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DeerVelvet

Technical manual

New Zealand
Deer Products

9 SUPPORT FOR GROWTH

9.1 Health Benefits

In Asia, velvet antler is taken:

- to support growth of children, and
- as a weight-gaining tonic for elderly people, invalids and athletes.

In Korea, a great deal of velvet antler is given to children by Oriental Medical Doctors to support growth and development, as well as to enhance the immune system and support mental ability. Velvet antler has also been used to improve strength of athletes (see the *Athletic Performance* section on page 73). Recent research has confirmed that velvet antler has the potential to enhance the growth of young laboratory animals.

9.2 Suggested Physiological Rationale

Velvet antler, particularly if processed at a low temperature, is likely to contain high levels of mixed growth factors. Although it is currently unclear what happens to these relatively small peptide factors during the digestive process, one could speculate that they may be involved in any growth effect of velvet antler. Additionally, or alternatively, components of velvet antler may alter the expression of growth factors within tissues and exert effects by indirect mechanisms.

9.3 Research Support

Velvet antler powder and velvet antler extract have been shown to aid growth in a dose-dependent manner in growing mice (Mineshita 1938), chickens (Bae 1975; Bae 1976; Yartsev 1989) and rabbits (Gavrin 1976). A patented formulation, which contained velvet extract together with emulsifiers delivered in β-cyclodextrin, enhanced the growth rate of young rats while a 'standard velvet extract' did not show a similar effect (Hsu *et al.* 2003). An ethanol-insoluble fraction of a water extract of velvet prevented a proportion of the weight loss observed in rats with adenine-induced anaemia (Yokozawa *et al.* 1994). Sung *et al.* (2003) demonstrated that powdered velvet antler significantly increased the growth of adult rats (starting weight ~300 g), although it had no significant effect on the growth of young animals (starting weight ~187 g).

Other studies have also shown no effect of velvet supplementation on the growth of young rats (Ahn 1994; Zhang *et al.* 2000), while a study described in more detail below did show a positive effect of velvet extract (Suttie *et al.* 2001). These conflicting results highlight that the dose and nature of the velvet product consumed, along with the physiological status of the recipient, are likely to play a major role in any effects on growth caused by velvet.

In vitro studies have revealed that New Zealand velvet antler extracts enhanced the growth of antler cells in a dose-dependent manner (Suttie *et al.* 2001). Similarly, Sunwoo *et al.* (1997a) demonstrated that an aqueous extract of Canadian wapiti velvet antler promoted the proliferation of bovine fibroblast cells in culture. Randel (2002) reported a stimulating effect of commercially available velvet extract pills on Normal Human Dermal Fibroblasts (NHDF cells), and

he proposed that this bioassay be used as a quantitative measure of velvet antler cell growth-stimulatory potency. Wang Ben Xiang's group in China have shown that polypeptides from velvet antler stimulate proliferation of epidermal cells, fibroblasts and rabbit costal cartilage cells (Guo *et al.* 1998; Zhou *et al.* 1999; Weng *et al.* 2001a; Weng *et al.* 2001b; Zhou *et al.* 2001; Weng *et al.* 2002; Guan *et al.* 2006). Comparable fractions from Chinese sika deer and from red deer velvet antler were equally potent at stimulating the proliferation of rabbit costal cartilage cells, but the red deer preparation provided stronger stimulation of the proliferation of epidermal cell than the sika velvet extract (Zhou *et al.* 2001). This demonstrates that the efficacy of velvet from different species of deer may vary.

Some growth studies in more detail

Growth of chickens

The effects of an extract of velvet antler on the growth of chickens was studied by Bae (1975). Groups of chicks were fed 0 (control), 3.75, 7.5, 18.75 or 75 mg extract daily for 8 weeks.

The results are shown in Table 6. At the close of the 8-week study the chickens weighed 1.7–1.8 kg, so at that time the doses were equivalent to between about 2–40 mg/kg for the velvet-treated groups. All doses were effective, but the 18.75 mg dose (about 11 mg/kg) gave the greatest response and resulted in an increase in weight gain of about 6%.

Table 6. Body weight changes in chickens fed experimental diets containing different concentrations of velvet extract for 8 weeks

Data are from Bae (1975). Means with different superscipts differ significantly.

	Dose of velvet extract (mg)				
Measure (g)	**0 (Control)**	**3.75**	**7.5**	**18.75**	**75**
Initial Body Weight	41	41	41	41	41
Final Body Weight	1,725^{a}	1,768^{ab}	1,779^{bc}	1,821^{c}	1,773^{bc}
Feed Intake	3,968	4,000	4,084	4,162	4,062

Growth of young rats

Suttie and Haines (2001) carried out a study to determine whether or not feeding an aqueous extract of New Zealand velvet antler to young male Wistar rats would stimulate growth. A secondary objective was to investigate if heat inactivation of the extract would influence the extent of any growth stimulation. The rationale for this was that, although the active ingredients for growth were not known, it was speculated they might be heat-labile polypeptide growth factors, for example IGF-I. If heat inactivation blocked activity, then some informed speculation on likely active substances could be made.

Seventy male albino Wistar rats about 6 weeks old, each weighing about 105 g, were randomly allocated to one of seven treatment groups (see below). The animals were housed in group cages with four to six rats per cage. The rats were fed *ad lib.* a purified casein-based diet with either no

velvet antler extract or various concentrations of velvet antler extract added (see below). Deionised water was available for drinking at all times.

An aqueous velvet antler extract was prepared, and half of it was inactivated by raising its temperature to 120°C for 2 hours. The active or heat-inactivated velvet antler extracts were added daily for 6 weeks to the purified casein diets at one of three dose rates, *i.e.* 10, 30 or 100 mg/kg bodyweight ('Low', 'Medium' and 'High' dose rates respectively). A control group was fed the casein diet containing no added velvet antler extract.

The treatment groups were as follows:

- Control
- Low Inactive
- Medium Inactive
- High Inactive
- Low Active
- Medium Active
- High Active

The rats were each weighed at the start of the study and weekly thereafter. At the close of the study the rats were killed and body organs were weighed and the femur was dissected for total calcium analysis. During the final week of the study, each rat was individually confined for 24 hours in a metabolism cage for the collection of urine samples. These samples were used to measure calcium and hydroxyproline excretion.

The rats were healthy throughout the trial and no health problems were noted. All 70 rats completed the trial.

The mean body weights of each group of rats, expressed as percentages of the body weight of the control animals, are shown for each week of the study in Figure 5. The group fed the high concentrations of active velvet antler extract grew significantly more throughout the study than the control group or the group fed the heat-inactivated extracts. During the first 3 weeks they rapidly achieved a 12% body weight advantage over the control animals, and then maintained most of this advantage during the rest of the study. The group fed the medium concentration of active velvet extract also grew significantly more during the final 3 weeks of the study compared with the control group or those groups fed the heat-inactivated diets. The overall weight gain also differed significantly (Table 7) among the groups. The groups fed the heat-inactivated extracts did not grow faster than the control and no dose response was observed. In contrast those groups fed the medium and high doses of active velvet antler extract grew significantly more in a dose-dependent manner than the control group.

Liver weight was significantly greater in the groups fed the medium and high doses of active velvet antler extract, but there were no significant differences in testes weights (Table 7). The calcium content of the femur was significantly greater in the group fed the high dose of active extract.

Hydroxyproline concentrations in urine were lower in the groups fed the medium and high doses of active velvet antler extract and also in the group fed the high dose of inactive antler extract. In

contrast urinary calcium was significantly lower only in the group fed the high dose of active extract (Table 7).

Figure 5. Effect of velvet extract supplementation on the growth rate of young male rats

Young rats were fed high, medium or low doses of active or heat-inactivated velvet antler extract or no velvet antler extract (control).

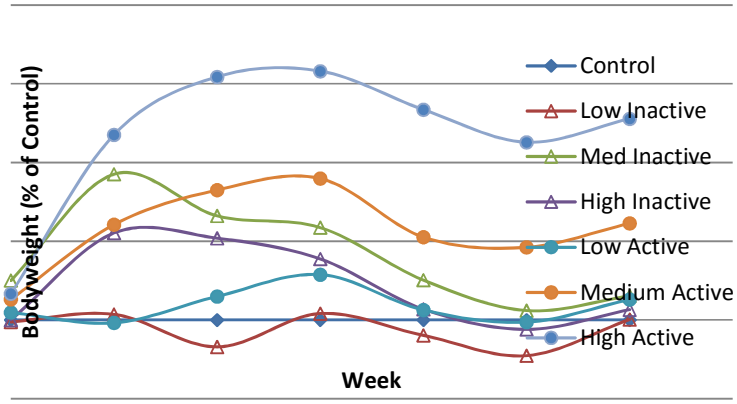

Table 7. Effect of velvet extract supplementation on weight gain, body organs, femur calcium, and urinary excretion of calcium and hydroxyproline of young male rats

	Treatment							
Measure	**Control**	**Inactive Low**	**Inactive Medium**	**Inactive High**	**Low**	**Medium**	**High**	**SED**
Weight gain[1]	221	221	223	223	224	236	253	11
Liver weight[1]	13.7	14.3	13.2	13.9	13.5	15.2	17.1	1.0
Testes weight[1]	3.12	3.21	3.11	3.13	3.07	3.13	3.25	0.13
Femur calcium[2]	129	129	132	132	131	130	144	4
Hydroxyproline[3]	5.1	4.4	5.2	3.4	5.6	3.7	3.9	0.5
Urinary calcium[3]	2.0	2.4	2.8	3.2	2.9	3.0	1.6	0.4

[1] g; [2] mg; [3] µmol/L

Feeding active velvet antler extract to male rats resulted in dose-dependent increases in weight gain. Heat-inactivation abolished the positive effect of the extract on weight gain. It can therefore be concluded that the growth response was due to the presence of heat-labile substances, possibly growth factors, present in the velvet extract.

In Bae's study in chickens (described above), all doses were effective but the 18.75 mg dose (about 11 mg/kg) gave the highest response, and resulted in an increase in weight gain of about 6%. In the present rat study, a dose of 30 mg/kg (medium active treatment) gave a 7% increase in weight gain. Thus, although a comparison between studies is not perfect because of the different species and velvet extracts used, the results of the present study in young rats are in broad agreement with Bae's findings. The results are at odds, however, with those of Sung *et al.* (2003). In their study the growth of young rats was not increased by supplementation with the 'recommended dose' of velvet powder, although that of adult rats was significantly enhanced. This may be due to a difference in dose rates between the two studies or it may be that the growth-enhancing factors were concentrated in the water-based extract used in this study as compared to the velvet powder used by Sung *et al*.

In the present study, liver weight but not testes weight was significantly increased by treatment with active velvet antler extract. In contrast, Bae (1976) found that testes weight of chickens but not liver weight was increased. This may reflect a difference between rats and chickens or a difference between the compositions of the two velvet extracts. In the present study the liver effect is consistent with an overall anabolic effect.

Taken together, the urinary calcium excretion and femur calcium data suggest that the high dose of active velvet antler extract increased calcium deposition and decreased urinary excretion. In data not shown, the mineral density of the bone was not altered by velvet antler extract treatment, so the most likely interpretation of the urinary calcium and femur calcium data is that it reflects an overall anabolic effect rather than a specific effect on bone.

The urinary hydroxyproline data show that the high dose of inactive velvet antler extract as well as the medium and high doses of active extract reduced excretion. A decrease in hydroxyproline excretion can reflect an increase in bone matrix synthesis. This is suggestive of one or more heat-stable factors in velvet antler having some influence on bone metabolism. Potentially these may include small heat-stable peptides or even polar steroids.

In conclusion, an extract of New Zealand velvet antler increased growth when fed to laboratory animals. This supports New Zealand velvet antler having the potential to benefit growth.

Growth of immunised rats

The effect of supplementation with Gycosant™, a patented velvet antler preparation (Sim 2000), was investigated in young rats that underwent an immune challenge (vaccination) (Sunwoo *et al.* 2000; Sim *et al.* 2001; Sim *et al.* 2002). Twenty four weanling Wistar rats were fed *ad lib.* a semi-synthetic diet containing 0% (control), 0.5%, 1% or 3% Glycosant™ powder for 54 days (6 rats per group). Partway through this period, at weeks 5 and 6, each rat was immunised by intra-peritoneal injections of ovalbumin emulsified with an equal volume of Freund's incomplete adjuvant.

Prior to the immunisations, feeding antler powder diets did not significantly affect growth rate (Figure 6) or feed intake. However, final body weights were significantly greater in the groups fed antler powder than the control animals (Table 8), which showed a greatly reduced growth rate following the immunogenic stress (Figure 6).

These data suggested that there are factor(s) in the antler powder that enhance the growth performance of recently immunised rats. Additional effects, on their immune systems, blood, and cholesterol metabolism, are discussed in subsequent sections.

Table 8. Initial and final body weights of immunised rats fed Glycosant™

Initial and final body weights of young rats fed for 8 weeks with Glycosant™ (0.5%, 1% or 3% of diet) or without Glycosant™ (Control), and immunised with ovalbumin on days 35 and 42. Data are means ± SEM (Sim *et al.* 2001).

	Treatment			
Measure	**Control**	**Gycosant™ 0.5%**	**1%**	**3%**
Initial body weight (g)	80.6 ± 3.7	81.2 ± 3.6	81.1 ± 2.7	80.6 ± 2.1
Final body weight (g)	402.9 ± 6.1	433.7 ± 8.3	436.5 ± 6.7	434.1 ± 8.1

Figure 6 Growth rate of immunised rats fed Glycosant™

The growth rates of young rats fed for 8 weeks with Glycosant™ (3% of diet) or without Glycosant™ (Control), and immunised with ovalbumin on days 35 and 42. Groups of rats fed 0.5% or 1% Glycosant™ showed almost identical growth curves as the 3% Glycosant™ group, and are omitted from the graph. Reproduced in part from Sim *et al.* (2001).