

Komunikasi Pendek/Short Communications

Haemoprotective Effects of *Ganoderma lucidum* Preparation in Cisplatin-treated Rats

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ABSTRAK

Kajian ini telah dijalankan untuk menentukan kesan perlindungan sediaan *Ganoderma lucidum* terhadap sel darah tikus Wistar jantan yang disuntik dengan Cisplatin. Lapan belas ekor tikus Wistar berumur 8 minggu (250 – 300 g se ekor) telah dibahagikan kepada tiga kumpulan. Kumpulan A telah diberikan dadah anti-kanser, Cisplatin, secara intravena melalui vena kaudal sebanyak 0.5 mg/kg berat badan selama 5 hari. Kemudiannya larutan ekstrak akues sediaan *G. lucidum* telah diberikan secara oral kepada tikus tersebut sebanyak 0.7 g/kg berat badan selama 24 hari. Kumpulan B pula telah disuntik dengan Cisplatin tetapi tanpa suplimen *G. lucidum*. Kumpulan C, kumpulan kawalan, diberikan diet basal dan disuntik dengan air salina normal. Kiraan terhadap sel darah selepas 24 hari menunjukkan bahawa apabila tikus dipaksa mengambil *G. lucidum*, terdapat peningkatan signifikan tahap sel darah merah ($9.30 \times 10^6 \text{mm}^3$; $p < 0.05$) dan kepekatan limfosit (53.3% ; $p < 0.01$) berbanding dengan Kumpulan B. Tahap sel darah merah, neutrofil (43.72% ; $p < 0.01$), monosit (1.1% ; $p < 0.05$), and basofil (0.74 % ; $p < 0.05$) dalam Kumpulan A adalah juga lebih signifikan berbanding sampel kawalan. Keputusan ini menunjukkan bahawa pemberian ekstrak sediaan *G. lucidum* secara oral boleh menghasilkan kesan perlindungan sel darah terhadap tikus Wistar jantan yang disuntik dengan Cisplatin.

ABSTRACT

This study was conducted to determine the haemoprotective effects of *Ganoderma lucidum* preparation in Cisplatin-injected male Wistar rats. Eighteen 8-week old male Wistar rats (250-300g each) were divided into three groups. Group A was given the anti-cancer drug, Cisplatin, which was intravenously injected at the caudal vein, at a dose of 0.5 mg/kg body weight, for five days. Aqueous extract of *G. lucidum* preparation was then

orally administered to the rats at a dose of 0.7 g/kg body weight for 24 days. Group B was injected with Cisplatin but not supplemented with *G. lucidum*. Group C, the control group, was given basal diet and injected with normal saline. Blood cell counts determined after 24 days showed that when the rats were force-fed with *G. lucidum* preparation, there was significant increase in the levels of red blood cells ($9.3 \times 10^6 \text{ mm}^3$; $p < 0.05$) and the concentration of lymphocytes (53.3%; $p < 0.01$) when compared to Group B. The levels of red blood cells, neutrophils (43.7%) ($p < 0.01$), monocytes (1.1%; $p < 0.01$), and basophils (0.7%; $p < 0.01$) in Group A were also significantly higher than those from the control group. The results indicate that oral administration of *G. lucidum* preparation can render haemoprotection in Cisplatin-injected male Wistar rats.

Ganoderma lucidum (Family Polyporaceae) has long been used in traditional medicine to cure various human diseases such as hepatitis, hypertension, cancer, natural killer (NK) cell activating activity, gastritis, and hypercholesterolemia (Wang et al. 1993; Kimura et al. 1988; Hwang et al. 1989; Sone et al. 1985). It has also been shown that *G. lucidum* is associated with the ability to enhance production of interleukin-2 in the presence of Con A and elevate the proportion of NK cells among mononuclear cells (Cheng et al. 1985 & 1988). It was also reported that the continued oral administration of *G. lucidum* could increase the immuno-ability to prevent serious damage or to recover rapidly from diseases (Yamada et al. 1992). These results show that *G. lucidum* may play an important role in the activation of host-mediated immune responses. Studies have also shown that supplementation of *G. lucidum* during chemotherapy can reduce side-effects such as bone marrow suppression and risk of infection (Jia et al. 1993).

In the present study, we investigated the haemoprotection of Cisplatin-injected male Wistar rats blood cells by continuous force-feeding of *G. lucidum* preparation for 24 days after injection with an antitumour drug, Cisplatin.

The normal level of white blood cells in blood circulation of rats is between 6000 and 18000/ul blood, of which the composition of lymphocytes are 43-85%, neutrophils 14-20%, monocytes < 6% and basophils very rarely occurring (Judy et al. 1995). Blood cell counts determined after 24 days showed that supplementation with *G. lucidum* preparation attenuated the percentage levels of lymphocytes (54.3%; $p < 0.01$) and red blood cells ($9.3 \times 10^6 \text{ mm}^3$; $p < 0.05$) population when compared to Group B which received Cisplatin only (Table 1). However, the increase in concentration of lymphocyte in the supplemented rats did not attain the original level as observed in the control group (59.40%; $p < 0.01$). Cisplatin treatment had significantly increased the percentage levels of neutrophil (43.7%; $p < 0.01$), monocyte (1.1%; $p < 0.05$), and basophil (0.7%; $p < 0.05$) as compared with the control. Supplementation with *G. lucidum* preparation lowered the

TABLE 1. Percentage levels of white blood cell components and red blood cells in male Wistar rats

Treatment	Lymphocyte (%)	Neutrophil (%)	Monocyte (%)	Basophil (%)	Eosinophil (%)	RBC x 10 ⁶ /mm ³
Normal Control	59.40±1.85 ^a	39.12±1.75 ^d	0.93±0.08 ^g	0.45±0.05 ^j	0.12±0.05	8.61±0.28 ^m
Cisplatin	42.12±0.67 ^b	54.66±0.45 ^e	2.24±0.39 ^b	0.82±0.18 ^k	0.16±0.07	8.28±0.46 ⁿ
Cisplatin + <i>G. lucidum</i>	54.34±0.97 ^c	43.72±1.02 ^f	1.10±0.09 ⁱ	0.74±0.11 ^l	0.10±0.04	9.30±0.18 ^p

a, b, c, d, e, f (p < 0.01); g, h, i, j, k, l, m, n, p (p < 0.05).

percentage levels of the neutrophils (43.7% ; p < 0.01), monocyte (1.1% ; p < 0.05), and basophil (0.7% ; p < 0.05) as compared to the controls.

In conclusion, the present study demonstrates that the oral administration of *G. lucidum* preparation renders haemoprotective effects of lymphocytes in Cisplatin-injected male Wistar rats.

MATERIALS AND METHODS

The *G. lucidum* capsules were provided by Ganoderma Nutraceuticals, Klang, Selangor, Malaysia. Eighteen eight-week old male Wistar rats (250-300g each) were housed in the Animal Unit, Medical Faculty, Universiti Kebangsaan Malaysia (UKM) and divided into three groups with six animals in each group. The animals were kept six per cage under 12 hr natural light/dark cycles and given deionized water *ad libitum*. The project has been approved by the UKM Animal Ethics Committee.

Group A was given the anti-cancer drug, Cisplatin, which was intravenously injected at the caudal vein, at a dose of 0.51 mg/kg body weight, for five days. The *G. lucidum* preparation was dissolved in water and orally administered at a dose of 0.7 g/kg body weight for 24 days. Group B was injected with Cisplatin in the caudal vein, as in Group A. Group C, the control group, was given basal diet, and injected with normal saline. Rats were sacrificed after 24 days and blood removed from the orbital sinus vein and heart in 5ml batches containing EDTA. Blood cells were smeared on glass slides, dried and stained with Leishman dye. Cell numbers were counted under microscope using a haemocytometer and an average of triplicate readings were obtained for each cell type.

Data were analysed using the One-way analysis of variance (ANOVA) test from the Statistical Package followed by *post-adhoc* Tukey test. For all comparison, differences were considered to be significant when p < 0.05.

ACKNOWLEDGEMENTS

The authors are grateful to the Faculty of Allied Health Sciences, Universiti Kebangsaan Malaysia for the funding of this project.

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