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PHYSIOLOGICAL STUDIES ON THE BLOOD IN DOMESTIC ANIMALS AND FOWLS

II. On the Blood Cells in the Mouse

Yoshio SHIMODA and Keiro NAKAI

Recent studies on the blood cells have been greatly advanced and some of them are practically applied to the zootechnical science. The diameter, number, hemoglobin contents, constituents, and other physico-chemical properties of the blood cells, and the mechanism of the formation and destruction of the blood cells in the domestic animal have been considerably clear. However, we have very little information as to what involves in the properties of the blood in the growing animal. It is necessary for us what the blood cells change their properties in the growing animal. From this point, the number of the blood cells and the diameter of the red ones in the growing mice were measured in this experiment.

N. YOSHIDA and Y. SAEKI[1] reported in 1949 on the properties of the blood accompanying the growth of the pig, and M. NAKAMUTA[2] in 1954 on the hematological studies on the pregnant farm animals, especially on the blood cells in the goat.

Material and Method

Material used in this experiment are albino mice, bred in our laboratory and fed with barley, corn, fish meal, grass, etc. These mice have their feed as they please. The temperature of the breeding box was kept on about from 16 to 26°C. They were measured, everyday within the first 10 days after birth and after that every 5 days, the bodyweight, number of the blood cells, and diameter of the red ones for 70 days after birth.

In collecting blood samples, the carotid artery was cut in the infant, and the tail (coccygeal artery and vein) cut in young or adult ones, and then these blood samples were immediately treated. The methods of these experiments were as follows:

1) Weigh of the body-weight: The body-weight were weighed with a rough balance.

2) Enumeration of the red cells: The number of the red cells were enumerated by the method of Thoma-Zeiss, 100 sections on the glass were observed and averaged.

3) Enumeration of the white cells: The number of the white cells were enumerated by the method of Thoma-Zeiss, 400 sections on the glass were observed and averaged. In diluting samples the modified Türk's solution used was as follows:

Glacial acetic acid	6 cc
1% of guentian violet	2~3 cc
Distilled water	300 cc

4) Measurement of the diameter of the red cells: The diameter of the red cells was measured directly with the ocular micrometer, 100 cells were observed and averaged.

Experimental Results

1) The growth curve

The average of the body-weight of 3 mice, 1 group, was plotted for the growth curve. The mean value, standard deviation, and confidence interval of the body-weight in mice are shown in Table 1 and the growth curve in Fig. 1. The empirical formula of the growth curve of mice calculated by the method of the least square is as follows:

$$\log(25.0-y) = 1.3944^{-0.009927x}$$

namely, $y = 25.0-248e^{-0.02286x}$.

Table 1. Body-weight in Mice (Grams)

Age (Days)	Mean y	Standard Deviation	Confidence Interval	Calculated Value y
0	1.2	0.0014	0.0	0.2
1	1.5	0.0129	0.1	0.8
2	1.8	0.0257	0.1	1.3
3	2.1	0.0386	0.2	1.8
4	2.4	0.0914	0.3	2.4
5	2.8	0.1443	0.3	2.9
6	3.1	0.1371	0.3	3.4
7	3.6	0.1771	0.4	3.9
8	4.0	0.1543	0.3	4.3
9	4.3	0.1457	0.3	4.8
10	4.6	0.1743	0.3	5.3
15	5.9	0.7390	0.3	7.4
20	7.5	0.3740	0.4	9.3
25	9.6	1.3880	0.4	10.9
30	12.2	0.6230	0.5	12.5
35	14.5	1.6700	0.7	13.9
40	15.9	1.3800	0.8	15.1
45	16.9	1.8910	0.9	16.1
50	17.6	1.8680	0.9	17.1
55	18.1	2.2580	1.0	17.9
60	18.8	2.4770	1.1	18.7
65	19.2	2.4460	1.1	19.4
70	20.0	2.4050	1.0	20.0

The degree of agreement of this formula is highly significant in the test.

2) The number of the blood cells

The number of the red cells in mice for 70

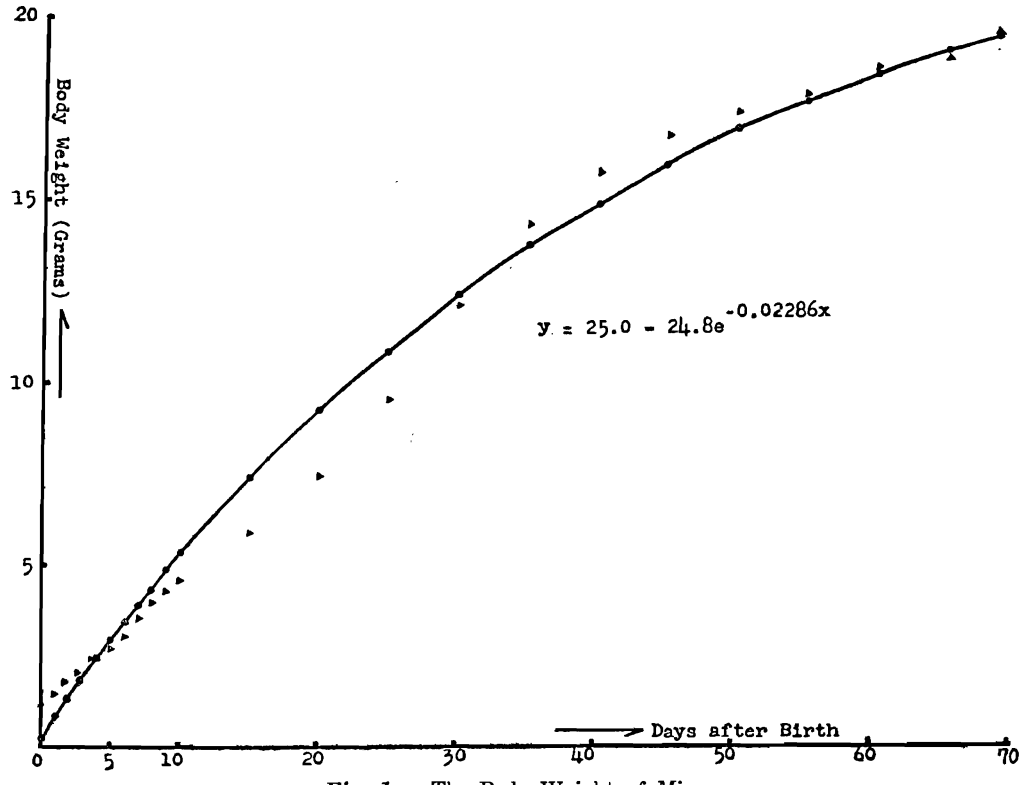

Fig. 1. The Body Weight of Mice

days after birth is about 5.5～14.5 millions per cubic millimeter, and it varies largely from 17.2 millions in maximum to 3.0 millions in minimum (Table 2), it is generally few in the new born mice and according to growth it increases gradually and becomes to maximum about 60 days after birth.

The number of the white cells is about 3.5～10.0 thousands per cubic millimeter and 17.8 thousands in maximum and 2.4 thousands in minimum respectively. In the new born mice the number of the white cells is 3.5 thousands, and it increases by degrees according to growth, and indicates approximately 10.0 thousands in maximum 30～55 days after birth (Table 2).

3) The diameter of the red cells in the growing mice

To observe the diameter of the red cells, for convenience sake, it is observed in the samples after red counts. It is 7.0 microns in the new born mice and 7.2 microns in maximum at second day after birth, and decreases by degrees, and over 50 days it is 5.7 microns and fixed to constant (Table 2).

Discussion

1) The growth curve

The growth curve shows S-shape. The data show that the body-weight of adult male seems to be heavier than that of adult female.

2) The number of the blood cells

The number of blood cells varies greatly among the same species. In fact, the number is not at all constant in the individual.

It is said that the number of the red cells varied also with the part of sampling and the environmental conditions of sampling. As having regards to these the red cells seem to increase according to growth.

The number of the white cells are not definite because of its remarkable changes, but it is clear that the number of the white cells shows low value in the infant mice. In the case of white counts, the ordinary Türk's solution can't destroy the red cells enough, so the modified Türk's solution is employed. This shows that the resisting power of the red cells are stronger than usual, it will be examine enough in this point later.

3) The diameter of the red cells

The diameter of the red cells in mice decreases with growth, and it fixes to constant according to growth. It is not clear that the reason why it is for the function of the red cells or other physiolo-

Table 2. The Number of the Red and White Cells, and the Diameter of the Red Cells in Mice

Age (Days)	No. of Red Cells (Millions)			No. of White Cells (Thousands)			Diameter of Red Cells (Microns)		
	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.
0	5.4	7.6	3.0	3.5	5.2	2.4	7.0	7.4	6.4
1	6.4	9.3	4.2	3.7	4.8	3.0	7.1	7.9	6.6
2	6.8	8.2	5.2	4.7	7.5	2.7	7.2	7.6	6.5
3	6.7	9.0	4.8	5.1	6.0	4.4	7.1	7.2	6.4
4	7.9	11.5	5.2	6.3	8.0	4.0	6.9	6.8	6.4
5	6.4	9.6	5.6	5.1	8.1	4.2	6.6	6.8	6.4
6	6.9	11.6	5.7	6.1	8.5	4.0	6.6	6.7	6.2
7	8.4	11.6	6.2	6.0	7.6	4.1	6.4	6.7	6.0
8	7.7	11.8	6.7	5.2	5.8	4.1	6.4	6.6	5.9
9	8.8	11.2	6.9	4.9	6.8	4.0	6.3	6.6	6.0
10	8.1	11.5	6.2	4.9	5.4	4.4	6.1	6.3	6.0
15	8.1	10.3	5.7	6.7	10.0	3.8	6.0	6.4	5.5
20	9.9	14.3	7.9	6.9	9.5	4.5	5.8	6.2	5.4
25	11.5	13.8	9.8	6.5	9.4	4.0	5.8	6.3	4.8
30	11.9	14.0	8.9	8.7	11.8	5.6	6.1	6.5	5.8
35	12.8	15.8	9.4	8.0	13.4	5.8	5.9	6.0	5.6
40	13.5	17.2	10.9	7.5	11.9	4.6	5.8	6.0	5.5
45	13.0	14.2	10.0	10.2	17.8	4.2	5.8	5.9	5.6
50	13.2	15.5	12.1	10.1	13.9	7.0	5.7	6.0	5.3
55	12.0	14.0	10.5	10.8	16.6	7.6	5.7	6.2	5.5
60	14.5	16.0	12.0	5.9	10.8	5.2	5.7	5.9	5.5
65	13.4	15.4	13.1	9.3	13.0	7.0	5.7	5.9	5.5
70	12.8	14.5	12.5	8.2	12.4	6.4	5.7	5.9	5.5

gical cause, but there is no considerable relationship between the number and diameter of the red cells. Within a week after birth, the diameter of the red cells is comparatively large, and the red cells form cubical and some are appeard macrocytic anisocytosis. In over 15-day-old mice the diameter becomes fixed value.

Conclusion

This paper contains the observations on the blood cells and the growth in mice. The results obtained are summarized as follows:

1) The growth curve of mice is obtained and its empirical formula is as follows:

$$y = 25.0 - 24.8e^{-0.02286x}.$$

2) The number of the red cells is diffused from 5.5 to 14.5 millions per cubic millimeter and increases by degrees accompanying growth.

3) The number of the white cells is diffused from 3.5 to 10.0 thousands per cubic millimeter.

4) The diameter of the red cells decreases with growth from 7.2 to 5.7 microns and is fixed to constant in adult. (Laboratory of Animal Physiology, Received Aug. 31, 1956)

References

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