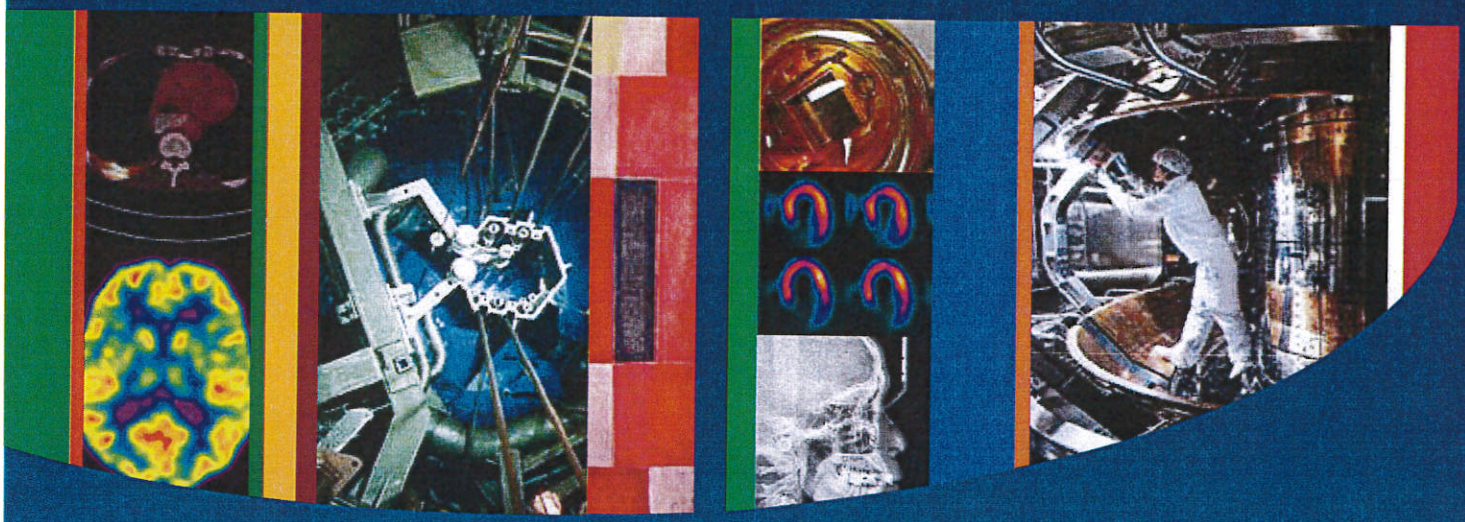
2013 IEEE NSS/MIC/RTSD Seoul, Korea

Institute of Electrical and Electronics Engineers

2013 IEEE NSS/MIC/RTSD

Nuclear Science Symposium & Medical Imaging Conference
& Workshop on Room-Temperature Semiconductor X-Ray and Gamma-Ray Detectors



"Beyond Imagination of Future Science"

October 27 - November 2, COEX, Seoul, Korea

Abstract Submission Deadline: May 13, 2013

Radiation Detectors and Instrumentation for Nuclear, High-Energy, Space, Solid-State and Bio- Physics Applications, and Homeland Security

Instrumentation and Methods for PET, SPECT, CT, MR, Optical, Multi-Modality and Application-Specific Medical Imaging, and Radiotherapy

Plenary Sessions | Oral Sessions | Poster Sessions | Short Courses
Refresher Courses | Workshops | Industrial Exhibits | Companion Program

General Chair	Hee-Joung Kim	Yonsei University
Deputy General Chair	Steve Meikle	University of Sydney
NSS Chair	Gyuseong Cho	KAIST
NSS Deputy Chair	Ikuo Kanno	Kyoto University
MIC Chair	Jae Sung Lee	Seoul National University
MIC Deputy Chair	Craig Levin	Stanford University
RTSD Co-Chairs	Jang Ho Ha	KAERI
	Ralph James	Brookhaven National Laboratory

2013 IEEE NSS/MIC/RTSD
"Beyond Imagination of Future Science"
Nuclear Science Symposium & Medical Imaging Conference
& Workshop on Room-Temperature Semiconductor X-Ray and Gamma-Ray Detectors
October 27 - November 2, COEX, Seoul, Korea

Antitumor Effect and Immune Activity for β-D-glucan

Yeun-Hwa GU[1] and Masahiro IWASA[2]

[1]Department of Radiological Science.Faculty of Health Seience. Junshin Gakuen University. 1-1-1 Chikushigaoka. Minami-ku. Fukuoka 815-8510 Japan
[2]Nihon BRM Research Center. Akasaka Tokyu Bilding 9F. 2-14-3. Nagata-cho. Tsioda-ku. Tokyo 100-0014 Japan

Key words: **β-D-glucan(EF2001)/Lymphocyte/NK cell/Radiation protection/Immune activity**

ABSTRACT

Radiation protection from death and stimulating leukocyte recovery by oral administrations consecutively of β-D-glucan (*Enterococcus Faecalis* 2001), 200 mg/kg and 400mg/kg b.w., once a day, before whole-body x-rays irradiation was confirmed by tests with C3H mice, meanwhile, its radioprotective actions compared to immunological enhancement. The survival of irradiated mice protected by β-D-glucan was significantly increased and statistically higher than that of mice pre-treated with oral administration. After administration of β-D-glucan, enhanced CD4 and CD8 cells, numbers of NK cells and CD4 and CD8 cells in mice were found and lymphocytes numbers was higher than in irradiated control group. Stimulated recovery of leukocyte, lymphocytes, and NK cells counts were observed in mice pre-treated with EF 2001. This effect of β-D-glucan may have some therapeutic implications for radiation-induced injuries. We can analyze a result of this study than this thing as follows. We think that CD 4 and CD 8 did immunological enhancement of β-D-glucan than helper T cells and suppressor T cell activation from their having been a rise. In addition, we think that indicating the activation of cell-mediated immune responses.

Antitumor Effect and Immune Activity for *β-D-glucan*

Yeun-Hwa GU[1] and Masahiro IWASA[2]

[1]Department of Radiological Science,Faculty of Health Seience, Junshin Gakuen University, 1-1-1 Chikushigaoka, Minami-ku, Fukuoka 815-8510 Japan
[2]Nihon BRM Research Center, Akasaka Tokyu Bilding 9F, 2-14-3, Nagata-cho, Tsioda-ku, Tokyo 100-0014 Japan

2013 IEEE NSS/MIC/RTSD
"Beyond Imagination of Future Science"
Nuclear Science Symposium & Medical Imaging Conference
& Workshop on Room-Temperature Semiconductor X-Ray and Gamma-Ray Detectors
October 27 - November 2, COEX, Seoul, Korea

Gu Lab

Purpose

- Antioxidant effect of *Enterococcus · Faecalis* derived from β-D-glucan, SOD-like activity, Immune activity.
  Anti-tumor effect.

- The reduction of side effects of radiation protection when used in combination with radiation therapy.
  Immune activator as immunotherapy.

Study of the presence or absence of anti-cancer effects and radiation protection which is the active ingredient of EF 2001 of β-glucan

Material and Methods

Machine: Flow cytometry	Becton Dickinson	FACS Caliber
Whole automatic blood cell measuring instrument	Nihonnkouden	Celltac-α
X-ray instrument	Phillips	MG226/4.5 (225keV)
Luminescence Reader	ALOKA	BLR201
Micro Plate Reader	TOYOSODA	MPR A-4

Anti Body kit	CD-3,CD-4,CD-8 3Color - Control	
AOA	SOD	Wako
	AAPH	

T-cell subset analysis -FACS-：A monoclonal antibody (we did fluorescence staining of the cell which reacted MoAb).) which did fluorescent labeling to a cell. We irradiated laser beam to a cell and analyzed a site gram in cellular distribution from front distraction (FSC), flank distraction (SSC) light afterwards.

Material and Methods

- Five C3H mouse (♂), week of age animal used for experiment
- Use machinery; a roentgen radiation device (Philips, the Netherlands):
- β-glucan; a β-glucan "super horin : (Nihon BRM Co., Ltd.)
- Administration; 200ml/kg, 400ml/kg; after extra breeding; more:Daily life oral administration
- ※To the group whom it does not give *β-glucan*, it is oral administration with distilled water of the same amount

Ex Groups (n=10) ICR Mouse, ♂♀, Administration method ; P.O

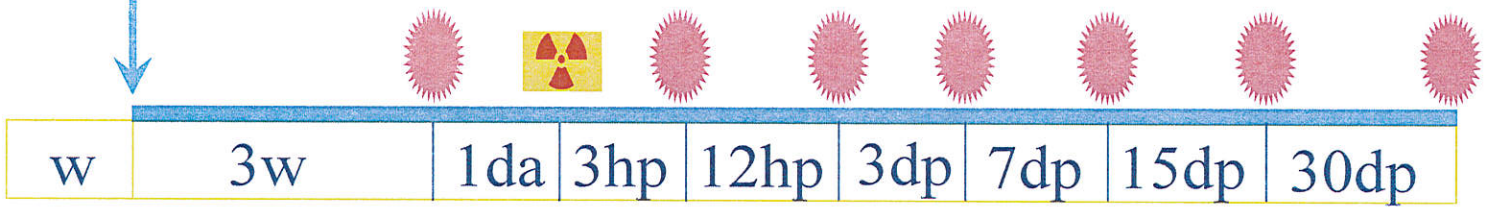
Control Group	**Water**	**0.3ml**
β-glucan	***β-glucan***	**250mg/kg**
2Gy	**Water**	
2Gy+ *β-glucan*	***β-glucan***	**250mg/kg**

and, + 2Gy-X-ray exposure group; Total: 8Group

Sample beginning of dosage (forced every other day: P.O)

Tail vein blood sampling

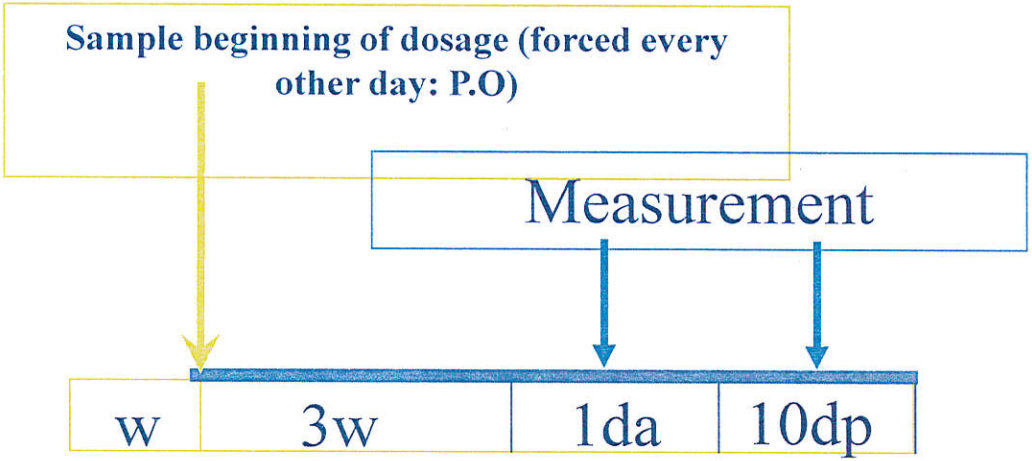
X-ray irradiation; 2Gy



Experiment Group; C57BL mouse, injection method; O.P

Control Group	**Water**	**0.3ml**
β-glucan	***β-glucan***	**200mg/kg** **400mg/kg**
2Gy	**Water**	
2Gy+ *β-glucan*	***β-glucan***	**200mg/kg**

and, + 2Gy-X-ray exposure group; Total: 8Group



X-ray irradiation; 2Gy

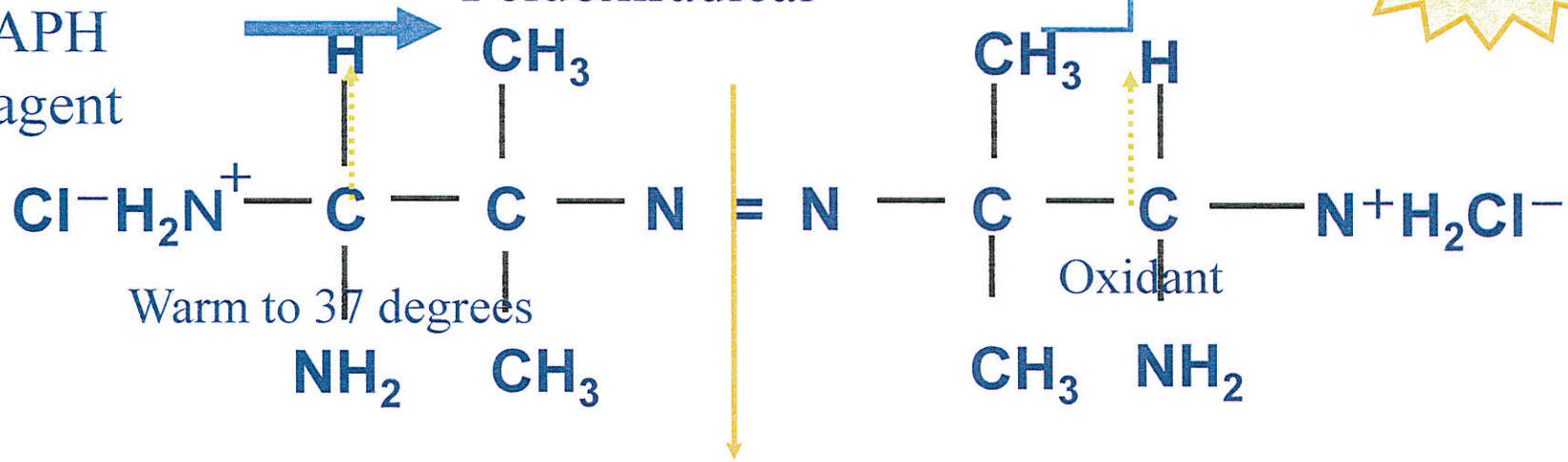
Antioxidant Activity ① AAPH

AAPH：2,2'-asobis（2-amisinopropan）two-hydrochloride $C_8H_{18}N_6 \cdot 2HCl$

【luminescence principle】

Luminol reagent → **Lumines cence**

AAPH reagent → Peluoxiradical

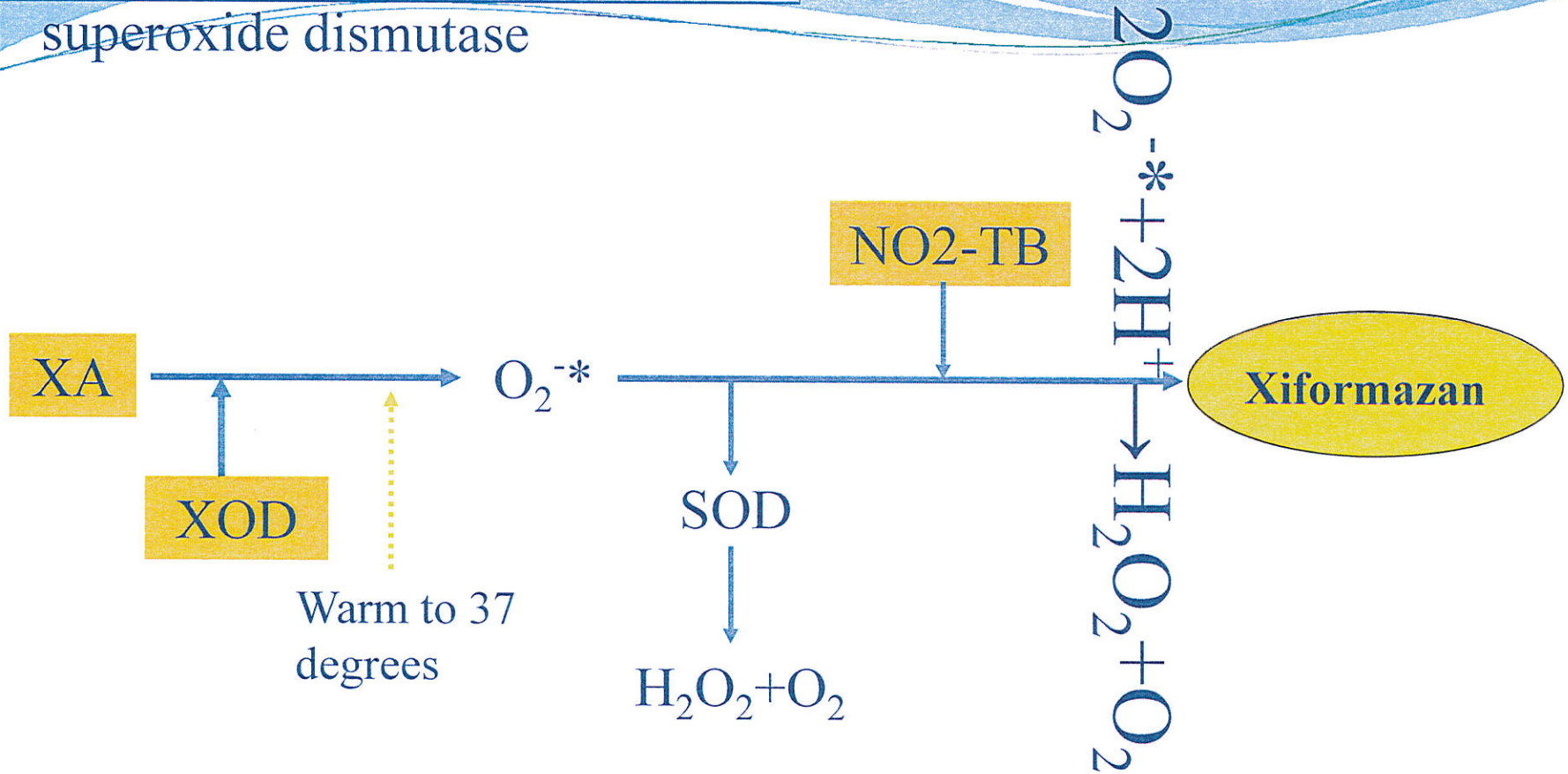


Radical scavenging

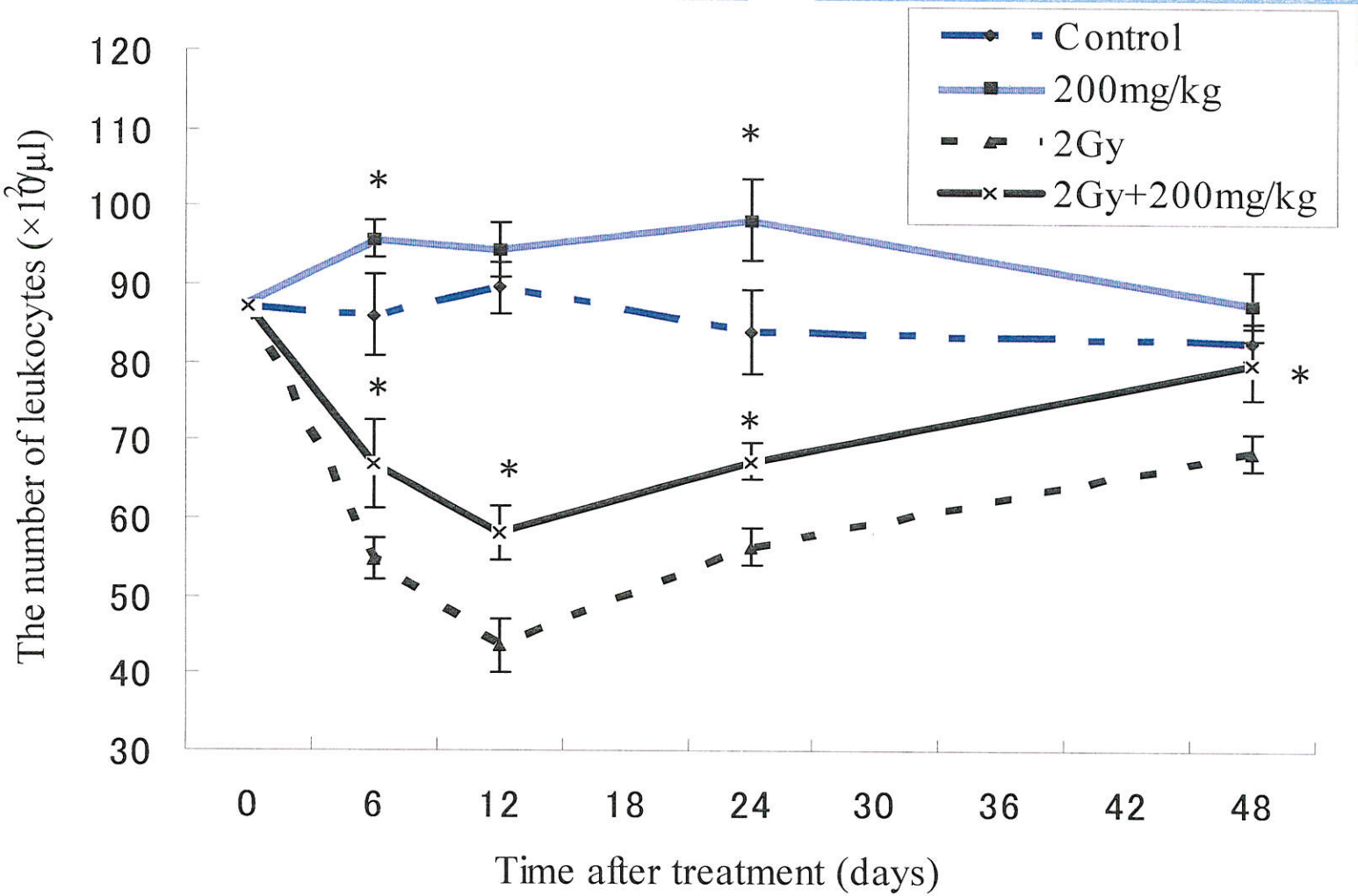
We did experiment group and the dosage same as blood count

Antioxidant Activity ② SOD

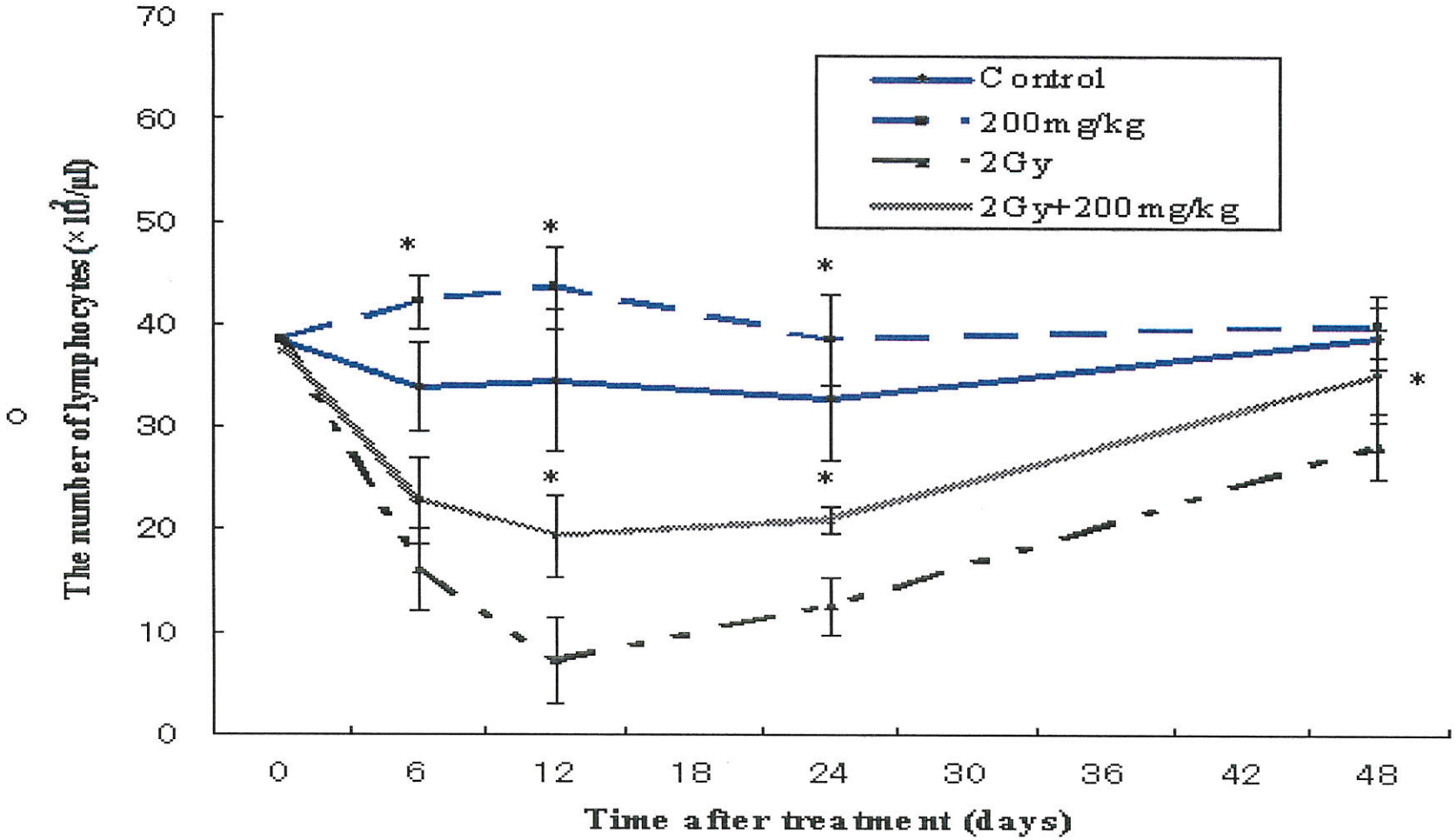
superoxide dismutase



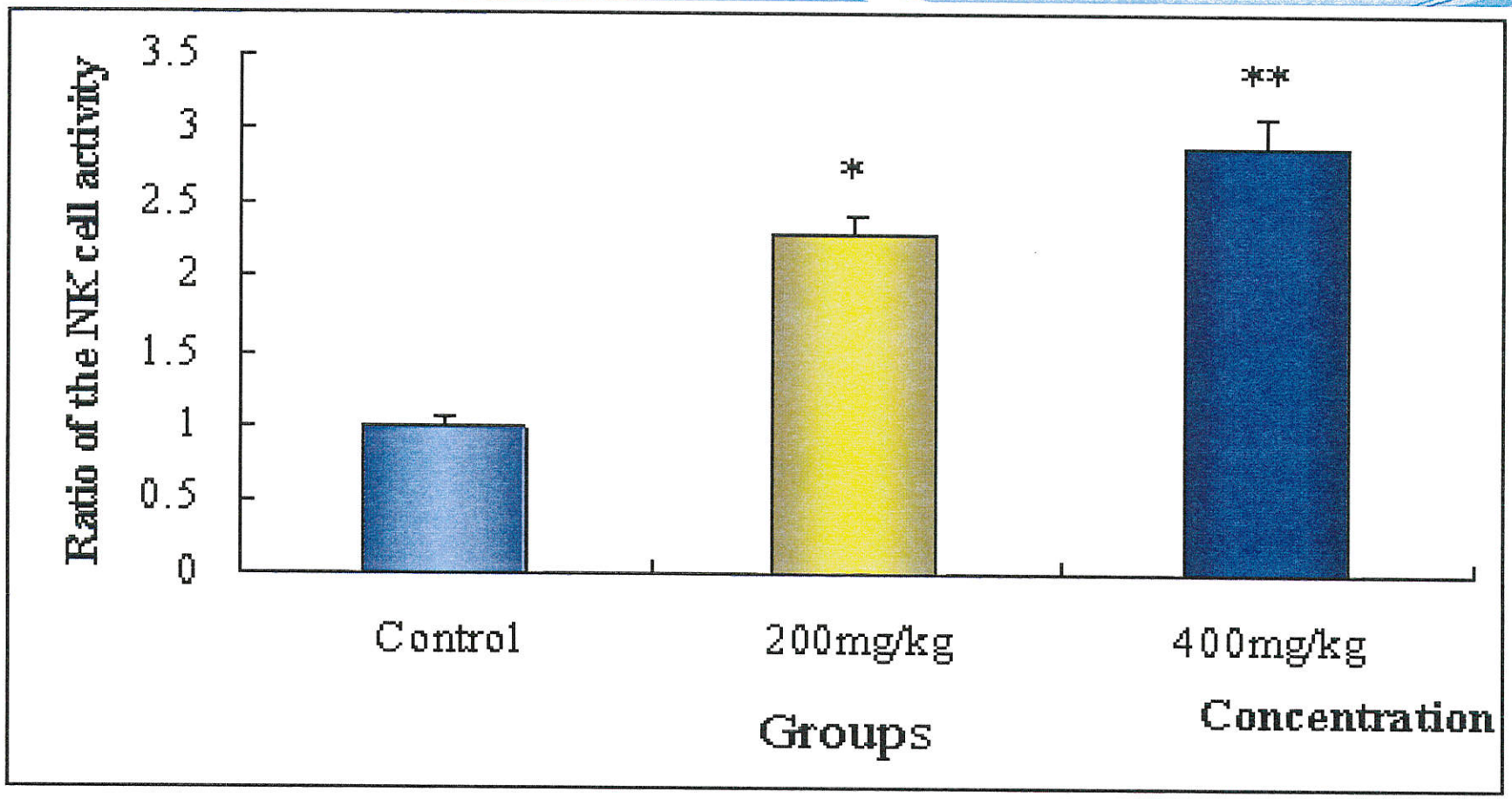
We did experiment group and the dosage same as blood count



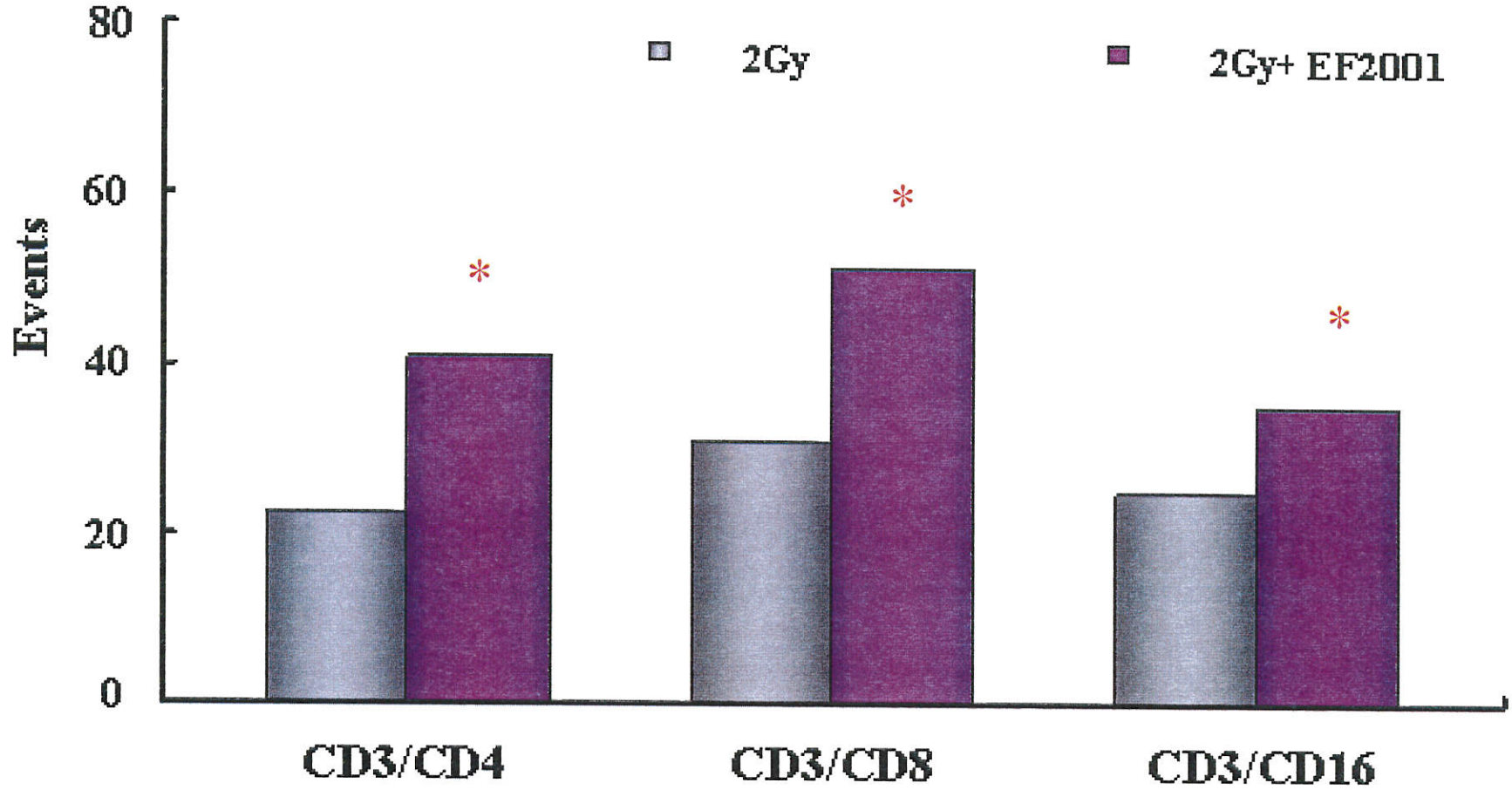
Leukocyte counts on different days after irradiation in mice of different groups. The number of leukocyte was calculated from the pre-irradiation values taken as 100%. The bars represent standard deviation. * Statistically significant ($P < 0.05$) from the control group.



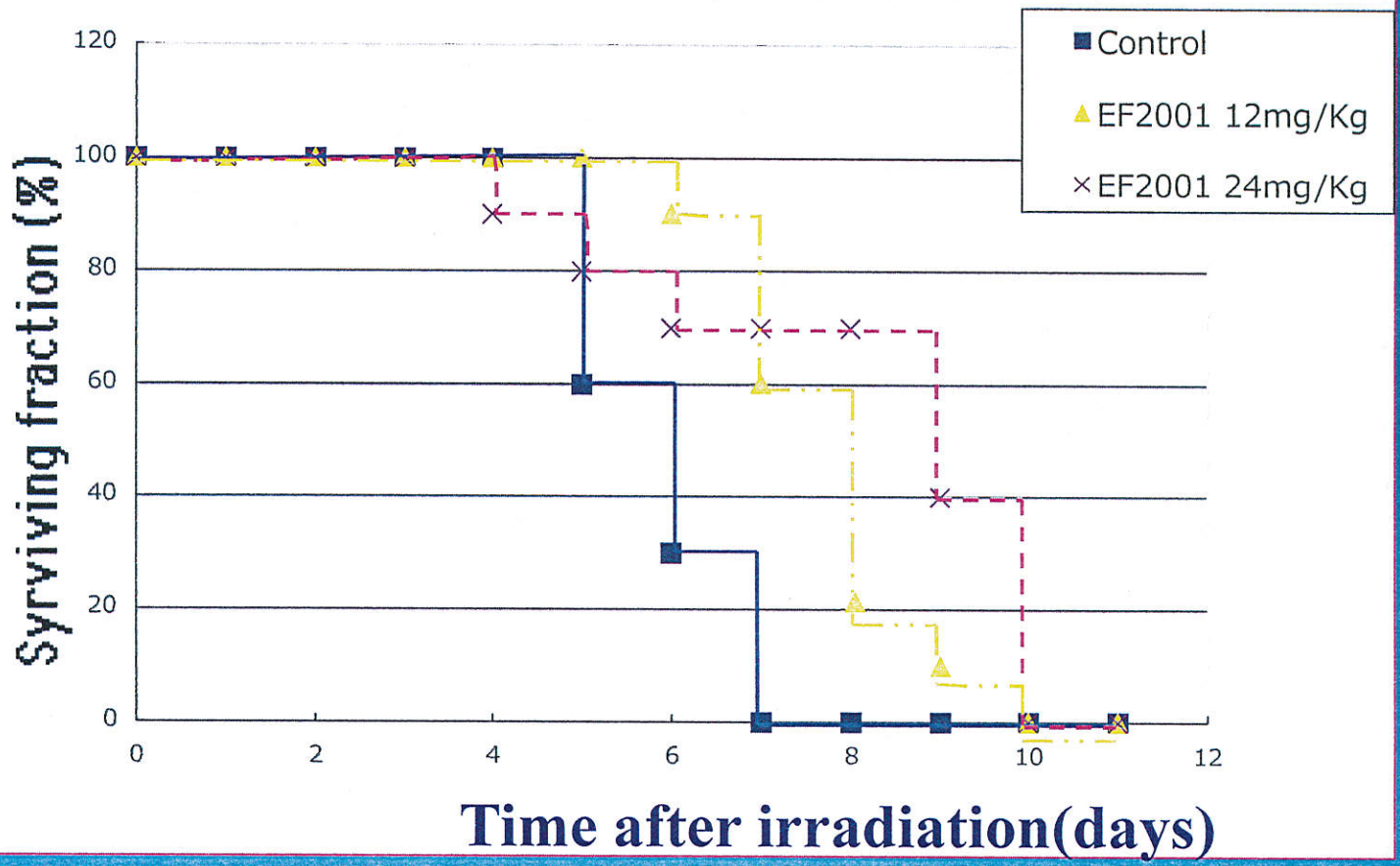
Lymphocyte counts on different days after irradiation in mice of different groups. The number of lymphocyte was calculated from the pre-irradiation values taken as 100%. The bars represent standard deviation. * Statistically significant ($P < 0.05$) from the control group.



Repeated dose effect of EF 2001 on the NK activity in mice. Groups of ten mice each were subjected to each treatment. Results represent means ± S.D. * Statistically significant ($P < 0.05$) from the control group.

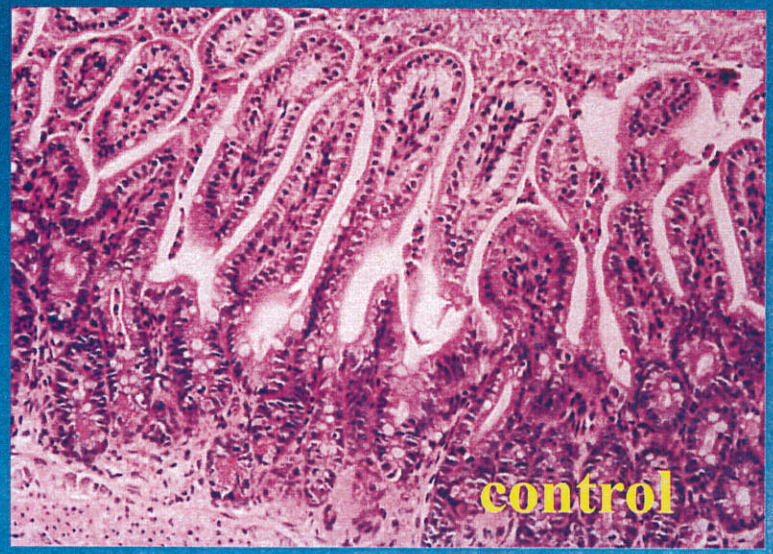


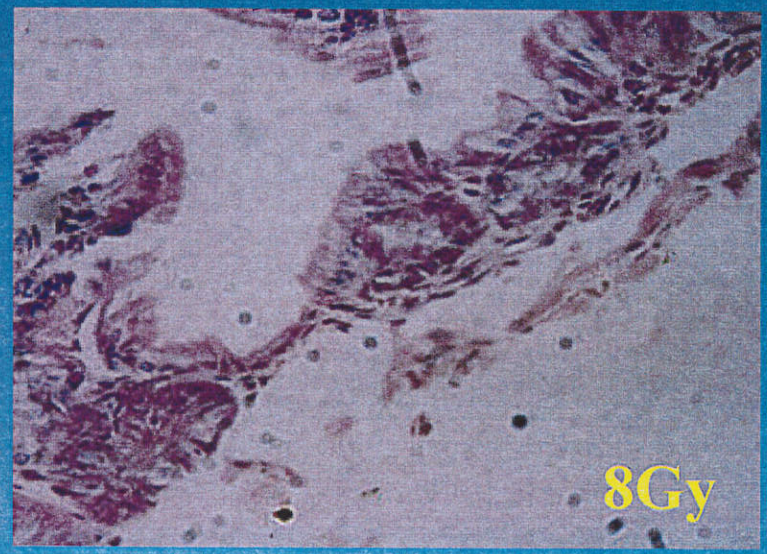
The increased percentage of CD4+, CD8+ and CD16+ T-lymphocytes in PBLs compared to the experimental data baselines of the groups. The unit is in percentage (%). Significantly different from*P<0.05 Control group vs. *EF2001* groups by Dunnett test.

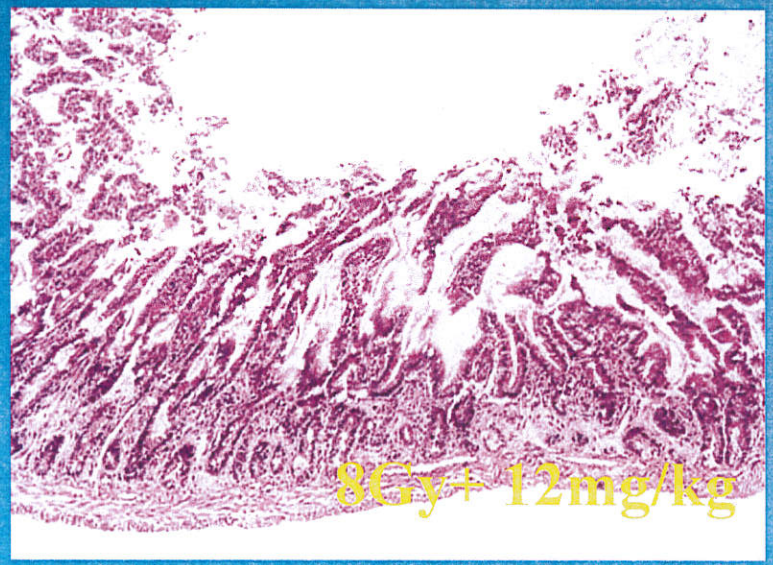


Survival after irradiation. Surviving fraction was increased after injection of EF2001.

Small intestines







Conclusion

- Anticancer effects to depend to resemble it such as activity of Th1, 2, 3, the interferon production, non-acquired immunity agent by stimulation of the macrophage which it inhibits tumor growth by *β-glucan* administration.

- The lymphoid measurement inhibits decrease of white blood cells cell count by *β-glucan* administration

- It is antioxidation activity by *β-glucan* administration antioxidation activity

- Cell-mediated immunity is a rise by immunological enhancement action by increase ⇒ *β-glucan* administration of CD4 and CD8 by *β-glucan* administration analysis of T-cell subset

- ▪ **Antitumor effect: It is inhibited tumor growth by NK-cell by *β-glucan* administration, cytokine, activity of TNF**
- **Antioxidation activity: Antioxidation activity by *β-glucan* administration**
- **Analysis of T-cell subset: It is CD4 and activity of CD8 by immunological enhancement action by *β-glucan* administration**

Anticancer effect and radiation protection effect of *β-glucan* were suggested.

β-glucan

① Increase of leukocyte count

lymphocyte (helper T-cell), monocyte, granulocyte count; increased

② SOD-activity

③ Killer T-cell, suppressor T-cell

Killer T-cell and suppressor T-cell of activator action from radiation damage were found.

Radioprotective effect from radical scavenging and immunological enhancement

Degree of a radioprotective effect is additive.

The mechanism that it is thought in this study

β-glucan

Immunological enhancement activity

β(1-3)・(1-6)D-Glucan

β(1-3)D-Glucan → It is lymphocyte activity of small intestinal from intestinal absorption difficulty. ***(Takaku et al.)***

β(1-6)D-Glucan → Enteral good bacteria disintegrate (connection with intestinal flora). ***(Gu et al.)***