Pharmacokinetic study of D-glucosamine hydrochloride produced from microbes and N-acetyl-D-glucosamine synthesized from D-glucosamine hydrochloride after oral administrations to dogs

Kazuo Azuma[1], Shiori Suguro[2], Yoshie Yamagishi[2], Masamich Yamashita[1], Tomohiro Osaki[1], Takeshi Tsuka[1], Tomohiro Imagawa[1], Ichiro Arifuku[3] and Yoshiharu Okamoto[1]

[1] Department of Veterinary Clinical Medicine, Tottori University, Tottori 680-8533, Japan , [2] Protein Chemical Co. Ltd., Tokyo 100-0011, Japan, [3] Tottori Institute of Industrial Technology, Sakaiminato, 684-0041, Japan

Summary

We evaluated the pharmacokinetics of D-glucosamine hydrochloride which was made by fermentation of microbes (GlcN-F) and N-acetyl-D-glucosamine synthesized from D-glucosamine hydrochloride (S-GlcNAc) after oral administration to dogs. In the GlcN-F group, the levels of Cmax (maximum drug concentration) ware significantly increased compared with those of the GlcN group ($p<0.05$). No differences were observed on Tmax (maximum drug concentration time), T1/2 (half-life period), AUC (area under the blood concentration-time curve) and MRT (mean residence time) between the GlcN-F and GlcN groups. In the GlcNAc group, the levels of Tmax were significantly decreased compared with those of the S-GlcNAc group ($p<0.05$). No differences were observed on Cmax, T1/2, AUC and MRT between the S-GlcNAc and GlcNAc groups. Our data indicate GlcN-F and S-GlcNAc also have equal pharmacokinetics compared with GlcN and GlcNAc, respectively. It is also indicated GlcN-F may have high absorptivity compared with GlcN.

Back grounds

GlcN is mainly produced by acid hydrolysis of chitin exact from crab and shrimp shells. However, it is indicated GlcN from shellfish may not be suitable for people with shellfish allergies. GlcN from non-shellfish and non-animal sources including microbes has gained increasing demand in recent years. Recently, an alternative process to produce GlcNAc also has been established, which involves the use of GlcN. To the best of our knowledge, there is no report which compared pharmacokinetic parameters between alterative GlcN or GlcNAc with preexisting GlcN or GlcNAc.

Materials and Methods

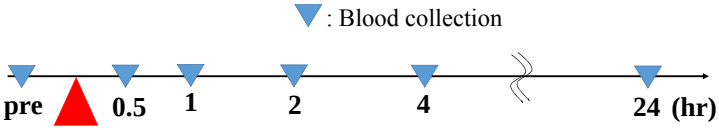
‣ Amino saccharides

1) Glucosamine (GlcN)
2) N-acetyl-D-glucosamine (GlcNAc)
3) GlcN made by fermentation of microbes (GlcN-F)
4) GlcNAc synthesized from GlcN (S-GlcNAc)

‣ Dogs

Six healthy beagle dogs (age: 2–6 years, body weight: 7–12 kg)

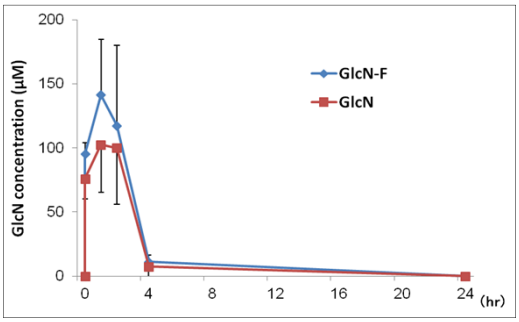
‣ Study design



Oral administrations of amino saccharides (300mg/kg)

Results

Figure 1. Plasma GlcN concentrations after oral administrations of GlcN or GlcN-F



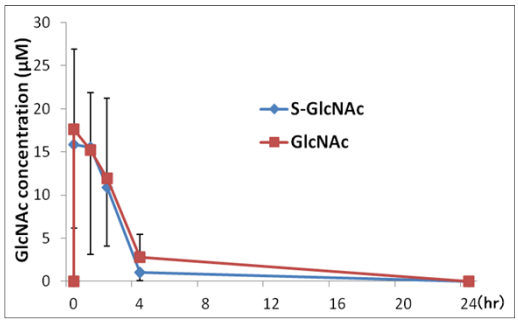
Data represent the mean ± S.D..

Table. 1 Effects of GlcN-F and GlcN on pharmacokinetic parameters

	Cmax (μM)	AUC (μg/ml・hr)	MRT (hr)	Tmax (hr)	T1/2 (hr)
GlcN-F	161.4 ± 13.2*	80.9 ± 23.0	5.7± 1.0	1.7 ± 0.6	2.5 ± 0.9
GlcN	107.0 ± 39.2	62.1 ± 33.4	4.6 ± 2.0	1.7 ± 0.6	2.9 ± 0.2

Data represent the mean ± S.D. for both groups.
***p < 0.05 compared with the GlcN group.**
Cmax: maximum drug concentration,
AUC: area under the blood concentration-time curve,
MRT: mean residence time
Tmax: maximum drug concentration time,
T1/2: half-life period,

Figure 2. Plasma GlcNAc concentrations after oral administrations of S-GlcNAc or GlcNAc



Data represent the mean ± S.D..

Table. 2 Effects of S-GlcNAc and GlcNAc on pharmacokinetic parameters

	Cmax (μM)	AUC (μg/ml・hr)	MRT (hr)	Tmax (hr)	T1/2 (hr)
S-GlcNAc	17.3 ± 10.3	10.5 ± 7.3	4.7± 3.1	1.3 ± 0.6	2.4 ± 0.6
GlcNAc	17.6 ± 9.3	15.3 ± 10.9	7.3 ± 5.5	0.5 ± 0.0*	2.6 ± 0.6

Data represent the mean ± S.D. for both groups.
***p < 0.05 compared with the GlcNAc group.**

Conclusion

Our data indicate GlcN-F and S-GlcNAc also have equal pharmacokinetics compared with GlcN and GlcNAc, respectively. It is also indicated GlcN-F may have high absorptivity compared with GlcN.