the relationship between fatty acid composition and hypotensive activity in SH rats, the results showed that in the LPCs with $\text{C}_{10:0}$ to $\text{C}_{20:0}$ fatty acids had a hypotensive effect except for fatty acids $\text{C}_{10:0}$ to $\text{C}_{20:0}$. The effects of LPC on blood pressure was tested on anesthetized rats. LPC $\text{C}_{14:0}$ showed the strongest hypotensive activity followed by $\text{C}_{16:0}$. $\text{C}_{16:1}$ LPC showed the hypotensive effect among LPCs with unsaturated fatty acids. LPC isolated from the alcohol extract of Rokujo is rich in $\text{C}_{16:0}$ and $\text{C}_{16:1}$ acids.

As LPC has **hemolytic** activity, the relationship between this activity and hypotensive activity was also examined. Using the red blood cells of rats, it was shown that hemolytic activity was strongest amongst $\text{C}_{18:0}$, $\text{C}_{18:1}$ and $\text{C}_{16:0}$ LPCs. However, $\text{C}_{14:0}$ which had the highest hypotensive activity, had moderate hemolytic activity and $\text{C}_{18:1}$ completely lacked hypotensive activity.

7. PROTECTIVE EFFECTS

Kim, Y.H., Shin, M.K., Lee, S.I., Lee, H. I. and Kim, W.H. 1979. Influence of the administration of Cervi cornu on the serum protein contents and prothrombin time in rats. Kyung Hee University Oriental Medicine Journal. 2: 61-68.

Each group of four rats was administered an antler extract of either elk, red deer, reindeer or formosa deer. They were then given a solution of CCl_4 (carbon tetrachloride) to

induce liver damage. One hour later, each group was administered a dose of the same antler extract. 48 hours after receiving the CCl₄, tests were conducted to measure **serum** albumin contents, serum total protein and prothrombin time.

In measuring **serum albumin** contents, the control group (CCl₄ only) mean was lower than for the normal group which did not receive CCl₄. Those receiving elk and reindeer had serum albumin content values closer to that of the normal group. The values for those receiving formosa deer extract had the highest values while the red deer results showed improvement from the control group but did not reach the values exhibited by the normal group.

The results for serum total protein contents showed that those receiving elk and formosa deer extracts had average results which were greater than for the control group and were also statistically significant.

Prothrombin is a clotting factor. In testing plasma prothrombin time, those receiving formosa deer extract had the shortest clotting time when compared to the control group. Elk and red deer also had significantly shorter clotting times than the control.

These results show the protective effect of antler extract. There was less cellular damage to the liver thereby allowing its protein making ability to continue even though in all cases its capacity was diminished as compared to the control.

Choi, D.Y., Shin, M.K., Lee, H.I. and Kim, W.H. 1979. A study on the effect of Cervi cornu against CCl₄ -induced liver damage in rats. Kyung Hee University Oriental Medicine Journal. 2: 43-51.

This experiment is similar to the one previously described. Rats were orally administered a dosage of deer horn extract for three days. On the third day, CCl₄ was administered one hour after the administration of deer horn extract. 48 hours later, blood samples were analyzed to measure enzyme levels and serum total cholesterol contents.

Serum **alkaline phosphatase** activity results showed that antler from all species, elk, red deer, reindeer and formosa deer had statistically significant lower levels of activity than the control group.

Extract from all deer species showed serum **glutamic oxaloacetate transaminase** (S-GOT) activity was less than the control group. The difference in average values as compared to the control group was not statistically significant. Control and specie group values were 3x to 4x higher than for the normal group that did not receive CCl₄.

Serum **glutamic pyruvic transaminase** activity for rats administered elk, red deer and reindeer extracts was significantly lower than the control group. Red deer extract showed highly significant results. Formosa deer extract results were not significant. All results were 6x to 7x higher than the normal group that did not receive CCl₄.

Serum total cholesterol contents in rats treated with CCl₄ showed statistically significant values for each trial group as compared to the control group. Antler extract from all four species, elk, red deer, reindeer and formosa deer, showed lower mean total cholesterol content values than the control.

herefore, this paper demonstrated that deer horn extract has some protective effects on induced **intracellular** liver damage. It may stabilize cellular membranes thus allowing the liver to maintain some of its normal metabolic functions.

8. GROWTH FACTORS IN VELVET ANTLER

Ko, K.M., Yip, T.T., Tsao, S. W., Kong, Y.C., Fennessy, P., Belew, M.C. and Porath, J. 1986. Epidermal growth factor from deer (*Cervus elaphus*) submaxillary gland and velvet antler. Gen. Comp. Endocrinol. 63: 431-440.

Scientists isolated **epidermal growth factor** (EGF)-like activity in the **submaxillary gland** (SMG) and velvet antler from male red deer (*Cervus elaphus*) ages 18 to 24 months.

Radioreceptor assay (RRA) binding curves provided evidence for the presence of **cervine** EGF-like (cEFG) activity in the SMG and antler velvet tissues. The SMG and serum had low levels of EFG-like activity. The **mitogenic** activity of semi-purified cEFG was demonstrated in two different **quiescent fibroblast** cultures. Extract from the bone matrix was found to contain little or no EFG-like activity. The overall results indicate that velvet tissue contains a significant amount of EFG-like activity independent of the SMG. It is suggested that because antler is a rapidly growing and differentiating tissue, it most likely contains multiple forms of EFG for rapid **mitosis** and sustained growth. Deer velvet tissue does not appear to depend on the SMG for its supply of EFG. The velvet tissues of the growing antler may be the site of synthesis for cervine epidermal growth factor. Mitogenic activity of EFG was also demonstrated.

Sunwoo, H.H., Nakano, T. and Sim, J. S. 1997. Effects of water soluble extract from antler of wapiti (*Cervus elaphus*) on the growth of fibroblasts. Can. J. Anim. Sci. 77: 343-345.

The growth of bovine skin fibroblasts was measured after treatment with water soluble antler extract at varying dosages. The extract was prepared from the antler tip of four year old wapiti stags (*Cervus elaphus*). A cell culture system was used to monitor growth promoting activity. Addition of the extract promoted growth of the fibroblasts. Cell number increase was dose dependent. The results suggest that growth promoting activity is present in the extract.

Huo, Y., Schirf, V. R. and Winters W. D. 1997. The differential expression of NGFS-like substance from fresh pilose antler of *Cervus nippon* Temminck. Biomedical Sciences Instrumentation. 33: 541-543.

Hairy antler extract was prepared by freeze drying and freeze fracturing particles which was dissolved in an acetate-acid buffer and extracted. The activities of known growth substances and the extract were compared. This study found that the extract had a similar effect to nerve growth factor effect on differentiation expression in **PC-12** cells. It was found that antler extracts stimulate the growth of nerve fibres, induce morphologic changes during differentiation and effect DNA synthesis in PC-12 cells.

9. IMMUNE SYSTEM EFFECTS

Suh, J.S., Eun, J.S., So, J.N., Seo, J.I. and Jhon, G.J. 1999. Phagocytic activity of ethyl alcohol fraction of deer antler in murine peritoneal macrophage. Biol. Pharm. Bull. 22(9): 932-935.

The ethyl alcohol fraction of *Cervus nippon* (CN-E) enhances the immune activity of mice by increasing the activity of **phagocytes** (white blood cells). Phagocytes are cells that engulf and absorb waste material, harmful microorganisms, or other foreign bodies in the bloodstream and tissues.

The fraction was administered orally to male mice once a day for 7 days at a dosage of 100mg/kg. **Macrophages** were obtained from the **peritoneal cavity**. In **murine** peritoneal macrophages, CN-E enhances phagocytic activity as compared to control mice. Engulfment of *Escheria coli* K-12 particles in peritoneal macrophages was enhanced. It is suggested that CN-E regulates phagocytic activity by reducing nitric oxide production in murine peritoneal macrophages and by increasing the concentration of calcium ions in the **cytosol** (cell fluid) without damaging the cells.

Choe, P.N. and Kim, K.H. 1987. Effects of *Cervi cornu* on depression of immune response induced by methotrexate in mice. Kyung Hee University Oriental Medicine Journal. 10: 589-604.

Deer horn can improve the immune system because it adds to the body's overall ability to resist disease. Other studies have shown that it contributes to the activity of liver function and hormonal mechanisms; it increases white blood cells and improves immune reactions. A water extract of antler from *Cervi cornu* was administered to mice which had been sensitized with sheep red blood cells to induce antibody reaction. The extract enhanced the cell-mediated and **humoral** immune response and restrained the depression of cell-mediated and humoral immune response induced by **methotrexate**. Compared to control groups, the following tests showed that immune responses were significantly

increased in the group treated with the antler extract: **delayed-type hypersensitivity; rosette forming cells; hemagglutinin titre and hemolysin titres.**

Shin, K.H., Lee, E.B., Kim, J.H., Chung, M. S. and Cho, S.Y. 1989. Pharmacological studies on the powdered whole part of unossified antler. Korean J. Pharmacogn. 20(3): 180-187.

A single oral dose of powdered antler showed a weak **immunopotentiating** action using carbon clearance tests in mice.

10. SEXUAL DYSFUNCTION

Zheng, Z. 1997. Analysis on the therapeutic effect of combined acupuncture and medication in 297 cases of male sterility. Journal of Traditional Chinese Medicine. 17(3): 190-193.

Pilose antler was used in combination with other traditional therapeutic methods to treat sexual dysfunction. 297 cases of male sterility was treated with by the combination of acupuncture, pilose antler essence injection to the **acupoints** and oral administration of antler extract in accordance with the Chinese materia medica for more than two months. The age of the patients ranged from 25 to 45 year and had conditions of **prostatitis, spermatemphraxis** or histories of **testitis**.

The patients were divided into several groups to be treated with the combinations of either two or all three methods mentioned earlier. As a result, the sperm count and the sperm motility were increased in most of the cases. The combination of the three methods was the most efficient treatment. This combination regulates *yin* and *yang*, promotes blood circulation and generates vital energy.

11. TOXIC EFFECTS

Shin, K.H., Lee, E.B., Kim, J.H., Chung, M. S. and Cho, S.Y. 1989. Pharmacological studies on the powdered whole part of unossified antler. Korean J. Pharmacogn. 20(3): 180-187.

Shin et al. demonstrated that deer horn has very weak **acute** and subacute toxicity with minimum lethal dosage being greater than 5g/kg orally in mice.

Song, S .K. 1970. Influence of deer horn on erythropoietin activity and radioactive iron uptake in rabbits. Journal of Catholic Medical College. 18: 51-63.

This study found that the **lethal dose (LD₅₀)** of antler extract (alcohol) administered by peritoneal injection in rabbits to be 1,082 mg/kg.

Wang, B.X., Liu, A.J., Cheng, X.J., Wang, Q.G., Wei, G.R., Cui, J.C. 1985. Anti-ulcer activity of the polysaccharides isolated from pilose antler. Acta Pharmaceutica Sinica. 20(5): 321-325.

Mice received pilose antler extract either orally or intraperitoneally 10g/kg the polysaccharides isolated from pilose antler. They were observed for 48 hours. No significant changes in behaviour and no deaths occurred. The limitation of the concentration and volume did not allow them to get LD₅₀ results. The results indicated that polysaccharides isolated from pilose antler have a very low toxicity.

12. WEIGHT GAIN

Shin, K.H., Lee, E.B., Kim, J.H., Chung, M. S. and Cho, S.Y. 1989. Pharmacological studies on the powdered whole part of unossified antler. Korean J. Pharmacogn. 20(3): 180-187.

Daily oral treatments of 1.5g/kg and 3.0 g/kg for 14 days showed no statistically significant differences in body weight gain and various organ weights compared to control rats. Specifically, the control group showed a weight gain of 76.5g, those given 1.5g/kg for 14 days gained 74.5g and a dosage of 3.0g/kg had a weight gain of 70.6g.

The effects of repeated treatments of powdered antler on various organ weights in rats showed a decrease in the weight of the thymus and spleen with the use of powdered antler as compared to the control group. The adrenal showed an increase in weight compared to the control. Liver and kidney weight changes showed no correlation between antler use and a pattern in weight gain.

13. DIABETES

Cho, H.J. and Jhon, G.J. 1994. Changes of gangliosides metabolism in streptozotocin-induced diabetic rats and effect of deer antler. J. Appl. Pharm. 2: 223-228.

In the diabetic rat, ganglioside metabolism is changed. Gangliosides make up about 6% of the membrane lipids in the gray matter of the human brain and are important in nerve and brain function. The membranes of the human nervous system contain at least 15 gangliosides for which no function is yet known. However, when their synthesis and breakdown is not tightly regulated, their derangements underlie the devastating effects of several human genetic diseases (Lehninger, 1993). The authors in this study cites studies which show that gangliosides have a role in the differentiation and growth of cells; it is a control factor in the phosphorylation of protein and receptors and it influences the fluidity of the cell membrane.

The study showed that the metabolism of gangliosides is changed because of diabetes. It appears that ganglioside metabolism was normalized after the administration of deer horn

extract. Gangliosides were examined from streptozotocin-induced diabetic rat brains. Blood glucose levels and insulin levels were measured. The effects of major lipid components extracted from deer antler on the diabetic rat brain were also examined. In normal rats, the major lipid components lowered both blood glucose and insulin levels. In the diabetic rat, only the blood glucose level was lowered with the major lipid components. In the diabetic rat, ganglioside metabolism was changed as GM1 increased and GD1a, GD1b and Gt1b were not synthesized. Undefined ganglioside was found.

After the administration of deer horn extract, blood glucose levels are reduced in normal and diabetic rats. Blood glucose reduction in the diabetic rat is less related to insulin secretion. Deer horn reduces blood glucose levels and normalizes the metabolic processes of gangliosides in the brain.

14. PHYSICAL STRESS

Kang, W.S. 1970. Influence of antler (deer horn) on the mesenteric mast cells of rats exposed to heat, cold or electric shock. The Journal of Catholic Medical College. 19: 1-10.

The administration of antler to rats prior to the infliction of stress from heat, cold or electric shock protects tissue **mast** cells in the mesentery from injury due to stress. Antler acts protectively if administered prior to stress because the number of mast cells maintaining their integrity were almost normal or slightly above normal.

Shin, K.H., Lee, E.B., Kim, J.H., Chung, M. S. and Cho, S.Y. 1989. Pharmacological studies on the powdered whole part of unossified antler. Korean J. Pharmacogn. 20(3): 180-187.

Repeated treatments of powdered antler to rats demonstrated a moderate anti-fatigue effect against immobilized stress (fatigue). There were significant increases in adrenal weight and ascorbic acid content in the adrenal. This suggests that the antler's anti-fatigue effect is related to its effect on the adrenal and its components. The adrenal glands secrete steroid hormones which help control heart rate, blood pressure, the way the body uses food and other vital functions. It also produces adrenaline and noradrenaline.

In this experiment, powdered antler was administered at 1g/kg for 4 days. 24 hours after the last dose, working capacity (minutes) was measured. Those administered 1g/kg had a significantly greater work capacity (73.5 ∇ 6.9 min.) than those administered 0.5g/kg (62.8 ∇ 5.7 min.) or the control group (54.8 ∇ 2.5 min.).

15. BLOOD AND IRON

Kim, K.W. and Park, S. W., 1982. A study on the hemopoietic action of deer horn extract. Korean Biochemical Journal. 15(2): 151-157.

Rats were administered a phenylhydrazine-HCL injection to induce hemolytic anemia. For four days after the injection, powdered deer horn extract was administered orally.

Elk deer horn and Formosa deer horn extracts were shown to have a stimulating effect on the **hematopietic** action of albino rats. It increased the animals ability to promote the recovery of red blood cells (erythrocytes). Liver homogenate showed increased activity (maximum 36.8%) of *d*-aminolevulinate dehydratase when deer horn was administered. The increased activity would partly support the stimulating effect of deer horn on hematopoietic action. Deer horn may promote the following activity for the increase of erythrocytes:

Succinyl Co A \Rightarrow *d*-aminolevulinate dehydratase \Rightarrow heme \Rightarrow hemoglobin \Rightarrow increased erythrocytes

Elk horn was shown to be more effective after 4 to 8 days than Formosa deer (25% and 15% respectively).

Yong, J.I. 1964. The effects of deer horn on the experimental anemia of rabbits. Journal of Pharmaceutical Society Korea. 8: 6-11.

Deer horn extract was administered orally for 4 to 17 days from the first day right after a 1% phenylhydrazine HCL injection to induce anemia. Phenylhydrazine was injected on two days. Anemic rabbits receiving deer horn had higher red blood cell counts, hemoglobin levels and hemocrit levels than the control group. Reticulocyte (immature erythrocytes) levels were lower in the group administered deer horn. With deer horn, there was a lower occurrence of anemia and a faster recovery from anemia than for the control group. By the 17th day, values for all experiments were similar for the control group and for the group given deer horn extract.

Shin, M.K., Lee, S.I., Kim, W.H. and Lee, H.I., 1979. Effect of deer horn on the iron bone marrow in experimentally induced anemic rat. K.H. University Oriental Medicine Journal. 2: 69-72.

Rats were administered phenylhydrazine HCL to induce hemolytic anemia. The rats received a deer horn water extract orally. Extracts were made from the antler of elk, formosa deer, reindeer and red deer. Results show that elk and reindeer had close results in that iron activity in the bone marrow was first observed on the 6th day and reached a high peak on the 14th day and retained the peak at day 16. For formosa deer and red deer, iron uptake activity in the bone marrow was first observed on the 10th day. Activity with the formosa deer extract reached a moderate peak on the 14th day and red deer extract

displayed moderate activity by the 16th day. The control group which did not receive any antler extract, began to exhibit low levels of increase in iron activity on the 14th and 16th days.

The authors conclude that the use of deer horn extracts show earlier and greater increases in iron activity than the control group which did not receive any extract. Of the four species, they stated that elk horn appeared to induce the most iron activity in bone marrow because its peaks were slightly higher than that of reindeer. However, the study did not state if the difference is statistically significant.

Song, S .K. 1970. Influence of deer horn on erythropoietin activity and radioactive iron uptake in rabbits. Journal of Catholic Medical College. 18: 51-63.

The **erythropoietin** level in the control group is increased from 8.35% to 17.19% when deer horn extract is administered to normal rabbits. In the depleted anemic rabbits, the hematopoietic factor for the control group is 14.29% whereas for the group administered deer horn it is 20.85%.

The blood radioactive iron uptake in normal rabbits was 17.63% and 26.95% in bled anemic rabbits following treatment with deer horn extract. This was higher than in the non-treated controls of 10.14% and 16.94% respectively. Higher radioactive iron uptake was observed for those administered deer horn extract as compared to control groups which did not receive the extract. Radioactive iron uptake was also significantly higher in spleen homogenates and bone marrow of bled anemic rabbits as compared to the control groups.

Erythropoietin activity was observed for several organs (liver, kidney, spleen and bone marrow) in starved rabbits. Slight increases in radioactive iron uptake were observed for all organs after the administration of deer horn as compared to control groups.

16. ANTI-TUMOR ACTIVITY

Kim, D.H., Han, S.B., Yu, K.U., Kim, Y.S. and Han, M.J. 1994. Antitumor activity of fermented antler on sarcoma 180 in mice.

Antler was fermented with *Bacillus P-92* thereby increasing the free amino acid content to 6x higher than untreated antler. **Sarcoma 180** cells were implanted to determine the effect of fermented and untreated antler on life span. Compared to the control group, the life span of mice treated with fermented antler increased by 39% and untreated antler increased by 24%. Survival rates were 33% and 22% respectively. Antler and fermented antler are both effective against tumors but fermented antler is more effective. However, better results were achieved when either remedy was administered before tumorization than after tumorization.

17. ANALGESIC EFFECT

Shin, K.H., Lee, E.B., Kim, J.H., Chung, M. S. and Cho, S.Y. 1989. Pharmacological studies on the powdered whole part of unossified antler. Korean J. Pharmacogn. 20(3): 180-187.

Shin et al., 1989, showed that a single oral dosage of powdered antler had positive analgesic (pain relieving) effects in two experiments.

In the first experiment, powdered antler was administered orally at 0.5g/kg and 1.0g/kg to mice. A 0.7% acetic acid saline solution was administered at 0.1ml/g intraperitoneally. After 10 minute, the frequency of writhing syndrome was measured. As compared to the control group, there was an inhibition of 49.1% and 51.6% respectively for the administration of 0.5g/kg and 1.0g/kg powdered antler. The drug aminopyrine was administered as a control drug at 0.2g/kg. It had an analgesic inhibition effect of 80.1%. However, aminopyrine is not recommended for use despite its analgesic and anti-inflammatory properties because of the risk of the loss of all or most white blood cells.

In the second experiment, Shin et al, 1989, also tested analgesic activity using the weak press irritation method. A subcutaneous injection of a dry yeast saline suspension was administered near the tails of mice. Deer horn was given orally after one hour. Pressure was applied to the infected spot and reaction to pressure was measured. After one hour, the analgesic effects were not significantly different for those administered powdered antler and the aminopyrine group from the control group. After two hours, the pain threshold in mice administered powdered antler was significantly greater than that of the control group. There was a positive correlation between increased dosage and increased pain threshold. The control drug aminopyrine increased the pain threshold more than the powdered antler. The pain threshold response at 3 hours was similar to the response at two hours.

18. SEDATIVE ENHANCING EFFECT

Shin, K.H., Lee, E.B., Kim, J.H., Chung, M. S. and Cho, S.Y. 1989. Pharmacological studies on the powdered whole part of unossified antler. Korean J. Pharmacogn. 20(3): 180-187.

To measure the effect of powdered antler on hexobarbital (a sedative) induced sleeping time, mice received oral administration of powdered antler at dosage rates of 1.0 mg/kg, 1.5 mg/kg and 3.0 mg/kg. After one hour, hexobarbital-Na 70mg/kg was injected within the peritoneal cavity. At 1 mg/kg, sleeping time increased 26%, at 1.5 mg/kg it increased 29.3% and at 3.0 g/kg it increased 77%. Thus, in combination with hexobarbital, powdered antler showed an enhanced sedative effect.

19. BONES AND CARTILAGE

Zhou, Q.L., Guo, Y.J., Wang, Y and Liu, Y.Q. 1999. Velvet antler polypeptides promoted chondrocytes and osteoblast precursors and fracture healing. Acta Pharmacol. Sin. 20(3): 279-282.

The effects of velvet antler were analyzed on bone-forming and cartilage cells and healing fractures in animal bodies. The effect of velvet antler total polypeptides and velvet antler **polypeptides**, VAP-A, VAP-B and VAP-C on the proliferation of **chondrocytes** and **osteoblast** precursors were studied. VAP-A and VAP-B were determined to be the active polypeptides as they accelerated cartilaginous and osteoblast growth. In vitro and in vivo results were consistent. Radial (forearm bone) fracture healing was accelerated when VAT-P was injected into the cross section of the fracture area. When the union rate of the fracture increased, hydroxyproline and calcium contents in the **callus** were enhanced. The polypeptides were shown to promote chondrocyte and osteoblast precursors and fracture healing.

20. LIVER

Lee, H. I. 1980. Histochemical studies on the effect of deer horn water extract on rat liver. Kyung Hee University Oriental Medicine Journal. 3: 35-50.

This experiment demonstrated that following starvation, hepatic regeneration and hepatic enzyme activity are enhanced by the ingestion of deer horn (Canadian elk) water extract. Rats were starved for 7 days. Two groups were fed a basal diet with one group receiving antler extract. In general, the groups receiving the extract recovered more quickly than the control group. Microscopic cellular changes induced by starvation showed that the group fed the extract in their diet displayed normal cellular appearance in 16 days versus 32 days for those fed the basal diet only. Hepatic glycogen contents recovered to normal in 8 days with the extract and 16 days without it. Liver enzyme results showed the following: **adenosine triphosphatase** activity took 8 days to recover with the basal diet alone and 4 days with the extract; **lactate dehydrogenase** activity fully recovered in 2 days for those fed the extract while those without it took 4 days for recovery; **cytochrome oxidase** activity recovery took 16 days for the group fed the extract while the other group took 32 days; for alkaline **phosphatase** no recovery was made by either group; and acid phosphatase activity was recovered within 32 days for those fed the extract while those who were not showed little recovery.

Jai, I.J. 1964. The effects of deer horn on the liver and other organs of cholesterol administered rabbits. Journal of the Pharmaceutical Society of Korea 8: 12-29.

Healthy male rabbits were fed cholesterol at a rate of 500 mg/day/kg/rabbit for 14 days. The group receiving a velvet antler water extract and cholesterol showed a greater recovery of hepatic **oxidative phosphorylation** (73%) as compared to the cholesterol

group (53%). All percentages in the study are based on the analysis of a normal group which did not receive cholesterol. Adenosine triphosphate content recovered to 65% within the test period while the control recovered 31%.

Increased liver lipid concentrations induced by the high cholesterol content showed lower lipid percentages for those fed deer horn than the control. However, the lipid content percentages were near normal for **phospholipids** (extract and cholesterol 101% of normal, cholesterol only 181%); triglyceride percentages were 283 for the group receiving extract and 361 for the cholesterol only group; and 1,166% total cholesterol for the extract group and 1,395% for the cholesterol only group. Glutamic oxaloacetate transaminase activity was restored closer to normal at 74% in the group receiving extract as compared to 62% of normal for the cholesterol only group. Histological findings also showed that the use of deer horn extract in a high cholesterol diet lowered the amount of fatty infiltration to the heart, liver and the adrenal gland as compared to those receiving only cholesterol.

Total serum cholesterol results showed that those fed only deer horn extract and no cholesterol maintained normal values over 28 days. Values for the group fed cholesterol and the extract increased from the initial value for the group by 316% while the cholesterol only group increased by 405%.

Similarly, the results on serum β -lipoprotein shows similar results for those receiving extract only and the normal group. The group receiving cholesterol only had a 98% increase from the initial value for the group after 28 days while the group receiving cholesterol and the extract had an increase of 88% in serum β -lipoprotein contents. Tests on serum glutamic oxaloacetate transaminase activity showed that the deer horn extract group did not have as great an increase in activity at 11.5% of initial value as compared to the cholesterol only group at 13.4% of initial value. The group receiving deer horn showed similar figures to the normal control group and virtually no change.

Wang, B.X., Chen, X.G. and Zhang, W. 1990. Influence of the active compounds isolated from pilose antler on synthesis of protein and RNA in mouse liver. Yao Hsueh Hsueh Pao. 25(5): 321-325.

Previous studies by the authors (see the section on aging in this report) show that protein liver content increases in senescence accelerated mice treated with a pilose antler water extract. It is suggested that pilose antler contains polyamines which activate RNA polymerase thereby increasing protein and RNA synthesis. A low dose of the polyamines of pilose antler (PASPA) at 30 mg/kg was more effective than a high dose at 60 mg/kg. However, the most effective dosage was not determined. The study also confirmed that senescence accelerated mice were more sensitive to the treatment than the control. The results suggest that PASPA is the main active substance responsible for the promotion of the synthesis of protein and RNA in mouse liver. Chemical analysis shows that there is a higher concentration of polyamines in the unossified portion of antler tip than in other parts.

There are three major polyamines in velvet antler: putrescine, spermidine and spermine. Putrescine and spermidine significantly increased the synthesis of RNA and protein in mouse liver tissue and RNA in liver cell nuclei while the effect of spermine was not significant. PU significantly increases RNA polymerase activity level. Although spermine and spermidine increased RNA polymerase activity levels by 20% and 30% respectively, it was not statistically significant.

21. SPINAL NERVES AND WHIPLASH

Kajihara, M. and Kokubu, N. 1971. Effect of *pantui* extracts (Pantocrin) on several enzyme activities of spinal nerves of rats. *Pharmacometrics*. 5:741-745.

The effect of Pantocrin, a preparation from unossified horns of Siberian deer was tested on the metabolism of the spinal nerves in rats. It was postulated that any abnormality in the glycolytic pathway in the nervous system could be a cause of neurosis. D-glucose is a major source of energy for the brain and the nervous system and requires several highly active enzymes for its metabolism. This experiment found that Pantocrin influences the **glycolytic pathway** in the rat spinal cord. Respiratory quotient (oxygen consumption) in the nerves increased significantly. Pantocrin significantly stimulated the glycolytic pathways in nerve tissues *in vivo* and *in vitro*. This activation was confirmed by the stimulation of enzymatic activity for aldolase, hexokinase and glycerokinase which are involved in glycolysis. It did not appear to affect other enzymes involved in glycolysis. These stimulations appeared to be specific to the spinal nerves because no similar activity was found in the liver. Specifically, aldolase activity was increased in nerve tissues but was inhibited in the liver. There was activation of nerve aldolase (C), but inhibition of muscle (A) and liver (B) aldolases.

Takikawa, K., Kokubu, N., Tahara, N. and Dohi, M. 1972. Studies of experimental whiplash injury II. Evaluation of *pantui* extracts, Pantocrin as a remedy. *Folia Pharmacol. Japan*. 68: 473-488

Glucose and enzymes are involved in the **TCA cycle** and in glycolysis are essential energy source for brain function. The whiplash study on rabbits found that on the 3rd day after induced whiplash, significant inhibitions of the glycolysis and TCA cycle were observed on the 3rd day and 6th day respectively. Only the TCA cycle rapidly recovered and returned to almost normal activity on the 21st day. It was noted that although these inhibitions in the tissues were not as significant as expected, the injection of Pantocrin treated the inhibitions effectively.

The effects of whiplash on nystagmus, an involuntary rapid and rhythmic movement of the eyeball, were measured. Nystagmus is an important factor in whiplash injury symptoms. Compared to the control group, an injection of Pantocrin recovered abnormalities associated with the injury significantly.

Takikawa, K., Kokubu, N., Kajihara, M. and Dohi, M. 1972. Studies of experimental whiplash injury III. Changes in enzyme activities of cervical cord and effects of *pantui* extracts, Pantocrin as a remedy. Folia Pharmacol. Japan. 68: 489-493.

Changes were observed in enzymatic activities in glycolytic pathways after the induction of injury and after treatment with pantocrin. Results were obtained from using the cervical vertebrae homogenates from whiplash injured rabbits and neck injured rats. It was noted that there were no differences in the inhibiting patterns of the enzymatic activities between rats and rabbits. Enzymatic inhibitions appeared to depend on the degrees of damage to the neck.

Oxygen consumption (respiratory quotient), glycolysis and the TCA cycle were noticeably impaired in the cervical vertebrae of rabbits on the 6th day after whiplash. The aldolase, glutamic oxaloacetate transaminase and alkaline phosphatase activities were significantly inhibited but recovered after an injection of Pantocrin.

The glycolysis and TCA cycle were inhibited in neck injured rats on the 6th day. Inhibitions of activities for enzymes involved in glycolysis (hexokinase, aldolase, glycerokinase, glutamic oxaloacetate transaminase, glutamic pyruvic transaminase and alkaline phosphatase) were significantly recovered by the injection of Pantocrin.

22. ENDOCRINE FUNCTIONS

Kim, K.B. and Lee, S.I. 1985. Effects of several kinds of antler upon endocrine functions in rats. K.H. University Oriental Medicine Journal. 8: 91-110.

The effects of antler velvet extract from 5 species were compared in rats administered an anti-thyroid compound (thiourea). The species tested were I: *Cervus elaphus sibiricus*, II: *Rangifer trandus articus*, III: *Cervus elaphus xanthophgus*, IV: *Cervus elaphus dybowskii*, and V: *Cervus nippon mantchuricus*. The effects of antler extract from these species on endocrine metabolism showed that they all had significant effectiveness on the recovery of endocrine metabolism as compared to the control group. However, sample V was the most effective overall in the recovery of hormone content in blood serum. Sample I was second and the others came in third at roughly the same rate of effectiveness. Sample V was found to be the most effective in recovery when measuring **triiodothyronine** content in blood serum. It was followed by samples III, I, IV and II. Sample V was most effective for the recovery of **teraiodothyronine** content in blood serum followed by I, IV, II and III. Sample II was found to be most effective in the recovery of testosterone content in blood serum followed by V, I, III and IV. Sample V was found the most effective when **cortisol** content in blood serum was measured followed by IV, III, I and II.

IV. Marketing Velvet Antler

INTRODUCTION

Velvet antler product has been entering the North American market very slowly through pharmacies and health food stores, several of which were surveyed to understand the marketing strategies for nutraceuticals. Velvet antler is considered to be a nutraceutical. It is available on the market mainly in encapsulated form, although skin care cream made out of velvet antler extraction is also available. Antler products cannot make any health claims on their labels.

TARGET MARKET

People aged fifty and above purchase the marketed antler products mainly as a natural remedy for arthritis. Customers access information on these products from Internet advertisements, magazine articles (Alive magazine), radio commercials, pamphlets available in health food stores or pharmacies, and from cultural medicine. However, velvet antler products are not as well-known as other traditional remedies such as ginseng or echinacea, and even most pharmacies are not familiar with this product. Velvet antler products may increase in popularity if they can access large chain store pharmacies. Most pharmacies and health food stores set their own standards for the products they stock. Some of the standards used by stores are discussed below.

DISTRIBUTION CRITERIA

Most of the retailers surveyed identified the reputation of the processor as one of the most important factors determining purchasing decisions of nutraceuticals. Processors must be reputable. One health food store owner suggested that independent deer antler producers should get their product marketed through renowned antler manufacturing companies to improve market penetration. This would also help ensure consistent product quality and safety. Product safety concerns include animal health (Chronic Wasting Disease), bacterial contamination (*E. coli*, *Salmonella* spp.), chemical contamination, and physical contamination such as dander.

Many retailers require some level of good manufacturing practices (GMPs) in the processing plants to ensure product safety and quality. A Hazard Analysis and Critical Control Point system implemented in processing plants is preferred. In some cases, a treatise by the vendor guarantees the safety and quality of the products, while in other cases stores send representatives to inspect the processors to verify sanitary processing conditions. Several retailers expressed a preference on Canadian products or Canadian companies, but will sell imported nutraceuticals from reputable sources. One company verifies the original manufacturers of these imported products. Other issues include the ability to provide appropriate, professional labeling and informational brochures.

Another significant factor that retailers consider when choosing nutraceuticals is product quality. However, the definition of quality differs from retailer to retailer, ranging from

raw ingredients to the finished product. Several stores verify sources of raw materials to ensure quality, and one retailer requires Canadian raw materials of natural sources. Another store requires the manufacturer to provide a full ingredient list, and if any ingredients are unknown, the store conducts further verification on a product. Another retailer selects products containing the least amount of food additives such as artificial colours and artificial sweeteners. The purity of the finished product is also assessed, as several stores require independent laboratory analysis of nutraceutical products before the products are purchased.

Most stores named the health benefits of nutraceuticals as an important consideration in making purchasing decisions. Several stores require the manufacturer to provide information about a product's benefits, including independent scientific or sponsored studies, journal articles, or magazine articles before stocking a product. One retailer listed proven scientific benefits as the most important factor in determining purchasing decisions.

Although the health benefits of the products are the most important factor to at least one retailer, customer demand was identified as the most important consideration by another store. This store was confident buying products that are well known to the consumers, such as vitamin C, and glucosamine, but are very reluctant about buying a new product such as velvet antler because of lack of customer demand. This particular retailer suggested that antler product manufacturers should promote the health benefits of their products through the media to raise consumer awareness.

Price was also mentioned by several retailers as a factor to consider when stocking a product, but at least one store stated that quality outweighed price. Another store identified package size and labeling as important considerations.

CURRENT MARKETING APPROACHES

Most stores surveyed stated that manufacturers approached their stores or head offices to market their products. Methods of product procurement include independent retailers making purchasing decisions, centralized purchasing by a purchasing office for a chain and independent and chain stores which order products from a wholesaler.

Most vendors or manufacturers provide product information in the form of brochures, pamphlets, independent scientific studies, and monographs either to the head office or directly to the stores. Pharmacists receive this information and have access to supplemental information from the Internet, Drug Information Line, academic institutions, the MedLine database, and doctors. Some stores have compiled their own manuals that include product characteristics, or they may request further scientific literature from the manufacturer. Manufacturers periodically offer "crash courses" on the benefits of their products to stores.

Once in stock, several stores have a trial period for nutraceuticals. One store keeps a product on the shelf for a three-month trial period, after which point the price is reduced.

If the product remains unsold, the store returns the product for credit or exchanges the product for another from the same manufacturer. Some stores have a “guaranteed sold” clause in their agreements with the manufacturer that credits the store for product that has not been sold before its expiry date or that has not sold within a defined period such as three to six months. After that period the store returns them to the manufacturer with approximately a 5% restocking charge or a full refund. Most of the stores surveyed keep the product on the shelf until the best before date or expiry date. One wholesaler credits any pharmacy clients that return expired nutraceuticals, and then returns the product to the manufacturer for credit. Another independent retailer does not return the product for credit, but reduces the selling price.

Several stores inform customers of the correct dosage of every product, and review customers’ diet, lifestyle, medication, and medical conditions to ensure correct usage of the product.

V. Research Process for the Scientific Literature Review

The following literature search method was used:

1. List of Keywords: The keywords which include synonyms for velvet antler were used:

General (deer species): Antler, Velvet antler, Deer antler, Elk antler, Soft antler, Deer horn, pilose antler, sika deer, Dama dama, Wapiti, *Cervus*, Cervidae.

Korean - Nokgak, Yonggakgyo, Nokyong, Nokkakgyo, Choona treatment, Nogyong.

Chinese - Lu rong (unossified antler), Lu jiao (calcified antler), Nog gag, Lu-chung.

Japanese - Rokujo

French - Bois

Russian - Pantui, Pantogematogen, Pantovit, Panta-forte.

German - Bast, Bastgeweih.

General (medical terminology): Medicinal effect, Traditional drugs/ medicine, Chinese medicine, Folk medicine, Health benefits, Nutraceutical, Homeopathic methods/ drugs, Alternative medicine.

Bones: Arthritis, Osteoporosis, Rheumatoid, Rheumatic-arthritis, Anti-inflammatory, Fracture healing.

Blood: Anti-coagulant, Anti-clotting, Circulation, Anemia, White blood cell promoter, Red blood cell promoter, Erythropoiesis, Hematopoiesis.

Heart: Cardiovascular, Heart benefit.

Brain: Brain tonic, Memory, Concentration.

Immune: Immune enhancement, Immunity, Anti-infection, Immuno-regulative, Phagocytes.

Sexual Function: Sexual function, Fertility, Sterility, Testosterone, Androgenic, Gonadotrophic.

Energy: Vitality, Stamina, Energy enhancement, Steroid, Steroid tendencies, Mood enhancement, Monoamine oxidase.

Fatigue: Stress, Fatigue.

Athletic performance: Athlete, Endurance, Muscular development.

Others: Anti-narcotic, Anti-aging, Anti-ulcer, Anti-morphine, Radiation-protective, Prostaglandin -like activity, Growth factor, Anti-tumor, Anti-cancer.

2. Database search: Silver Platter databases were accessed through the WebSPIRS

interface in the University of Saskatchewan's library computers. The databases used were:

Agricola	1970-2000/06
Biological Abstracts	1990/01-2000/06
CAB Abstracts	1972-2000/04
International Pharmaceutical Abstracts	1970-2000/06
MEDLINE ® Advanced	1966- 2000/08
Zoological Records	1993-2000/06

3. Citation search: (i) References of previously published literature listed at the end of each article, are browsed. Then the relevant citations are identified.

(ii) Velvet antler drug manufacturing companies, such as, "Qeva" and "NATRAflex" have some relevant scientific literature and citations posted on Internet. Those citations are also collected for this review.

4. Correspondence: Letters and emails were sent to leading people in the field of velvet antler research and to several velvet antler product manufacturer companies requesting to provide reference information for journal articles indicating the health benefit of velvet antler.

5. Science Citation Index: Partial use of Science Citation Index to get further information about literature published on health benefit of velvet antler. Key words mentioned earlier were used for this purpose. Names of the authors were used to locate other published literature relevant to the topic.

Problems:

- Very few articles are published indicating the health benefit of velvet antler.
- Often the sources are too obscure to locate the articles.
- Unwillingness of some contacts to share information.