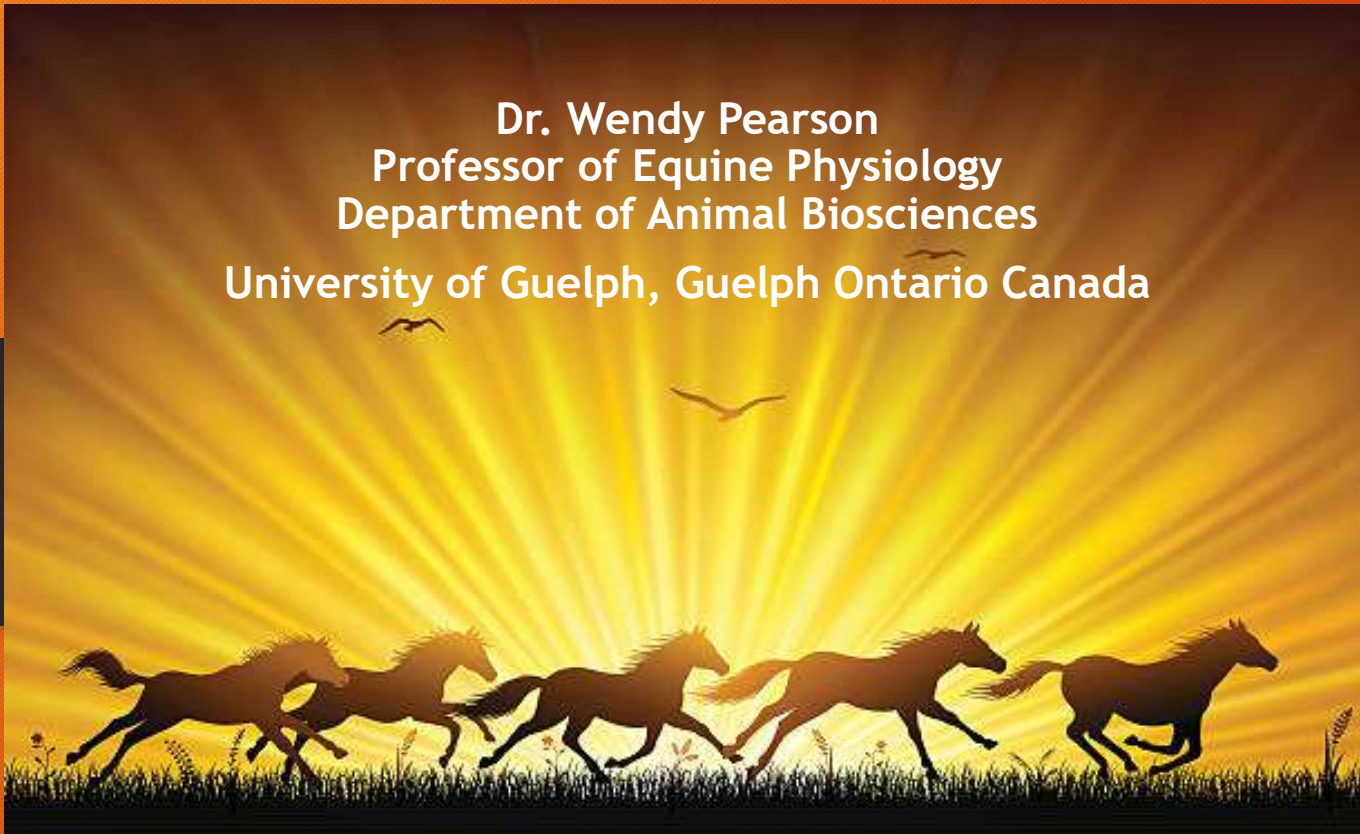


Dr. Wendy Pearson
Professor of Equine Physiology
Department of Animal Biosciences
University of Guelph, Guelph Ontario Canada



UNIVERSITY OF
GUELPH

Nutritional Joint Care Supplements
Closing the gap between science and fiction

What is Feed?

UNIVERSITY OF
GUELPH



- provision of substrates for maintenance of bodyweight and replenishment of energy reserves in working muscle and other tissues
- promotion of tissue adaptation, growth, and repair
- promotion of general health and well-being
- application of competition feeding strategies appropriate to the athletic task.

Is feed anything else?

UNIVERSITY OF
GUELPH



Joint care supplements

UNIVERSITY OF
GUELPH



- Dietary
- Ingredients from natural sources
- Preserve the structure and/or function of healthy cartilage
- NOT marketed to treat disease

Can 'treatments' be natural?

UNIVERSITY OF
GUELPH



Drugs coming from plants

UNIVERSITY OF
GUELPH



Reserpine

Ephedrine

Salicylic acid

Nicotine

Linoleic acid

Stevioside

Rotenone

Taxol

Strichnine

Thymol

yohimbine

Allantoin

Digitalis

Atropine

Cocaine

Berberine

Codeine

Morphine

Ouabain

Pilocarpine

Quinine

Rutin

scopolamine

Anisodine

Bromelain

Bergenin

Borneol

Colchicine

Curcumin

Danthron

L-dopa

Hesperidin

Gossypol

Galanthamine

pinitol

Health and performance issues related to nutrition

UNIVERSITY OF
GUELPH



- Osteoarthritis and joint diseases
- Cushings disease
- diabetes
- cancer
- renal disease
- Heart disease
- Dermatitis
- Poor feed utilization
- Poor growth
- Poor reproductive performance
- Reduced athletic performance
- Bad attitude
- etc

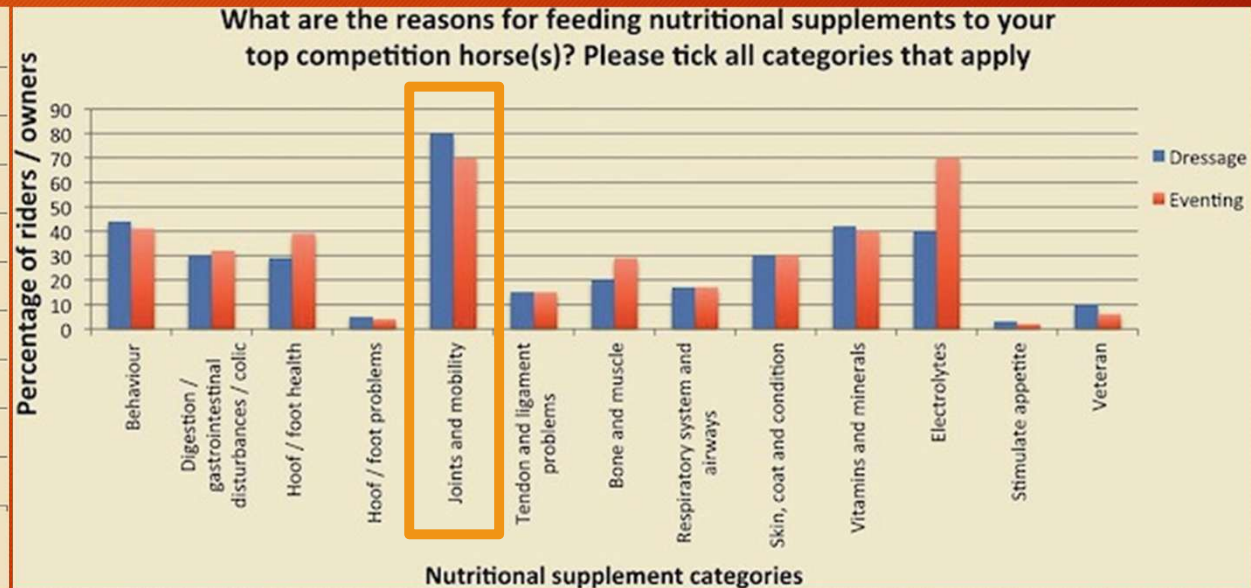
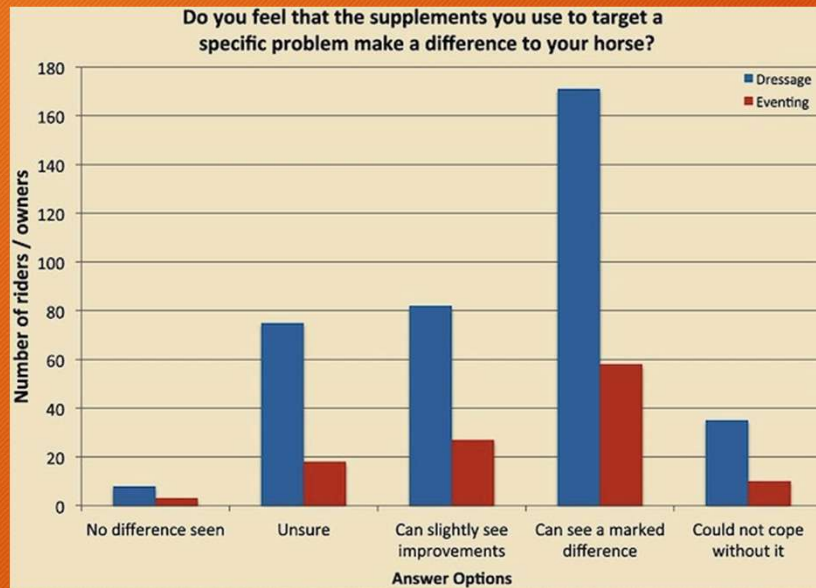
Industry dynamics

UNIVERSITY OF
GUELPH

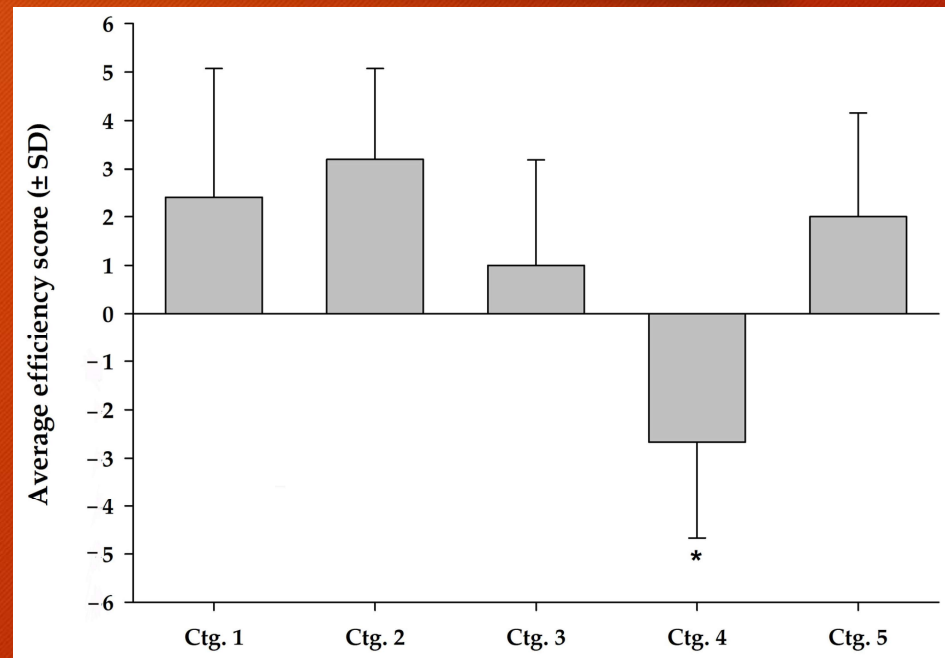
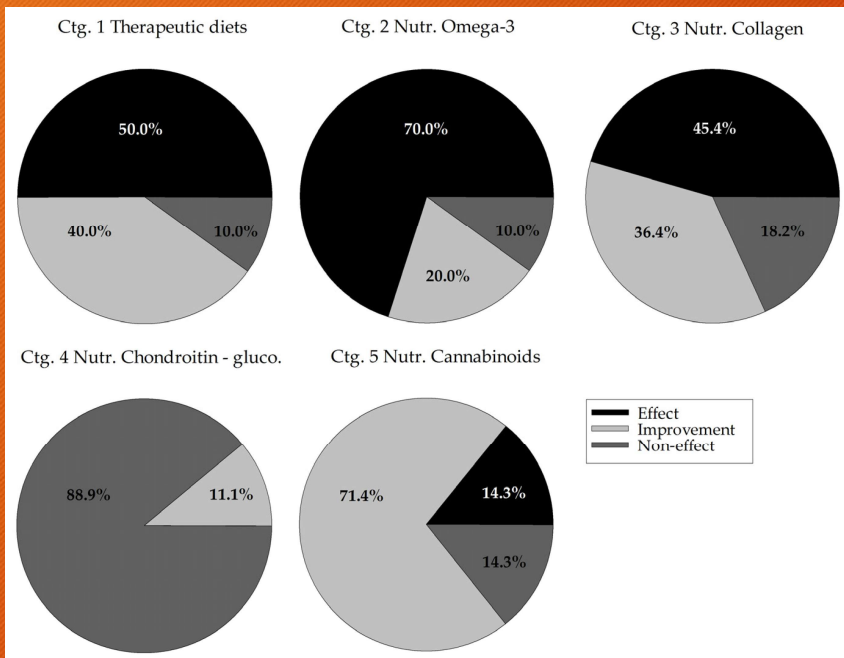


- OA most common joint disease in companion animals
 - Affects 20-25% of dogs; >80% of geriatric dogs
 - Radiographic evidence in 60-90% of cats over 12 yrs
 - OA accounts for ~60% of performance-limiting conditions in horses
- Joint supplements largest nutraceutical category in horses
 - 40-50% of all supplements used in US
 - 60-70% of performance horses in North America are fed a joint supplement
- Global pet supplements market > \$3B p.a.
 - Joint health largest sector

Horses



Dogs and cats



Barbeau-Grégoire M, Otis C, Cournoyer A, Moreau M, Lussier B, Troncy E. A 2022 Systematic Review and Meta-Analysis of Enriched Therapeutic Diets and Nutraceuticals in Canine and Feline Osteoarthritis. *Int J Mol Sci.* 2022 Sep 8;23(18):10384. doi: 10.3390/ijms231810384. PMID: 36142319; PMCID: PMC9499673.

Science sells!

UNIVERSITY OF
GUELPH



“Show me the damn proof that this racehorse supplement really works.”



The Clinical Study

The mission: to see if active ingredients could stimulate the immune system and improve performance of the horse.

For 42 days... one group of horses was supplemented with Echinacea and a second group of horses was given a placebo. Each group's response was recorded.

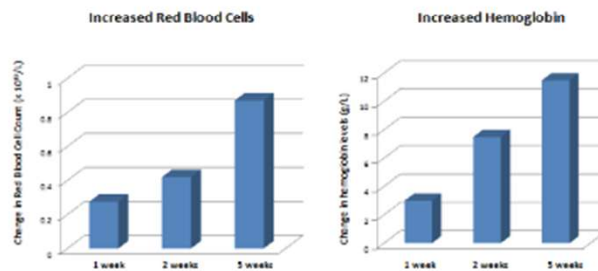
The Results?

- ✓ Increased the size and concentration of peripheral red blood cells, and the concentration of hemoglobin and packed red cell volume
- ✓ Effectively stimulated equine immunocompetence,
- ✓ Improved the quality of blood by increasing hemoglobin levels and the number of red blood cells which, by virtue of their effects on oxygen transport cells
- ✓ Elevated the parameters of exercise physiology and performance.

Bottom line? It WORKS!

“If it hasn't been shown by science to work, we don't put it in our products,” says a Biomedical Research Laboratories spokesperson.

Can a specialized equine supplement help increase red blood cell and hemoglobin levels in performance horses?



Yes, horses that were fed an active ingredient in EPO-Equine™ daily showed significant increases in red blood cell and hemoglobin levels compared to horses fed a placebo.¹

Wow, right?

INGREDIENTS

- echinacea
 - boron
 - vitamin B 3, 6, 12
 - folate
 - inositol
 - iron
 - dandelion extract
 - yellow dock extract
 - vitamin C
 - nickel
 - Alpha lipoic acid
 - lutein
 - choline
 - PABA
 - lycopene
-
- lycopene - reduced mean volume (MCV) of red cells DECREASED in rats (Wei Sheng Yan Jiu. 2011 Sep;40(5):620-3.)

TABLE 1: Label claim of glucosamine free base (GFB) compared to measured levels of GFB in 23 commercial glucosamine supplements

Product	Label claim GFB (mg) /50 mg product	Measured amount	
		GFB (mg)/50 mg product (mean \pm s.d.)	Measured GFB (% expected GFB)
A	5.29	11.7 \pm 0.5	221.2
B	18.4	40.5 \pm 6.5	220.1
C	7.3	10.4 \pm 0.2	142.5
D	7.3	9.4 \pm 0.3	128.8
E	10.3	13.2 \pm 1.2	128.0
F	29.4	36.6 \pm 1.0	124.5
G	15.6	17.8 \pm 1.2	114.1
H	22.6	25.5 \pm 2.6	112.8
I	15.0	16.5 \pm 2.1	110.0
J	15.4	16.8 \pm 2.2	109.0
K	13.3	14.3 \pm 1.7	107.9
L	4.2	4.5 \pm 0.4	106.5
M	4.39	4.5 \pm 0.1	102.5
N	5.29	5.4 \pm 0.2	102.1
O*	29.7	27.5 \pm 1.7	92.6
P*	5.0	4.6 \pm 0.1	92.0
Q*	27.4	22.1 \pm 1.5	80.7
R*	4.9	3.4 \pm 0.2	69.4
S*	15.9	9.8 \pm 1.0	61.6
T*	1.7	0.5 \pm 0.1	29.4
U*	4.39	0.5 \pm 0.0	11.4
V*	29.6	2.9 \pm 0.0	9.8
W*	11.0	0.0 \pm 0.0	0

Results expressed as mean \pm s.d. for n = 3. *Substance failed to meet label claims.

Quality control

UNIVERSITY OF
GUELPH



Oke S, Aghazadeh-Habashi A, Weese JS, Jamali F. Evaluation of glucosamine levels in commercial equine oral supplements for joints. *Equine Vet J.* 2006 Jan;38(1):93-5.

Perception does not (always) equal reality!



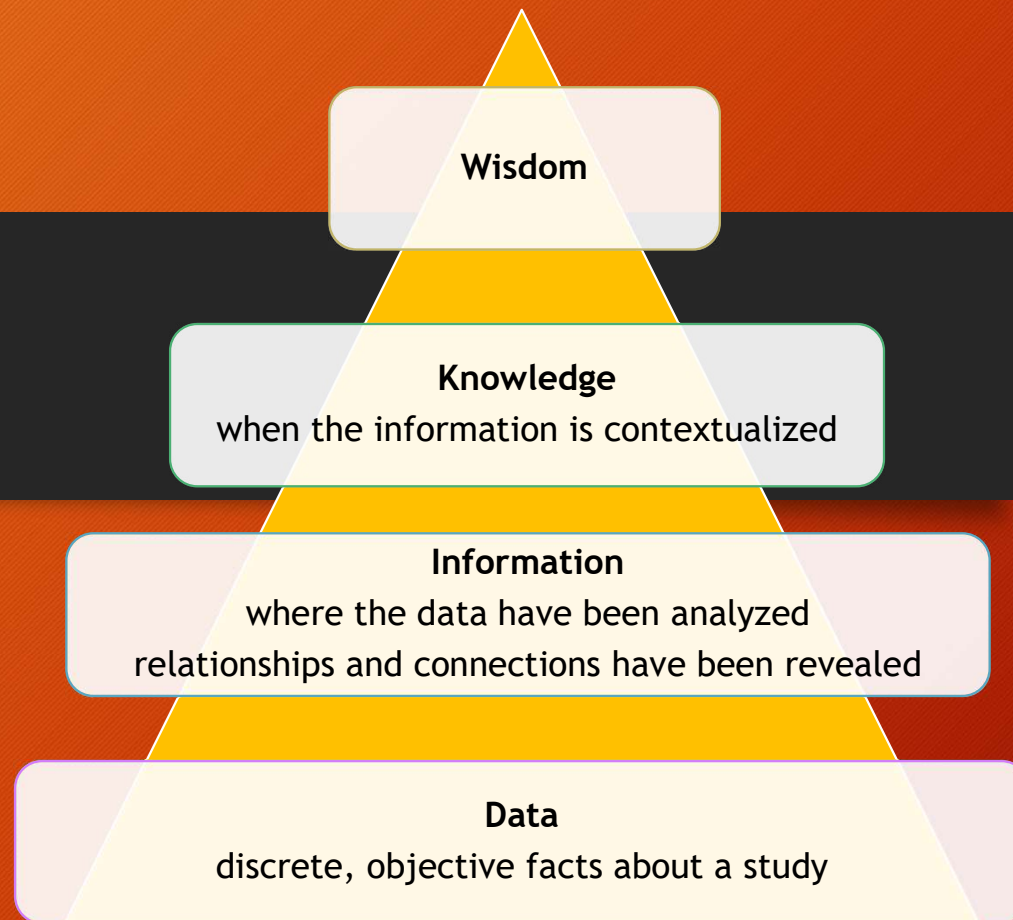
Perception does not (always) equal reality!

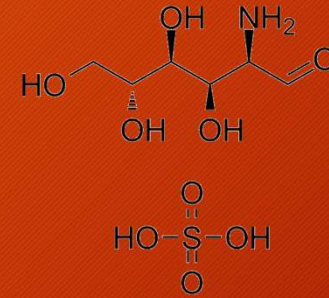
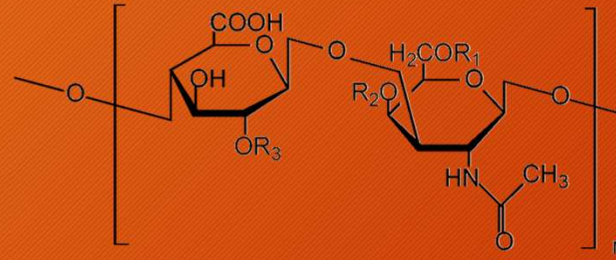
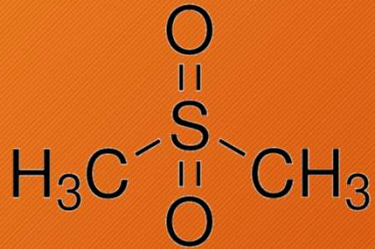
UNIVERSITY OF
GUELPH



- most marketing of ‘science-based’ is indirect
- what’s wrong with indirect research?
 - interactions between ingredients
 - species-specific responses to the ingredients
 - most indirect research is not conducted on the target species
 - DOSE!
- This is an industry reliant on science but sadly lacking in it..

The Goal





Companion animal (and equine) research

UNIVERSITY OF
GUELPH

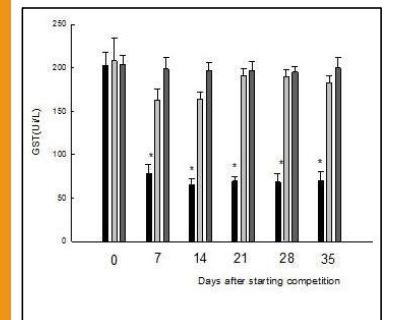
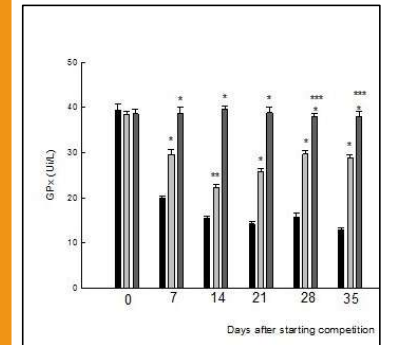
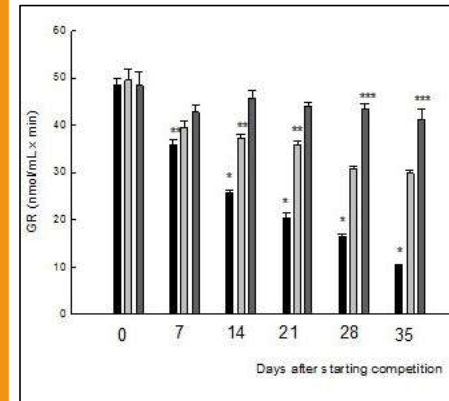


MSM, GBNs, spirulina, medicinal plants





Methylsulfonyl methane (MSM)



Marañón et al. The effect of methyl sulphonyl methane supplementation on biomarkers of oxidative stress in sport horses following jumping exercise. *Acta Vet Scand.* 2008 Nov 7;50(1):45.



Glucosamine-Based Nutraceuticals

Yamada et al. Effects of oral treatment with chondroitin sulfate and glucosamine in an experimental model of metacarpophalangeal osteoarthritis in horses. BMC Vet Res. 2022 Jun 9;18(1):215.

Table 1 Joint angles (in degrees), visual lameness (AMEP scale) and evaluation by motion sensors (Lameness Locator) measured from T0 to T4 in the GC and GT

	T0	T1	T2	T3	T4	p-value, Friedman-test between time-points	p-value, ANOVA*	
Joint angles								
GC	Mean ± SD	138.8 ± 5.0	142.8 ± 3.0	150.8 ± 5.3	148.3 ± 6.5	149.5 ± 8.3	0.004	0.158
	Median (IQR)	140.3 (133.5-148)	145.3 (146.5-149)	151.5 (146-154.5)	150.3 (142.5-159)	150 (146.5-152)		
GT	Mean ± SD	143.8 ± 6.2	148.8 ± 5.3	147.8 ± 5.1	146.4 ± 2.1	148.1 ± 2.1	0.005	
	Median (IQR)	143.5 (140-146)	149.5 (147-151.5)	148 (143.5-150)	146 (144.5-146.5)	147.5 (146.5-149.5)		
Lameness Locator								
GC	Mean ± SD	2 ± 3	44 ± 32	33 ± 20	21 ± 8.1	25 ± 22	0.015	0.795
	Median (IQR)	3 (0-9)	44 (22-62)	27 (14-59)	21 (14-25)	19 (11-30)		
GT	Mean ± SD	1 ± 3	22 ± 20	16 ± 5	13 ± 13	11 ± 12	0.001	
	Median (IQR)	0 (0-2)	26 (6-30)	17 (12-21)	11 (4-19)	8 (0-19)		
AMEP score								
GC	Mean ± SD	0 ± 0	2 ± 1	2 ± 1	1 ± 1	2 ± 1	0.011	0.169
	Median (IQR)	0 (0-0)	2 (0-3)	2 (0-3)	1 (0-3)	2 (0-3)		
GT	Mean ± SD	0 ± 0	2 ± 1	2 ± 0	1 ± 1	1 ± 1	<0.001	
	Median (IQR)	0 (0-0)	3 (0-3)	2 (0-3)	1 (0-2)	2 (0-2)		
p-value Mann-Whitney U test between groups at each time-point								
Lameness Loca	0.382	0.15	0.232	0.195	0.13			
AMEP score	1	0.798	0.779	0.555	0.538			

ANOVA analysis of variance, GC control group, SD standard deviation, GT treated group
*P-value of time-point*group interaction by nonparametric two-way ANOVA

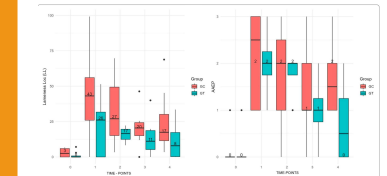


Fig 1 Lameness assessment. Boxplot graphs were applied when data were not normally distributed, and the best measure of central tendency and the median. The scores were obtained after the lameness evaluation using the American Association of Equine Practitioners lameness scale (AMEP) and analysis using the motion sensor (Lameness Locator), at time T0 to T4 for the control group (GC) and treated group (GT). The lower represent the median, and the box of the graph corresponds to the range of 25th to 75th percentile, the top of the box corresponds to the score of 25th of the median, and the line inside corresponds to the median (line that divides the sample by 50%). In the number of distribution, *P-value of difference between groups at a P < 0.05.

Parameter	T0	T1	T2	T3	T4	P-value, Friedman-test between time-points	P-value, ANOVA*	
CTFI (g/gM)								
GC	Mean ± SD	252.2 ± 8.99	310.8 ± 8.84	363.8 ± 9.88	393.8 ± 11.3	393.2 ± 8.61	0.003	0.508
	Median (IQR)	262.1 (252.7-269)	312.3 (304.6-320)	363.1 (356.1-372)	393.3 (387.1-400)	392.8 (386.1-399)		
GT	Mean ± SD	368.3 ± 4.2	338.8 ± 1.1	429.2 ± 20.19	363.8 ± 10.64	614.1 ± 11.1	<0.001	
	Median (IQR)	369.1 (311.3-391)	337.8 (331.3-344)	429.2 (398.3-459)	363.8 (354.3-373)	614.1 (607.2-621)		
PGE2 (g/gM)								
GC	Mean ± SD	25.8 ± 16.7	82.6 ± 40.4	75.8 ± 36.4	474.2 ± 27.5	503 ± 20.4	0.004	0.078
	Median (IQR)	21.3 (0.2-33)	82.6 (46-126)	75.8 (46-116)	474.2 (458-490)	503 (490-516)		
GT	Mean ± SD	47.2 ± 40.7	67.2 ± 23.2	53.8 ± 47.4	43.9 ± 46.2	61.3 ± 3.9	0.171	
	Median (IQR)	34.9 (9-75)	53.8 (28-75)	43.9 (15-57)	34.9 (19-47)	51.3 (24-61)		
Chondroitin sulfate (gM)								
GC	Mean ± SD	232 ± 9.5	264 ± 10.6	254 ± 9.6	318 ± 12.7	288 ± 8.4	0.211	
	Median (IQR)	232 (151-238)	264 (165-269)	254 (156-260)	318 (251-324)	288 (222-296)		
GT	Mean ± SD	244 ± 8.1	37.8 ± 5	242 ± 10.7	318 ± 16.4	347 ± 12.7	0.103	
	Median (IQR)	270 (249-33)	37.8 (6-24)	242 (17-307)	318 (246-312)	347 (322-44)		
Hyaluronan acid (gM)								
GC	Mean ± SD	556.5 ± 110.6	301.6 ± 136	362.2 ± 122.8	310 ± 106.8	381.5 ± 127.7	0.034	
	Median (IQR)	574.2 (475.5-656)	297 (216-387)	352 (242.5-461)	310 (198-409)	381.5 (297.5-466)		
GT	Mean ± SD	579.9 ± 75.3	304.8 ± 11.6	387.7 ± 18.2	302.1 ± 164.4	471.5 ± 10.7	0.001	
	Median (IQR)	552 (411-624)	304.8 (272-310)	387.7 (358-396)	302.1 (198-402)	471.5 (466-476)		
p-value Mann-Whitney U test between groups at each time-point								
CTFI (g/gM)	0.798	0.234	0.505	0.614	0.779			
PGE2 (g/gM)	0.279	0.036	0.261	0.181	0.231			
Chondroitin sulfate (gM)	0.161	0.234	0.013	0.231	0.585			
Hyaluronan acid (gM)	0.024	0.019	0.067	0.201	0.192			

ANOVA analysis of variance, GC control group, CTFI = Cartilage of type I Collagen, PGE2 prostaglandin E2, SD standard deviation, GT treated group



Herbs

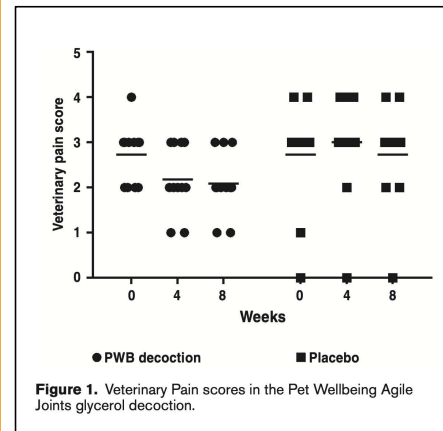


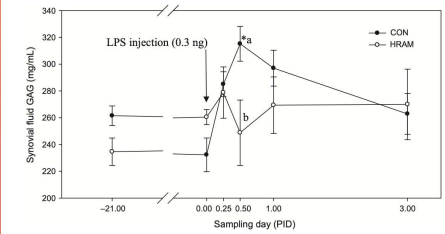
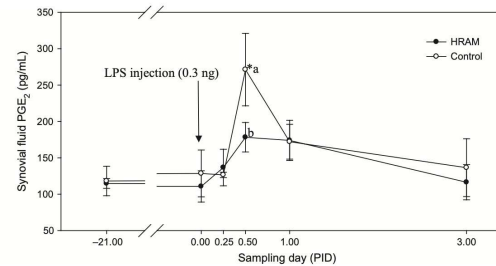
Figure 1. Veterinary Pain scores in the Pet Wellbeing Agile Joints glycerol decoction.



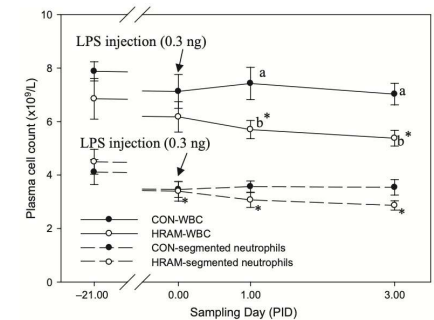
Cardeccia et al. A pilot study examining a proprietary herbal blend for the treatment of canine osteoarthritis pain. *Can Vet J.* 2022 Jan;63(1):55-62.

Herbs

UNIVERSITY OF
GUELPH

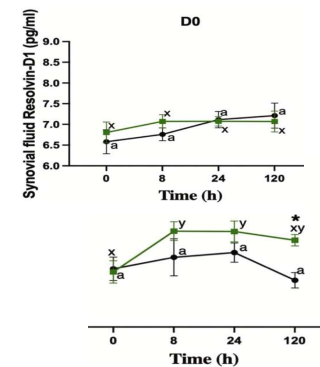
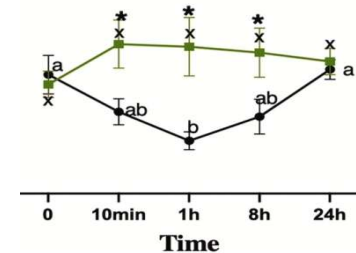
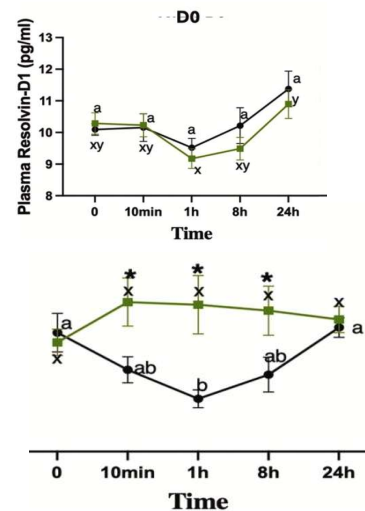


Pearson et al. Oral rosmarinic acid-enhanced *Mentha spicata* modulates synovial fluid biomarkers of inflammation in horses challenged with intra-articular LPS. *J Vet Pharmacol Ther.* 2012 Oct;35(5):495-502.

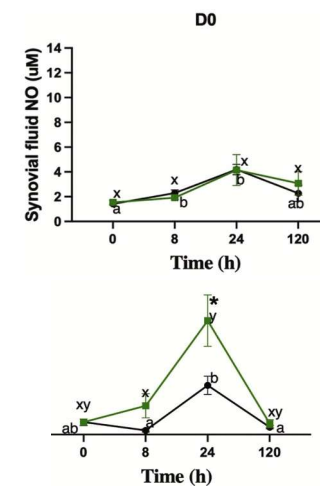




Spirulina (*Arthrospira platensis*)

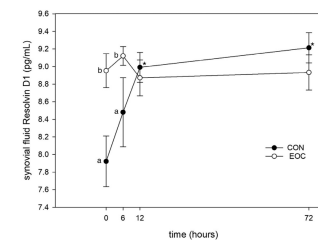
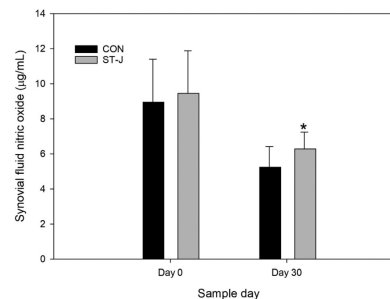


Golestani et al. Spirulina supplementation regulates inflammation and supports cartilage health in adult sedentary horses following moderate-intensity exercise. *J Equine Vet Sci.* 2026 Mar;158:105804.

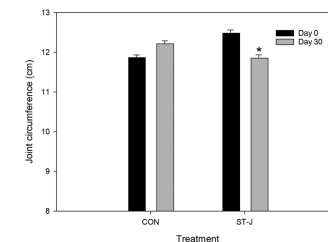




Omega-3 oils



Korac et al. Effect of a dietary nutraceutical "STRUCTURE-Joint" on response of horses to intra-articular challenge with IL-1: implications for tissue adaptation to stress. *Transl Anim Sci.* 2024 Dec 7;8:txae172.



How much do the products cost?



Equine Product	Primary Actives	Smallest Size	Approx Price (CAD)	Typical Dose	Cost/Day (CAD)
NAF Glucosamine 12,000 + MSM	Glucosamine, MSM	900 g	\$44	15-30 g/day	\$0.75-1.50
Equithrive Complete Joint	Resveratrol, HA	1.5 kg	\$90	30 g/day	\$1.80-2.00
Ramard Total Joint Care	Glucosamine, HA, omega-3	510 g	\$100	15-30 g/day	\$3.00-5.00
Animed Glucosamine 5000	Glucosamine ± MSM	1.1 kg	\$35	30 g/day	\$0.80-1.20
Mad Barn MSM Powder	MSM	5 kg	\$100	10-20 g/day	\$0.20-0.50

How much do the products cost?



Canine Product	Primary Actives	Smallest Size	Approx Price (CAD)	Typical Dose	Cost/Day (CAD)
Cosequin Max Strength + MSM	Glucosamine, Chondroitin, MSM	60-120 tabs	\$36	1-2/day	\$0.60-1.20
VetriScience Glycoflex	Glucosamine, Green-lipped mussel	60 chews	\$34	1-2/day	\$0.60-1.10
YuMOVE Advanced	Glucosamine, HA, omega-3	60 tabs	\$48	1/day	\$0.80-1.00
Zesty Paws Mobility	Glucosamine, MSM, Turmeric	90 chews	\$30	1/day	\$0.30-0.50
Liquid-Vet Joint Formula	Glucosamine, MSM	30 packets	\$49	1/day	\$1.50-2.00

Does Cheaper = Better?



- cost is important, BUT.....
- liquids
 - extracts leave much of the active principles of the plants behind (many not water soluble...)
 - approx 90% water
 - PubMed - 'herbal extract equine' - 22 papers - 3 in horses
- assuming equivalent ingredients
 - which products actually work?? Based on what evidence?

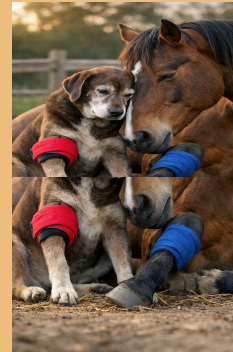


What about safety?

Clinical and Demographic Patient Data

Characteristic	Glucosamine Group (n = 22)	Placebo Group (n = 12)
Male-female ratio	12:10	6:6
Mean age, y	68.6	70.7
Median No. of drugs	1	1
Diet controlled, No. (%)	4 (18)	3 (25)
Baseline hemoglobin A _{1c} , %	6.45	6.25
Final hemoglobin A _{1c} , %	6.50	6.09

Scroggie et al. The effect of glucosamine-chondroitin supplementation on glycosylated hemoglobin levels in patients with type 2 diabetes mellitus: a placebo-controlled, double-blinded, randomized clinical trial. Arch Intern Med. 2003 Jul 14;163(13):1587-90.



Bunnell et al. Case report: Treatment of joint supplement toxicity resulting in acidemia, hyperglycemia, electrolyte derangements, and multiple organ dysfunction. Front Vet Sci. 2023 Jun 29;10:1141978.

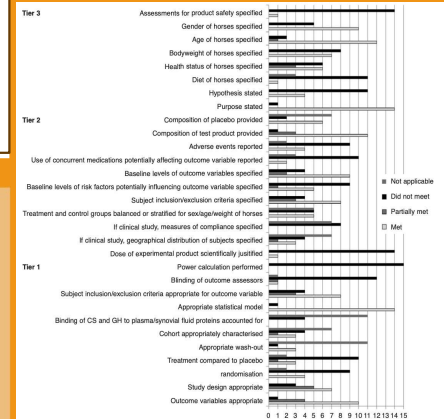


Fig. 1. Distribution of quality criteria across research papers evaluating glucosamine-based nutraceutical compounds (GBN) for horses. Bars represent % of papers that met quality criteria. Criteria are presented in increasing order of importance or quality score.

Pearson et al. Low quality of evidence for glucosamine-based nutraceuticals in equine joint disease: review of in vivo studies. Equine Vet J. 2009 Sep;41(7):706-12.

TAKE HOME MESSAGES

UNIVERSITY OF
GUELPH



1. Evidence is limited and often indirect

Most joint supplement claims rely on indirect or low-quality research, making true efficacy difficult to determine

2. Dose, formulation, and product quality matter

An ingredient only works if it's present at an effective dose, bioavailable, and accurately formulated (which is not always the case)

3. Science (not the perception of science) should guide decisions

- Choosing supplements should be based on critical evaluation of evidence and product-specific research, not marketing claims



UNIVERSITY OF
GUELPH

wpearson@uoguelph.ca



Thank you!