Hematologic, Hemostatic, and Biochemical Effects in Cats Receiving an Oral Chondroprotective Agent for 30 Days*

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ABSTRACT

The objective of this study was to evaluate the effects of a chondroprotective agent on hematologic, hemostatic, and biochemical variables in clinically normal cats when administered at twice the recommended levels for 30 days. Fifteen clinically normal female domestic shorthaired cats were used. Twelve cats were given a chondroprotective agent orally, twice daily for 30 days. Three cats served as environmental controls and did not receive any treatment. The Wilcoxon’s rank sum with a Bonferroni correction was used to evaluate the data statistically. Hematologic, hemostatic, and biochemical variables were assessed before treatment and on days 3, 14, and 30 of treatment. All cats remained healthy and showed no adverse reactions to treatment. No clinically and statistically significant shift outside a standard reference range was noted for any parameter. Hematocrit and red blood cell concentrations were decreased from pretreatment concentrations during days 3, 14, and 30 of treatment; however, these values were within a standard reference range at all time points. No significant changes were noted in platelet count, prothrombin time, or activated partial thromboplastin time. There were significant decreases in platelet aggregation response to high and low concentrations of collagen on day 3 and to the high concentration of collagen on days 14 and 30 compared with pretreatment values, but these values were not different from those of untreated cats. There was an increased time to response with the high concentration but not the low concentration of collagen on days 3, 14, and 30. Some parameters, such as potassium, anion gap, alkaline phosphatase, and bicarbonate, showed changes from pretreatment values at some but not all days of treatment.

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However, median concentrations remained within normal reference ranges, suggesting that these minor shifts were not indicative of clinical significance.

Oral chondroprotective agents are widely prescribed in veterinary medicine for the treatment of degenerative joint disease. Safety studies have been performed in dogs; however, to date little is known about the safety of their use in cats. In this study, administration of this chondroprotective agent did not result in any clinically important change in hematologic, biochemical, and hemostatic variables when administered to healthy adult cats for 30 days at twice the recommended dosage.

**INTRODUCTION**

Degenerative joint disease (osteoarthritis) occurs in cats. One study reported an incidence of 20% (14/68) in cats older than 12 years in a radiographic survey. When degenerative joint disease is diagnosed in cats, treatment options are limited. Corticosteroids and nonsteroidal antiinflammatory drugs (NSAIDs), which are commonly used in dogs, have potentially serious side effects. In dogs, steroid use has been associated with iatrogenic hyperadrenocorticism, glucocorticoid-induced hepatopathy, and pancreatitis. The use of NSAIDs can lead to gastrointestinal ulceration, hepatic toxicity, renal necrosis, and platelet abnormalities. Although steroid use is generally better tolerated in cats than in dogs, NSAIDs are not well tolerated in cats, which limits long-term use. Most NSAIDs are metabolized by the liver. Aspirin can be used safely at low doses; however, aspirin is one of the NSAIDs that has been shown to decrease glycosaminoglycan content in cartilage and has the potential to cause osteoarthritis to advance. Butorphanol, a synthetic opiate partial agonist, has been used for pain control in cats but may cause sedation.

Recently, such oral chondroprotective agents as glucosamine and chondroitin sulfate have been recognized for use in cats to help manage pain associated with osteoarthritis and to possibly allow for repair of articular cartilage. Glucosamine is an amino sugar, and chondroitin sulfate is the most abundant glycosaminoglycan in cartilage. Additional research also suggests administration of glycosaminoglycans may be beneficial in the treatment of feline interstitial cystitis because interstitial cystitis in humans is related to a diminished glycosaminoglycan layer in the bladder.

Polysulfated glycosaminoglycan (PSGAG; Adequan®, Luitpold Pharmaceuticals, Inc, Shirley, NY) is approved for use in dogs but not in cats. Nevertheless, a study of the effects on hematologic values after single intramuscular injections of low-dose and high-dose PSGAG in six cats was reported. A transient, dose-dependent prolongation of activated partial thromboplastin time (APTT) and prothrombin time (PT) was observed. Another injectable PSGAG (pentosan polysulfate) has been shown to induce thrombocytopenia in some human individuals. These highly sulfated forms have similar structures to heparin and a pronounced anticoagulation ability related to the extent of their sulfation. Chondroitin sulfate administered orally has not been associated with the degree of “heparinoid” activity seen with the polysulfated forms. The antithrombotic effect of chondroitin sulfate has been purported to be one of the mechanisms by which it functions as a treatment for degenerative joint disease because it has the ability to prevent fibrin thrombi in synovial or subchondral microvasculature, thereby maintaining blood flow to joints.

Cosequin® (Nutramax Laboratories, Inc, Edgewood, MD), an oral chondroprotective nutritional supplement, has been widely used by veterinarians in dogs, cats, and horses for the...
treatment of degenerative joint conditions.\textsuperscript{1} Cosequin is not a PSGAG but a combination of glucosamine hydrochloride, low–molecular-weight chondroitin sulfate, and manganese ascorbate. This agent has been shown to be safe and clinically effective in vivo by reducing pain, inflammation, and associated lameness in humans and animals.\textsuperscript{18–25} In vitro studies have shown that the glucosamine and chondroitin sulfate components act synergistically on chondrocytes,\textsuperscript{26, 27} suggesting different mechanisms of action.\textsuperscript{28, 29} Glucosamine and low–molecular-weight chondroitin sulfate have been shown to be bioavailable in animals.\textsuperscript{30,31}

A controlled study was reported on the hematologic, hemostatic, and biochemical effects of orally administered glucosamine/chondroitin sulfate (Cosequin) in a beagle colony.\textsuperscript{3} Glucosamine/chondroitin sulfate administration for 30 days induced minor but not clinically important changes in hematologic and hemostatic values, and all values stayed within normal reference ranges. The purpose of the study reported here was to assess the effects of the same oral chondroprotective agent on hematologic, hemostatic, and biochemical variables in healthy cats when administered for 30 days at twice the recommended dose.

\section*{Materials and Methods}
\subsection*{Cats and Experimental Design}
Fifteen clinically normal adult, female, domestic shorthaired cats aged 2 through 5 years, with body weights of 3.4 through 3.8 (mean=3.6) kg, were selected for the study on the basis of not having been given (within the last 30 days) any drugs known to affect platelet function or coagulation variables. For a 2-week acclimatization period and during the study, cats were housed indoors in groups, were fed a commercial dry cat chow, and received water ad libitum. All cats were evaluated concurrently and were adapted to the procedures through frequent handling. Cats were randomly assigned using a lottery to either the treatment or control group. Of the 15 cats, 12 were administered the chondroprotective agent (one capsule, orally, every 12 hours, for 30 days). Each capsule contains a combination of 250 mg glucosamine HCl (FCHG49\textsuperscript{TM} Nutramax Laboratories, Inc, Edgewood, MD), 200 mg purified sodium chondroitin sulfate (TRH122\textsuperscript{TM}, Nutramax Laboratories, Inc, Edgewood, MD), and 38 mg manganese ascorbate.

The remaining three cats did not receive the compound (untreated control group). This group was used as an environmental control and was not given placebos, which were considered unnecessary for the purposes of this study.

\subsection*{Blood Sample Collection}
Blood samples (6 mL) were collected from the jugular vein, using a 22-gauge needle. Cats in the treatment group were sampled on the first day of treatment before oral administration of the agent (day 0), and also on days 3, 14, and 30 of its administration. Blood samples were not obtained from untreated cats on days 0 and 3 but were collected as environmental control samples on days 14 and 30. Samples were obtained in the morning, before administration of the agent to cats receiving the compound. These times were chosen to approximate steady-state concentration of the agent (day 3) and to evaluate its effects when given for an interval of 30 days. The midpoint time (day 14) was arbitrarily chosen to augment the interpretation of the data collected. All animal protocols had been approved by the College of Veterinary Medicine’s Institutional Animal Care and Use Committee.

\subsection*{Hematologic Procedures}
The packed cell volume was determined by use of the microhematocrit procedure. Leuko-
cyte and erythrocyte concentrations, hemoglobin concentration, mean corpuscular volume, and mean corpuscular hemoglobin concentration were determined by use of an automated cell counter (Coulter S-790, Coulter Electronics, Hialeah, FL).

**Coagulation Procedures**

PT and APTT were determined using a fibrometer (BBL Fibrosystems, Cockysville, MD) and commonly accepted clinicopathologic laboratory techniques as previously reported by Barr.²,3²

**Serum Biochemical Procedures**

Serum biochemistry concentrations were determined by use of reagent kits and a centrifugal autoanalyzer (Encore, Baker Instruments Corp, Allentown, PA).

**Platelet Aggregation Determination**

Sample handling and measurement of platelet aggregation and adenosine triphosphate (ATP) release were done using an electronic aggregometer (Model 500, Chrono-Log Co, Havertown, PA) coupled to a recorder (Model 700, Chrono-Log Co, Havertown, PA) as described previously.²,3² A 450 µL aliquot of mixed whole blood was combined with 450 µL heparinized Tyrode’s solution (0.5 mM MgCl₂, 0.9 mM NaH₂PO₄, 2.0 mM CaCl₂, 137.0 mM NaCl, 24.0 mM NaHCO₃, 4.0 mM KCl, 5.5 mM glucose, and 2 IU/mL of heparin). Where ATP release was measured, 90 µL Chrono-Lume (Chrono-Log Co, Havertown, PA) was placed in the aggregometer cuvette at the end of the aggregation. Each lot of Chrono-Lume was tested for its ability to enhance platelet aggregation before use in the study, and the lot was rejected if enhancement occurred. After equilibration for 2 minutes at 37°C, 5 or 10 µM adenosine diphosphate (ADP) was added in a 5 or 10 µL volume, respectively. Platelet aggregation (measured as changes in electrical impedance in ohms) in response to ADP was measured. Other 450 µL aliquots were treated similarly except that 2 or 5 µM collagen was added in place of ADP in a 2 or 5 µL volume, respectively, and platelet aggregation and ATP release (measured in µM compared with an ATP standard) were measured. Aggregation studies were done between 30 and 120 minutes after blood sample collection. Aggregation was considered complete after 6 minutes as determined previously.²,3² Platelet counts were measured by use of an automated cell counter.

**Analysis of Data**

For cats treated with the chondroprotectant, the Wilcoxon’s signed rank test was used to test for differences in hematologic and serum biochemical variables and coagulation between pretreatment and 3-, 14-, and 30-day samples from each cat. To account for three time points being compared to pretreatment value, a Bonferroni correction was used. Because of this, findings were considered significant at \( P < 0.017 \). In instances where a significant change was detected using the Wilcoxon’s signed rank test, the Wilcoxon’s rank sum test was performed to compare that treatment group value with the control group value at the same sample collection time. This additional test was completed to rule out environmental or technique changes as a cause for differences. The Wilcoxon’s rank sum test was not performed on all data in an attempt to reduce the incidence of experimental, type-I error. Because we were particularly interested in perturbations in the hemostatic variables, these values were adjusted by dividing the day-3, day-14, and day-30 values by the pretreatment values before performing statistical analysis on these adjusted values. This additional step was performed to reduce the incidence of error resulting from
Results

No cats developed clinical illness during the study. None of the cats vomited after administration of the chondroprotective agent. Attitude, appetite, and water consumption remained subjectively constant throughout the period as determined by the investigators (non-blind) and support staff (blind).

In the chondroprotective group, hematocrit and red blood cell (RBC) concentrations were decreased on days 3, 14, and 30 of the trial from the pretreatment value levels; however, these changes were not statistically significant when compared with those of the untreated cats (Table 1). The remaining hematologic parameters were unaffected by the administration of oral chondroprotectant. Clotting parameters (PT and APTT) did not show prolonged times.

In the chondroprotective group, there was a significant decrease in red blood cell concentration on days 3, 14, and 30 from the pretreatment value levels; however, these changes were not statistically significant when compared with those of the untreated cats (Table 1). The remaining hematologic parameters were unaffected by the administration of oral chondroprotectant. Clotting parameters (PT and APTT) did not show prolonged times.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Before Treatment</th>
<th>3</th>
<th>14</th>
<th>30</th>
<th>Reference Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hematocrit (%)</td>
<td>36 (34–45)</td>
<td>31 (27–36)*</td>
<td>30 (26–34)**</td>
<td>31 (24–37)*</td>
<td>25–45</td>
</tr>
<tr>
<td>Red blood cells (x10^6/µL)</td>
<td>8.6 (7.7–10.0)</td>
<td>7.6 (6.4–8.9)*</td>
<td>7.1 (6.4–8.6)*</td>
<td>7.3 (6.0–8.3)*</td>
<td>5.5–10.3</td>
</tr>
<tr>
<td>White blood cells (x10^6/µL)</td>
<td>8.6 (2.3–16.9)</td>
<td>8.8 (3.3–19.0)</td>
<td>10.7 (7.3–19.4)</td>
<td>8.9 (4.4–23.2)</td>
<td>6.1–21.1</td>
</tr>
<tr>
<td>Neutrophils (x10^3/µL)</td>
<td>4.9 (0.4–11.6)</td>
<td>4.2 (1.2–11.8)</td>
<td>5.7 (0.7–11.8)</td>
<td>6.5 (2.5–17.2)</td>
<td>2.6–13.6</td>
</tr>
<tr>
<td>Lymphocytes (x10^3/µL)</td>
<td>2.6 (0.4–5.7)</td>
<td>2.4 (1.8–6.3)</td>
<td>2.2 (0.8–6.0)</td>
<td>2.0 (1.4–4.9)</td>
<td>1.3–9.1</td>
</tr>
<tr>
<td>Monocytes (x10^3/µL)</td>
<td>0.2 (0–0.7)</td>
<td>0.1 (0–0.6)</td>
<td>0.1 (0–0.6)</td>
<td>0.2 (0–0.6)</td>
<td>0–0.7</td>
</tr>
<tr>
<td>Eosinophils (x10^3/µL)</td>
<td>0.7 (0–1.9)</td>
<td>0.5 (0–1.3)</td>
<td>0.7 (0.1–2.3)</td>
<td>0.9 (0.3–1.7)</td>
<td>0.2–4.3</td>
</tr>
<tr>
<td>Basophils (x10^3/µL)</td>
<td>0 (0–0)</td>
<td>0 (0–0.4)</td>
<td>0 (0–0.2)</td>
<td>0 (0–0.3)</td>
<td>0–0.2</td>
</tr>
<tr>
<td>Mean platelet volume (fL)</td>
<td>10.4 (10.4–11.8)</td>
<td>10.2 (9.7–12.6)</td>
<td>10.4 (9.5–14.2)</td>
<td>10.5 (9.0–12.0)</td>
<td>11.3–15.0</td>
</tr>
<tr>
<td>Prothrombin time (sec)</td>
<td>10 (10–13)</td>
<td>10 (10–12)</td>
<td>11 (8–11)</td>
<td>10 (9–12)*</td>
<td>8–11</td>
</tr>
<tr>
<td>Activated partial thromboplastin time (sec)</td>
<td>16 (12–25)</td>
<td>15 (13–21)</td>
<td>14 (10–16)*</td>
<td>13 (10–15)*</td>
<td>11–23</td>
</tr>
<tr>
<td>Mean corpuscular volume (fL)</td>
<td>41 (40–46)</td>
<td>40 (39–45)</td>
<td>41 (39–46)</td>
<td>42 (39–46)</td>
<td>41–51</td>
</tr>
<tr>
<td>Red cell distribution width (%)</td>
<td>16.5 (14.8–18.5)</td>
<td>16.4 (14.1–17.9)</td>
<td>16.9 (15.4–19.8)</td>
<td>16.9 (15.0–21.4)</td>
<td>14.8–20.0</td>
</tr>
</tbody>
</table>

*Significantly different from before treatment (P<.017).
†Significantly different from untreated at same time point (P<.05).
significant decrease in the ability of the platelet to respond to collagen on day 3 (69% decrease for high and 74% decrease for low concentrations of collagen). Aggregation response at both low and high concentrations of collagen was somewhat restored by days 14 and 30 (range of 33% to 55% decrease) compared with pretreatment values and only significantly different for the high concentration of collagen. However, these changes were not statistically different compared with those of untreated cats. Onset of platelet aggregation in treated cats was not different from that of untreated cats or from pretreatment values at the low concentration of collagen. Onset was numerically prolonged 100% in response to the high concentration of collagen at all time points (P < .017 on day 3 but not on days 14 or 30).

Serum chemistry parameters were largely unaffected by administration of chondroprotectant in this study (Table 2). Median concentrations of all parameters were within the reference range for all days tested during the experiment and no parameter was different from untreated cats. Creatinine concentrations in cats receiving the chondroprotectant were significantly decreased from pretreatment values on day 3 but were not statistically different on days 14 and 30. Serum potassium concentration decreased significantly on day 3 as did anion gap on day 30 but remained within reference range. Serum bicarbonate concentration increased from pretreatment values on days 14 and 30 but remained within reference range.

Serum enzyme activity (alanine aminotransferase, aspartate aminotransferase, alkaline phosphatase, amylase) and cholesterol concentrations were all within reference ranges and showed no consistent shift over time. Remaining electrolyte concentrations were unaffected by chondroprotectant administration, as were serum glucose, serum urea nitrogen, and bilirubin.

Two cats had elevated liver enzymes, both before and during treatment; however, activity levels recovered somewhat while in the treatment group. The cause of these elevated activities was not determined.

**DISCUSSION**

The experimental design of this safety study (pretreatment value serving as control and untreated group blood samples only on days 14 and 30) permitted an appropriate evaluation with a minimum number of animals. However, this design may limit the interpretation of some parameters. Therefore future studies would benefit from having a concurrently handled untreated control group (i.e., placebo treatment and blood sampling of all cats at all time points).

None of the cats showed any discomfort or gastrointestinal signs. This is in agreement with other published studies using the identical agent in dogs. The orally administered chondroprotectant agent appeared to induce minimal hematologic, hemostatic, and biochemical effects in cats, similar to those previously reported with the same agent in dogs and in humans. However, injectable PSGAG has been shown to produce dose-dependent, albeit transient increases in coagulation times. Other than a slight decrease in hematocrit and red blood cell concentration, which nevertheless remained within normal physiologic ranges, the oral chondroprotectant induced no clinically significant changes in hematologic parameters in this study. It is possible that the changes noted in hematocrit and red blood cell concentration reflect the volumes of blood needed for analysis instead of any changes attributable to the agent tested. The lack of blood samples before treatment and on day 3 from the untreated control group limits the ability to confirm this hypothesis.

The changes observed in the biochemical as-
<table>
<thead>
<tr>
<th>Variable</th>
<th>Before Treatment</th>
<th>3</th>
<th>14</th>
<th>30</th>
<th>Reference Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total protein (g/dL)</td>
<td>7.3 (6.6–8.3)</td>
<td>7.2 (6.4–8.0)</td>
<td>7.4 (6.2–8.3)</td>
<td>7.6 (6.6–8.5)</td>
<td>6.5–8.9</td>
</tr>
<tr>
<td>Albumin (g/dL)</td>
<td>3.2 (2.7–3.6)</td>
<td>3.2 (2.8–3.6)</td>
<td>3.2 (2.6–3.9)</td>
<td>3.4 (2.6–4.0)</td>
<td>3.2–4.7</td>
</tr>
<tr>
<td>Globulin (g/dL)</td>
<td>4.2 (3.6–4.7)</td>
<td>4.1 (3.2–4.7)</td>
<td>4.2 (3.2–5.0)</td>
<td>4.0 (3.1–4.9)</td>
<td>2.8–4.8</td>
</tr>
<tr>
<td>Creatinine (mg/dL)</td>
<td>1.2 (0.8–1.6)</td>
<td>1.1 (0.7–1.2)*</td>
<td>1.1 (0.7–1.4)</td>
<td>1.1 (0.8–1.3)</td>
<td>0.6–2.3</td>
</tr>
<tr>
<td>Glucose (mg/dL)</td>
<td>94 (80–186)</td>
<td>91 (79–143)</td>
<td>93 (78–125)</td>
<td>94 (77–160)</td>
<td>63–140</td>
</tr>
<tr>
<td>Sodium (mEq/L)</td>
<td>153 (151–155)</td>
<td>152 (150–157)</td>
<td>154 (150–156)</td>
<td>153 (149–155)</td>
<td>148–161</td>
</tr>
<tr>
<td>Potassium (mEq/L)</td>
<td>3.7 (2.9–4.3)</td>
<td>3.5 (3.0–3.7)*</td>
<td>3.8 (2.5–4.0)</td>
<td>3.4 (3.2–3.9)</td>
<td>3.3–5.2</td>
</tr>
<tr>
<td>Chloride (mEq/L)</td>
<td>119 (115–122)</td>
<td>117 (114–121)</td>
<td>117 (115–122)</td>
<td>119 (115–122)</td>
<td>116–130</td>
</tr>
<tr>
<td>Bicarbonate (mEq/L)</td>
<td>17 (13–19)</td>
<td>18 (16–20)</td>
<td>19 (15–21)*</td>
<td>18 (17–20)*</td>
<td>13–24</td>
</tr>
<tr>
<td>Anion gap (mEq/L)</td>
<td>22 (19–23)</td>
<td>20 (18–24)</td>
<td>20 (18–25)</td>
<td>19 (16–24)*</td>
<td>12–24</td>
</tr>
<tr>
<td>Serum urea nitrogen (mg/dL)</td>
<td>23 (18–35)</td>
<td>24 (18–30)</td>
<td>27 (22–31)</td>
<td>27 (20–32)</td>
<td>17–35</td>
</tr>
<tr>
<td>Calcium (mg/dL)</td>
<td>8.7 (8.3–10.3)</td>
<td>9.2 (8.5–10.6)</td>
<td>9.0 (8.1–10.8)</td>
<td>9.1 (8.7–10.3)</td>
<td>8.2–11.5</td>
</tr>
<tr>
<td>Phosphorus (mg/dL)</td>
<td>3.8 (2.3–4.6)</td>
<td>4.0 (2.5–4.8)</td>
<td>3.7 (2.2–5.3)</td>
<td>3.7 (3.0–6.3)</td>
<td>2.7–6.5</td>
</tr>
<tr>
<td>Magnesium (mEq/L)</td>
<td>2.0 (1.5–2.2)</td>
<td>1.9 (1.6–2.1)</td>
<td>1.9 (1.6–2.1)</td>
<td>1.9 (1.8–2.2)</td>
<td>1.6–2.4</td>
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<tr>
<td>Alanine aminotransferase (U/L)</td>
<td>68 (40–850)</td>
<td>51 (35–328)</td>
<td>60 (37–424)</td>
<td>60 (36–316)</td>
<td>35–134</td>
</tr>
<tr>
<td>Aspartate aminotransferase (U/L)</td>
<td>27 (17–112)</td>
<td>25 (17–92)</td>
<td>21 (13–68)*</td>
<td>23 (15–47)</td>
<td>13–46</td>
</tr>
<tr>
<td>Alkaline phosphatase (U/L)</td>
<td>27 (15–44)</td>
<td>32 (14–47)</td>
<td>37 (19–62)*</td>
<td>39 (22–50)</td>
<td>15–96</td>
</tr>
<tr>
<td>γ-Glutamyltransferase</td>
<td>2 (2–2)</td>
<td>2 (2–2)</td>
<td>2 (2–2)</td>
<td>2 (2–2)</td>
<td>0–2</td>
</tr>
<tr>
<td>Creatine kinase</td>
<td>341 (120–2123)</td>
<td>311 (147–570)</td>
<td>320 (83–722)</td>
<td>237 (133–649)</td>
<td>71–502</td>
</tr>
<tr>
<td>Bilirubin</td>
<td>0.1 (0.1–0.8)</td>
<td>0.1 (0.1–0.6)</td>
<td>0.1 (0.1–1.7)</td>
<td>0.1 (0–1.6)</td>
<td>0–0.4</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>101 (68–153)</td>
<td>110 (79–162)*</td>
<td>92 (72–157)</td>
<td>110 (74–156)*</td>
<td>73–265</td>
</tr>
</tbody>
</table>

*Significantly different from before treatment (P<.017).
ssessments do not appear to be clinically important. Although there were statistically significant changes in platelet aggregation tests, these changes were not severe enough to be manifest as changes in routinely performed coagulation studies. Bruising or abnormal hematoma formation after venipuncture was not noted in any cat at any time during the study, unlike that reported for high doses of PSGAG administration in cats.11

In the dog, the same orally administered chondroprotectant caused a transient decrease in hematocrit, hemoglobin, white blood cell, and segmented neutrophil values; however, the values remained within normal physiologic ranges. These parameters returned to pretreatment concentrations by day 30 of administration. However, similar to the study reported here, no decreases in PT or APTT were noted when the chondroprotectant agent was administered to dogs for 30 days. The same study design (blood sampling before treatment and days 3, 14, and 30 after treatment) was used in the dog study. Therefore the effects noted on hematocrit and hemoglobin may have been partially caused by frequent blood sampling. A human crossover study reported no change in hematocrit and hemoglobin when individuals were treated for 8 weeks with the same oral chondroprotective agent.19

There has been some speculation that dietary glucosamine can raise serum glucose levels; however, glucose concentration was not affected in this study.

Glucosamine and chondroitin sulfate are sold as dietary supplements, and the purity, content, and activity vary greatly between products.33 Because glucosamine and chondroitin sulfate are extracted from animal sources, lower purity compounds may have inherent safety risks, such as protein hypersensitivity; therefore the results of this study should not be extrapolated to other products. Recent articles have suggested methods by which veterinarians and consumers can make intelligent choices in choosing marketed products.34, 35

CONCLUSION

The oral administration of this combination of low–molecular-weight chondroitin sulfate, glucosamine HCl, and manganese ascorbate as a chondroprotective agent to cats appears to be safe, with few, if any, findings of clinical significance. As with any long-term supplement, the veterinarian is advised to assess the patient’s baseline status before the initiation of any intervention method. Regular monitoring of the patient will ensure the therapy provides not only adequate efficacy but also a sufficient margin of safety to justify continuation of use.

REFERENCES
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