

RINGKASAN

PENGARUH PEMBERIAN CADMIUM PERORAL TERHADAP BERAT TESTIS, DIAMETER TUBULUS SEMINIFERUS, DIAMETER LUMEN TUBULUS SEMINIFERUS DAN TEBAL EPITEL TUBULUS SEMINIFERUS TIKUS PUTIH

(rattus norvegicus strain Wistar)

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Pengertian bahan kimia beracun didefinisikan sebagai bahan kimia yang dalam jumlah kecil menimbulkan keracunan pada manusia atau makhluk hidup lainnya. Umumnya zat-zat toksik masuk lewat oral, pernapasan atau kulit, kemudian beredar ke seluruh tubuh atau ke organ-organ tertentu. Bahan kimia tersebut dapat langsung mengganggu organ-organ tubuh tertentu, seperti testis, paru-paru, hati, ginjal dan lain-lain. Tetapi dapat pula zat-zat tersebut berakumulasi, pada organ tubuh makhluk hidup misalnya hati, ginjal, testis, darah atau cairan pembuluh limfe dan organ lain sehingga menghasilkan efek dalam jangka panjang. Di dalam industri perlu dipelajari suatu cabang ilmu khusus tentang efek bahan kimia beracun, yaitu toksikologi industri yang khusus mempelajari racun-racun yang dipergunakan, diolah maupun dihasilkan oleh pabrik atau perusahaan. Penelitian ini bertujuan untuk mengetahui pengaruh cadmium terhadap berat testis serta tingkat kerusakan tubulus seminiferus tikus putih (*Rattus Norvegicus Strain. Wistar*) yang ditandai dengan berkurangnya diameter tubulus seminiferus, tebal epitel tubulus seminiferus dan melebarnya lumen tubulus seminiferus setelah diberi cadmium peroral dalam berbagai dosis toksik secara akut. Manfaat dari penelitian ini adalah untuk memberikan informasi kepada masyarakat tentang bahaya cadmium yang mempunyai sifat toxican/racun apabila masuk kedalam tubuh manusia mengakibatkan kerusakan pada testis dan mengurangi tingkat kesuburan pada pria dan dapat dimanfaatkan oleh ilmuan lain untuk mengembangkan ilmu pengetahuan dan teknologi. Cadmium sendiri adalah logam berat yang bersifat toksikan artinya logam ini dapat mempengaruhi semua organ makhluk hidup terutama organ tersebut sangat rentan atau sensitif, salah satunya testis

sebagai organ reproduksi pria. Pengaruh Cd terhadap testis akan bekerja menghambat sistem hormone yaitu testoteron, sintesa protein, enzim, dan reaksi biomolekuler sel. Konsentrasi cadmium di dalam dan di luar tubulus seminiferus mempunyai perbedaan yang nyata tergantung kelarutan lipid dan barrier spesifik. Penampilan barrier ini mempunyai hubungan yang spesifik antara pasangan sel-sel Sertoli yang berdekatan. Barrier ini hanya ada menjelang pubertas (Tendeau,1982 ; Setchell, 1986). Hipotesis penelitian ini adalah apakah pemberian cadmium dapat menurunkan berat testis tikus putih jantan, dan apakah pemberian cadmium dapat mempengaruhi diameter tubulus seminiferus, tebal epitel tubulus seminiferus dan lebar lumen/diameter lumen tubulus seminiferus/tikus putih (*Rattus Norvegicus* Strain *.Wistar*). Secara anatomi dan fisiologi testis merupakan kelenjar ganda karena secara fungsional bersifat eksokrin dan juga endokrin. Bagian eksokrin terutama menghasilkan sel kelamin (sel benih). Sehingga testis di anggap sebagai kelenjar sitogenik. Sedangkan bagian edokrin menghasilkan sekret internal yang dilepaskan oleh sel – sel khusus (Leeson dan Leeson, 1995).

Metode penelitian yang digunakan adalah metode penelitian yang sebenarnya (*true experimental*), karena semua variable yang berpengaruh pada perlakuan dapat dikendalikan. Semua tikus putih jantan dibagi dalam 5 kelompok, masing-masing kelompok terdiri dari 6 ulangan, bahan cadmium diberikan dengan variasi dosis dan perlakuan secara oral selama 6 minggu (45 hari) kelompok I kontrol, kelompok II 0,05 mg/kg BB/ hari, kelompok III 0,10 mg/kg BB/ hari, kelompok IV 0,15 mg/kg BB/hari, kelompok V 0,20 mg/kg BB/hari kemudian testis ditimbang selanjutnya dibuat preparat histologi dengan menggunakan pewarnaan PAS dan diamati dibawah mikroskop sinar dengan menggunakan micrometer garis. Data yang diperoleh kemudian dianalisis dengan statistik (anova) dari hasil yang diperoleh bahwa berat testis mempunyai nilai $P=0,004$ ini berarti ada perbedaan yang nyata yang diperlihatkan antara kelompok P1 dan P0, P2 dan P3, P3 dan P0 serta P4 dan P0. Sedangkan pengaruh cadmium terhadap diameter tubulus seminiferus diperoleh nilai $P=0,001$ ini berarti ada perbedaan yang nyata yang dapat dilihat antara kelompok P1 dan P2, P1 dan P0, P2 dan P4, P3 dan P4 serta P4 dan P0 sedangkan tebal epeitel

tubulus seminiferus juga ada perbedaannya yang nyata antara kelompok pada pemberian Cd dengan berbagai dosis yang diperlihatkan antara P1 dan P2, P1 dan P3, P1 dan P0, P2 dan P4, P3 dan P4, P3 dan P4 serta P4 dan P0. Selanjutnya pada penelitian ini lebar lumen tubulus seminiferus tidak ada perbedaan yang nyata (homogen) karena dari uji anava diperoleh nilai $P=0,069$.

Dari hasil penelitian ini disimpulkan bahwa berat testis, diameter tubulus seminiferus, tebal epitel tubulus seminiferus sesuai dengan hipotesis (hipotesis terbukti) namun lebar lumen tubulus seminiferus hipotesis tidak terbukti. Saran peneliti perlu dilakukan penelitian lebih lanjut dengan menggunakan spesies mamalia yang lebih tinggi dan lebih spesifik (penelitian biomolekuler).

SUMMARY

THE INFLUENCE OF PER ORAL CADMIUM FEEDING ON TESTICULAR WEIGHT, SEMINIFEROUS TUBULE DIAMETER, THE DIAMETER OF SEMINIFEROUS TUBULE LUMEN, AND THE THICKNESS OF SEMINIFEROUS TUBULE EPITHELIUM IN WHITE RATS

(*rattus norvegicus strain. Wistar*)

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Toxic chemical substance is defined as substances that, even in its small amount, may induce toxicity in human and other living beings. Generally, the entry points of toxicants are per oral, respiratory, or dermal, and they disperse to whole body or to certain organs. Those toxicants may directly damage the organs, such as testis, lung, liver, kidney, etc. They may also accumulate in organs, such as liver, kidney, testis, blood, or lymph nodes, resulting in long-term effects. In industry, a field of science, industrial toxicology, has been developed to study toxicants employed, processed, and produced by industrial companies. The objective of this study was to identify the influence of cadmium, on testicular weight and the level of damage in seminiferous tubule of white rats (*Rattus Norvegicus Strain.Wistar*) as indicated by the decrease of seminiferous tubule diameter, the thickness of seminiferous tubule epithelium, the diameter of seminiferous tubule lumen, after being fed with per oral cadmium in various acute toxic doses. The benefit of this study was to provide information on cadmium, which is a hazardous toxicant as it may induce damage in testis and reduce fertility in male. The information can be used to further develop science and technology. Cadmium it self is a toxic heavy metal, able to affect organs, particularly those that are susceptible or sensitive. One of those organs is testis, in which the effect of Cd in testis may inhibit enzymatic systems, testosterone, protein synthesis, enzyme, and cellular biomolecular reactions. Cadmium concentration within and outside seminiferous tubule has significant difference, depending on lipid solubility and specific barrier. The characteristics of the barriers have specific correlation with the adjacent Sertoli cell couples. The barriers present only before puberty (Tendean, 1982 ; Setchell, 1986). The hypothesis of this study was that whether cadmium feeding could reduce testicular weight of male white rats, and whether cadmium feeding could have influence on the diameter of seminiferous tubule, seminiferous tubule epithelial thickness and the width/diameter of seminiferous tubule lumen in white rats (*Rattus Norvegicus Strain Wistar*). Anatomically and physiologically, testis is regarded as a double tissue as it functionally has exocrin as well as endocrin characteristics. As an exocrin, it

primarily produces germ cells, so that it is regarded as cytogenic tissue. As an endocrin, it produces internal secretes released by particular cells (Leeson dan Leeson, 1995).

This was a true experimental study, since all affecting variables in treatment were controlable. All male white rats were divided into 5 group, each subjected to 6 repetition. Cadmium was fed in varied dose per oral for 6 weeks (45 days) in group I (control), group II received II 0.05 mg/kg BW/day, group III 0.10 mg/kg BW/day, group IV 0.15 mg/kg BW/day, and group V 0.20 mg/kg BW/day. Subsequently, testis was scaled and histological preparations were made using PAS staining and observed under light microscope with micrometer. Obtained data were analyzed using Anava. Results revealed that testicular weight had $p = 0.004$, indicating significant difference between groups P1 and P0, P2 and P3, P3 and P0 as well as P4 and P0. The influence of cadmium on the diameter of seminiferous tubule had $p = 0.001$, also showing significant difference in in groups P1 and P2, P1 and P0, P2 and P4, P3 and P4 as well as P4 and P0. The thickness of seminiferous tubule epithelium also had significant difference in P1 and P2, P1 and P3, P1 and P0, P2 and P4, P3 and P4, P3 and P4 as well as P4 and P0. However, the diameter of seminiferous tubule lumen had no significant difference (homogeneous) because the Anava test revealed $p = 0.069$.

In conclusion, cadmium feeding has influence on testicular weight, seminiferous tubule diameter, and the thickness of seminiferous epithelial cells, while it has no influence on the diameter of seminiferous tubule lumen. It is suggested to conduct further biomolecular studies by involving higher and more specific mammalia species.

ABSTRACT**THE INFLUENCE OF PER ORAL CADMIUM FEEDING ON TESTICULAR WEIGHT, SEMINIFEROUS TUBULE DIAMETER, THE DIAMETER OF SEMINIFEROUS TUBULE LUMEN, AND THE THICKNESS OF SEMINIFEROUS TUBULE EPITHELIUM IN WHITE RATS
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Cadmium is a toxic heavy metal that can affect all organs of living beings, particularly those that are sensitive or susceptible. One of the organs in the body of human being is testis, a reproductive organ. The effects of cadmium on testis present as the inhibition of testosterone system, protein synthesis, and cellular biomolecular reaction. The objective of this study was to identify the threat of cadmium, as a toxic heavy metal on the health of human body, and, in particular, to identify the effect of cadmium on testicular damage by analyzing testicular weight and the level of damage in seminiferous tubule of white rats (*Rattus Norvegicus Strain Wistar*) as indicated by the decrease of seminiferous tubule diameter, the thickness of seminiferous tubule epithelium, the widening if seminiferous tubule lumen, after being fed with per oral cadmium in various acute toxic doses.

This was a true experimental study observing the variables of testicular weight, the width of seminiferous tubule lumen, the thickness of seminiferous tubule epithelium, and the diameter of seminiferous tubule. Experimental animals involved were 30 white rats (*Rattus Norvegicus Strain Wistar*) divided into 5 treatment groups, in which P0, as control, was given only with distilled water, P1 was given with Cd of 0.05 mg kg/bw/day, P2 of 0.10 mg kg/bw/day, P3 of 0.15mg kg bw/day, and P4 of 0.20 mg kgbw/day. After being given with per oral Cd for 45 days, we carried out scaling and histological preparations making.

Results were analyzed using Anova, and it was found that testicular weight had $p = 0.004$ ($p < 0.05$), indicating the difference of testicular weight due to cadmium feeding. The diameter of seminiferous tubule and the thickness of seminiferous tubule lumen each had $p = 0.001$, also showing a significant difference. However, the diameter of seminiferous tubule lumen had $p = 0.069$ ($p > 0.05$), indicating no significant difference or homogeneity in each treatment group.

Keywords: *testis, seminiferous tubule, toxicants, cadmium, heavy metal*