

## INTISARI

### **HISTOLOGIS DUODENUM PADA TIKUS JANTAN (*Rattus norvegicus albinus*) MODEL DIABETES MELITUS TIPE 2 YANG DIBERI TERAPI NANOPARTIKEL EKSTRAK ETANOL DAUN SIRIH MERAH (*Piper Crocatum*)**

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Diabetes melitus tipe 2 (DMT-2) merupakan penyakit yang ditandai dengan keadaan hiperglikemia. Salah satu efek patologis DMT-2 adalah pada duodenum. Tanaman sirih merah diketahui memiliki bahan aktif yang bersifat antidiabetik dan penerapan teknologi nanopartikel pada obat mampu meningkatkan bioavailabilitas maupun absorbsinya. Penelitian ini bertujuan untuk mengetahui histologis duodenum tikus model DMT-2 yang diterapi nanopartikel ekstrak etanol daun sirih merah.

Tiga puluh ekor tikus dikelompokkan secara acak menjadi lima kelompok: kontrol non-DMT-2 (KN), kontrol DMT-2 (KD), dan DMT-2 yang diberi nanopartikel ekstrak etanol daun sirih merah (NPEDSR) dengan dosis 30 (P1), 60 (P2), dan 90 (P3) mg/kgBB. Induksi DMT-2 dilakukan dengan injeksi streptozotocin-*nicotinamide* (STZ-NA) secara intraperitoneal. Penentuan tikus DMT-2 berdasarkan hasil pemeriksaan kadar glukosa darah 72 jam pasca induksi STZ-NA minimal 150 mg/dl. Pemberian NPEDSR dilakukan selama 28 hari berturut-turut, sekali sehari. Pada hari ke-29 tikus dieutanasi, duodenum dikoleksi dan difiksasi kemudian dibuat preparat histologi menggunakan pewarnaan Hematoksilin-Eosin.

Hasil penelitian menunjukkan perubahan struktur histologis duodenum berupa hiperplasia kelenjar Lieberkühn dan terbentuknya ruang subepitel pada KD, P1, dan P2, sedangkan KN dan P3 tidak ditemukan. Tinggi vili dan kedalaman kript Lieberkühn pada KD serta P1 berbeda signifikan dibandingkan KN ( $P < 0,05$ ), namun pada P2 dan P3 tidak berbeda signifikan dibandingkan KN ( $P > 0,05$ ). Pada tunika submukosa, tunika muskularis, dan tunika serosa tidak terjadi perubahan. Kesimpulan dari penelitian ini DMT-2 menyebabkan pemendekan vili, hiperplasi kelenjar Lieberkühn, terbentuknya ruang subepitel dan peningkatan kedalaman kript Lieberkühn. Pemberian NPEDSR dosis 90 mg/kgBB pada tikus penderita DMT-2 menyebabkan kondisi histologis duodenum menyerupai tikus non-DMT-2.

**Kata kunci:** Daun sirih merah, diabetes melitus tipe 2, duodenum, nanopartikel

## ABSTRACT

### **HISTOLOGY FEATURES OF THE TYPE 2 DIABETES MELLITUS RAT (*Rattus norvegicus albinus*) MODEL'S DUODENUM TREATED WITH RED BETEL LEAF (*Piper crocatum*) ETHANOLIC EXTRACT NANOPARTICLES**

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Type 2 diabetes mellitus (T2DM) is a disease characterized by hyperglycaemia. One of the pathological effects of T2DM is on the duodenum. The red betel plant recognized to provide anti-diabetic bioactive components and the application of nanoparticle technology to drugs can increase their bioavailability and absorption. This study aims to determine the histological picture of the duodenum of T2DM model rats treated with nanoparticles of red betel leaf ethanol extract.

Thirty rats were randomly assigned to five groups: non-T2DM control (NC), T2DM control (DC), T2DM which were given nanoparticles of red betel leaves ethanol extract (NPRBE) at a dose of 30 (P1), 60 (P2), and 90 (P3) mg/kgBW. Type 2 diabetes mellitus induction was performed by intraperitoneal injection of streptozocin-nicotinamide (STZ-NA). Determination of T2DM rats based on the results of an examination of blood glucose levels 72 hours after STZ-NA induction at least 150 mg/dl. Nanoparticle of red betel leaves ethanol extract was administered for 28 days, once a day. On the 29 days, the rats were euthanized, the duodenum was collected and fixed, then histological preparations were made using Hematoxylin-Eosin staining.

The results showed that changes in the histological structure of the duodenum in the form of hyperplasia of the Lieberkühn glands and the formation of subepithelial spaces in KD, P1, and P2, while KN and P3 were not find. The villi height and crypt depth in KD and P1 was significantly different from KN ( $P < 0,05$ ) while the villous height and crypt depth in P2 and P3 was not significantly different from KN ( $P > 0,05$ ). There were no histologic changes in the tunica submucosa, tunica muscularis, and tunica serous. The conclusion of this study is that DMT-2 causes shortening of the villi, hyperplasia of the Lieberkühn glands, formation of subepithelial spaces and an increase in the depth of Lieberkühn's crypts. Administration of NPRBE at a dose of 90 mg/kgBW to rats with DMT-2 caused the histological condition of the duodenum to resemble that of non-DMT-2 rats.

**Keywords:** Duodenum, nanoparticles, red betel leaf, type 2 diabetes mellitus.