

Product Data Sheet

Product Name: 1-Deoxynojirimycin

Cat. No.: GN10317

Chemical Properties

Cas. No. 19130-96-2

Chemical Name (2R,3R,4R,5S)-2-(hydroxymethyl)piperidine-3,4,5-triol

SMILES C1C(C(C(C(N1)CO)O)O)O

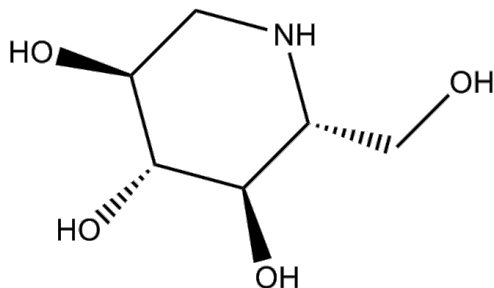
Formula $C_6H_{13}NO_4$ M.Wt 163.17

Solubility H_2O : ≥ 34 mg/mL (208.37 mM) Storage Store at $-20^{\circ}C$

General tips For obtaining a higher solubility , please warm the tube at $37^{\circ}C$ and shake it in the ultrasonic bath for a while. Stock solution can be stored below $-20^{\circ}C$ for several months.

Shipping Condition Evaluation sample solution : ship with blue ice All other available size: ship with RT , or blue ice upon request.

Structure



Protocol

Cell experiment [1]:

Cell lines 3T3-L1 preadipocytes

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Preparation Method

3T3-L1 preadipocytes were cultured in DMEM medium supplemented with 10% fetal bovine serum (FBS) at 37°C in a 5% CO₂ humidified atmosphere. For differentiation, preadipocytes were induced with DMEM containing 10% FBS, 0.5mM 3-isobutyl-1-methylxanthine, 1mM dexamethasone, and 5mg/mL insulin for two days, and then continued to culture in medium containing 10% FBS, 5mg/mL insulin with or without 1-Deoxynojirimycin for the next 10 days. For beige adipogenic differentiation, 3T3-L1 preadipocytes were incubated for two days with DMEM containing 10% FBS, 1mM dexamethasone, 0.5mM 3-isobutyl-1-methylxanthine, 5mg/mL insulin, 1nM 3,5,30-triiodothyronine and 0.125mM indometacin, and then cells were switched to medium containing 10% FBS, 5mg/mL insulin, 1nM 3,5,30-triiodothyronine and 0.125mM indometacin with or without 1-Deoxynojirimycin for another 10 days.

Reaction Conditions

10μM 1-Deoxynojirimycin for 10 days.

Applications

1-Deoxynojirimycin significantly promoted beige remodeling of 3T3-L1 preadipocytes by up-regulating the expressions of beige-adipocyte specific markers UCP1, PRDM16, and TMEM26, while down-regulating the expressions of white adipocyte markers aP2, PPARγ, and Pref-1, accompanied with decreased lipid deposition. The ratio of p-AMPK/AMPK was up-regulated by 1-Deoxynojirimycin treatment, and the effects of 1-Deoxynojirimycin on p-AMPK/AMPK, UCP1, and PRDM16 could be blocked by AMPK inhibitor Compound C.

Animal experiment [2]:

Animal models db/db mice

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Preparation Method The mice were divided into five groups (n = 6): Group 1: wild-type C57BLKS mice were treated intravenously with normal saline through the tail vein. Group 2: db/db mice were treated intravenously with normal saline by tail vein. Group 3: db/db mice were treated intravenously with a 1-Deoxynojirimycin dose of 20mg/kg/day through the tail vein. Group 4: db/db mice were treated intravenously with a 1-Deoxynojirimycin dose of 40mg/kg/day through the tail vein. Group 5: db/db mice were treated intravenously with a 1-Deoxynojirimycin dose of 80mg/kg/day through the tail vein. All doses were given for four weeks.

Dosage form 20, 40, and 80mg/kg/day; i.v.

Applications 1-Deoxynojirimycin significantly reduced the levels of serum triglyceride (TG), total cholesterol (TC), low density lipoprotein cholesterol (LDL-C) and liver TG, as well as activities of serum alanine aminotransferase (ALT), and aspartate transaminase (AST); 1-Deoxynojirimycin also alleviated macrovesicular steatosis and decreased tumor necrosis factor α (TNF- α), interleukin-1 (IL-1), interleukin-6 (IL-6) levels in liver tissue. Furthermore, 1-Deoxynojirimycin treatment significantly increased hepatic glycogen content, the activities of hexokinase (HK), pyruvate kinase (PK) in liver tissue, and decreased the activities of glucose-6-phosphatase (G6Pase), glycogen phosphorylase (GP), and phosphoenolpyruvate carboxykinase (PEPCK).

References:

- [1] Li AN, Chen JJ, Li QQ, et al. Alpha-glucosidase inhibitor 1-Deoxynojirimycin promotes beige remodeling of 3T3-L1 preadipocytes via activating AMPK. Biochem Biophys Res Commun. 2019 Feb 19;509(4):1001-1007.
- [2] Liu Q, Li X, Li C, et al. 1-Deoxynojirimycin Alleviates Liver Injury and Improves Hepatic Glucose Metabolism in db/db Mice. Molecules. 2016 Feb 27;21(3):279.

Background

1-Deoxynojirimycin is an alkaloid compound found in mulberry leaves and other plants. By inhibiting α -glucosidase and modulating various signaling pathways^[1-2]. 1-Deoxynojirimycin exhibits anti-

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diabetic, anti-obesity, and antiviral effects, and is commonly used in research related to diabetes, obesity, and viral infections^[3-4].

In vitro, 1-Deoxynojirimycin (30 μ M) was used to treat mitochondrial hypertrophic cardiomyopathy (HCM) cell models, including cytoplasmic hybrid cells (cybrids) and induced pluripotent stem cell-derived cardiomyocytes (iPSC-CMs). 1-Deoxynojirimycin significantly improved mitochondrial function, enhanced mitochondrial membrane potential and ATP production, restored mitochondrial cristae structure, improved calcium homeostasis and electrophysiological properties, and reduced cellular hypertrophy^[5]. 1-Deoxynojirimycin (10 μ M) was used to treat 3T3-L1 preadipocytes for 10 days, significantly inhibiting the differentiation of cells into white adipocytes, reducing lipid deposition, and down-regulating the mRNA expression levels of fatty acid-binding protein 4 (aP2), peroxisome proliferator-activated receptor γ (PPAR γ), and preadipocyte factor-1 (Pref-1). At the same time, 1-Deoxynojirimycin up-regulated the mRNA and protein expression levels of uncoupling protein 1 (UCP1), PR domain-containing protein 16 (PRDM16), and transmembrane protein 26 (TMEM26), promoting the conversion of white preadipocytes into beige adipocytes^[6].

In vivo, 1-Deoxynojirimycin (20, 40, and 80mg/kg) was administered via tail vein injection to treat db/db mouse models, with administration once daily for four consecutive weeks. 1-Deoxynojirimycin significantly reduced body weight, blood glucose, and serum insulin levels in db/db mice in a dose-dependent manner, improving glucose tolerance and insulin tolerance. In addition, 1-Deoxynojirimycin significantly increased GLUT4 translocation in skeletal muscle and the phosphorylation levels of Ser473-AKT, p85-PI3K, Tyr1361-IR- β , and Tyr612-IRS1, thereby improving insulin sensitivity by activating the insulin signaling PI3K/AKT pathway^[7]. 1-Deoxynojirimycin (20, 40, and 80mg/kg) was administered via tail vein injection to treat db/db mouse models, with administration once daily for four consecutive weeks. 1-Deoxynojirimycin significantly reduced serum triglyceride (TG), total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C), and liver TG levels in db/db mice in a dose-dependent manner, while also reducing the activities of serum alanine aminotransferase (ALT) and aspartate aminotransferase (AST). In addition, 1-Deoxynojirimycin significantly alleviated hepatic steatosis and reduced the levels of tumor necrosis factor α (TNF- α), interleukin-1 (IL-1), and interleukin-6 (IL-6) in liver tissue. 1-Deoxynojirimycin also significantly increased hepatic glycogen content, enhanced the activities of hexokinase (HK) and pyruvate kinase (PK) in liver tissue, and reduced the activities of glucose-6-phosphatase (G6Pase), glycogen phosphorylase (GP), and phosphoenolpyruvate carboxykinase (PEPCK)^[8].

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References:

- [1] Wang H, Shen Y, Zhao L, et al. 1-Deoxynojirimycin and its Derivatives: A Mini Review of the Literature. *Curr Med Chem*. 2021;28(3):628-643.
- [2] Mehmood A, Battino M, Chen X. 1-Deoxynojirimycin: a comprehensive review of sources, biosynthesis pathways, strategies to enhance its production, and anti-diabetic activities. *Food Funct*. 2025 Jun 16;16(12):4673-4701.
- [3] Zhang W, Mu W, Wu H, et al. An overview of the biological production of 1-deoxynojirimycin: current status and future perspective. *Appl Microbiol Biotechnol*. 2019 Dec;103(23-24):9335-9344.
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- [5] Zhuang Q, Guo F, Fu L, et al. 1-Deoxynojirimycin promotes cardiac function and rescues mitochondrial cristae in mitochondrial hypertrophic cardiomyopathy. *J Clin Invest*. 2023 Jul 17;133(14):e164660.
- [6] Li AN, Chen JJ, Li QQ, et al. Alpha-glucosidase inhibitor 1-Deoxynojirimycin promotes beige remodeling of 3T3-L1 preadipocytes via activating AMPK. *Biochem Biophys Res Commun*. 2019 Feb 19;509(4):1001-1007.
- [7] Liu Q, Li X, Li C, et al. 1-Deoxynojirimycin Alleviates Insulin Resistance via Activation of Insulin Signaling PI3K/AKT Pathway in Skeletal Muscle of db/db Mice. *Molecules*. 2015 Dec 4;20(12):21700-14.
- [8] Liu Q, Li X, Li C, et al. 1-Deoxynojirimycin Alleviates Liver Injury and Improves Hepatic Glucose Metabolism in db/db Mice. *Molecules*. 2016 Feb 27;21(3):279.

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