

The Effect of Corn Pollen on Some Antioxidant Indices and Biochemical Indices of Muscle after Exertion of Rat

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Abstract In order to find out the effect of corn pollen on the antioxidant system we made exertion models in rat and examined the actions of corn pollen. We destroyed the pollen membrane mechanically and administered 3.0g/kg daily for 15 days orally, made it swim so that we could make exertion models. After that, we examined antioxidant indices. As a result, corn pollen significantly increased the decreased thigh muscle catalase and SOD activity and decreased the thigh muscle, serum and urinal MDA levels significantly.

Key words corn pollen, anti-oxidation

Introduction

Recently, the study on the pollens such as the pine tree pollen, pollens on bees, rape pollen and so on is intensified to use in prevention and therapy of diseases, but there are few data about corn pollen usage.

Pollen contains lots of nutritional and bioactive materials among natural products. Pollen is the only complete nutritional natural food that has protein, oil, sugar, vitamins, minerals, hormones, enzymes, and etc [4, 10].

The nutritious value of pollen equals with those of 48% bean flour mixed with 16% of dried protein enzyme, 16% of dried milk, 10% of casein, and 10% of yolk [6, 8]. The proteins in the pollen are globulin, albumin, protamin, gluten and simple protein, glucoprotein, nucleoprotein, lipoprotein. The characteristic of pollen protein is that the half of pollen consists of 2 to 5 amino acids. Free amino acids is 4~7% and higher than the other plants.

Among 22 amino acids distributed in the nature now, 20 amino acids were discovered in the pollen [2, 6, 7].

The level of essential amino acids among them in pollen are 5~7 times as much as beef or egg and 3~10 times than honey which is very well-known as the best healthy food [3, 5].

Pollen contains 13~30% of protein, 1~17% of lipid, 12~39% of carbohydrate and 0.6wt% of vitamin B₁, 1.7wt% of B₂, 29.0wt% of nicotine acid, 70~150wt% of vitamin C and in addition, serin, sistin, especially iron, calcium and magnesium are included properly. Besides, it contains 90 kinds of enzymes such as nucleic acid, catalase, amylase, protease and sexual hormones, growth stimulator, antibiotics, etc which are necessary to the body [1, 9, 10].

Pollen contains antiviral or antibiotic materials that kill *Bacillus typhi* or *Escherichia coli* [6].

Now in order to harvest more corn profit as required by the Juche-oriented farming method,

3/4 of the corn tassel is cut off. If we use the thrown-away tassels uselessly in the past to contribute to the people's well-being, it is not only very significant economically, but also very beneficial to the public health reality, however, there are few data about research on the corn pollen.

Therefore, we tried to find out the effect of corn pollen on the anti-oxidation system of the body.

1. Objectives and Methods

1.1. Material

We gathered corn pollen in Unjon County, North Phyongan Province during the period of July to August and destroyed the pollen membrane for 2 days mechanically using a pollen micro pulverizer. The pollen with 95% of corn membrane destruction is examined through microscope and used in this experiment. Control group uses the distilled water.

We use the rats weighing at 150~180g that were bred in the animal department of Pyongyang Medical College of **Kim Il Sung** University without distinction of gender.

1.2. Method

In experimental group, the corn pollen is orally administered with 3.0g/kg daily for 15 days to the rats. Then we made it swim in the 20-liter of water tank for 20 minutes to make the exertion model and examined the antioxidant indices.

1.2.1. CAT activity examination

Oxidation-reduction titration by potassium permanganate is used to measure CAT activity.

1.2.2. SOD activity examination

Nitrous acid method is used to measure SOD activity.

1.2.3. MDA level examination

2-thiobarbituric acid method is used to measure MDA level.

1.2.4. Muscle glycogen, glucose, protein level examination

Anthrone method for muscle glycogen level, o-toluidine boric acid method for muscle glucose level and filter paper bromphenol blue method for muscle protein level are used respectively.

2. Result and Discussion

2.1. The effect of corn pollen on the rat's thigh muscle CAT and SOD activity after exertion

First, we examined the effect of corn pollen on the rat's thigh muscle CAT and SOD activity after exertion (table 1).

As you can see in table 1, the CAT activity in the corn pollen group which had exertion before being fed with corn pollen was $0.87 \pm 0.04 \text{ U} \cdot \text{g}^{-1}$, and that of the control group which only had an exertion was $(0.40 \pm 0.03) \text{ U/g}$, so the corn pollen group has the significant-increased thigh muscle CAT activity ($p < 0.05$).

Table 1. The effect on the rat thigh muscle CAT and SOD activity

Group	CAT $/(U \cdot g^{-1})$	SOD $/(U \cdot g^{-1})$
Normal	0.90 ± 0.01	1.37 ± 0.14
Control	0.4 ± 0.03	0.56 ± 0.13
Corn pollen	$0.87^* \pm 0.04$	$1.35^* \pm 0.16$

* $p < 0.05$ (comparing with control group), $n=7$

The SOD activity in the corn pollen group which had exertion before being fed with corn pollen was (1.35 ± 0.16) U/g, and that of the control group which only had an exertion was (0.56 ± 0.13) U/g, so the corn pollen group has the significant increase thigh muscle SOD activity ($p < 0.05$).

2.2. The effect of corn pollen on the rat's thigh muscle MDA level, serum MDA level and urinal MDA level after exertion

Next, we examined the effect of corn pollen on the rat thigh muscle MDA level, serum MDA level and urinal MDA level after exertion (table 2–4).

As you can see in table 2, the thigh muscle MDA level after exertion with the administration of corn pollen was (640.8 ± 40.3) nmol/g and that of the control group without administration was (1048.7 ± 39.8) nmol/g, which shows significant decrease in the experimental group.

Table 2. The effect on the rat thigh muscle MDA activity

Group	MDA/(nmol·g ⁻¹)
Normal	460.7 ± 26.5
Control	1048.7 ± 39.8
Corn pollen	$640.8^* \pm 40.4$

* $p < 0.05$ (comparing with control group), $n = 7$

Table 3: The effect on the serum MDA activity

Group	MDA/(nmol·g ⁻¹)
Normal	2.4 ± 0.64
Control	13.6 ± 2.7
Corn pollen	$4.6^* \pm 2.7$

* $p < 0.05$ (comparing with control group), $n = 7$

The serum MDA level after exertion with the administration of corn pollen was (4.6 ± 2.7) nmol/mL

Table 4: The effect on the urinal MDA level

Group	MDA/(nmol·mL ⁻¹)
Normal	11.2 ± 0.8
Control	27.8 ± 1.4
Corn pollen	$13.6^* \pm 1.2$

* $p < 0.05$ (comparing with control group) $n = 7$

and that of the control group without administration was (13.6 ± 2.7) nmol/mL, which shows significant decrease in the experimental group (table 3).

The urinal MDA level after exertion with the administration of corn pollen (13.6 ± 1.2) nmol/mL, and that of the control group without administration was

(27.8 ± 1.4) nmol/mL, which shows significant-decreased MDA in the experimental group.

2.3. The effect of corn pollen on the muscle glycogen, glucose, and protein level after exertion

The results of muscle glycogen, glucose and protein level of the rats which were fed with corn pollen for 15 days and forced to swim for 20 minutes are as follows (table 5).

As you can see in table 5, the muscle glycogen level in the experimental

Table 5: The effect of the corn pollen on the muscle glycogen, glucose and protein level after exertion

Group	Glycogen/g%	Glucose/g%	Protein/(mg·g ⁻¹)
Normal	0.62 ± 0.07	66.5 ± 12.8	28.2 ± 2.4
Control	$0.40^{\Delta} \pm 0.05$	$38.6^{\Delta} \pm 7.8$	$19.3^{\Delta} \pm 1.5$
Corn pollen	$0.59^* \pm 0.05$	$64.5^* \pm 6.3$	$26.2^* \pm 2.1$

Δ $p < 0.05$ (comparing with Normal), * $p < 0.05$ (comparing with control), $n = 7$

group which has exertion with corn pollen administration was (0.59 ± 0.05) g%, in the control group without administration was (0.4 ± 0.05) g%, which means significant increase in muscle glycogen level in the experimental group ($p < 0.05$) and the glucose and protein levels are also significantly increased in the experimental group with the administration of the corn pollen ($p < 0.05$).

These above results show the positive effect of corn pollen on the altered antioxidation system of the body and its activity to increase the muscle glycogen, glucose and protein concentration significantly, and these actions are related to those of the various bioactive materials rich in corn pollen.

Conclusion

Corn pollens give the positive impact on the muscle, serum and urinal antioxidation indices and increase the glycogen, glucose and protein concentration of muscle.

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