Carbohydrate Research, 34 (1974) 200–202

Note

D-Psicose metabolism in the rat*

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(Received December 31st, 1973; accepted January 31st, 1974)

D-Psicose (D-*ribo*-2-hexulose), the C-3 epimer of D-fructose, is present in small quantities in commercial mixtures of D-glucose and D-fructose obtained from hydrolysis of sucrose or isomerization of D-glucose. D-Psicose is also present in processed cane and beet molasses[1,2], and is found in wheat[3] and *Itea* plants[4], and in the antibiotic psicofuranine[5]. Human urine contains some 15–30 mg per liter where it presumably derives from the diet, since it disappears from the urine of subjects who have fasted for 48 h[6]. It has also been reported in washings from human skin[7]. Because of the presence of D-psicose in the diet and the lack of information on its metabolism, we undertook a preliminary examination of its metabolism when given intraveneously and when fed to rats.

D-[U-^{14}C]Psicose (272 mCi/mole) was prepared by the method of Tipson *et al.*[8] and purified by chromatography on Whatman No. 3 paper with 6:4:3 (v/v) 1-butanol–pyridine–water as eluent. Intermediate and final products were purified until only single known components were shown by chromatography on paper with three different eluents. Purity of the final product was also shown by gas-liquid chromatographic examination of the trimethylsilyl derivative.

Radioactivity was assayed in a Beckman CPM-100 liquid scintillation counter. [^{14}C]Carbon dioxide was determined as described by Jeffay and Alvarez[6]. Radioactivity in the carcass was determined by measurement of a methanol extract of the residue obtained by dissolving the carcass in alkali, neutralization, and evaporation to dryness.

When liver glycogen was isolated and hydrolyzed[10], only D-glucose was observed by chromatography and measurement of radioactivity.

D-[U-^{14}C]Psicose (15 mg, 1.5 μCi in 0.5 ml of 0.15M saline solution) was intraveneously injected into a series of fasted (24 h) rats (150–200 g) which were placed in separate Delmar–Roth metabolism cages, where their urine and exhaled [^{14}C]carbon dioxide were collected for 6 h. During this period, 97–98% of the radioactivity was excreted in the urine where it was associated with D-psicose, as observed by paper chromatography. Liver glycogen contained 1.0% of the radio-

*Journal paper No. 5002 of the Purdue Agricultural Experiment Station, Lafayette, Indiana 47907.

activity. Only 0.6% of the radioactivity was exhaled as [^{14}C]carbon dioxide (Table I). These results indicate that intraveneously administered D-psicose is rapidly removed by the kidney and is metabolized to only a small degree.

TABLE I

METABOLISM OF D-[U-^{14}C]PSICOSE IN THE FASTED (24 h) RAT AFTER INTRAVENOUS INJECTION OR ORAL FEEDING[a]

Component analyzed	(%) *Radioactivity recovered after*[b]		
	I.v. administration	*Oral feeding*	
	6 h	*7 h*	*72 h*
Carbon dioxide	0.6	4.0	15.1
Urine	97–98	35.4	37.3
Feces			12.5
Glycogen	1.0		
Carcass			38.7

[a]Animals fed orally were given free access to food and water. [b]Values are average determinations from four animals.

After oral administration of D-[U-^{14}C]psicose (2 μCi) by stomach tube, radioactivity was recovered as shown in Table I. Of the exhaled [^{14}C]carbon dioxide 26% was exhaled within 7 h and 80% within 24 h. Much of the radioactivity was rapidly excreted in the urine where 95% of the excreted radioactivity was recovered within the first 7 h, and of this at least 70% as D-psicose. The remaining 30% of the radioactivity in the urine is associated with unidentified products of metabolism. Rapid excretion of orally administered D-psicose suggests its easy passage through the wall of the small intestine, where it enters the blood and is eliminated through the kidneys in the same way as intraveneously injected D-psicose. The increased metabolism to [^{14}C]carbon dioxide and the finding that 39% of the radioactivity is retained by the carcass for 72 h following oral feeding of D-psicose suggest that a large portion of D-psicose is metabolized by intestinal microorganisms into products, some of which are absorbed into the animal's metabolic system.

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