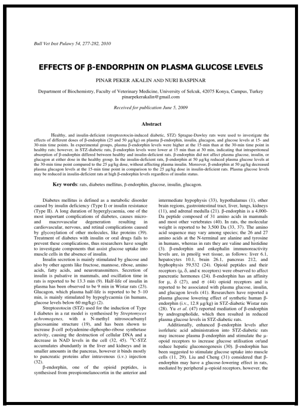
Effects of [beta]-endorphin and its derivatives on mouse skeletal muscle

University of Birmingham - Skeletal muscle development and regeneration mechanisms vary by gender



Bull Vet Inst Pulawy 54, 277-282, 2010

EFFECTS OF β-ENDORPHIN ON PLASMA GLUCOSE LEVELS

PINAR PEKER AKALIN AND NURI BASPINAR

Department of Biochemistry, Faculty of Veterinary Medicine, University of Selcuk, 42075 Konya, Campus, Turkey
pinarpekerakalin@gmail.com

Received for publication June 5, 2009

Abstract

Healthy, and insulin-deficient (streptozotocin-induced diabetic, STZ) Sprague-Dawley rats were used to investigate the effects of different doses of β-endorphin (25 and 50 μg/kg) on plasma β-endorphin, insulin, glucagon, and glucose levels at 15- and 30-min time points. In experimental groups, plasma β-endorphin levels were higher at the 15-min than at the 30-min time point in healthy rats; however, in STZ-diabetic rats, β-endorphin levels were lower at 15 min than at 30 min, indicating that intraperitoneal absorption of β-endorphin differed between healthy and insulin-deficient rats. β-endorphin did not affect plasma glucose, insulin, or glucagon at either dose in the healthy group. In the insulin-deficient rats, β-endorphin at 50 μg/kg reduced plasma glucose levels at the 30-min time point compared to the 25 μg/kg dose, without affecting plasma insulin. Moreover, β-endorphin at 50 μg/kg decreased plasma glucagon levels at the 15-min time point in comparison to the 25 μg/kg dose in insulin-deficient rats. Plasma glucose levels may be reduced in insulin-deficient rats at high β-endorphin levels regardless of insulin status.

Key words: rats, diabetes mellitus, β-endorphin, glucose, insulin, glucagon.

Diabetes mellitus is defined as a metabolic disorder caused by insulin deficiency (Type I) or insulin resistance (Type II). A long duration of hyperglycaemia, one of the most important complications of diabetes, causes micro- and macrovascular degeneration resulting in cardiovascular, nervous, and retinal complications caused by glycosylation of other molecules, like proteins (39). Treatment of diabetes with insulin or oral drugs fails to prevent these complications, thus researchers have sought to investigate components that assist glucose uptake into muscle cells in the absence of insulin.

Insulin secretion is mainly stimulated by glucose and also by other agents like fructose, mannose, ribose, amino acids, fatty acids, and neurotransmitters. Secretion of insulin is pulsative in mammals, and oscillation time in rats is reported to be 13.3 min (9). Half-life of insulin in plasma has been observed to be 9 min in Wistar rats (23). Glucagon, which plasma half-life is reported to be 5–10 min, is mainly stimulated by hypoglycaemia (in humans, glucose levels below 60 mg/kg) (2).

Streptozotocin (STZ) used for the induction of Type I diabetes in a rat model is synthesised by *Streptomyces achromogenes*, with a N-methyl nitrosocarbamyl glucosamine structure (19), and has been shown to increase β-cell polyadenine-diphospho-ribose synthetase activity, causing the destruction of cellular DNA and a decrease in NAD levels in the cell (32, 45). ^{14}C-STZ accumulates abundantly in the liver and kidneys and in smaller amounts in the pancreas, however it binds mostly to pancreatic proteins after intravenous (i.v.) injection (32).

β-endorphin, one of the opioid peptides, is synthesised from preopiomelanocortin in the anterior and intermediate hypophysis (33), hypothalamus (1), other brain regions, gastrointestinal tract, liver, lungs, kidneys (11), and adrenal medulla (21). β-endorphin is a 4,000-Da peptide composed of 31 amino acids in mammals and most other vertebrates (40). In rats, the molecular weight is reported to be 3,500 Da (33, 37). The amino acid sequence may vary among species; the 26 and 27 amino acids at the N-terminal are alanine and tyrosine in humans, whereas in rats they are valine and histidine (3). β-endorphin and enkephalin immunoreactivity levels are, in pmol/g wet tissue, as follows: liver 6.1, hepatocytes 10.1, brain 26.1, pancreas 212, and hyphophysis 59,532 (24). Opioid peptides and their receptors (μ, δ, and κ receptors) were observed to affect pancreatic hormones (24). β-endorphin has an affinity for μ, δ (27), and σ (44) opioid receptors and is reported to be associated with plasma glucose, insulin, and glucagon levels (41). Researchers have reported a plasma glucose lowering effect of synthetic human β-endorphin (i.v., 12.8 μg/kg) in STZ-diabetic Wistar rats (28). Yu *et al*. (47) reported mediation of β-endorphin by andrographolide, which then resulted in reduced plasma glucose levels in STZ-diabetic rats.

Additionally, enhanced β-endorphin levels after isofeluric acid administration into STZ-diabetic rats may increase plasma β-endorphin and stimulate the μ-opioid receptors to increase glucose utilisation or/and reduce hepatic gluconeogenesis (30). β-endorphin has been suggested to stimulate glucose uptake into muscle cells (11, 29). Liu and Cheng (31) considered that β-endorphin may have a glucose-lowering effect in rats, mediated by peripheral μ-opioid receptors, however, the

Description: -
-Effects of [beta]-endorphin and its derivatives on mouse skeletal muscle
-Effects of [beta]-endorphin and its derivatives on mouse skeletal muscle
Notes: Thesis (Ph.D) - University of Birmingham, Department of Physiology, Faculty of Medicine, 1997.
This edition was published in 1996

Tags: #Skeletal #muscle #lipid #deposition #and #insulin #resistance: #effect #of #dietary #fatty #acids #and #exercise

Effects of dantrolene and its derivatives on Ca(2+) release from the sarcoplasmic reticulum of mouse skeletal muscle fibres

Velema MS, Kwa BH, de Ronde W 2012 Should androgenic anabolic steroids be considered in the treatment regime of selected chronic obstructive pulmonary disease patients? Acylcarnitines: potential implications for skeletal muscle insulin resistance.

Induction of glucose uptake in skeletal muscle by central leptin is mediated by muscle β 2

For most of the human population this is avoidable, given that causes of intramyocellular lipid deposition are predominantly lifestyle-mediated. Most studies have shown a positive correlation between intramyocellular lipid deposition and nPKC activity, particularly the serine kinases PKCθ and PKCε. D,H , ventricular septal defect VSD Fig.

A need for NAD+ in muscle development, homeostasis, and aging

The filtrates were then dried and dissolved in 50 µl of ultrapure water. In contrast, PKCη is localized primarily to the skin and lung , PKCγ is abundant in the brain , and PKCθ is abundant in skeletal muscle. Grynkiewicz G, Poenie M, Tsien RY 1985 A new generation of Ca2+ indicators with greatly improved fluorescence properties.

AMPK promotes skeletal muscle autophagy through activation of forkhead FoxO3a and interaction with Ulk1

Potential efficacy of broccoli sprouts as a unique supplement for management of type 2 diabetes and its complications. Pivalate-generating prodrugs and carnitine homeostasis in man.

Role of carnitine and its derivatives in the development and management of type 2 diabetes

J Support Oncol 3 3 : 221—222. Fig 1 MuCre-driven expression of ROSA26 LacZ reporter gene in developing skeletal and cardiac muscle

cells.

Induction of glucose uptake in skeletal muscle by central leptin is mediated by muscle β 2

Stewart JD, Masi TL, Cumming AE, Molnar GM, Wentworth BM, Sampath K, et al. We have explored the effects of ND on molecular pathways involved in the modulation of protein synthesis.

AMPK promotes skeletal muscle autophagy through activation of forkhead FoxO3a and interaction with Ulk1

The results of our study demonstrate that clove extract and its active agent NGC can be potential therapeutic agents for alleviating insulin resistance. A role for smad6 in development and homeostasis of the cardiovascular system. Tandem mass spectrometry: a new method for acylcarnitine profiling with potential for neonatal screening for inborn errors of metabolism.

Myocardial deletion of Smad4 using a novel α skeletal muscle actin Cre recombinase transgenic mouse causes misalignment of the cardiac outflow tract

In this study, they found that T2D women with complications displayed almost 25% lower serum free L-carnitine levels than compared with diabetic patients with no complications.

Related Books

- Intestinal toxicity and inner cleansing
- Cutting, Shaping and Finishing of Stone
- Salads and sandwiches and specialty dishes for restaurants and tea rooms
- Archives économiques et financières - létat des fonds, revu et mis à jour au 31 mars 1978.
- Roads to freedom - essays in honour of Friedrich A. von Hayek.