

The Effect of Ionization on Mice Growth and Breeding Performance

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이온 靜電이 생쥐의 成長과 繁殖能力에 미치는 影響

이 무 환

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이온靜電이 離乳後의 어린 생쥐의 成長에 영향을 미치지 않았으며, 11.5 g ~ 16.2 g의 생쥐는 이온處理에 의하여 약간의 體重增加를 보였으나 統計의 有意差는 없었다. 또한 먹이의 攝取量에는 영향을 주지 않았다.

이온靜電處理區와 非處理區를 교체처리한 시험에서 사춘기의 생쥐 體重은 처음으로 처리한區, 이온처리 경험이 있는 생쥐를 처리한區, 非處理區의 順으로 감소되었다.

高蛋白質먹이와 高炭水化物먹이의 給與로 인한 體重變化는 보이지 않았으나 이들간에 약간의 차이가 보였다.

이온處理方法間의 비교시험에서 普通荷電法이 7時間荷電法보다 성적이 우수하였다.

妊娠前에 이온處理된 어미생쥐로 부터 出生된 한배새끼의 數는 非處理區보다 현저히 많았으며 새끼의 成長도 正常的이었다.

ABSTRACT

The aim of the present experiment was to investigate the effects of anionization on the various stage of mice growth, the feeding level of diets, the switch-over effects, effects of plane of nutrition on growth of mice, the effects of method of ionization on growth of mice and associated breeding performance. Mice in polyethylene cages

were placed on vinyl plate charged anion by an Electrical Ionizing Machine.

At an early growing stages body weight gains of mice anionized were not different from the un-ionized group. The dietary intake did not affect significantly the body weight of mice 15-17g. The growth of mice of 11.5-16.2g was not affected by ionization statistically, but the ionized group increased slightly. The switching over from the untreated to the ionization slightly depressed the ionized mice by 2.4g, the untreated switched over to

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ionization group by 2.28g as compared with the 3.29g for the untreated during the 4-day-feeding period. Plane of nutrition and ionization did not significantly affect the growth of mice of 7.1-15.8g when mice were fed high-protein and high-carbohydrate diets. The Common Ionization Method was appeared statistically superior to the Overnight-Ionization Method. The growth rate of the offspring of mice ionized prior to conception was found to be normal but the number of progeny was considerably high.

INTRODUCTION

As long ago as 500 B.C. Aotus¹⁾, a Greek physician first used electric stimulation for a partial medical treatment. In the healthy body the acid-base balance is maintained by buffers, present in the blood neutralizing rapidly food and metabolic acids. When the common acids dissociate into their respective cations and anions, the anionic component may be considered to be base. Bases are weak or strong depending on their affinity for the hydrogen ion, HCO_3^- , HPO_4^- , H_2PO_4^- , and protein are relatively strong bases because they have a strong affinity for the hydrogen ion²⁾³⁾. When anions are dominant in the body, the pH value of blood is maintained in weak alkalinity

that is found in healthy body (pH 7.35 - 7.4). If cations (Na^+ , K^+ , Mg^{++} , Ca^{++}) are dominant, pH value of blood shows acidity in the body. If the blood is acid one may feel lethargic, with senile symptoms, and so unable to keep healthy²⁾.

Anionization is to charge electrically to bring the body into a weak alkaline blood condition, thus the ionized body increase its ability to clean blood, to strengthen resistance against disease, to cure rheumatism, exudative diathesis and the scrofulous tendency of the body³⁾⁴⁾. For human being the recommend ionization technique is shown in Table 1.

The growth of mice affected by ionization has not so far been reported. Therefore, the intention of this study is to find out the possible effects of anion charging on mouse growth and associated breeding performance during different growing periods of mouse.

MATERIALS AND METHODS

Mice used in the present experiments were obtained from The Je-Ju Animal Health Research Institute, Je-Ju, Korea. Twelve 25 day-old mice weaned with a body weight of 6 g were used until they reach 19 g (before puberty)⁵⁾ for the anionization studies, and some mice matured for a

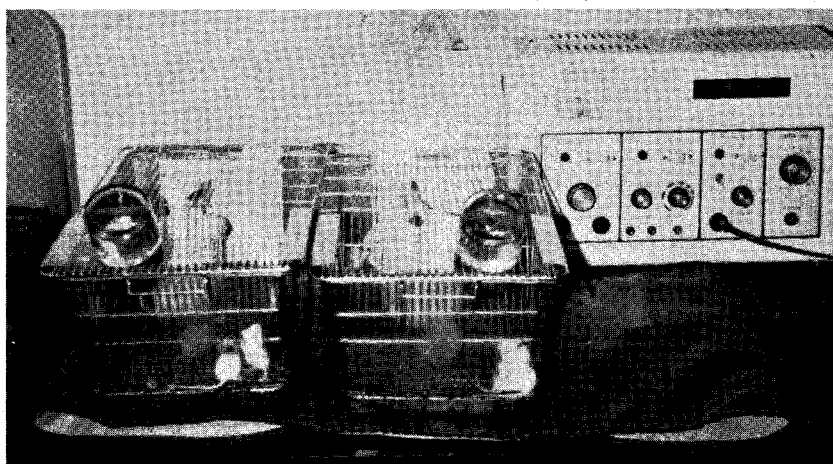


Photo 1. Electrical ionizing machine (Home-Lator, SJ - 104)

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Table 1. Some instances of anionizations depending on the symptoms

Condition	Methods	Common Method			Overnight Method	
		Power	Time	Daily	Power	Time
To improve physical condition		Medium	30 min	Once or twice	Weak	6-9 hrs.
Trouble internal organs		"	"	"	"	"
Trouble nervous system		"	"	"	"	"
Weak heart and blood system		"	"	"	Not recommended	
Diabetes		"	"	"	Weak	6-9 hrs.
Obesity		"	"	"	"	"
Thyroid gland		"	"	"	"	"

breeding performance trial. Each mouse was weighed individually every day or few days interval. Mice in the treatment group were housed in polyethylene cages with stainless steel wire floor.

The mixed diet was moistened with water and forced to pass through a chopper and dried at 65 °C. to form pellets. Anion charging was applied by placing cages on a vinyl plate which was charged electrically using an Electrical Ionizing Machine⁶⁾ (Home-Lator, SJ-104, power: 100v 50-60Hz, 46 × 30 × 20 cm).

The ionization charge was gradually increased from the 0.5 unit (525 volts) on the first day and to 1-1.5 unit (550-600 volts) using the Common Ionizing Method⁶⁾. The body weights were measured individually or on a group basis daily or

at several days interval. The results were treated statistically using the t-test, F-test and factorial analysis for prediction of difference and probable interaction.

Trial 1: Effects of ionization and diet level on body weight.

Weaned mice were acclimatized for ionization for 3 days before the start of the experiment. The Overnight Method was applied at 0.5 unit (525 volts) for 7 hours ionization. Each mouse was fed ad lib. except for the restricted feeding experiment. The diets used in this trial are shown in Table 2 and 3.

Trial 2: Effects of switching over from the un-ionization to ionization or vice versa on body weight of mice near puberty.

Twenty four mice were allocated to 3 cages

Table 2. Ingredient and composition of diet 1*

Basal diet ¹⁾	80 %
Casein	20 %
* Chemical composition of diet 1	
Crude protein	31.9 %
Crude fat	2.77 %
Crude fiber	2.70 %
Nitrogen free extracts	42.9 %
Minerals	1.9 %
Metabolizable energy	232 Kcal/ 100g

1) Ingredient and composition of basal diet: 63% corn, 4% wheat bran, 20% soybean oil meal, 11% fish meal, 50 ppm antibiotics and 290 Kcal/100 g metabolizable energy. 3.46% ether extracts, 53.6% nitrogen free extracts, 3.38% crude fiber and 2.3% ash.

Table 3. Ingredient and composition of diet 2*

Basal diet ¹⁾	83.3 %
Dried whole milk ²⁾	16.7 %
* Chemical composition of diet 2	
Crude protein	22.4 %
Crude fat	7.3 %
Crude fiber	2.8 %
Nitrogen free extracts	51.1 %
Minerals	1.87 %
Metabolizable energy	304 Kcal/ 100 g

1) Ingredients of basal diet were similar to diet 1.
2) Chemical composition of dried whole milk: 4% moisture, 26.5% butter fat, 25.5% protein, 38.2% lactose and 5.8% minerals.

with 8 in each. Mouse in each treatments was fed the Diet 2 (Table 3) ad lib. for 5 days. The Common Method was applied at 1 unit (550 volts) for 30 minutes twice daily.

Trial 3 : Effects of ionization and plane of nutrition on body weight of mice.

In this trial 24 mice were allocated to four cages with 6 in each. Mice were fed ad lib. either a high-protein or a high-carbohydrate diet as in Table 4. The Common Method was applied for ionization for all treatments.

Trial 4 : The Common Method vs. The Overnight Method.

Twenty four mice were fed ad lib. Diet 1 allocating to three cages with 6 in the treatment of The Common Method (30 minutes ionization two

ce, 6 in the treatment of The Overnight Method (7 hour ionization) and 12 mice for the control for 7 days.

Trial 5 : Breeding performance of mice previously anionized.

Three female mice anionized before conception and an unionized female mouse were mated with anionized male and unionized male, respectively. Number of offspring, birth weight and after birth weight were measured. The diet 2 was fed ad lib. during the experimental period.

RESULTS AND DISCUSSION

The body weight increases of mice in trial 1 are shown in Table 5, 6 and 7.

The differences of mean body weight gains

Table 4. Ingredient and composition of diet 3*

Ingredients	High protein diet (%)	High carbohydrates diet (%)
Basal diet ¹⁾	70	70
Casein	29	-
Soybean oil	1	3.7
Dextrose	-	26.3

* Chemical composition of diet 3

Crude protein	36.2	15.1
Crude fat	3.4	6.1
Crude fiber	2.4	2.4
Nitrogen free extracts	37.5	61.8
Minerals	1.7	1.6
Metabolizable energy	212 Kcal/ 100 g	341.3 Kcal/100 g

1) Ingredient and composition of basal diet were similar to diet 1.

Table 5. Effect of ionization on body weight of mice at post-weaning¹⁾, trial 1 (g)

Day	Anionization		Unionization	
	Body weight	B.W.G. ²⁾	Body weight	B.W.G.
Initial	6.25		6.32	
5th day	6.68	0.11	6.44	0.03
7th day	7.25	0.29	7.08	0.32
12th day	10.76	0.70	10.50	0.68
Mean daily increase		0.41		0.38

1) Diet 1 feeding

2) B.W.G.: Body weight gains

between the two treatments were 4.51 g and 4.18 g for the ionized and the unionized group, respectively. Immediately after weaning, these ionized mice showed slightly higher growth rates than the unionized group but there was no significant difference between the two groups (Table 5).

To find out the possible stimulating effect of ionization on growing mice of 11.5–12.10 g these were fed for 11 days (Table 6).

Body weight differences were found 4.7 g and 3.39 g in the ionization and the unionization, respectively. In the preliminary datum the author has observed that a slight stimulatory effect of ionization on rat⁷⁾.

As shown in Table 6, a similar tendency was found. However, the results gave no significant differences. The mechanism involved in this stimulatory effect of ionization on early growing mice could be partly explained by early works that

ionization might bring about alkaline blood pH value to keep body healthy³⁾⁶⁾. The author has observed that the ionized mice were more active than untreated mice.

To investigate the effects of different feeding levels on daily body weight gain of mice by ionization, diets (Diet 2) were given 2 and 3 g per day to 15–17 g mice. When the diet was restricted to 2 g daily for 4 consecutive days, ionized mice lost weigh 0.032 g and the unionized group lost 0.36 g. When the diet was increased to 3 g daily, mice gained 2.4 g and 3.29 g in the ionized and the unionized groups, respectively.

The levels of dietary allowances did affect significantly ($p < 0.05$), according to the 2×2 factorial analysis⁸⁾. The significant correlatin between dietary intake and body weight gain of 21-day old mice⁹⁾ and mid-age-mice¹⁰⁾ has been demonstrated. In this experiment, ionization was found to

Table 6. Effect of ionization on growth of mice at mid-growth stage¹⁾, trial 1 (g)

Treatment	Anionization		Unionization	
	Body weight	B.W.G. ²⁾	Body weight	B.W.G.
Day				
Initial	11.50		12.10	
4th day	12.94	0.48	13.49	0.46
7th day	14.56	0.54	14.67	0.39
9th day	14.95	0.20	14.95	0.14
11th day	16.20	0.63	15.49	0.27
Differences	4.70		3.39	
Mean \pm SX	0.47 \pm .27		0.34 \pm 0.26	

1) Diet 2 feeding

2) B.W.G.: Body weight gains per day.

Table 7. Effects of anionization on daily body weight changes of mice fed different levels of diets¹⁾, trial 1 (g)

Treatment	Anionization		Unionization	
	2 g daily	3 g daily	2 g daily	3 g daily
Day				
Initial	0.046	0.688	0.015	1.006
2nd day	0.320	0.306	0.240	0.454
3rd day	0.110	1.376	- 0.410	1.580
4th day	-0.508	0.030	- 0.205	0.250
Difference	-0.032	2.4	- 0.36	3.29
Mean	-0.008	0.60	- 0.09	0.823

1) Diet 2 feeding.

be a slightly depressing factor in body weight gain when mice were fed 2-3 grams of diet daily.

Suspension extended to switching over from untreated to ionization or vice versa in trial 2. The growth of mice affected by switching over is shown in Table 8.

Body weight increases were found slightly higher in the unionization at 3.29 g than ionized group at 2.4 g during 5-day growing period of mice. The unionized mice switched over to the ionization showed decreased growth rates at 2.28 g which was close to the weight gains of ionized

group. Table 8 shows that as mice grew near to maturity, ionization depressed mice growth. However, the results did not bring about any statistical significance analysed by F-test⁷.

A further switching over experiment was carried out in trial 2, and the results are shown in Table 9.

During the 4-day growing period, the body weight gains in the ionization switched over to untreated, the untreated group switched over to ionization, and the untreated group were found 0.75 g, 0.5 g, and 1.2 g, respectively. No statistical significant differences were predicted according to

Table 8. Effects of switching over from the unionization to ionization on growth of mice of near puberty¹⁾, trial 2 (g)

Treatment Day	Ionization		Unionized - Ionization		Unionization	
	B.W. ²⁾	B.W.G. ³⁾	B.W.	B.W.G.	B.W.	B.W.G.
Initial	14.79		15.13		15.34	
2nd day	15.48	0.69	15.91	0.78	16.35	1.01
3rd day	15.78	0.30	15.68	0.23	16.80	0.45
4th day	17.16	1.38	17.27	1.59	18.38	1.58
5th day	17.19	0.03	17.41	0.14	18.63	0.25
Differences	2.4		2.28		3.29	
Mean daily gains		0.60 ± 0.36		0.69 ± 0.45		0.82 ± 0.61

($\bar{X} \pm S\bar{x}$)

1) Diet 2 feeding.

2) B.W.: Body weight.

3) B.W.G.: Body weight gains per day.

Table 9. Effects of switching over to ionization or vice versa on the growth of mice near puberty¹⁾, trial 2 (g)

Treat. Dates	Ionized - Union ²⁾		Unionized - Ion ³⁾		Unionization	
	B.W.	B.W.G.	B.W.	B.W.G.	B.W.	B.W.G.
Initial	17.16 ± 0.85		18.56 ± 0.42		17.59 ± 1.73	
2nd day	17.27 ± 0.54	0.11	18.27 ± 0.31	-0.29	18.41 ± 1.73	0.82
3rd day	17.35 ± 0.53	0.08	18.85 ± 0.05	0.58	18.15 ± 1.73	-0.26
4th day	17.51 ± 0.46	0.16	18.73 ± 0.18	-0.12	18.62 ± 1.73	0.47
5th day	17.91 ± 0.48	0.40	19.06 ± 0.21	0.33	18.79 ± 1.73	0.17
Difference	0.75		0.5		1.2	
Mean daily gains		0.19 ± 0.10		0.13 ± 0.21		0.30 ± 0.25

($\bar{X} \pm S\bar{x}$)

1) Diet 2 feeding.

2) Switch from ionized mice to unionization.

3) Switch from unionized to ionization.

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a 3×2 factorial analysis. From Table 9, growth rates of mice near puberty had a steady state growth curve in the ionized group. It is assumed that fattening type of body weight increase in mice might be depressed when mice were ionized

at near mature. Ionization has been recommended as a mean of control for human obesity³⁾⁶⁾.

Table 10, is the results of growth weight of mice fed high-protein diet and high-carbohydrate diet.

Table 10. Effects of ionization and feeding high-protein and high-carbohydrate diets on mice growth¹⁾, trial 3 (g)

Day \ Treatments	High - Prot. Ion.	High - CHO Ion.	High - Prot. Untreated	High - CHO Untreated
Initial	8.41	7.85	7.55	8.64
3rd day	9.45	8.38	8.58	9.44
5th day	10.02	10.09	9.15	9.76
7th day	10.33	9.61	9.99	10.19
Differences	1.92	1.76	2.38	1.55
Mean daily gains	0.27 ± 0.21	0.25 ± 0.20	0.34 ± 0.28	0.22 ± 0.19

($\bar{X} \pm S\bar{x}$)

1) Diet 3 fed ad lib.

Table 11. Effects of methods of ionization on mice growth¹⁾, trial 4 (g)

Day \ Methods	The Overnight ²⁾ Method	The Common ³⁾ Method	Untreated
Initial	12.74	11.46	11.55
2nd day	12.54	11.24	11.07
3rd day	13.05	11.99	11.78
4th day	13.64	13.47	12.37
5th day	14.90	13.74	12.41
6th day	13.41	13.71	12.78
7th day	13.57	14.09	12.92
Differences	0.82 ^a	2.63 ^b	1.37 ^{ac}
Mean daily gains ($\bar{X} \pm S\bar{x}$)	0.12 ± 0.07	0.37 ± 0.11	0.19 ± 0.04

1) Diet 1 fed ad lib.

2) 7 hour - ionization.

3) Two 30 minutes - ionization.

Table 12. Effects of mice previously anionized on conception rate and growth¹⁾, trial 5 (g)

Treat.	Anionized before conception				Unioniz.
Items \ Mother	Female 1	Female 2	Female 3	Ave.	Female 1
No. offspring (hsad)	6	5	8	6.3	3
Birth weight (g)	1.44	1.23	1.233	1.3	0.88
4th day weight (g)	2.11	1.52	2.41	2.0	2.43
8th day weight (g)	3.14	2.40	3.34	2.96	3.99
12th day weight (g)	3.65	3.53	3.98	3.72	5.15

1) Diet 2 fed.

There was no significant differences among total body weight gains of mice in the high-protein-ionization group (1.92 g), the high-carbohydrates-ionization group (1.76 g), the high-protein-untreated group (2.38 g) and the high-carbohydrate-untreated group (1.55 g) during 7-day growing period of mice in trial 3. It was found that protein in diet slight resistance against ionization by mice. It could be partly explained that protein is relatively strong base in body and maintains body in good health¹⁾.

In trial 4, to compare The Common Method and The Overnight Method, results as shown in Table 11 were analysed statistically.

Mice gained total body weight during 6 days at 0.82 g, 2.63 and 1.37 g in the 7-hour-ionization, the two-30 minutes ionization and the untreated group, respectively. The Common Method (two-30 minutes-ionization) was found superior ($p < 0.01$) to The Overnight Method or untreated group.

To secure breeding ability of mice previously ionized three female mice and one unionized female were bred in trial 5. The number of offsprings and their growth weights are listed in Table 12.

Average birth weights were 1.3 g and 0.88 g in the ionized and the unionized, respectively. This result has indicated that the ionization during the growing period of mice did not bring about any detriments in breeding performances and growth of both sexes. No reference is available on human relating to effect of ionization on breeding performance.

REFERENCES

- 1) Avers C.J.: *Cell Biology*, 2nd Ed. D. van Nostrand Co. 1981.
- 2) Krause, M.V. and L.K. Mahan: 6th Ed. *Food, Nutrition and Diet Therapy*, 6th Ed. W.B. Saunders Co. 1978.
- 3) Mastumoto Tadashi: *Oriental Electro Medical Methods* 2nd. Ed. Nihong Kengko Gakueng, Tokyo, 1979.
- 4) National Research Council, *National Academy of Sciences, Nutrient requirements of laboratory animals*, Washington D.C., 1978.
- 5) Okuki Minolu, *Laboratory Animals*, Nan-Sando, 1971.
- 6) Shin-Jin Electro Medical Instrument Co. Seoul, Korea. *Theory and Practical Electro Medical Treatments*, 1977.
- 7) Lee, Mu-Hwan: *Effect of ionization on growth of rat*. J. Jeon-Ju University (in press) vol 3, 1984.
- 8) Snedecor, G.W.: *Statistical Methods*, 5th Ed. The Iowa State University Press, 1962.
- 9) Tuig, J.G.V., D.R. Romsos and G.A. Leveille: *Maintenance energy requirements and energy retention of young obese and lean mice housed at 33° and fed a highcarbohydrate or a high-fat diet*. J. Nutr. 110: 35-41, 1980.
- 10) Lin, P.Y., Romsos, D.R. & Leveille, G.A.: *Food intake, body weight gain and body composition of the young obese mouse*. J. Nutr. 107, 1715-1723, 1977.