

## ABSTRAK

# AKTIVITAS EKSTRAK LADA HITAM (*Piper nigrum L*) TERHADAP PERBAIKAN DISFUNGSI REPRODUKSI TIKUS JANTAN HIPERGLIKEMIA YANG DIINDUKSI ALLOXAN : STUDI PERILAKU, HORMONAL, HISTOLOGI TESTIS DAN EKSPRESI GEN *NITRIC OXIDE SYNTHASE*

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**Latar Belakang:** Diabetes melitus (DM) menyebabkan terjadinya disfungsi reproduksi pria dalam berbagai tingkatan. Kontrol endokrin terhadap spermatogenesis, libido, dan ereksi penis semuanya terpengaruh efek negatif.

**Tujuan:** Menganalisis pengaruh pemberian ekstrak lada hitam (*Piper nigrum L*) dalam memperbaiki disfungsi reproduksi pada tikus jantan hiperglikemia yang diinduksi *Alloxan*, dengan penilaian komprehensif meliputi perilaku (libido dan ereksi), hormonal (kadar testosteron intratestikular), histologi testis (jumlah sel spermatosit dan sel Leydig), ekspresi gen NOS, dan analisis spermatozoa

**Metode:** Penelitian ini menggunakan *Posttest-only Randomized Control Group* pada tikus jantan sebanyak 30 ekor yang terbagi menjadi 5 kelompok. Semua kelompok diberikan pakan standar. K1 hanya diberikan pakan standar saja. K2, K3, P1, dan P2 diinduksi *Alloxan* 150 mg/kgBB. K3 mendapat tambahan sildenafil 1 mg/kgBB atau asam askorbat 1mg/kgBB + Zinc 0,6 mg/kgBB. P1 dan P2 diberikan ekstrak etanol lada hitam 122,5 mg/kgBB dan 245 mg/kgBB. Fungsi reproduksi dinilai dari berbagai aspek yaitu: ekspresi gen NOS, kadar testosteron intratestikular, fungsi ereksi, analisis spermatozoa, libido, dan histologi testis tikus. Data dianalisis menggunakan uji normalitas *Shapiro-Wilk* dan uji homogenitas, dilanjutkan dengan uji *one way ANOVA*, uji non parametrik *Kruskal Wallis* dan *uji Pos Hoc*.

**Hasil:** Pemberian ekstrak lada hitam dosis **122,5 mg/KgBB** dapat meningkatkan aspek ekspresi gen *Nitric Oxide Synthase* (NOS) pada *Corpus Cavernosum*, fungsi ereksi, dan perilaku seksual (libido) pada tikus jantan model hiperglikemia. Sementara itu, dosis **245 mg/KgBB** terbukti meningkatkan kadar testosteron intratestikular, jumlah sel Leydig, serta kualitas spermatozoa pada tikus jantan model hiperglikemia.

**Simpulan:** Pemberian ekstrak lada hitam terbukti dapat memperbaiki gangguan fungsi reproduksi tikus jantan model hiperglikemia.

**Saran:** Peneliti selanjutnya disarankan melakukan uji klinis untuk menilai keamanan, efek samping, dan toksisitas ekstrak lada hitam karena berpotensi menjadi terapi afrodisiaka tambahan bagi pasien diabetes melitus dengan gangguan reproduksi.

**Kata Kunci:** Disfungsi reproduksi, ekstrak lada hitam, hiperglikemia, tikus jantan.

**ABSTRACT**  
**ACTIVITY OF BLACK PEPPER EXTRACT (*Piper nigrum* L.) ON IMPROVING  
REPRODUCTIVE DYSFUNCTION IN MALE  
RATS ALLOXAN-INDUCED HYPERGLYCEMIA:  
A STUDY BEHAVIORAL, HORMONAL, AND  
HISTOLOGICAL TESTICULAR AND  
NITRIC OXIDE SYNTHASE  
GENE EXPRESSION**

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**Background:** Diabetes mellitus (DM) causes male reproductive dysfunction at various levels. Endocrine control of spermatogenesis, libido, and penile erection all negatively impact these effects.

**Objective:** To analyze the effect of black pepper (*Piper nigrum* L.) extract on improving reproductive dysfunction in alloxan-induced hyperglycemic male rats. A comprehensive assessment included behavioral (libido and erection), hormonal (intracerebral testosterone levels), testicular histology (spermocyte and Leydig cell counts), NOS gene expression, and spermatozoa analysis.

**Methods:** This study used a posttest-only randomized control group with 30 male rats divided into five groups. All groups were fed a standard diet. K1 was fed only the standard diet. K2, K3, P1, and P2 were induced by alloxan at 150 mg/kgBW. K3 received additional sildenafil at 1 mg/kgBW or ascorbic acid at 1 mg/kgBW + zinc at 0.6 mg/kgBW. P1 and P2 were given 122.5 mg/kgBW and 245 mg/kgBW of black pepper ethanol extract. Reproductive function was assessed using various aspects, including NOS gene expression, intratesticular testosterone levels, erectile function, spermatozoa analysis, libido, and testicular histology. Data were analyzed using the Shapiro-Wilk normality test and homogeneity test, followed by one-way ANOVA, the non-parametric Kruskal-Wallis test, and the post-hoc test.

**Results:** Administration of black pepper extract at a dose of 122.5 mg/kgBW increased Nitric Oxide Synthase (NOS) gene expression in the Corpus Caverosum, erectile function, and sexual behavior (libido) in male rats with hyperglycemia. Meanwhile, a dose of 245 mg/kgBW increased intratesticular testosterone levels, Leydig cell count, and spermatozoa quality in male rats with hyperglycemia.

**Conclusion:** Administration of black pepper extract has been proven to improve reproductive dysfunction in male rats with hyperglycemia.

**Suggestion:** Further researchers are advised to conduct clinical trials to assess the safety, side effects, and toxicity of black pepper extract because it has the potential to be an additional aphrodisiac therapy for diabetes mellitus patients with reproductive disorders.

**Keyword:** Black pepper extract, hyperglycemia, male rats, reproductive dysfunction.