Effects Diets Containing Some Red Ginseng Extracts in Rats

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(Received February 29, 1980)

홍삼 함유 식품의 백쥐 사육 효과

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(1980년 2월 29일 접수)

Abstract

To study the effects of diets containing red Ginseng, rats were fed diets containing various amounts of red Ginseng for 10 weeks. The Ginseng diets were 600 *mg* of red Ginseng extract concentration, 1,200 *mg* of red Ginseng powder, 6,000 *mg* of red Ginseng tea, 3,000 *mg* of red Ginseng extract concentration, 6,000 *mg* of red Ginseng extract concentration, 12,000 *mg* of red Ginseng extract concentration per *Kg* of diet, and control.

As results, growth rate, feed efficiency ratio, organ weight, and hematocrit value showed no statistically significant differences between red Ginseng fed animals and the controls. Serum cholesterol level and GPT were slightly lower in the experimental animals than those in the controls. These differences, however, were not statistically significant. Serum GOT activities for all experimental animals showed no statistically significant except for Group fed with 6,000 *mg* of red Ginseng extract concentration per *Kg* diet. This Group revealed significantly lower GOT activities than those of the controls statistically. No abnormalities of liver, spleen, and kidney were observed in the experimental animals.

Introduction

In our previous reports[1,2], feeding effects in the rats fed with jelly, candy, drink, nectar, orange juice containing Ginseng extracts have been studied. Data of growth rate, feed efficiency ratio, organ weight change, hematocrit value, serum cholesterol level, SGOT (serum glutamic-oxaloacetic transaminase), SGPT (serum glutamic-pyuvic transaminase), and pathological observations showed no statistical significances between Ginseng fed animals and controls. No abnormalities of liver, spleen and kidney tissues were observed in the rats fed with diets containing Ginseng extract. As results of swimming test, a statistically significant increase of the swimming time was found in the experimental animal groups.

In this continued work, the effects of diets containing red Ginseng extract concentration, red Ginseng powder, and red Ginseng tea in rats were studied. Diets contained much higher amounts of Ginseng than the previous 2 experiments and Ginseng used in this experiment was red Ginseng. As in the

previous work[2], rats fed with diets containing various amounts of red Ginseng were tested in terms of growth rate, feed efficiency ratio, organ weight change, hematocrit value, serum cholesterol level, serum GOT, serum GPT, and pathological observations and the results are presented.

Materials and Mcthods

Animal and treatment

Animals were treated as the method described previously[2]. Fourty-two healthy weanling male-youngsters of Sprague-Dawley strain were divided into 7 groups. Each group consisted of 6 male youngsters weighing 76~81 *g* each. Commercial stock diets[2] were fed for 4 days before the experimental diets were fed. The animals were fed *ad libitum* for 10 weeks (April 2~June 10, 1979) with the special diets containing red Ginsengs and water.

Red Ginseng sample

Red Ginseng extract concentration, red Ginseng powder, and red Ginseng tea containing 10 % of red Ginseng extract concentration were supplied by Department of Monopoly, R.O.K.

Diets

Diets containing red Ginseng compound were prepared as in Table 1. Control (Group 1) contained no Ginseng compound, Group 2 red Ginseng extract concentration 600 *mg/Kg* diet, Group 3 red Ginseng powder 1,200 *mg/Kg* diet, Group 4 red Ginseng tea 6,000 *mg/Kg* diet, and Group 5, 6 and 7 red Ginseng extract concentrations, 3,000, 6,000, and 12,000 *mg/*

Table 1. Composition of experimental diets

Constitutent	Group						
	1	2	3	4	5	6	7
Carbohydrate*1	64.9	64.9	64.9	64.9	64.9	64.9	64.9
Red Genseng extract conc.	—	0.06	—	—	0.3	0.6	1.2
Red Ginseng powder	—	—	0.12	—	—	—	—
Red Ginseng tea	—	—	—	0.6	—	—	—
Casein	18	18	18	18	18	18	18
DL-methionine	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Soybean oil	5	5	5	5	5	5	5
Tallow	5	5	5	5	5	5	5
Salt mixture*2	4	4	4	4	4	4	4
Vitamin mixture*3	1	1	1	1	1	1	1
Celluflour	2	2	2	2	2	2	2

Group 1 : Control
Group 2 : Red Ginseng extract concentration 600 *mg/Kg* diet
Group 3 : Red Ginseng powder 1.200 *mg/Kg* diet
Group 4 : Red Ginseng tea 6,000 *mg/Kg* diet
Group 5 : Red Ginseng extract concentration 3,000 *mg/Kg* diet
Group 6 : Red Ginseng extract concentration 6.000 *mg/Kg* diet
Group 7 : Red Ginsrng extract concentration 12,000 *mg/Kg* diet
*1 : Starch : Sucrose : Glucose = 70 : 20 : 10
*2 : Hubble Mendel Wakeman mixture (*g* in 100 *g*)

Calcium carbonate	54.30	Magnesium carbonate	2.50
Magnesium sulfate	1.60	Sodium chloride	6.30
Potassium chloride	11.20	Potassium phosphate monobasic	21.20
Ferric phosphate	2.05	Potassium iodide	0.008
Manganese sulfate	0.035	Sodium fluoride	0.01
Aluminum potassium sulfate	0.017	Cupric sulfate	0.009

*3 : Vita-M manufactured by Yu-Yu Industrial Co., Ltd., Seoul, Korea
p-Amino benzoic acid 50 *mg*, biotin 0.2 *mg*, and inositol 100 *mg* per *Kg* of diet were supplemented

Table 2. Body weight gain (*g*)*1

Group	Initial body weight (*g*)	Final body weight (*g*)	Body weight gain (*g*)	t-Test*3
1	80.7±6.3	402.3±42.2	321.6±44.8	
2(5)*2	78.6±9.0	420.6±52.3	342.0±53.1	NS
3(5)*2	76.5±10.6	384.9±12.8	308.4±23.1	NS
4	77.4±11.5	389.9±20.2	312.5±23.4	NS
5	77.3±6.5	408.3±33.1	330.9±33.9	NS
6	80.4±6.2	387.8±26.4	307.4±29.2	NS
7	78.5±5.1	425.2±25.6	346.6±28.2	NS

* 1 : Mean ± standard deviation
* 2 : Number of animal used
* 3 : Compared to Group 1, $p<0.05$
NS : Non significant

Kg diet, respectively.

Measurement of parameters

Growth rate, feed efficiency ratio, organ weight and hematocrit value were determined by the methods described in the previous reports[1,2]. Serum cholesterol level was measured by the method of Frankel *et. al.*[3]. Activities of serum GOT and GPT were determined by the methods of Henry *et. al.*[4] and Amador *et. al.*[5]. One international unit (IU/*l*) of GPT and GOT is the oxidation of one *μmole* of NADH per minute at 30°C at their assay conditions. For the pathology study, liver, kidney, heart, and spleen were removed from all experimental animals at the end of 10 week-feeding study. The selected organs were fixed in 10 % formalin solution and checked the abnormalities under the microscope. Statistical analysis was performed by a computer to obtain t-test, mean value and standard deviations.

Results and Discussion

Growth rate

Table 2 shows the effects of feeding with diets containing various amounts of red Ginseng on the increase of body weight after 10 week-feeding. Throughout these experiments, Group 7 (12,000 *mg* of red Ginseng extract concentration per *Kg* of diet) revealed the highest body weight increase 346.6 *g*, compared to 342.0 *g* for Group 2, 330.9 *g* for Group 5, and 321.6 *g* for control (Group 1). On the other hand, increase of body weight in Group 3, 4 and 6 were slightly lower than control which were 308.4 *g*, 312.5 *g*, and 307.4 g, respectively. This differences to the control, however, were not statistically significant.

In the previous reports[1,2], differences between control and Ginseng fed animals (Ginseng jelly, candy, nectar drink, and orange juice) showed also statistical insignificance, although the control revealed the highest increase in body weight after 6 week or 12 week-feeding.

Han and Cho[6] reported also no statistically significant difference in body weight increase between control and experimental animals when they fed rats with diets containing 2 % Ginseng powder for 43 days. Same results were obtained by Kim *et. al.*[7] in their 15 day-feeding experiments.

In conclusion, the results of present experiment as well as our previous two experiments confirmed that no significant difference between Ginseng fed-animals and control diet-fed animals, although controversy was reported by several investigators[8,9,10,11]. In the present experiment amounts of Ginseng and feeding period were much higher and longer (600~12,000 *mg* /*Kg* diet), with comparison of others[8~11].

Food intake and feed efficiency ratio (FER)

Table 3 shows food intakes and FER during 10 week-feeding experiment with diets containing various amounts of red Ginseng. As shown in Table 3, Group 7 (diet containing 12,000 *mg* of red Ginseng extract concentration/*Kg* diet) showed the highest food intake 1,637.9 *g*, and Group 2, 1,583.5 *g*, Group

Table 3. Total food intake and feed efficiency ratio (FER)*1

Group	Total food intake (*g*)	t-Test*3	FER	t-Test*3
1	1,506.5±154.2		0.213±0.014	
2(5)*2	1,583.5±195.2	NS	0.215±0.012	NS
3(5)*2	1,410.7±19.7	NS	0.219±0.016	NS
4	1,472.5±48.3	NS	0.211±0.011	NS
5	1,566.4±121.3	NS	0.207±0.009	NS
6	1,530.1±171.3	NS	0.201±0.007	NS
7	1,637.9±138.1	NS	0.212±0.007	NS

*1 : Mean ± standard deviation
*2 : Number of animal used
*3 : Compared to Group 1, $P<0.05$
NS : Non significant

Table 4. Organ weight (*g*)*1

Group	Liver	t-Test*3	Kidney	t-Test*3	Heart	t-Test*3	Spleen	t-Test*3
1	13.88±1.65		2.92±0.39		1.17±0.23		0.70±0.14	
2(5)*2	14.66±1.90	NS	2.86±0.30	NS	1.26±0.09	NS	0.82±0.24	NS
3(5)*2	13.50±0.82	NS	2.88±0.40	NS	1.38±0.11	NS	0.78±0.16	NS
4	13.30±0.84	NS	2.70±0.19	NS	1.32±0.08	NS	0.82±0.10	NS
5	14.70±1.65	NS	2.78±0.32	NS	1.28±0.17	NS	0.85±0.12	NS
6	12.87±0.59	NS	2.57±0.26	NS	1.25±0.08	NS	0.72±0.16	NS
7	14.43±1.87	NS	2.77±0.22	NS	1.38±0.25	NS	0.78±0.10	NS

*1 : Mean ± standard deviation
*2 : Number of animal used
*3 : Compared to Groupl, $P<0.05$
NS : Non significant

5, 1,566.4 *g*, Group 6, 1,530.1 *g*, Group 4, 1,472.5 *g*, and Group 3, 1,410.7 *g*, while the control group showed 1,506.5 *g*. This results were in good agreement with the previous reports[1,2] that indicated no significant statistical differences in food intakes between Ginseng fed animals and control animals.

FER results were 0.219 for Group 3, 0.215 for Group 2, 1.213 for Group 1 (control), 0.212 for Group 7, 0.211 for Group 4, 0.207 for Group 5, and 0.201 for Group 6. FER was 0.225~0.255 for 6 week-feeding experiment[1], 0.158~0.182 for 12 week-feeding experiment[2], and 0.201~0.219 for 10 week-feeding in the present experiment. This slight decrease seemed to be caused by extending the feeding period.

Organ weight

Table 4 shows the results of organ weight at the end of 10 week-feeding experiments. Organs tested were liver, kidney, heart, and spleen. As in other parameters, such as body weight, FER, and food intake, it was found that organ weight was not affected significantly by feeding of red Ginseng to rats. This fact was also confirmed by Han *et. al.*[11] and Shibata *et. al.*[12].

Hematocrit value and serum cholesterol

Table 5 shows the hematocrit values and serum cholesterol contents, respectively, of the rats fed with red Ginseng diets and control. As reported by other investigators[1,2,11,13], there were no statistically significant differences in hematocrit values for all experimental animals. Same results were found in serum cholesterol content[1,2,14].

Serum GOT and GPT activities

Table 6 shows the results of serum GOT and GPT activities. As in other reports[2,15], serum GPT and GOT activities were not significantly affected by feeding of Ginseng diets in rats.

Table 5. Hematocrit value (%) and serum cholesterol level (*mg%*)*1

Group	Hematocrit value (%)	t-Test*3	Serum chlesterol (*mg%*)	t-Test*3
1	48.0±4.0		118.1±11.1	
2(5)*2	48.4±1.5	NS	112.2±14.0	NS
3(5)*2	44.8±4.5	NS	112.0±8.3	NS
4	45.3±2.3	NS	110.8±2.4	NS
5	47.1±2.7	NS	116.3±6.9	NS
6	46.3±4.0	NS	115.3±12.5	NS
7	44.6±2.5	NS	113.3±14.7	NS

*1 : Mean ± standard deviation
*2 : Number of animal used
*3 : Compared to Group 1, $P<0.05$
NS : Non significant

Table 6. Serum GOT and GPT activities*1

Group	GOT activity (IU/*l*)	t-Test*3	GPT activity (IU/*l*)	t-Test*3
1	89.6±10.1		34.1±16.8	
2(5)*2	77.6±14.7	NS	23.2±4.8	NS
3(5)*2	84.8±17.9	NS	31.1±4.9	NS
4	101.8±26.5	NS	27.6±6.4	NS
5	99.7±14.3	NS	27.4±5.3	NS
6	79.3±4.0	S	22.8±4.2	NS
7	84.3±13.0	NS	25.3±10.2	NS

*1 : Mean±standard deviation
*2 : Number of animal used
*3 : Compared to Group 1, $P<0.05$
NS : Non significant
S : Significant

Pathology

After 10-week feeding with diets containing various amounts of red Ginseng, liver, spleen, and kidney were removed from each experimental animals at the end of experiment. The organs were fixed in 10 % formalin solution and observed under microscope and compared with ones from control animals. No abnormalities were found and the results were agreed with previous works[1,2,12].

In conclusion, with our 2 previous experiments it was confirmed that feeding of diets containing red Ginseng in an amount to 12,000 *mg* of red Ginseng extract concentration per *Kg* of diet did not caused any significant statistical differences in terms of growth rate, food intake, FER, hematocrit value, serum cholesterol, and GPT and GOT activities. No abnormalities were also found in liver, kidney and spleen of all experimental animals.

요 약

홍삼 정(精) 600 *mg/Kg* diet, 홍삼 분(粉) 1,200 *mg/Kg* diet, 홍삼 차(茶) 6,000 *mg/Kg* diet와 홍삼 정 기준군의 5배, 10배, 20배에 해당되는 양으로써, 홍삼 정 3,000 *mg/Kg* diet, 홍삼 정 6,000 *mg/Kg* diet, 홍삼 정 12,000 *mg/Kg* diet의 과량을 각각 정상 식이에 첨가하여 이유 후의 체중 76~81 *g*정도의 Sprague-Dawley strain의 웅성(雄性) 백쥐 42마리를 6마리씩 7군으로 나누어 10주간 사육하였다.

10주 사육 후에 체중 증가율, 사료 효율, 장기 무게 hematocrit value, serum cholesterol 농도, serum GOT, GPT 활성 등을 측정하여 정상 식이군과 비교한 결과 체중 증가율, 사료 효율, 장기 무게, hematocrit value 등은 모두 정상 식이군에 비해서 실험군이 통계적인 유의차를 보이지 않았으며, S-cholesterol 농도 및 S-GPT 활성은 실험군이 정상식이군에 비해 다소 낮은

경향이었으나, 통계적인 유의차는 없었고, S-GOT 활성은 홍삼 정 10배군 만이 대조군에 비해 유의적으로 낮았으나, 그의 모든 실험군은 정상 식이군에 비해 통계적으로 유의차가 없었다.

백쥐 각 군의 간, 신장, 비장등의 조직 세포를 검사한 결과 하등의 이상 조직을 발견하지 못하였다.

Acknowledegment

This investigation was supported by the research grant of Korea Ginseng Research Institute.

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