

A review of dose levels of deer velvet products in relation to efficacy

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Abstract

Deer velvet has been used in Traditional Chinese Medicine (TCM) for millennia and has a growing market as a Western Dietary Supplement. In addition an alcohol extract of deer velvet, Pantocrine, has been developed in Russia. The way in which deer velvet is taken varies markedly in different markets. In Asia, it is typically combined with other medicinal products, whereas for its use in the West velvet is frequently ground and taken alone as a capsule. The dietary supplement business has frequently requested advice on effective doses for proven therapeutic effects but no dose response studies using deer velvet have been attempted in a Western nation. Variations in deer velvet quality, method of preparation, clinical endpoint and length of treatment have all hampered analysis of effective dose and meant that there has been no robust advice on dose.

The present review draws data from a variety of studies and sources and expresses various measures of clinical effectiveness in terms of milligrams of deer velvet powder equivalent. The review concludes that 1500–3000 mg/day (i.e. about 20–40 mg/kg/day) of deer velvet powder equivalent is required by a healthy person for an effective performance improving response. The review also points out that there are insufficient data to make any recommendations for the use of deer velvet for non-healthy people or for the possible effectiveness of long term low dose (200–400 mg/day) administration.

The data are presented as a preliminary guide prior to future specific dose response studies. Individuals should consult a medical practitioner before taking any deer velvet product, and consumption should be discontinued if any side effects are experienced.

Keywords: deer velvet powder, Pantocrine, clinical trials, dose, efficacy

Introduction

Deer velvet has been used as an ingredient in Traditional Medicine in Asia for many thousands of years (Fennessy 1991). Methods of harvesting, preparing and administering deer velvet most likely were developed and optimised using the available technology of the time, which would have gradually evolved through the ages. Likewise the clinical use of deer velvet, the optimal combinations with other ingredients and the dose required to form effective treatments would have developed over time. It is possible to trace some of this history in translations of the ancient Chinese *Materia Medica* texts

(Bensky *et al.* 1986). Deer velvet in Asia is processed by a combination of heat and air drying and can be stored in a dry state. When it is required for use, thin slices are cut from appropriate parts of the stick. In the 21st century deer velvet still has extensive use as a medicinal, much in the way that it has been used for centuries. Traditional Oriental Medical Doctors (OMD) have accumulated a wealth of knowledge of the effectiveness of deer velvet for different human conditions and particularly the dose required and length of treatment according to the specific needs of each patient. Typically deer velvet is prescribed in combination with other ingredients, at a high dose for a fairly short period of time. The other ingredients are carefully selected to potentiate the desired attributes of deer velvet but also to reduce any possible negative side effects. The dry ingredients are typically used to make a soup (Suttie & Haines 2001, 2002)

In the first half of the 20th century Russian scientists and clinicians sought to develop natural products which could improve health and wellbeing. They began using deer velvet, but found difficulty obtaining consistency of responses. Consequently they developed an ethanol extract of deer velvet, Pantocrine, to effectively standardise the product. Pantocrine was then standardised for effectiveness itself, using a battery of bioassays which included assays of gonadotrophic and blood pressure reducing effects (Archer & Palfreyman 1983). Pantocrine can be taken orally, in a liquid or tablet form or the ethanol extract can be injected (Pavlenko 1969; Brechman Undated).

In the last 15 years deer velvet has entered the Western Dietary Supplement market. Typically deer velvet is processed by traditional techniques or a combination of hot ovens and air drying or is freeze dried. The dried deer velvet is ground to a fine powder and then is capsulated. Alternatively the ground powder can be extracted with water or ethanol, and the resultant extract can be consumed as it is, or freeze dried for capsulation or incorporation into foods and beverages. A recent innovation has been to put deer velvet extract into fine sprays for sub-lingual self dosing (Suttie *et al.* 1994; Suttie & Haines 2002).

Deer velvet is a challenging product to market in a Western Country as non-Asian people have no tradition of using it for health promotion and because no clear simple message to typify its activity has been developed. In Asia deer velvet is predominantly used as an aid to healing, regeneration and to protect against disease (Suttie

& Haines 2001). These are hard marketing messages for a culture familiar with consuming medicinal drugs only during periods of illness or recuperation. Deer velvet is currently marketed mainly as a dietary supplement to improve athletic performance and for anti-aging activity, primarily due to its high levels of insulin-like growth factor 1 (IGF1) (Suttie & Haines 2001). Until recently there was little clinical evidence of efficacy. But if deer velvet had a simple defined effect in a relevant area of human need then its use today would be more extensive. Exacerbating this issue of marketing challenge is the fact that deer velvet is a relatively expensive product. The global price for deer velvet is largely driven by the demand of the major market – Korea. This tends to keep the price fairly high, although dramatic fluctuations from year to year and even within a year take place. As with all natural products, the composition of deer velvet is highly variable, although steps are being taken to standardise the product (Haines *et al.* 2004). The way deer velvet is taken as a dietary supplement also varies from the traditional usage in Asia described above, as relatively low doses of deer velvet are consumed on a daily basis, typically without other ingredients (Suttie & Haines 2002).

However, probably the most frequent question asked by Western consumers of deer velvet is ‘what is the required dose?’ (Arguably you cannot know an appropriate dose until you have a proven efficacy, so this question may be a little premature). Gradually proof of efficacy and standardisation of the product are being addressed by science, but until more human clinical trials are completed it seems unlikely that accurate information on dose will be available. It is human nature to want to perceive benefit from consuming a product and repeat sales depend on clear benefits being shown. It is possible that the marketing difficulties described above result in consumers taking too low a dose to experience a positive benefit. Clearly a review of what science, Western Medicine and OMD know about deer velvet dose would be useful.

There is an extensive literature in Russia, Korea, China and Japan which describes a plethora of clinical trials in humans, clinical observations by health professionals and small animal trials that have used deer velvet in a range of product forms, typically Pantocrine or alternative water or organic solvent extracts. Much of this literature has been translated into English and has been reviewed (Archer & Palfreyman 1983). This literature contains considerable information about the relationship between the dose of deer velvet and the effect, however no attempt has hitherto been made to reanalyse all available data and express the effective dose in units of deer velvet powder/kg of bodyweight. That is, it has not been possible to evaluate the deer velvet dose data in a way which is

directly comparable to modern use as a Western dietary supplement.

The aim of the study reported here was to calculate the equivalent deer velvet powder doses from published literature and then relate those to the published efficacies. The intention is to ultimately develop a series of preliminary recommendations on the effective deer velvet powder dose for specific applications. The initial aim however was to recommend a minimum effective dose for typical consumers of deer velvet which could be used for marketing advice.

Materials and methods

A large number of published and unpublished Russian, Chinese, Korean, Japanese and Western documents were read and, if presented, data relating to dose of deer velvet and efficacy were abstracted. The information was collated into three categories:

- Doses of deer velvet recommended by medical practitioners
- Human clinical trials and clinical case studies
- Small animal trials

In all studies where an extract was used in the trial, or prescribed by a medical practitioner, the information in the publication relating to yield of extract has been used to calculate the equivalent amount of deer velvet powder administered. All dose/efficacy comparisons in this paper are thus presented as milligrams of deer velvet powder equivalent (mg VPE). The authors recognise the pitfalls of this approach, as extracts may have concentrated particular ingredients, leading to efficacies that would not be observed in a subject consuming deer velvet powder. Nevertheless this approach leads, for the first time, to an appraisal of dose which is presented in a form comparable to the typical usage of deer velvet as a Western Dietary Supplement.

Results

Doses of deer velvet recommended by medical practitioners

In TCM, the recommended dose is 900–1200 mg/day taken as a powder or 3000–4500 mg/day boiled in water, soup or Chinese wine (Bensky *et al.* 1986).

In Korea, adults over 16 years are typically prescribed 8000 mg/day, with other ingredients, for periods of 15 days. Children under 16 receive half that dose. The dose can be increased or decreased to suit individual requirements, or if side effects such as indigestion are experienced (Peter Yoon Personal communication).

Using data presented in Brechman (Undated), we calculate that Pantocrine, which is the ethanol extract of deer velvet produced in Russia, contains about 111 mg VPE/ml. This information is supported by yield data published by Gladilov (1962), who also found that

Pantocrine made from moose antlers yielded 110 mg VPE/ml. Consequently, 110 mg VPE/ml of Pantocrine is the factor we have used to convert the doses of Pantocrine reported in the Russian literature to equivalent deer velvet powder doses. Pantocrine is prescribed either as the liquid or as tablets which contain either 0.5 or 1.0 ml of the liquid. Skulkova (1982), as quoted by Archer and Palfreyman (1983), indicated that the typical Russian Pantocrine dose is 25–40 drops or 1–2 tablets twice daily about 30 minutes prior to a meal. These correspond to doses of 250–440 mg VPE/day and 220–440 mg VPE/day, respectively. Pantocrine can also be injected at a similar dose level. Reshetnikova (1954) reported that the dose was up to 660 mg VPE/day for periods of treatment up to one month.

There are no medical practitioner recommendations for deer velvet powder in Western countries, but Blalok (2001), a veterinarian, has found a daily dose of about 20 mg VPE/kg to be effective in treating lameness in dogs and horses. For a 75 kg person, this is equivalent to a dose of 1500 mg VPE/day. Capsule manufacturers typically recommend one to four 250 mg capsules per day, but there is no researched basis for this (R. Swann Personal communication).

Human clinical trials and clinical case studies

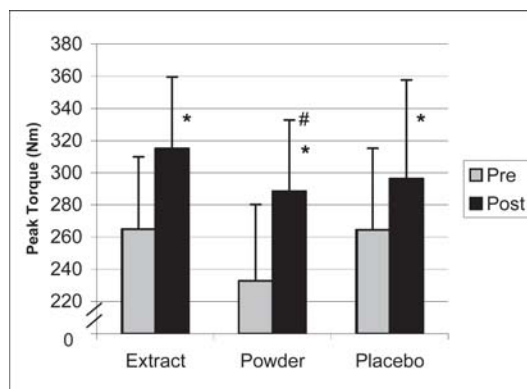
Taneyeva (quoted by Brechman Undated), tested the effect of Pantocrine treatment on the performance of 50 men aged between 18 and 23 years, each running 3000 metres. The men first ran 3000 metres and their individual times were recorded. On a subsequent day each man was given a single oral dose of Pantocrine (2200 mg VPE) 30 minutes before the start of the 3000 metre race. The average improvement in time taken to run the race was 5%. In a subsequent trial the same dose was administered for 12 days, and further performance improvements were observed.

Gerrard *et al.* (1998) investigated the effect of treating previously untrained young male students for 10 weeks with a water-based extract of deer velvet on increase in muscular strength during weight training. The dose of velvet was 350 mg VPE/day. A double-blind placebo-controlled trial design was used, and there were 12 students in each treatment group. Prior to the trial the students were subjected to a battery of strength tests, and this was repeated at the close of the trial after they had undergone the rigorous training either with or without deer velvet treatment. The students gained in strength during the trial, and those treated with deer velvet showed a greater increase than the placebo controls, although this was not statistically significant. For example the total work done in a test where the students had to complete 25 maximal repetitions of a leg extension/flexion exercise was 4013 joules before the trial (mean of all 24

students) and 4515 and 4274 joules for the velvet treated and placebo groups, respectively. These represent 12.5% and 6.5% increases, respectively.

Sleivert *et al.* (2003), conducted a similar trial to that of Gerrard *et al.* (1998) except that the dose of deer velvet was 1500 mg VPE/day, either as deer velvet powder or the equivalent extract dose. The results showed, as before, that the training increased strength, but the increase in strength was significantly greater in the group consuming deer velvet powder compared to the placebo control group (Figure 1). Peak torque increased 21% in the deer velvet powder group, 19% in the deer velvet extract group but only 12% in the placebo group.

Figure 1 Leg extension peak torque pre- and post-training (means \pm standard deviations) for groups of men treated with deer velvet powder, deer velvet extract or a placebo (Sleivert *et al.* 2003).



* Significantly different from pre-supplementation scores for the group

Significant difference in change score between the powder and the placebo group

Recently Broeder *et al.* (2004) have tested the effects of treating men who were already engaged in weight training with deer velvet powder for 10 weeks. They conducted a double-blind trial with groups of nine men who were given either 2700 mg deer velvet powder each day or a placebo control. The strength of the men was tested prior to the start of the treatment period and at the close, but they were allowed to follow their own schedule of weight training during the trial, in contrast to the above studies. Although both groups gained in strength, the group administered the deer velvet gained significantly more strength than the control group (Table 1). Not only were they significantly stronger, but they also demonstrated unexpected improvements in aerobic performance.

Gerrard *et al.* (In submission) tested the effect of deer velvet pre-treatment for 14 days on muscle damage following a simulated downhill run in men who were not trained runners. The men were either treated with

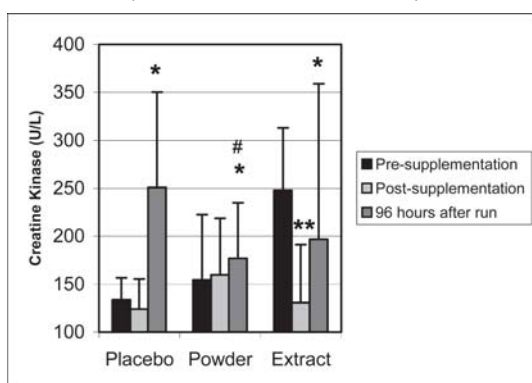
Table 1 Aerobic capacity, anaerobic power, and bench press and leg squat results (means \pm standard deviations) for groups of men undergoing strength training and treated with either a placebo or 2700 mg/day deer velvet for 10 weeks. * and ** indicate significant differences with $p < 0.05$ and $p < 0.01$, respectively, for comparisons between pre- and post-treatment results (Broeder *et al.* 2004).

Variable	Placebo		NZDAV ^a	
	Pre-treatment	Post-treatment	Pre-treatment	Post-treatment
$\dot{V}O_2$ max (liters) ^b	3.94 \pm 0.59	4.01 \pm 0.58	4.30 \pm 0.45	4.72 \pm 0.60**
$\dot{V}O_2$ max (ml/kg) ^b	43.2 \pm 6.9	44.0 \pm 5.9	46.5 \pm 8.1	50.0 \pm 8.9**
Peak Power (W) ^c	690.7 \pm 196.4	677.6 \pm 193.2	776.9 \pm 131.1	772.8 \pm 160.5
Avg Power (W/0.22 km) ^c	542.6 \pm 131.9	515.4 \pm 144.4	619.4 \pm 101.3	606.2 \pm 101.4
Time To Peak Power (sec) ^c	6.9 \pm 2.2	6.4 \pm 1.3	7.9 \pm 2.6	7.0 \pm 1.4
Bench Press (kg) ^d	123.2 \pm 24.0	128.3 \pm 27.5*	120.0 \pm 23.6	125.0 \pm 25.7*
Bench Press/Body Weight ^d	1.30 \pm 0.18	1.35 \pm 0.16	1.26 \pm 0.17	1.31 \pm 0.20*
Leg Squat (kg) ^d	150.5 \pm 28.2	156.6 \pm 30.4*	159.3 \pm 42.7	175.0 \pm 43.5**
Leg Squat/Body Weight ^d	1.60 \pm 0.31	1.68 \pm 0.36	1.68 \pm 0.40	1.85 \pm 0.39*

^a NZDAV = New Zealand Deer Antler Velvet; ^b Treadmill test results; ^c Cycle ergometer results; ^d Strength testing results.

1500 mg deer velvet powder or the equivalent dose of extract or a placebo each day. They then ran on a downhill treadmill for 35 minutes. A number of measurements were made including muscle biopsies, haematological measures and subjective soreness assessments for a period of 4 days after the run. The most notable finding was that the elevation in blood creatine kinase, a marker of muscle damage, was significantly lower in the deer velvet powder treated group (Figure 2). There was a trend that the subjective assessment of soreness was also less in this group. The trial design does not permit a conclusion about whether

Figure 2 Creatine kinase (CK) levels (mean \pm standard deviation) at pre-supplementation, post-supplementation, and 96 hours following a 35 min downhill run for groups of men pre-treated for 14 days with a placebo or with 1500 mg VPE/day of deer velvet powder or deer velvet extract (Gerrard *et al.* In submission).



* Significantly different from post-supplementation scores for the group

** Significantly different from placebo group at baseline

Significant difference in CK rise vs. placebo group at 96 hours post-run

the deer velvet protected the runners' muscles from damage or increased their rates of healing.

Taneyeva (as quoted by Brechman Undated) tested the effect of Pantocrine on mental performance in men aged 18-23 years. They were asked to make corrections to text by substituting letters. Treatment with deer velvet increased the number of corrections made compared to control subjects (Table 2).

Albov *et al.* (1969) presented a series of clinical case studies in which the effects of Pantocrine on reducing blood pressure in cardiac patients was assessed. Overall they reported that 275–495 mg VPE/day orally for 30 days lowered blood pressure. They also reported positive effects with slightly lower injected doses.

Conaglen *et al.* (2003) investigated sexual function in 32 normal men aged 45-65 years in a 12 week placebo-controlled double-blind trial. Subjects were randomly assigned to receive 1000 mg of deer velvet powder or a placebo control each day. There were no significant differences in sexual behaviour or plasma hormone concentrations between the treatment groups.

Allen *et al.* (2002) examined the effect of elk velvet antler taken concurrently with standard medications on symptoms of rheumatoid arthritis, to determine efficacy

Table 2 The influence of an alcohol deer velvet extract on text correction results. * indicates that the increase in number of corrections was statistically significant (Taneyeva quoted by Brechman Undated).

Treatment	Dose of Deer Velvet (mg VPE/kg)	Number of Subjects	Increase in Number of Corrections
Alcohol-only Control	-	9	90
Pantocrine	1100	11	132
Pantocrine	2200	11	141*

Table 3 The influence of a water-based deer velvet extract given in feed for 8 weeks on weight gain in chickens. * indicates that the percentage increase in weight compared to controls was statistically significant (Bae 1975).

Dose of Deer Velvet (mg VPE/day)	Start Weight (g)	Final Weight (g)	Initial Dose (mg VPE/kg)	Final Dose (mg VPE/kg)	Percentage Increase in Weight Compared to Control
0 (Control)	41	1725	0	0	
3.75	41	1768	91	2	2.5
7.5	41	1779	183	4	3.2*
18.75	41	1821	457	10	5.7*
75.0	41	1773	1829	42	2.9*

Table 4 The influence of deer velvet extract, either heated at 120°C for two hours or not heat treated, on rat growth. * indicates that the weight gain was significantly greater than the control group (Suttie & Haines 2000).

Dose of Deer Velvet (mg VPE/kg)	Extract Treatment	Weight Gain (g)	Percentage Increase Compared to Control
0	-	221.1	
50	Heated	221.3	0.1
150	Heated	223.0	0.9
500	Heated	222.8	0.8
50	Unheated	224.1	1.4
150	Unheated	236.0*	6.7
500	Unheated	253.0*	12.6

Table 5 The effect of treatment for 10 days with 250 mg VPE of a deer velvet extract on recovery from anaemia in rabbits (Kim *et al.* 1979a).

Treatment	Control	Elk Velvet	Red Deer Velvet	Sika Deer Velvet
Percentage Change in Haemoglobin Level	175	223	199	178

Table 6 The effect of treatment with deer velvet extract for five days on radioactive iron uptake in either normal or anaemic rabbits. * indicates that the increase in iron uptake was significantly greater for the velvet treated rabbits than for each parallel group of controls (Song 1970).

Rabbits	Dose of Deer Velvet (mg VPE/kg)	Percentage Uptake of Radioactive Iron	Percentage Increase Compared to Controls
Normal	0	10.1	
	3278	17.6*	74
Anaemic	0	16.9	
	3278	27.0*	60

at different dose rates and to enable sample size estimation and dose standardization for a subsequent larger study. Forty patients with stage II rheumatoid arthritis were randomly assigned to one of four groups of 10 patients each. One group received daily a placebo and the other three groups received 430, 860, or 1290 mg of elk velvet antler, together with other appropriate medication. At one month, there were no significant differences between groups in number of adverse events or health status. The greatest improvement was observed in the 1290 mg elk

velvet antler group, while the least was in the placebo group, although the differences between treatment groups were not statistically significant.

Small animal trials

Bae (1975) measured the effect of deer velvet treatment on the growth of chickens. He fed groups of chickens either a base diet or feed supplemented with a water-based extract of deer velvet at one of four different dose levels for a period of 8 weeks. Deer velvet supplement-

Table 7 The effect of treatment with extracts prepared from velvet from different deer species on enzyme activities and plasma cholesterol, total protein and albumin levels in rats after liver damage induced by CCl₄ treatment. Data presented are from two separate studies (Choi *et al.* 1979; Kim *et al.* 1979b). Deer velvet extracts were each given at 125 mg VPE/kg in both experiments. The figures in parentheses are the percentage changes compared to the positive controls. * indicates a significant difference between the velvet treated groups and the positive controls, which were treated with CCl₄ but not with velvet.

Plasma Constituent	Untreated Control ¹	Positive Control ²	Elk Velvet	Red Deer Velvet	Sika Deer Velvet
Alkaline Phosphatase ³ (King-Armstrong Units)	10.1	40.3	35.9* (-10.9%)	36.0* (-10.7%)	35.4* (-12.1%)
Pyruvic transaminase ³ (Karmen Units)	22.9	174.1	144.8* (-16.8%)	137.4* (-25.3%)	141.1* (-19.0%)
Total Cholesterol ³ (mg/dl)	62.7	75.0	67.0* (-10.5%)	66.0* (-12.0%)	67.6* (-9.9%)
Total Protein ⁴ (g/dl)	5.97	5.64	6.13* (8.9%)	5.97* (5.9%)	6.01* (6.6%)
Albumin ⁴ (g/dl)	3.54	3.10	3.50* (12.9%)	3.39* (9.4%)	3.77* (21.6%)

¹ Not treated with CCl₄; ² Treated with CCl₄; ³ Choi *et al.* (1979); ⁴ Kim *et al.* (1979b)

tation was found to significantly influence the weight gain of the chickens (Table 3).

Suttie and Haines (2000) fed young rats a water-based extract of deer velvet in one of three doses daily for six weeks. In each of the groups treated with deer velvet, half were fed extract which had been heated at 120°C for two hours and the other half was fed unheated extract. There were no significant differences in weight gain in the groups of rats fed the heat treated extract, compared to controls, but in contrast there was a dose dependant increase in weight gain in the rats fed the unheated extract (Table 4).

The effect of water-based extracts of deer velvet from several species of deer on the recovery of haemoglobin levels in the blood of rabbits with phenylhydrazine-induced anaemia was studied by Kim *et al.* (1979a). The treated animals were given extracts of elk, red deer or sika deer velvet, administered orally at 250 mg VPE/day, for 10 days after maximal anaemia had been induced. Each of the velvet extracts induced a faster repletion of blood haemoglobin than the control treatment (Table 5). However, no statistics were reported.

Song (1970) conducted a trial on the effect of an ethanol extract of deer velvet on anaemia in rabbits using a massive dose of 3278 mg VPE/kg. He conducted a series of paired experiments with groups of 16 either normal or anaemic rabbits which were either injected with deer velvet extract daily for five days or with saline. He showed that deer velvet treatment significantly increased radioactive iron uptake into the red blood cells in both normal and anaemic rabbits (Table 6).

The effect of deer velvet extracts on recovery after liver damage induced by carbon tetrachloride (CCl₄) was studied in rats by Choi *et al.* (1979). They administered water-based extracts of deer velvet from

elk, red deer and sika deer at a dose of 125 mg VPE/kg. The rats were pre-treated for two days with the deer velvet, then liver damage was induced by oral administration of CCl₄ for two days and the plasma enzyme and cholesterol levels were measured a day later. The deer velvet extract pre-treatment reduced the severity of liver damage. The extracts from the different species of deer appeared to be equally effective (Table 7).

In a subsequent trial using the same experimental design, Kim *et al.* (1979b) measured the effects of the deer velvet extracts on serum protein and albumin levels following liver damage induced by CCl₄. In this experiment, the deer velvet extracts restored the plasma protein and albumin levels, both of which were lowered in positive control rats by CCl₄ treatment, back to the levels of untreated controls (Table 7).

Brechman *et al.* (1969) developed a technique to standardise Pantocrine using a bioassay that measured the weight increase of seminal vesicles of immature mice following treatment. There are many experiments

Table 8 The effect of deer velvet extract treatment on seminal vesicle weight in immature mice. * indicates that the percentage increase of the velvet treated mice was significantly different than the untreated controls (Brechman *et al.* 1969).

Dose of Deer Velvet (mg VPE/kg)	Percentage Increase in Seminal Vesicle Weight
0	-
1481	10
1948	18*
2920	36*

Table 9 Effect of deer velvet extract treatment on testosterone levels in senescence-accelerated mice (SAM-P) or control mice of a similar strain which are not senescence-accelerated (SAM-R) (Wang *et al.* 1988).

Mouse Strain	Dose of Deer Velvet (mg VPE/kg)	Plasma Testosterone (ng/ml)	Percentage Change Compared to Untreated Mice Within Strain
SAM-R	0	58.4	
	326	108.8	86
	752	87.2	49
SAM-P	0	30.2	
	326	84.0	178
	752	126.3	318

Table 10 Effect of deer velvet extract treatment on monoamine oxidase B (MAO-B) in liver and brain of senescence-accelerated mice (SAM P) or control mice of a similar strain which are not senescence-accelerated (SAM-R) (Wang *et al.* 1988).

Mouse Strain	Dose of Deer Velvet (mg VPE/kg)	MAO-B in Liver (dpm/10 mg wet tissue weight)	Percentage Change Compared to Untreated Mice Within Strain	MAO-B in Brain (dpm/10 mg wet tissue weight)	Percentage Change Compared to Untreated Mice Within Strain
SAM-R	0	5.29		2.43	
	326	2.85	46	1.99	18
	752	2.47	53	1.21	50
SAM-P	0	13.45		4.07	
	326	11.47	15	1.39	66
	752	10.22	24	0.81	80

published but Table 8 gives representative data. Dose dependant increases in seminal vesicle weights with treatment are reported, albeit at a very heavy dose.

Wang *et al.* (1988) used strains of mice that are either prone (SAM-P) or resistant (SAM-R) to accelerated senescence to test whether a water extract of deer velvet could influence hormonal and enzymatic changes in the body caused by ageing. They found that deer velvet treatment dose dependently raised plasma testosterone levels in the SAM-P but not the SAM-R mice (Table 9). This was interpreted as an anti-ageing effect of velvet.

Wang *et al.* (1988) also found that deer velvet treatment dose dependently lowered monoamine oxidase levels in the brain and liver in both strains of mice (Table 10). Again, this was interpreted as a demonstration of an anti-ageing effect of velvet.

Shin *et al.* (2001) used water and ethanol extracts of deer velvet to determine the effects on stamina, as assessed by swimming time of mice. Both extracts dose dependently increased swimming time (Table 11).

Table 11 Effect of an ethanol extract or a water-based extract of deer velvet on swimming time in mice. *, **, and *** indicate that treatments were significantly different from respective controls, with $p < 0.05$, $p < 0.01$ and $p < 0.001$, respectively (Shin *et al.* 2001).

Extract Type	Dose of Deer Velvet (mg VPE/kg)	Swimming Time (minutes)	Percentage Increase From Control
Ethanol	0	18	
	156	30*	66
	312	48**	167
	625	69***	283
Water	0	36	
	312	59*	64
	625	108**	200
	1050	283***	228

Discussion

The analysis of the above data is fraught with problems, and it is probably most useful to seek only the broadest interpretations and conclusions. In most cases the health benefits are not proven and in all cases the mechanisms of action and the active ingredients are not characterised. The deer velvet preparations used are not standardised and multiple variables, as set out in the Introduction, are likely to confuse the picture still further. No conclusion in the text is to be taken as a health or cause/effect claim. Nevertheless this discussion attempts to bring together

Table 12 Summary of human efficacy trials using deer velvet at various dose levels. The calculation of dose per kg bodyweight is based on a 75 kg person.

Dose (mg VPE/day)	Dose (mg VPE/kg/day)	Number of Trials	Effectiveness
<1000	13	2	No effect
1000–1500	13–20	3	Small effect, borderline statistically significant
>2000	27	3	Clear effect, statistically significant (where statistics are presented)

conservative conclusions and outline areas for future research.

It is clear that Asian use of deer velvet is typically at much higher doses for shorter periods than the Western usage of deer velvet as a dietary supplement, where presumably the supplement is consumed daily. There are no data on the benefits of consumption of deer velvet at low doses for extended periods in the Western dietary supplement literature. OMD prescribe velvet at high doses because it is effective for the treatment of the health conditions that they have diagnosed. This differs from self medication for long periods at low doses. As the deer velvet industry seeks to define itself, it should consider this dose versus function dilemma. The difficulty may be the requirement to develop a health claim, with the attendant costs.

There are few clinical trials with healthy people taking velvet but they can be roughly ranked as in Table 12. This table combines the trials presented above for athletic performance, cognitive function and sexual performance. It is thus a very preliminary analysis. Nevertheless a pattern emerges: doses of over 2000 mg/day (about 27 mg/kg for a 75 kg person) appear to be effective, and lower doses are either not effective or only marginally effective at raising performance. This is about twice the dose currently recommended by dietary supplement manufacturers.

Even fewer clinical trials have been conducted with people who are suffering an illness or disease condition and who have been treated with deer velvet and at this stage no conclusions are possible.

The small animal trials reported here almost exclusively show statistically significant results, but the doses are massive compared to normal human clinical or experimental consumption. Great care should be taken in extrapolation from these studies to the situation in people. This is an issue for many dietary supplements, and effectiveness advertised by marketers and manufacturers, based on small animal data, may bear no relationship to effectiveness at a typical human dose rate.

This review has brought together a body of data and attempted to present it a consistent format for

comparison, by expressing it as mg VPE. This approach has revealed that, as expected, Asian use of velvet is at a much higher dose than dietary supplement use, the likely effective dose as a dietary supplement is higher than currently thought and the results of small animal trials are positive but at massive doses. These findings provide some challenges to the deer velvet industry.

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