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Hematological Changes in Dogs Administrated Excessive Garlic-extracts

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과량의 마늘투여로 인한 개의 혈액학적 변화

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요 약 : 마늘은 백합과 식물로서 인류의 식생활에서 중요한 역할을 할 뿐 아니라 최근에는 항암작용을 가진 것으로도 알려져 세계적으로 많은 연구가 수행되고 있다. 그러나 같은 백합과 식물인 양파의 경우 과량 섭취시 개에서 용혈성 빈혈이 유발된다는 것은 잘 알려진 사실이지만 마늘의 경우 이러한 부작용에 관한 보고는 전혀 없는 실정이다. 따라서 본 연구에서는 체중 25 kg 이상의 성견을 대상으로 마늘 추출액을 투여한 결과 다음과 같은 성적을 얻었다. 총적혈구수(RBC), 헤모글로빈(Hb)함량, 혈구용적(PCV), 평균적혈구용적(MCV), 평균적혈구혈색소농도(MCHC)는 실험기간 중 유의한(P<0.05) 감소경향을 나타내었다. GSH 함량은 6일째 유의한(P<0.01) 증가를 나타내었다. 본 실험 성적의 결과 과량의 마늘 투여시에도 양파에서와 동일한 용혈성 빈혈이 발생되는 것으로 생각된다.

Key words : garlic, dog, anemia, GSH

Introduction

Garlic(*Allium sativum*) is a widely distributed plant and is used in all parts of the world like onions. The importance of garlic has been recognized in ancient times in Egypt, China, and was regarded as one of the most treasured foodstuff and medical agent[8,28].

The oldest recorded mention of garlic for medical purpose was by Hypocrites who used garlic as a prophylactic against snake bite, for treating pneumonia and suppurating wounds. But a scientific basis for the medical use of garlic was established by Wills[28], who demonstrated that the growth of *Eberthella typhosa* and *Escherichia coil* was inhibited by garlic.

Recently, epidemiological, clinical and laboratory data have proven that garlic contained many biologically active compounds beneficial to human health. These include pharmacological substances that are active against cardiovascular, neoplastic and other diseases. It is also reported that garlic lowers serum cholesterol, enhances blood fibrinolytic activity and inhibits platelet aggregation. Additional claims have been made on its hypoglycemic effects and anticarcinogenic properties[1,4,5,8,10,12,15,17,20,21,23-28].

In Korea, garlic has also been used for several hundred years as herbal medicine for the treatment of numerous diseases such as dysentery, hypertension, arteriosclerosis, diabetes, pneumonia, acute and chronic infectious gastritis, and inappetence. And it has been proved that garlic contains counterpoison activity against heavy metal toxicity[3]. Now, the amount of garlic consumption in Korea is much more than any other country in the world since it is used as the main spice in almost all foods.

Recently, many studies are now in progress all over the world to develop its unique properties for pharma-

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cological use. However, there are few reports concerning its side effect following excessive administration.

This study was conducted to determine whether excessive garlic can induce similar changes as onion-induced hemolytic anemia. Routine hematological test, erythrocyte reduced glutathione(GSH), methemoglobin were examined.

Materials and Methods

Experimental animals

Five clinically normal, adult, mixed-breed (mean body weight 24.5 $\pm$ 1.2 kg) dogs were used in the present study. The dogs were housed seperately and received food and water ad libitum.

Experimental design

Peeled garlic bulbs were homogenized, filtered through gauge, boiled for 15 minutes and the precipitate was removed by filtration. These garlic-extract was equivalent to 5 g/kg body weight of whole garlic. Dogs were administrated orally with garlic-extract by stomach tube for 7 days. About 5 m*l* of blood was taken from saphenous vein at 1 day intervals for first 10 days, and at 12th, 15th, 20th, 30th day using E.D.T.A. contained syringes.

Hematological examinations

The erythrocyte (RBC) count, hematocrit (Hct) value, mean corpuscular volume (MCV), mean corpuscular hemoglobin concentration (MCHC) were deterimined using an automatic cell counter (HEMA VET. America). The concentration of GSH in erythrocytes was deterimined by measurement of the 5.5'-dithiobis-(2-nitrobenzoate) derivative (Beutler *et al*), and met-hemoglobin concentration was by the methods of Yamato.

Analysis of data

Statistical analysis was performed using student's t-test.

Results and Discussion

The changes of the number of RBC, Hct value, Hb concentrations, MCV and MCHC are shown in Fig 1~5. On the 7th day after administration of garlic extracts, the average RBC count was decreased to

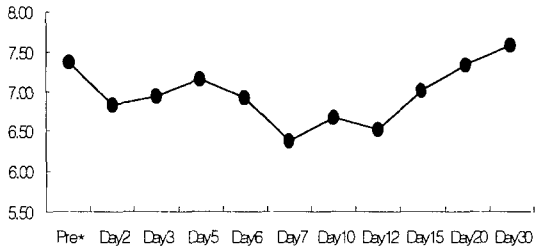

Fig 1. Mean level of RBC, administrated excessive garlic-extracts in dogs (Pre*: means before experiment).

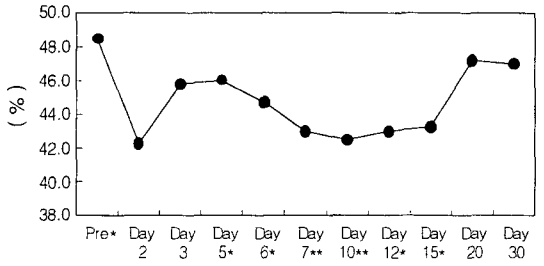

Fig 2. Mean level of Hct, administrated excessive garlic-extracts in dogs (*: P<0.05; **P<0.01; Pre*: means before experiment).

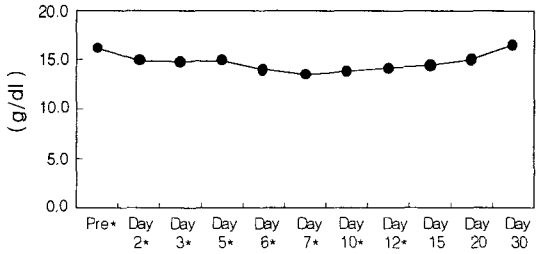

Fig 3. Mean level of Hb, administrated excessive garlic-extracts in dogs (*: P<0.05; Pre*: means before experiment).

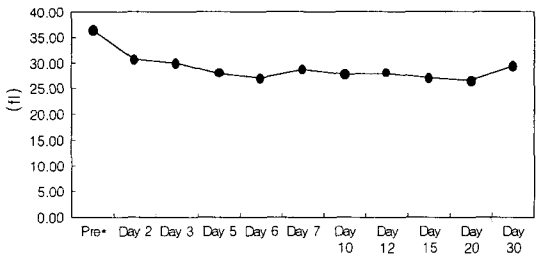

Fig 4. Mean level of MCV, administrated excessive garlic-extracts in dogs (Pre*: means before experiment).

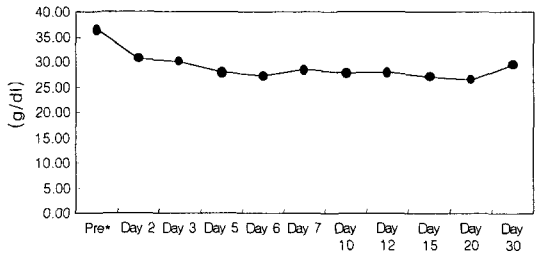

Fig 5. Mean level of MCHC, administrated excessive garlic-extracts in dogs (Pre*: means before experiment).

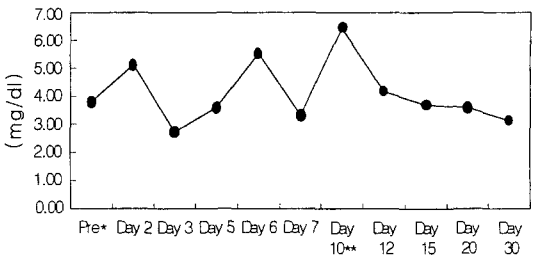

Fig 6. Mean level of GSH, administrated excessive garlic-extracts in dogs (Pre*: means before experiment).

86.2% of the initial value($7.37 \pm 1.40 \times 10^6/cm^3$), and returned to the normal value on the 20th day.

The Hct value and Hb concentration also had similar changes to that of RBC count, and were significantly ($p<0.05$) lower than those of initial value of the 7th day. These changes were remained till the 10th day after administration of garlic extracts.

MCV and MCHC values were also significantly ($p<0.01$) decreased on the 15th day, then returned to the normal value on the 30th day.

Harvey and Racker[11], Ogawa *et al*[18] reported that excessive onion consumption resulted in decreasing of the number of RBC, hemoglobin concentrations, hematocrit values and MCHC. The results of present study, we agreed with the reports of many others[11,16,18,30,31], and clarified that not only excessive onion intake but also excessive garlic intake can induce hemolytic anemia in dogs.

Erythrocyte GSH is an important component of the cells of antioxidant defense, acting both as substrate for glutathione peroxidase in the removal of hydrogen peroxidase and lipid hyperoxidase, and directly as a free radical scavenger. When erythrocytes are exposed to oxidative stress, GSH is converted to the oxidized form[7,29].

Erythrocytes can reduce oxidized glutathione, and some oxidant drugs actually increase GSH synthesis[19].

Certain dogs are highly susceptible to onion-induced hemolytic anemia, and these dogs are due to a high concentration of erythrocyte GSH, which accelerates the oxidative damage produced by sodium n-propylthiosulfate from onions[30,31].

In the present study, erythrocyte GSH concentration was significantly($P<0.01$) increased in the 10th day, compared to the initial value.

These results may have been due to the increased GSH synthesis induced by oxidative injury to erythrocytes, when fed the excessive amount of garlic-extract.

For these results we concluded that the intake excessive amount of garlic can induce similar changes as onion-induced hemolytic anemia.

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